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SAD

► Separation Anxiety Disorder

Safety

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Definition

Accidents are a leading cause of death in autism (Gillberg, Billstedt, Sundh, & Gillberg, 2010) (Pickett, Paculdo, Shavelle, & Strauss, 2006; Shavelle, Strauss, & Pickett, 2001). The risk for accidents in autism likely reflects the role of several factors including associated cognitive disabilities, impulsivity, and behavior problems sometimes combined with relatively good motor abilities. Unusual restricted and sensory interests may also contribute to this problem, e.g., a child who likes spinning things may try to manually explore a spinning fan. While individuals with autism can be nervous about many new situations, at other times, they may seem driven to explore things that are intensely interesting to them.

In some ways the problem is not, of course, confined to children with autism, i.e., injuries are the leading cause of death in children and youth in the USA. For every injury that is fatal, about 200 other injures result in emergency room visits. Some steps can be taken to insure safety for the individual both in and outside of the home. This includes basic awareness of safety in the context of the age and level of functioning of the child. Obvious hazards should be attended to. Guns should not be in the home, and careful security should be provided for poisons and dangerous substances (including medications). Similarly, access to flammable materials, knives, and electrical cords should be limited. Within the home, careful attention should be paid to kitchen and bathroom areas and any areas that present obvious hazards (e.g., swimming pools). Given that drowning is a potential concern, children with autism should be taught to swim. Explicit teaching of safety should also occur. Various accommodations for individuals of differing levels of ability and cognitive understanding can be made. This can include use of visual support for teaching as well as special stickers that indicate that something is harmful (see Volkmar & Wiesner, 2009). Parents should be aware of plants in and near the home that may

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be poisonous. Both at home and school, the Poison Control Center number should be posted near the phone.

Some children present special issues that raise safety concerns. For children who mouth objects, a careful check of sources of lead-based paint should be made. Such children should not be given access to toys with small parts (i.e., that could be a choking hazard). Other children can have problems with bolting or wandering. Wandering can be presented with use of special locks, monitoring devices, and so forth. Bolting can be a problem for less cognitively able children, e.g., jumping out away from a parent on a busy street or jumping out of a car while it is in motion. Appropriate steps to insure safety should be made. Children who wander may be induced to wear a special bracelet that identifies them. Helper dogs have also been used. For children whose impulsivity is a major problem, medications and behavioral interventions can be used.

Both at home and at school, outside areas can present special hazards. At school, the presence of other children may complicate monitoring of a child with a social disability. Accidents are probably more frequent in areas where children have less supervision and where social demands are greater, e.g., recess, gym, and cafeteria. Explicit teaching of safety concepts (including dealing with fire drills) should be part of the student's program in school. School staff should be prepared to prevent accidents and also have sufficient training in simple first aid that they can immediately respond. In some areas, e.g., where there is access to a pool or potentially dangerous materials, children should not be left without appropriate supervision. As with other aspects of teaching, a structured approach with explicit rules and routines can help teach safety concepts. This task becomes easier as children acquire language, but even for less verbal children, use of picture schedules and visual cues can help to teach safety issues. As children get older, explicit teaching about common situations, such as crossing the street or use of simple appliances, can be included. Some computer aids are now available, and it is likely that more will be available in the future.

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Short Biography

Born in1974, Clare Sainsbury – a British woman with Asperger's syndrome – studied at Oxford University in the UK. For many years, she ran an online support group for university students on the autistic spectrum. Her highly acclaimed book – *Martian in the Playground: Understanding the Schoolchild with Asperger's Syndrome*, published in 2000 – won the TES/NASEN award

for best academic book. She has spent several years working part time with children and teenagers with severe autism.

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Sameness, Insistence on

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Definition

Insistence on sameness (IS) is a component/variant of restricted repetitive behavior, a core feature of autistic disorder. IS behaviors are characterized by extreme behavioral rigidity, where things must be "just so" and change is not tolerated. Perhaps some of the most richly detailed and clinically astute descriptions of the need for sameness found in autistic disorder can be found in Leo Kanner's seminal paper "Autistic Disturbances of Affective Contact" (Kanner, 1943):

> There is a marked limitation in the variety of his spontaneous activities. The child's behavior is governed by an anxiously obsessive desire for the maintenance of sameness that nobody but the child may disrupt on rare occasions. Changes of routine, of furniture arrangement, of a pattern, of the order in which every day acts are carried out, can drive him to despair.

As noted above, the need for sameness in autistic disorder can manifest itself in various ways. These can include extremely rigid eating habits, insisting on taking a particular route to school or work, requiring objects to be placed a certain way, or elaborate rituals around activities of daily living. These behaviors can be excessive and may cause significant impairment to individuals with autism. Preventing or stopping such behavior is often quite difficult, as affected individuals may become anxious, agitated, or aggressive if they are interrupted. As noted by Wahlberg and Jordan (2001), people with autism seem almost incapable of adjusting their behavior to manage the many interruptions and unexpected events that can happen on a daily basis. Given the significant problems these behaviors can pose (for both the individuals with autism as well as their families), relatively little is known about their phenomenology and treatment.

Historical Background

Insistence on sameness behaviors have traditionally been subsumed under the restricted repetitive behavior (RRB) core domain of autism. In the Diagnostic and Statistical Manual of Mental Disorders – 4th Edition (DSM-IV-TR; APA, 2000), criteria for RRB can be met by a person exhibiting at least one of the following: "(a) encompassing preoccupation with one or more stereotyped and restricted patterns of interest that is abnormal either in intensity or focus; (b) apparently inflexible adherence to specific, nonfunctional routines or rituals; (c) stereotyped and repetitive motor mannerisms (e.g., hand or finger flapping or twisting or complex whole-body movements); or (d) persistent preoccupation with parts of objects." What becomes clear upon examination of these criteria is that they are very broad, ranging from repetitive movements of the body to more cognitively mediated symptoms such as intense interests or the need for sameness. There has been growing interest in studying the structure of RRB in autism, as identifying distinct types of behavior may help guide treatment and aid researchers in subsetting groups, as one of the major obstacles in the field has been the tremendous phenotypic variability found in the disorder.

To date, at least six studies (Bishop, Richler, & Lord, 2006; Cuccaro et al., 2003; Lam, Bodfish, & Piven, 2008; Mooney, Gray, Tonge, Sweeney, & Taffe, 2009; Shao et al., 2003;

Szatmari et al., 2006) have examined the structure of repetitive behavior in autism empirically using factor analysis of the RRB domain of the Autism Diagnostic Interview-Revised, a standardized assessment used to inform diagnosis (ADI-R, Rutter, Le Couteur, & Lord, 2003). An additional study examined the factor structure of RRB in more detail using the Repetitive Behavior Scale-Revised (Lam & Aman, 2007). All of these studies independently verified the presence of an insistence on sameness factor in individuals with autistic disorder. This provides evidence that insistence on sameness is a distinct subtype of repetitive behavior in autism, which may aid treatment research and work examining the neurobiological and genetic underpinnings of the disorder.

Current Knowledge

Explaining Insistence on Sameness in Autistic Disorder

It is not yet understood exactly *why* individuals with autistic disorder crave sameness and loathe change. However, several theories have been offered to try to explain these sameness behaviors in autism; this has been covered comprehensively by Turner (1999). A brief summary of each of these hypotheses is below.

1. Homeostasis. This theory postulates that IS and other repetitive behaviors in autism are the result of too much stimulation from the environment, which the individual finds aversive (Hutt & Hutt, 1970). If novel situations are too arousing, then insisting on sameness in activities and the environment could help maintain homeostasis.
2. Weak central coherence. This hypothesis posits that people with autism are characterized by preferential processing of local rather than global processing of the environment (Frith & Happe, 1994). This can lead to a focus on seemingly insignificant details and an inability to understand the wider context of a situation.
3. Executive dysfunction. Problems in executive functioning can lead to difficulties generating, planning, and controlling behavior. These deficits are consistent with the presence of sameness behaviors in autism; the inability to initiate novel behavior thus leads to a persistence on a restricted set of behaviors (e.g., Hughes, Russell, & Robbins, 1993).
4. Sameness behaviors as a form of compulsive behavior. Researchers have questioned whether sameness behaviors in autism are related to compulsive behaviors found in obsessive-compulsive disorder (OCD, DSM-IV; APA, 2000). Compulsions are defined as repetitive behaviors that serve to reduce anxiety or distress, rather than generate pleasure (American Psychiatric, 2000). Therefore, insisting on sameness may reduce anxiety elicited by changes in the environment. This theory has also guided some medication treatment approaches in autism (described below).
5. Sensory reinforcement. Here, it is postulated that there is something intrinsically reinforcing about sameness behaviors: that the behavior is self-stimulatory (Lovaas, Newsom, & Hickman, 1987).

It is important to note that it is unlikely that there is any single explanation that can account for insistence on sameness behaviors in autism. These theories are not mutually exclusive, and it is possible that individual instances may have different substrates.

Measurement of Insistence on Sameness

The Sameness Questionnaire (Prior & MacMillan, 1973). This 28-item informant-based measure was developed to compare children with autism to children with childhood schizophrenia. This questionnaire includes several items that are designed to assess the child's resistance to change (e.g., Does he insist on furniture remaining in the same place? Does he object to visiting new places?) but also includes items that assess motor stereotypies and compulsions.

The Behavior Flexibility Rating Scale (*BFRS*; Green, Sigafoos, Pituch, Itchon, O'Reilly, & Lancioni, 2006). Intended for use in individuals with developmental disabilities, this questionnaire has 16 items that serve to identify specific situations related to a resistance to change and to

rate the extent to which individuals show problems with environmental changes. Three dimensions of flexibility are assessed: flexibility toward objects, flexibility toward the environment, and flexibility toward persons.

Repetitive Behavior Scale-Revised (*RBS-R*, Bodfish, Symons, & Lewis, 1999; Lam & Aman, 2007). The *RBS-R* is an informant-completed questionnaire intended to assess the variety of RRBs observed in individuals with autism spectrum disorders. The RBS-R has 5 empirically derived subscales, one of which is called "Ritualistic/Sameness Behaviors" that has 12 items tapping insistence on sameness behaviors.

The Yale-Brown Obsessive-Compulsive Scale (*Y-BOCS*; Goodman, Price, Rasmussen et al., 1989) *and the Children's Yale-Brown Obsessive-Compulsive-Scale* (*CY-BOCS*; Scahill et al., 2006). Both the Y-BOCS and CY-BOCS were originally intended to assess obsessive-compulsive disorder in typically developing individuals. Due to the communication limitations in autism, usually the Compulsion section of the Y-BOCS/CY-BOCS is used. This clinician-administered rating tool does probe for some elements of sameness behavior; however, it also queries other types of RRB and provides an overall severity score for all repetitive behaviors combined.

The Childhood Routines Inventory (*CRI*; Evans et al., 1997). The CRI is a 23-item parental report questionnaire that assesses repetitive and perfectionistic behaviors in the context of normative development. Questions cover many aspects of insistence on sameness, such as "prefers the same household activities every day," "repeats actions over and over," and "prefers to have things done in a particular order or way."

Insistence on Sameness: Specific to Autism?

Although the need for sameness is characteristic of autistic disorder, such behavioral rigidity is also found in other populations. Repetitive, ritualistic, and "just so" behaviors are highly common among typically developing children, around the ages of 2–3 years (Gesell et al., 1974). For example, children may line up objects, have elaborate bedtime routines, and have very rigid rules around food presentation. If these demands are not met, tantrums can result; indeed, the characterization of "the terrible twos" may reflect an aspect of this normative development (Evans et al., 1997). As many as 85% of children aged 2–3 exhibit some of these "just so" behaviors, and by the age of 6 years, these behaviors begin two wane, giving way to more flexible behaviors that are necessary to negotiate the next phases of development (Evans et al., 1997).

The need for sameness is also found in other clinical populations, such as obsessive-compulsive disorder (DSM-IV, APA, 1994), Prader-Willi syndrome (Wigren & Hansen, 2005), and Down syndrome (Evans & Gray, 2000). Research in this area is in its infancy, however. More work needs to be done to examine the specificity of sameness behaviors in autism and how (or if) they differ from other disorders in frequency, severity, and typography. Such knowledge could guide research to the neurobiological underpinnings of the disorder (Militerni, Bravaccio, Falco, Fico, & Palermo, 2002).

Treatment

There is some debate in the literature as to whether a person with autism's desire for sameness should be accommodated (by reducing change) or be a target for treatment (by teaching the individual to cope with change) (Mesibov et al., 2005). However, for at least some individuals, the need for sameness is so extreme that it can intensify social difficulties, lead to aggression and/or anxiety, and severely limit the day-to-day activities of the entire family. In these cases, IS may be a reasonable target for intervention.

1. *Behavioral treatments*. To date, there are no well-established behavioral treatments that have focused on the reduction of IS in autism. However, there are several established approaches in psychological literature that could be applied to reducing IS behaviors in autism, including replacement-based interventions, graduated stimulus change, and the use of visual schedules. For a review, please see Green et al. (2007). Clearly, further research is needed to fully develop and empirically validate these treatment approaches.

2. *Psychopharmacological treatments.* Because of the potential link between the compulsive behaviors found in OCD and the repetitive behaviors found in autism, selective serotonin reuptake inhibitors (SSRIs) have been of interest to researchers and practitioners alike. There have been at least seven randomized controlled trials of SSRIs in autism to date (for a review, see Williams, Wheeler, Silove, & Hazell, 2010). The largest, well-controlled study of citalopram in children with autism ($n = 149$) showed no reduction of repetitive behaviors in general with active treatment (King et al., 2009). At this point, there is not a great deal of empirical support for the use of SSRIs to treat repetitive behavior in autism. However, in these studies, repetitive behaviors were measured more generally; it is unknown whether extreme IS behaviors in particular would be more responsive to treatment with an SSRI. More research in this area may be warranted.

Future Directions

As stated previously, one of the largest obstacles in the study of autistic disorder is the extreme variability and heterogeneity in the phenotype. One promising line of research is to use insistence on sameness to subset groups. Although insistence on sameness is characteristic of autistic disorder, not *all* people with autism display this class of behavior. Identifying individuals with high levels of IS may be a way to identify groups of people with autistic disorder that are more behaviorally homogeneous, which would be of tremendous use to workers in the field who are trying to delineate the neurobiological and genetic causes of autism.

Although research in this area is in its infancy, there is growing evidence that insistence on sameness in autism may have, at least in part, a genetic basis. Several groups have looked at sibling pairs with autism to see how insistence on sameness aggregates in families (Cuccaro et al., 2003; Lam et al., 2008; Shao et al., 2003; Szatmari et al., 2006). Three of these studies (Shao et al., 2003;Szatmari et al., 2006; Lam et al., 2008) provided evidence that insistence on sameness behaviors are familial (whereas another forms of repetitive behaviors, Repetitive Motor Behaviors, are not). Further evidence for a genetic basis for IS behaviors is provided by recent study of the relationship between sameness behaviors in individuals with autism and obsessive-compulsive symptoms in their parents (Abramson et al., 2005). Briefly, they found that insistence on sameness was positively correlated with obsessive-compulsive behaviors in parents. Further, when individuals with autism were grouped on the basis of parental Y-BOCS scores (clinically significant versus nonclinically significant), individuals whose parents had clinically significant Y-BOCS scores had higher ADI-R insistence on sameness factor scores.

It is recognized that although autism is a strongly genetic disorder, its phenotypic presentation is so complex that the identification of candidate genes or other etiological mechanisms is unbelievably complex. These studies provide preliminary data that subsetting groups of individuals with autism by severity of insistence on sameness may be a useful way to reveal phenotypically and potentially etiologically distinct subgroups of individuals with autism. More research in this area is needed.

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Sarafem

► Fluoxetine

Savant Skills (in Autism)

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Definition

Savant syndrome is a rare but remarkable condition in which persons with developmental disabilities, including autism, have some spectacular, exceptional, and unexpected abilities ("islands of genius") that stand in marked, jarring juxtaposition to overall limitations. These special abilities are generally music, art, calendar calculating, lightning calculating, or mechanical visual-spatial skills. Whatever the special ability, it is always coupled with massive memory which is exceedingly deep, but limited within very narrow confines.

Savant syndrome occurs in approximately one in ten persons with autistic disorder, ranging in ability from "splinter skills" to "talented" to "prodigious." That latter term is a high threshold category in which, in absence of a disability, the person would be classified as a prodigy or genius; there are probably fewer than 100 known, living prodigious savants in that extremely high-level performance category. Savant syndrome can be congenital (present from birth) or acquired (a neurotypical person in whom unexpected savant abilities emerge following head injury, stroke, dementia, or other CNS disease).

Savant syndrome is not a disease or disorder by itself. The special abilities seen in the savant are always grafted on to some underlying disability, including autistic disorder.

Theories to Explain Savant Syndrome

There is no single theory which can explain all cases of savant syndrome. Neuropsychologists have concentrated on "weak central coherence," "mind blindedness," "executive dysfunction," and "hypersystemizing" as core defects in both autism and savant syndrome. These ideas are discussed at length in the 2010 book *Autism and Talent* by Happe and Frith which addresses the question of why savant syndrome is overrepresented in autistic disorders compared to other developmental disabilities. Rimland (1964) and Treffert (2010) postulate that in the savant, there is a process of "recruitment," "rewiring," and "release" of available and still intact brain capacity as a compensatory mechanism for damage to other brain areas (most often left hemisphere) and damage to the higher level semantic memory circuits which produces a reliance on lower level, habit or procedural memory circuits. This produces the typical clinical picture of right brain skills coupled with "automatic" memory seen most often in the savant. Casanova and Trippe (2010) propose that differences in connectivity, favoring short-range connections compared to long-range connections in minicolumns of the brain, are responsible both for autism itself as well as the novel abilities of savants. Powell (2006) and others have been exploring how "quantum mechanics" and the mechanism of "entanglement" might account for savant abilities including even the extrasensory perception or "psi" capacities in some savants. This theory suggests that suppression of the "dominance" of one area of the brain permits both the release of nondominant skills and the "without reckoning" memory of savants. The brain area release and substitution phenomenon has been called "paradoxical functional facilitation" and is applicable in both congenital and acquired savants (Kapur, 1996).

Historical Background

The first account of savant syndrome is a scientific paper that appeared in the German psychology journal *Gnothi Sauton* in 1873, describing lightning calculator with an extraordinary memory (Moritz, 1783). Rush (1789) reported the case of Thomas Fuller, a lightning calculator "who could comprehend scarcely anything, either theoretical or practical, more complex than counting." But the word "savant" did not appear until 1887 when Down described eleven patients with "special faculties" among the hundreds of patients with severe cognitive

disabilities he had seen during his career at Earlswood Asylum in London. These skills included art, music, mathematics, precise time-keeping, and memory. One boy had memorized "The Rise and Fall of the Roman Empire" and could recite it backward or forward. Down named this condition "idiot savant" since at that time "idiot" was an accepted scientific term for IQ below 25. He combined that with the term "savant" derived from the French word *savoir* meaning "learned person." It is not clear how many of Down's patients were autistic, as distinct from mental retardation, but in that same article Down described what he called "developmental retardation" as separate from "congenital" and "accidental" retardation. In so doing, it is clear his "developmental retardation" category would include what is now classified as early-onset and late-onset autistic disorder (Treffert, 2006).

In his 1914 *Mental Deficiency (Amentia)* textbook, Tredgold devoted an entire chapter to the "idiot savant" with a succinct, colorful, and capturing description of the idiot savant. That term endured until 1988 when Treffert suggested "savant syndrome" be substituted as the name for this remarkable condition because of the negative connotation of "idiot" and because not all persons with savant syndrome have low IQ. Then in 1988, the popular, award-winning movie *Rain Man* made "autistic savant" household words. That was an extremely useful public education tool but with the caveat that not all persons with autism are savants and not all savants are autistic.

Current Knowledge

The Condition Is Rare but One in Ten Autistic Persons Show Some Savant Skills

In Rimland's (1978) survey of 5,600 children with autism, 531 (9.8%) were reported by parents to have special abilities, and a 10% incidence of savant syndrome in autistic disorder has become the generally accepted figure in autistic disorder. However, Hermelin (2001) estimated the incidence to be as low as "one or two in 200." Bolte and Poustka (2004) indentified savant skills in 13% of 243 individuals with autism based on at least one special skill as assessed on the Autism Diagnostic Interview-Revised (ADI-R). Howlin et al. (2010) reported that in a sample of 137 persons with autism involved in long-term follow-up, 28.5% of individuals showed some savant skills based on either cognitive testing or parental reports. That number is probably higher than in other studies because the presence of savant skills, in some cases, was based solely on cognitive scores, particularly block design, on formal IQ testing.

The generally accepted figure for prevalence of savant skills in autistic disorder remains at about one in ten (10%). That figure may be adjusted upward somewhat as larger series of such cases are assembled.

But savant syndrome is not limited just to autistic disorder. In a survey of an institutionalized population with a diagnosis of mental retardation, Hill (1977) reported the incidence of savant syndrome was 1:2,000 (.06%). A more recent survey of 583 facilities found a prevalence rate of 1.4 per 1,000 (Saloviita, Ruusila, & Ruusila, 2000). Whatever the exact figures, mental retardation and other forms of developmental disability are more common than autistic disorder, so a reasonable estimate is that approximately 50% of persons with savant syndrome have autism as the underlying disorder and the other 50% have other forms of developmental disability, mental retardation, or other CNS injury or disease as the underlying disorder. Thus, not all autistic persons have savant syndrome, and not all persons with savant syndrome have autistic disorder.

Interestingly, in Kanner's (1971) follow-up of his original 11 cases, 6 had outstanding savant skills in music or memory. In Miller's (1998) report on 45 individuals with savant abilities, 22 had autism or symptoms highly suggestive of that disorder.

Savant Skills Typically Occur in Particular Categories of Abilities

Considering all the skills in the human repertoire, it is interesting that savant skills narrow to five general categories: *music*, *art*, *calendar calculating*, *lightning (rapid) calculation*, *and*

mechanical and/or spatial skills such as measuring distances with precise accuracy, the ability to construct complex models or structures, mapmaking, or direction finding. These special skills tend to be those associated with right hemisphere function. Other skills are also reported from time to time such as polyglot (language acquisition); unusual sensory discrimination in smell, touch, or vision including synesthesia; perfect appreciation of passing time without benefit of a clock; and outstanding knowledge in specific fields such as neurophysiology, statistics, or navigation.

Generally, a single skill exists, but in some instances several skills exist simultaneously. Whatever the special skill, it is always accompanied by prodigious memory. Some observers rank memory as a separate special skill. However, prodigious memory within the area of the special skill cuts across all the special ability areas as a shared, integral part of the syndrome itself.

There Is a Spectrum of Savant Skills

The most common form of savant skills are "*splinter skills*," which include obsessive preoccupation with, and memorization of, music and sports trivia, license plate numbers, maps, historical facts, or obscure items such as vacuum cleaner sounds, for example. *Talented savants* are those whose special skills are more highly honed and are very conspicuous when viewed in contrast to overall limitations. *Prodigious savants* are those persons whose skills are at such a spectacular level that if no disability was present, they would be classified as prodigy or genius (Treffert, 1988).

The Special Skills Are Always Accompanied by Massive Memory

Whatever the special abilities, a remarkable memory of a unique and uniform type wields the condition together. Terms such as automatic, mechanical, concrete, and habit-like have been applied to this extraordinary memory. Down (1887) used the term "verbal adhesion"; Critchley (1979) used the term "memory without reckoning," and Tredgold (1914) used the term "automatic." Such unconscious memory suggests what Mishkin, Malamut, and Bachevalier (1984) referred to as nonconscious "habit" formation rather than a "semantic" memory system. They proposed two different types of memory: a higher level corticolimbic circuit for semantic memory and a lower level corticostriatal circuit for the more primitive habit memory, which is sometimes referred to as procedural or implicit memory. Savant memory is characteristically very deep, but exceedingly narrow within the confines of the accompanying special skill.

Males Outnumber Females in Both Autism and Savant Syndrome

Males outnumber females in savant syndrome by an approximate of 6:1 ratio compared to an approximate of 4:1 ratio in autistic disorder. In explaining that finding, Geschwind and Galaburda (1987) point out in their work on cerebral lateralization that the left hemisphere normally completes its development later than the right hemisphere and is thus subjected to prenatal influences, some of which can be detrimental, for a longer period of time. In the male fetus particularly, circulating testosterone, which can reach very high levels, can slow growth and impair neuronal function in the more vulnerably exposed left hemisphere, with actual enlargement and shift of dominance favoring skills associated with the right hemisphere. A "pathology of superiority" was postulated, with a compensatory growth in the right brain as a result of impaired development or actual injury to the left brain.

This finding explains why the savant skills described above tend to be "right brain" abilities. It may account as well for the high male/female ratio in other disorders, including autism itself, since left hemisphere dysfunction is often seen in autism (Rimland, 1964); Treffert, 2010). Other conditions, such as dyslexia, delayed speech, and stuttering, also have a high male predominance in incidence, which may be a manifestation of the same left hemisphere growth interference in the prenatal period described above.

Intelligence and Savant Skills

When Down coined the term "idiot savant," it was immediately linked with mental retardation since at that time "idiot" referred to an IQ below 25. As it

turns out, that was not only a regrettable term for present day usage, but it was also in error since almost all reported cases have occurred in persons with an IQ above 40. That early association with mental retardation has led to the erroneous impression that savant syndrome is always associated with cognitive impairment. That is not the case. *Low IQ is not a requisite for savant syndrome*.

IQ levels in savant syndrome can range from below 40, which is quite rare, to as high as 140. The majority of savants have IQ levels between 40 and 70, but as many as 25% have IQ scores above 70. Bolte and Poustka (2004), for example, compared performance of 33 savant and 26 nonsavant autistic subjects on the Wechsler Adult Intelligence Scale-Revised (WAIS-R). Full-scale IQ scores for the savants ranged from 38 to 128, with a mean of 83.3; the nonsavant autistic control group IQ levels were somewhat lower (71.4) but that was not statistically significant. Miller (1998), in a review of studies where detailed IQ information was available, found that the mean overall IQ/IQ estimate for savants with autism was 71 (range 40–99) with the mean verbal IQ of 77 (range 52–114) and mean nonverbal IQ of 75 (range 47–92). Howlin et al. (2010) found, in their 10-year follow-up on 137 autistic savants, that nonverbal ability, using a variety tests appropriate to each individual, gave a mean performance level of 69.9 (range 28–135). Verbal ability scores in that group showed a mean verbal IQ/or ratio IQ estimate (based on any test) of 52.9 (range 7–134).

Thus, although savant syndrome *can* occur in persons with autism with very low IQ scores, in the majority of cases IQ falls within the mild learning disability range.

Some autistic savants do have IQ levels in the superior range, and wide scatter on intelligence testing is a consistent characteristic of this group. Because of the wide scatter on such testing, some investigators have concluded that savant syndrome argues for "multiple intelligence" theory against "general intelligence" and the validity of the g factor (Treffert, 2010). Whatever the case, while some savants do have IQ scores below 70, having an IQ score above 70 does not "disqualify" someone from having savant syndrome.

"Treatment" and "Training the Talent"

Savant syndrome is a combination of special skills grafted on to some underlying disability such as autism. Any formal "treatment" therefore would be directed at the underlying disability. With respect to the special skills, appropriate intervention is called "training the talent."

In 1930, Phillips framed the question of dealing with special skills this way: "The problem of treatment comes next....is it better to eliminate the defects or train the talent?" Experience since that time shows that question need not be either/or. Instead, by "training the talent," one can actually help ameliorate the "defect." Supporting and nurturing whatever the special skill – music, art, and math – leads eventually to improved language, social, and daily living skills *without trade-off or loss of those special skills* as progress continues in other areas of functioning and learning. The special skills are a way of engaging the savant. They are not frivolous or interfering. They are a form of expression and can be a "conduit toward normalization," with the eventual goal of channeling those abilities more usefully.

Clark (2001) developed a savant skill curriculum using a number of successful strategies currently employed in the education of gifted children (enrichment, acceleration, and mentorship) and autism education (visual supports and social stories) in an attempt to channel and apply, usefully, the often nonfunctional obsessive savant and splinter skills of a group of students with autism. This special curriculum did prove highly successful in the functional application of savant skills and an overall reduction in the level of autistic behaviors in many subjects. Improvements in behavior, social skills, and academic self-sufficiency occurred, along with better communication skills in some subjects. These strategies are woven into a number of successful approaches now in various autism treatment centers and classrooms.

Simultaneously, some specialized schools are developing, such as Soundscape Centre in England which is the only specialized educational facility in the world uniquely dedicated to

the needs and potential of persons with sight loss and special musical abilities, including musical savants. Some savants with special graphic abilities have now graduated from prestigious art schools, and some with special musical abilities have likewise graduated from equally prestigious music schools. There are also a number of savants with a Ph.D. degree in mathematics or other fields.

Grandin and Duffy's book – *Developing Talents: Careers for Individuals with Asperger Syndrome and High-Functioning Autism* (2004) – is an excellent, practical resource which outlines methods for helping children "develop their natural talents" using "drawing, writing, building models, programming computers," and similar skills to help in the search for eventual work experience.

The Case of Nadia and the "Dreaded Trade-off" Versus Progression of Skills

In 1978, Selfe reported the case of Nadia who lost her special art skills when exposed to traditional schooling. This raised the question whether there might be a "dreaded trade-off" of special skills for acquisition of better language, social, and daily living skills. Experience has shown this to be not the case, and Nadia's experience is the exception rather than the rule.

Rather, based on following certain savants over a number of years, a pattern of progression of savant skills emerges first with *replication*, then *improvisation*, and finally, in some cases, the capacity to be *creative*. A fuller description of this pattern of progress in a number of savants can be found in Treffert's, 2010 *Islands of Genius: The Bountiful Mind of the Autistic, Acquired and Sudden Savant* book or his chapter on savant syndrome in *Autism and Talent* (Happe & Frith, 2010).

Family History and Savant Syndrome

The role of family history in savant syndrome is an unsettled one. Two studies, one with 25 savants and another with 51 subjects, showed relatives with special skills in *some*, but not all, cases (Duckett, 1976; Young, 1995). Young traveled to a number of countries and met with 51 savants and their families. There was a family history of similar skills in some, but not all, cases, but even in the absence of a history of a specific skill, there was a familial predisposition toward high achievement.

Might there be a gene for savant syndrome? Here, results are also mixed. Nurmi et al. (2003), using parental reports on special skills, compared 21 multiplex autism families (multiple affected members, mainly affected sibling pairs and their parents) which he identified as "savant skills positive" with 74 similar families that he identified as "savant skills negative." Results showed "the sub-set of 21 savant skills positive families yielded significantly increased evidence for linkage to 15q11-q13." The 73 families in which the individuals with autism had few or no savant skills showed no evidence of such linkage. Ma et al. (2005) attempted to replicate those findings using the savant skill factor (SFF) from the Autism Diagnostic Interview-Revised (ADI-R) instead of parental reports. Their results "failed to demonstrate linkage to 15q-11-q13" in their sample. But the differing definitions for savants in these two studies make for a difficult comparison.

The exploration of family history in savant syndrome, based on experience thus far, suggests that "family history" needs to extend beyond first-degree relatives to uncles, aunts, and cousins, for example, and beyond the present generation to prior generations in the family. Only with that more extensive and careful exploration will the contribution of family history to savant syndrome become more clear.

Future Directions

There has been more progress toward better understanding savant syndrome in the past 25 years than in the prior 100 since Down's first description of this extraordinary condition in 1887. Many unanswered questions still remain but interest in exploring those is accelerating, particularly with the rapid emergence of newer technologies that allow the study of brain *function*, not just brain *structure*. Savant syndrome

provides a unique window into the brain, using those new techniques, to learn more talent, memory, and creativity itself, not only in savants but in everyone else as well. Future direction of research to better understand the savant and services to better help him or her to reach their full potential will include what follows.

New Technologies

The brain sits well protected in the rigid box surrounding it. It cannot be "scoped" like other organs and biopsies are problematical. Therefore, various imaging techniques are the least intrusive way of studying brain structure and organization. CT and MRI scans permit high-resolution images of brain architecture, including deep structures. Even more illuminating though are functional studies such as PET and SPECT. Those require isotopes however, so functional MRI (fMRI) is more often used to look at the brain at work. And it is study of brain function that will ultimately provide keys to better understanding not just savant syndrome but autism itself.

Some theorize that autism, and savant syndrome, is a result of abnormal "connectivity" in the brain. Diffusion tensor imaging (DTI) measures water flow in the complex neuronal network, and diffusion tensor tracing (DTT) traces those actual connections between the hemispheres, within the hemispheres, and between the upper and lower brain structures, projecting tracings of the actual fibers and the pathways that connect those fiber tracts. Casanova and Trippe (2010) speculate that minicolumn organization (or disorganization) may be vital in autism itself, and Mottran et al. (2006) and colleagues extend changes in synaptic plasticity to account for some unusual synaptic connectivity in savant syndrome. Studies of such connectivity patterns are also underway.

One of the problems with studying savant syndrome with these technologies is that it requires virtual immobilization in the MRI and similar machines. It is impossible of course to play a piano, or sculpt, in an MRI machine. So in order to truly view the brain while the savant is "at work" with their special skill, methods need to be devised to allow brain function studies with less immobilization. Near-infrared spectroscopy (NIRS) measures hemoglobin flow using a scalp cap and does not require the individual to be immobile and will be applied in such studies. Also new magnetoencephalography technology provides a great deal of information beyond traditional EEG in terms of sensitivity and magnification, and it can provide extremely detailed information about the electrical activity in both surface and deep areas in the autistic and savant brain.

A Savant Syndrome Registry and Broad-Based, Controlled Studies

The relative rarity of savant syndrome, contrasted with the attention-getting extraordinary nature of some abilities, has led to largely anecdotal reporting of cases through the years. The lack of a standardized definition of "savant syndrome," the absence of uniform neuropsychological testing of savants, and the lack of quantification of savant skills into distinct categories has hampered research efforts with large sample, control groups. To that end, a *worldwide savant syndrome registry* has been recently organized by Treffert and Rebedew collecting cases largely from the savant syndrome web site at www.savantsyndrome.com along with professional journal reports, personal correspondence, and media descriptions. To date, 309 cases of savant syndrome from 33 countries have been entered into that registry. Those cases have been categorized by ability, disability (formal diagnosis) age, gender, family history, medical history, congenital or acquired type, geographic location, and a number of other variables. From that analysis, now underway, there can be determination, on a large sample basis, of the distribution of autism versus other diagnoses as the underlying disability, the frequency of various abilities, a breakdown of congenital cases versus acquired cases, gender distribution of savant skills, age of savants, family history, medical history, educational level, vocational and socioeconomic status, and a variety of other parameters. Cases will be added to that registry as they are discovered and reported. A second phase of that "registry" will consist of gathering information from an even

more detailed questionnaire completed by those savants, families, and caregivers willing to do so.

Having savants registered by geographic location should help those researchers hoping to find willing subjects in their particular countries to participate in these larger case studies including control groups.

Exploring the Interface Between Prodigy, Genius, and Savant Syndrome and Other Quandaries

As more savant cases come to attention, both congenital and acquired, the interface between prodigy, genius, and savant syndrome becomes a natural area for exploration. These conditions likewise provide a fertile field for investigation regarding the nature of talent and the role of "innate" versus "learned" abilities, the age old nature versus nurture argument. They also raise the question of "multiple" intelligences versus a "general" intelligence, or "g" factor. Savants, whether congenital or acquired, seem to "know things they never learned," which gives entry to the area of genetic or ancestral memory for exploration as well. Finally, savant syndrome, both congenital and acquired, provides a striking confirmation of brain plasticity and is a natural workshop to explore those mechanisms as well. Research into these areas is already underway, and more will follow.

Development of Methods of "Training the Talent" and Resources to Use Those Special Skills

A better understanding of, and appreciation for, savant skills has taken them out of the "Gee whiz, look at that" category and cast them into a vigorous treatment – "training the talent" – effort with the hope those special abilities can be used vocationally in many cases fostering increasing independence and community acceptance. Studies are underway, and will increase in the future, as to what are the best methods to use in education efforts: special classrooms, regular classrooms, or hybrid approaches. Already, some programs have successfully placed savant and neurotypical "gifted and talented" students together in combined programs. Private schools specifically designed for, and dedicated to elementary, middle school and high school students with savant syndrome and high-functioning autism have likewise emerged. Those provide particular populations for research on program effectiveness and outcome.

But while there has been the development of an increasingly rich network of educational services for K-12 students with savant syndrome, autism, and Asperger's, until recently those students, now adults, have faced a very barren landscape of similar services for the over-18 age group. But that is changing for the better, and there is a solid effort underway to incorporate more adult savants, with their special talents, into the regular workforce. Grandin and Duffy (2004) have provided a good blueprint for developing talents as a pathway to careers that utilize the unique skills of the savant. There are now employment agencies in several countries that successfully specialize just in the matching of individuals with Asperger's with willing employers. The years ahead will see more and more such efforts as the network of services for the over-18-year-old autism and savant populations expands to provide a comparable network of services available to them during their regular school years. A very comprehensive Transition Tool Kit is available from *Autism Speaks* either as a printed version or downloaded at the *Autism Speaks* web site (request Autism Speaks Transition Took Kit). It fills a need for practical information for persons with savant syndrome, and their families, in making the transition to adulthood.

A Challenge to the Capabilities of All of Us

Until savant syndrome can be fully understood and explained, there can be no explanation and understanding of the full intricacy and capacity of the human brain. For no model of brain function, including memory, will be complete until it can fully incorporate and elucidate how it is possible to have such a jarring juxtaposition of ability and disability within the same individual. While that question has intrigued all the researchers approaching it, this past century and a quarter since first described by Down, newer

technologies now make it possible to more clearly unravel this remarkable condition, with all the implications it has for better understanding not just the savant but in better understanding brain function in everyone in terms of talent, skills, learning, memory, and creativity itself.

But there is more to savant syndrome than just neurons, circuits, and the brain's marvelous intricacy. Future research findings will surely be of great *scientific* interest. But there are many lessons to be learned as well of *human* interest from these remarkable people and their equally remarkable families, caregivers, teachers, and therapists that surround them. These people that care *about* the savant, as they care lovingly *for* them, provide valuable examples of the power of unconditional positive regard, support, encouragement, patience, and optimism that benefit anyone "differently abled" (as it is sometime called) with savant syndrome and autism. The investigation of both the scientific interest of the savant, as well as the human interest involved, can provide valuable and unique insights into actualizing and maximizing human potential in whomever, and in whatever quantity, it exists within all persons.

See Also

- ▶ Autistic Disorder
- ▶ Autistic Savants
- ▶ Weak Central Coherence

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SB5

► Stanford-Binet Intelligence Scales and Revised Versions

SCAN-A (Adults)

► Screening Test for Auditory Processing Disorders

SCAN-C (Children)

► Screening Test for Auditory Processing Disorders

Scavenging

► Pica

Schaffer v. Weast (Burden of Proof in Moving a Child to Another Placement)

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Synonyms

Schaffer v. Weast and the Burden of Persuasion

Definition

The party seeking relief bears the burden of persuasion under the Individuals with Disabilities Education Act (IDEA). A burden of persuasion is "a party's duty to convince the fact finder to view the facts in a way that favors the party."

In *Schaffer v. Weast*, the United States Supreme Court ruled that the party challenging the status quo bears the burden of persuasion under the IDEA. In *Schaffer*, the plaintiff, Brian Schaffer, suffered from learning disabilities and speech-language impairments. Believing that Brian required more intensive attention, Brian's parents initiated a due process hearing challenging the public school's Individual Education Plan (IEP). The Supreme Court ruled that Brian's parents, as the party seeking relief from the school's IEP, must prove that the school's proposed IEP was inadequate to meet Brian's needs.

The Court reached this decision for various reasons. First, the Court noted that, with few exceptions, under Anglo-American law, the burden of persuasion is traditionally placed on the party challenging the status quo. Second, there was no reason to believe that Congress intended to place the burden of persuasion on defendants. In addition, the Administrative Procedure Act (APA) governs initial IEP challenges. The APA places the burden of persuasion on plaintiffs. By incorporating the APA into the IDEA, Congress intended to place the burden of persuasion on

plaintiffs. Third, pragmatically, placing the burden on school districts as a matter of course would squander public funds because school districts would be forced to litigate every IEP prior to implementation. Congress has repeatedly amended the IDEA to reduce the expense of enforcement. Thus, Congress did not intend school districts to incur great costs litigating each IEP before implementation. Fourth, Congress provided for equal access to information for parents challenging an IEP. This includes parents' rights to review all records on their child, an independent evaluation of the child, and options rejected by the school board. Thus, Congress provided parents with some resources necessary to challenge an IEP.

Implications for ASD Students

Customarily, parents challenge IEPs. A school district challenging an IEP, however, would also assume the burden of persuasion.

The IDEA currently requires school districts to provide voluntary mediation sessions. These sessions attempt to resolve disputes without litigation. Additionally, parents are encouraged to play a major role in the design of services to meet the student's particular needs.

Litigation Strategies

Practitioners should be aware that school districts need not disclose evidence of how other similarly situated children with ASD have performed in either analogous or dissimilar placements. Parents challenging an IEP should obtain trained legal and psychological counsel as many practitioners report using knowledge and language beyond that of a lay person's understanding to their advantage. If parents cannot afford professional help, however, their complaint will not be dismissed because "parents have a recognized legal interest in the education . . . of their child." Parents who meet their burden are entitled to reimbursement for expenditures if the school district has not made a "free appropriate public education available to the child."

See Also

▶ Individuals with Disabilities Education Act (IDEA)

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Schaffer V. Weast and the Burden of Persuasion

► Schaffer v. Weast (Burden of Proof in Moving a Child to Another Placement)

Schedule of Reinforcement

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Definition

General Definition

A schedule of reinforcement specifies the relation between one or more responses (i.e., response classes) and one or more reinforcing consequences. In addition to describing when a reinforcing consequence is available, different schedules of reinforcement have been shown to result in different patterns of responding (Ferster & Skinner, 1957). Schedules of reinforcement should be considered during the planning phase for interventions for individuals with autism spectrum disorders (ASDs). In addition, schedules of reinforcement may need to be revised after an intervention has been implemented to ensure continued desirable outcomes and overall long-term success.

Schedules of reinforcement can be particularly important in various applied situations. Careful design and implementation of an appropriate schedule of reinforcement may increase the likelihood of learning a new response (i.e., skill acquisition). For example, an otherwise effective educational intervention may have limited effect if the consequence does not occur often enough, with sufficient immediacy, or with sufficient magnitude or quality. The design of interventions to reduce inappropriate behaviors and increase appropriate alternative behaviors should include careful planning of appropriate schedules of reinforcement to result in desirable short-term and long-term effects.

Historical Background

Much of the earliest work on schedules of reinforcement is credited to the work of B. F. Skinner (Ferster & Skinner, 1957; Green, Sanders, & Squire, 1959; Skinner, 1953). Ferster and Skinner conducted extensive research on the effects of varying the relation between a particular response or pattern of responses and access to reinforcing consequences (e.g., food). Their research showed that the several parameters consistently effected patterns of responses, even when overall amount of reinforcement accessed was similar across conditions. For example, they found that reinforcement could be arranged to result in relatively fast or slow responding with or without pauses after reinforcement depending on how food deliveries were arranged. Research on schedules of reinforcement has continued to show reliable relations between schedules of reinforcement and particular patterns of behavior in both animals and humans.

Current Knowledge

Simple Versus Complex Schedules

Schedules of reinforcement may be separated into two broad categories, simple schedules and complex schedules. Simple schedules arrange a single contingency, such as reinforcement for every fifth response. In a complex schedule of reinforcement, more than one schedule is arranged and more than one schedule may be in effect at a given time. It is likely that real-life situations are associated with many schedules of reinforcement impacting an individual's behavior at any given time.

Simple Schedules

There are two general types of simple schedules of reinforcement, continuous reinforcement schedules and intermittent reinforcement

schedules. In a continuous reinforcement schedule (CRF), each occurrence of a response is reinforced. An example of a CRF schedule is the child's parent praises the child every time a child correctly places a puzzle piece. In contrast to CRF reinforcement schedules, intermittent reinforcement schedules arrange a reinforcer for some but not all occurrences of the target behavior. To use the puzzle example again, an intermittent schedule of reinforcement would mean the child's parent providing praise after some but not all correct placements of puzzle pieces.

Recommendations often include using CRF schedules when beginning a new intervention, such as to increase or improve communication (Cooper, Heron, & Heward, 2007). The rationale for using a CRF schedule during the initial phases of teaching has to do with increasing the likelihood the learner will contact the contingency between the target behavior and a reinforcing consequence. By increasing the probability of this behavior-consequence relation, the behavior may be more likely to increase (i.e., be reinforced). After the behavior begins to increase, it is often recommended that the schedule be shifted from a continuous schedule to an intermittent schedule.

Intermittent reinforcement schedules can be based on either a *ratio* or *interval* schedule. In a ratio schedule, reinforcement occurs after a specified number of behaviors have occurred (e.g., reinforcement will occur after 5 sit-ups are completed). In an interval schedule, reinforcement occurs after the first response after a specified time period passes (e.g., the first request that occurs after 30 min have passed will be reinforced).

In addition to the ratio or interval schedule arrangement, intermittent schedules will also be either *fixed* or *variable*. In a fixed schedule, the criterion for reinforcement remains exactly the same for each opportunity (e.g., reinforcement will occur after every fifth sit-up). However, in a variable schedule, the specific criterion for reinforcement will vary for each opportunity and the schedule is usually expressed as the mean (e.g., reinforcement may occur after anywhere between 2 sit-ups and 10 sit-ups but will occur after a mean of 5 sit-ups).

Taken in combination, interval schedules are often described as fixed ratio (FR), fixed interval (FI), variable ratio (VR), or variable interval (VI) schedules. Each schedule, the associated pattern of responding, and examples will be presented below.

Fixed Ratio (FR) Schedules

Fixed ratio schedules of reinforcement specify that reinforcement will occur after a constant number of occurrences of the target behavior. For example, if the target behavior is correctly spelling one's name and an FR3 schedule is used, then the reinforcer would be presented after every third correctly spelled name.

Researchers have shown that FR schedules maintain a relatively high rate of responding. However, FR schedules are also associated with a post-reinforcement pause: After accessing a reinforcer, there is often a pause before the person again begins to engage in the target behavior (see Fig. 1).

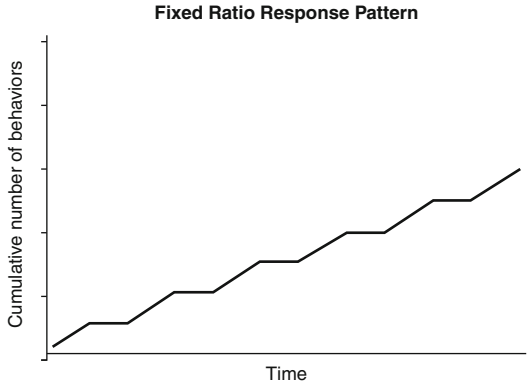
Variable Ratio (VR) Schedules

Variable ratio schedules of reinforcement specify the mean number of responses that will occur to access reinforcement. Thus, across subsequent reinforcer deliveries, sometimes the number of target behaviors will be greater or less than the mean. To again use the example of correct name spelling, the behavior could be reinforced on a VR 3 schedule. Under this schedule, the reinforcer might be delivered after 1, 5, 2, and 4 correct instances of name writing, the mean of which is 3.

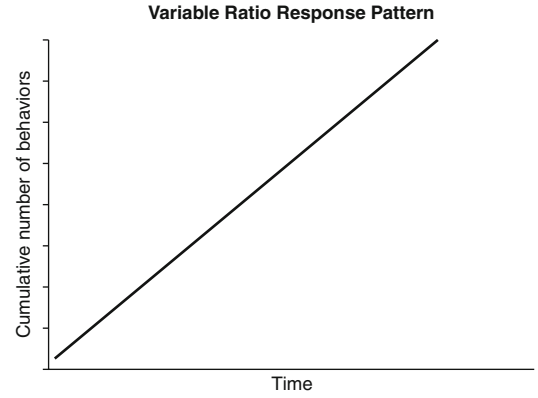
Researchers have consistently found that VR schedules of reinforcement result in a relatively high rate of responding. Variable ratio schedules do not result in post-reinforcement pauses, which is in contrast to FR schedules (see Fig. 2).

Fixed Interval (FI) Schedules

Fixed interval schedules of reinforcement specify reinforcement will be delivered for the first response after a predetermined amount of time has elapsed. Reinforcement on a FI schedule is still contingent on the target behavior, so while the fixed interval may be 5 min, reinforcement will not be delivered until after the target behavior



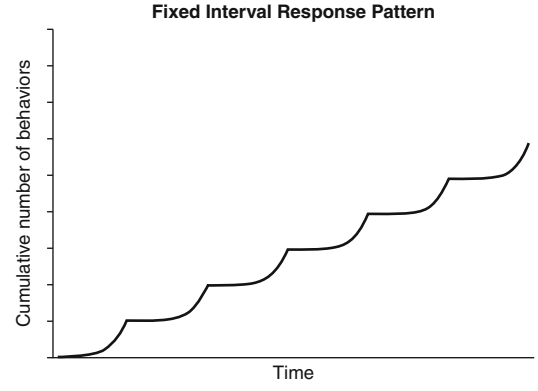
Schedule of Reinforcement, Fig. 1 Illustration of characteristic pattern of responding under a FR schedule, note the stable rate of responding (indicated by the constant increasing slope) and the post-reinforcement pause (indicated by the flat sections of the data path)



Schedule of Reinforcement, Fig. 2 Illustration of characteristic pattern of responding under a VR schedule, note the stable and relatively high rate of responding and no post-reinforcement pause; also note rate of responding is generally higher in a VR schedule than a VI schedule

occurs. For example, on a FI 5-min schedule, reinforcement for requests for a break may not be granted until after 5 min have passed, so a request at 4 min would not be reinforced. However, if the person requests a break after another 4 min have passed (i.e., a total of 8 min have elapsed), then the request would be reinforced.

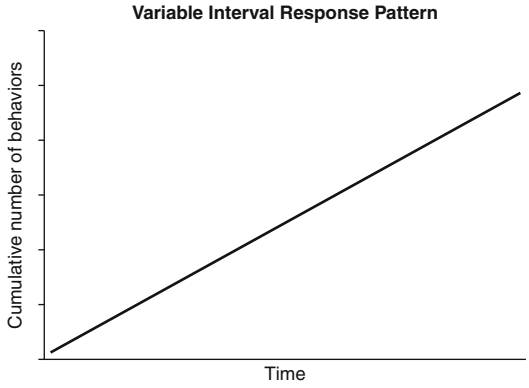
Researchers have often found that FI schedules of reinforcement result in a characteristic pattern. Immediately following reinforcement, there is usually period of time with no responding (a pause similar that which is seen in FR schedules); the behavior then begins to occur at a low to moderate rate before achieving a high rate just before the interval ends. This pattern of slow responding at the beginning of the interval and fast responding at the end has been called the FI scallop due to the unique shape when performance is graphed on a cumulative record (see Fig. 3). While this pattern of responding has been consistently found with research using animal subjects, the FI scallop pattern of responding with human participants has been less reliable (See Chance, 2009).



Schedule of Reinforcement, Fig. 3 Illustration of characteristic pattern of responding under a FI schedule, note the FI scallop comprised of increasing rate of responding leading to high rate responding (indicated by the progressively increasing slope) and the post-reinforcement pause (indicated by the flat sections of the data path following the steep/high-rate responding)

Variable Interval (VI) Schedules

Variable interval schedules of reinforcement arrange reinforcement for the first behavior that occurs after a certain amount of time has passed. However, the length of each reinforcement interval may differ from the preceding and subsequent intervals. VI schedules are arranged such that individual intervals will vary around a mean interval. For example, a VI 10-min reinforcement schedule could be selected for the behavior of requesting a break. Under this schedule, reinforcement might be delivered for the first response after 6 min for one interval and after 15 min for a different interval. Over subsequent intervals, reinforcement would become available after 10 min had passed, on average. Again, it is important to



Schedule of Reinforcement, Fig. 4 Illustration of characteristic pattern of responding under a VI schedule, note the stable and moderate rate of responding (as compared to the VR schedule) and no post-reinforcement pause

remember that reinforcement does not occur after the interval time passes; instead, reinforcement occurs following the first target behavior observed after the interval time has passed.

Researchers have consistently found that VI schedules of reinforcement result in moderate rate behavior. In addition, the VI schedule is not associated with a post-reinforcement pause (see Fig. 4).

Additional Simple Schedules

Differential Reinforcement

Several schedules of reinforcement have been considered differential reinforcement schedules. These schedules of reinforcement are designed to increase a particular behavior relative to other behaviors or increase the occurrence of a particular pattern of behavior. Differential reinforcement schedules include differential reinforcement of other behavior, differential reinforcement of incompatible behavior, differential reinforcement of alternative behavior, differential reinforcement of high-rate behavior, and differential reinforcement of low-rate behavior.

Differential Reinforcement of Other Behavior (DRO)

Differential reinforcement of other behavior schedules arrange reinforcement for the nonoccurrence of a particular target behavior. DRO schedules are often arranged using a time-based criterion for reinforcement, for example, a child might be reinforced if they have not engaged in disruptive behavior for 10 min. In this example, the goal of the DRO schedule is to increase the occurrence of other behaviors (i.e., any behavior that is not the disruptive behavior).

Differential Reinforcement of Incompatible (DRI) and Alternative Behavior (DRA)

Differential reinforcement of incompatible behavior schedules arrange reinforcement for a target behavior that is incompatible with another behavior (the second behavior is often an inappropriate behavior). A DRI schedule, for example, could arrange reinforcement for having hands folded on one's lap. In this example, placing folded hands in one's lap is incompatible with hitting peers and may therefore contribute to reducing the occurrence of hitting peers and increasing hand folding. In other words, folding hands and hitting others cannot occur at the same time.

Similar to DRI, differential reinforcement of alternative behavior arranges reinforcement for a particular target behavior and is often designed to help reduce an inappropriate behavior. In contrast to DRI, the reinforced behavior in a DRA schedule is not incompatible with the other behavior, so the two behaviors could, in theory, occur at the same time. However, the behavior targeted for reinforcement in the DRA schedule can be selected, in part, because it is unlikely to occur at the same time as the behavior targeted for reduction. A DRA could be arranged to increase a child's hand-raising as part of an intervention to reduce hitting peers. In this case, it is possible that the child could hit a peer with one hand while raising other hand, but this may be unlikely.

Functional communication training (FCT) is a special case of DRA. In FCT, an appropriate, communicative response is reinforced as part of an intervention to reduce the occurrence of an inappropriate response (see Carr & Durand, 1985 for early research on FCT). In the case of FCT, the appropriate response is a communicative response that accesses the same reinforcer as the inappropriate behavior. For example, a child's hitting might be maintained by removal

of work, so FCT could be used to reinforce asking for a break from work.

Differential Reinforcement of Low-Rate Behavior (DRL)

Differential reinforcement of low-rate behavior arranges reinforcement for behavior occurring below a specific rate criterion. The goal of a DRL schedule is to reduce the rate of the target behavior without completely eliminating it. DRL might be used, for example, to reduce the rate of repeating requests to play with a particular toy. The DRL schedule could arrange reinforcement for a request only when a sufficient amount of time passed since the previous request. There are several ways in which the rate of behavior can be calculated, but the outcome is similar regardless of the method used to calculate the rate, and reinforcement only occurs when behavior occurs at or below a target rate.

Differential Reinforcement of High-Rate Behavior (DRH)

Differential reinforcement of high-rate behavior arranges reinforcement for behavior occurring above a specific rate criterion. The goal of DRH schedules is to increase the rate of a particular behavior. DRH could be used to increase the rate of behaviors such as correctly typed words per minute. In this example, reinforcement could be arranged only for correct typing that occurs above the criterion level for words per minute.

Time-Based Simple Schedules

While schedules of reinforcement are typically based on the occurrence of target behavior, they may also be used to arrange reinforcement at particular times, regardless of behavior. In time-based schedules, a stimulus or event with demonstrated reinforcing properties is delivered at specific times whether or not the target behavior has occurred. These time-based schedules are sometimes called *noncontingent reinforcement* (NCR) because the consequence is not contingent on a particular response.

Time-based schedules can be arranged as either fixed-time or variable-time schedules. In a fixed-time (FT) schedule, the reinforcer is delivered at a specific time, such as every 30 min (e.g., FT 30-min schedule). Reinforcers can also be arranged on a variable-time (VR) schedule, such that the reinforcer is delivered after differing amounts of time, varying around an average. For example, reinforcement could occur after 10 min, 15 min, and 20 min for an average of 15 min (which would be a VR 15-min schedule).

Time-based reinforcement schedules have been used in interventions to reduce inappropriate behavior. Researchers have shown that when reinforcers are delivered every so often (i.e., on a FT or VT schedule), the target behavior may decrease (e.g., Vollmer, Iwata, Zarcone, Smith, & Mazaleski, 1993). This reduced level of inappropriate behavior has often been attributed to a decrease in motivation for the reinforcer for the target behavior. For example, if a child engaged in hitting because it has resulted in attention in the past (i.e., attention is the reinforcer), using a VT schedule, an adult might provide attention every 5 min on average. With the VT schedule in place, the child may receive sufficient access to adult attention and therefore not engage in hitting others.

Complex Schedules

There are a variety of ways in which several schedules of reinforcement can be combined. When two or more simple schedules are combined, the resulting schedule is called a *complex schedules*. Complex schedules can include two simple schedules operating simultaneously, called a concurrent schedule. Complex schedules can also include two or more simple schedules that occur in a particular order, such as multiple schedules or mixed schedules. Furthermore, complex schedules can include a combination of schedules occurring at the same time at some times and in a particular order at other times (e.g., concurrent chains schedules). These complex schedules can be analogous to common situations in which a person must choose between two or more behaviors and reinforcement contingencies.

Future Directions

Research on schedules of reinforcement can still be seen today, though it may not be discussed as such. An important outcome for individuals with ASDs is increasing and maintaining appropriate behaviors while decreasing and eliminating inappropriate behaviors. Researchers and practitioners should continue to look at the relation between reinforcement and acquisition of appropriate behaviors (e.g., social skills, academic behaviors, personal care) with a particular focus on potential relations between reinforcement schedules during learning and extent to which learned behaviors maintain when some or all supports are removed. Recent research in behavioral momentum (see Nevin & Grace, 2000 for a review of behavioral momentum) has illustrated that overall reinforcement in a context may play an important role in maintenance of behavior (i.e., behavioral persistence). Other researchers have used progressive ratio schedules to examine maintenance of behavior (see Roane, 2008 for a discussion). Ultimately, much of the success of individuals with autism will be based on their acquisition of appropriate behaviors, and schedules of reinforcement play a key role in both the speed at which behaviors may be acquired and the extent to which the learning will be demonstrated independently after interventions are removed or reduced.

See Also

- ▶ Applied Behavior Analysis
- ▶ Behavior Analysis
- ▶ Negative Reinforcement
- ▶ Positive Reinforcement
- ▶ Reinforcement

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Schedules

▶ Daily Routines

Schizophrenia

▶ Psychotic Disorder

Scholarships

▶ FAFSA

Scholz's Disease

▶ Metachromatic Leukodystrophy

School Function Assessment

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Synonyms

School function assessment (test); SFA

Abbreviations

CP	Cerebral palsy
LD	Learning disability(ies)
VABS	Vineland adaptive behavior scales

Description

"School function," as used by the School Function Assessment (SFA), refers to a student's ability to perform important *nonacademic* functional activities that support or enable participation in the academic and related social aspects of an educational program. The SFA (Coster, Deeney, Haltiwanger, & Haley, 1998) is a criterion-based instrument intended to facilitate collaborative program planning as it relates to elementary school students with disabilities. It provides measures of the student's current level of participation in, and performance on, functional tasks as well as supports needed to perform functional tasks. The content of the SFA covers all major areas of functioning related to the school setting, which includes within and outside classroom settings. Specific attention is given to areas of functioning that may be particularly demanding for students with physical and/or sensory impairments.

The SFA is a judgment-based questionnaire-style assessment to be completed by one or more professionals who consistently work with or observe the student, such as a teacher, aide, or school psychologist. The SFA has three components: participation, task supports, and activity performance. Each component has a varying number of scales.

The participation component (part I) evaluates the extent to which the student participates in the six major school activity settings: (a) general or special education classroom, (b) playground or recess, (c) transportation to and from school, (d) bathroom and toileting activities, (e) transitions to and from class, and (f) mealtime or snack time. Participation in each setting is measured on a 6-point scale: *1, participation extremely limited; 2, participation in a few activities; 3, participation in all aspects with constant supervision; 4, participation in all aspects with occasional assistance; 5, modified full participation;* and *6, full participation*.

The task support component (part II) evaluates the supports currently provided to the student during school-related functional tasks. Supports can include adult help (assistance) or specialized equipment or materials (adaptations). The task support component consists of four scales: physical task support assistance, physical task support adaptations, cognitive/behavioral task support assistance, and cognitive/behavioral task support adaptations. Supports are measured on a 4-point scale: *1, extensive assistance or adaptations; 2, moderate assistance or adaptations; 3, minimal assistance or adaptations;* and *4, no assistance or adaptations*.

The activity performance component (part III) evaluates the student's performance on school-related functional activities. The activity performance component consists of 18 scales, each of which examines in detail one of the tasks addressed in part II: travel, maintaining and changing position, recreational movement, manipulation with movement, using materials, setup and cleanup, eating and drinking, hygiene, clothing management, functional communication, memory and understanding, following social conventions, compliance with adult directives and school rules, task behavior/completion, positive interaction, behavior regulation, personal care awareness, and safety. Activity performance scales are measured on a 4-point scale: *1, does not perform; 2, partial*

performance; 3, inconsistent performance; and *4, consistent performance*.

Interpretation of SFA results can provide information about the student's general functioning as well as help identify strengths and weaknesses in functioning. Scores on the participation and task support components may be useful in identifying priority areas for intervention (Silverman, Stratman, & Smith, 2000). Scores on the activity performance component may be useful in identifying specific functional activities that most limit the student's participation. A functional profile of the student's strengths, weaknesses, and needs for task supports can be created using each component of the SFA. This functional profile may be used to facilitate collaborative program planning for the student.

Historical Background

The SFA was developed to evaluate activity participation, task supports, and functional skill mastery related to *nonacademic* tasks in a school setting (Coster, Mancini, & Ludlow, 1999). It was intended for use with students with disabilities, especially in the development of specific objectives on the student's individual education plan (IEP). The fundamental belief behind the use of the SFA is that nonacademic task performance within the school setting can have a significant impact on the student's educational successes and difficulties.

With the authorization of the Education of All Handicapped Act in 1975, schools were required to remove barriers that limited students with disabilities from participating in appropriate educational programs and to ensure educational programming and support services are effective. As inclusive practices in special education programs increased, it became increasingly apparent that an adaptive behavior instrument that takes into account a variety of school-related performance expectations (physical, cognitive, and social) and the degree of task mastery was needed. As a comprehensive, criterion-referenced instrument, the SFA was designed to meet those needs.

The SFA differs from other predominantly norm-referenced adaptive behavior instruments in several ways (Coster et al., 1999). First, ratings on the SFA are criterion based, meaning the student's score is compared to a set "cutoff" score instead of an age-based or grade-based peer group. Thus, if the student reaches a designated cutoff score, mastery has been attained for the skill being measured. The criterion-based rating scale makes the results of the SFA valuable when identifying specific objectives to address in the student's educational program (Reschly, 1990). Second, the SFA takes into account the effects of physical impairments on the student's ability to perform everyday nonacademic activities such as moving around the classroom, interacting with peers, and eating a meal. Third, the SFA evaluates the extent to which the student's physical and social environment affects their performance on functional tasks.

Psychometric Data

Although the SFA is referenced in, or is the focus of, over 20 articles in refereed journals, there are limited data on the psychometric qualities of the SFA beyond those provided by the test authors when the SFA was published (Coster et al., 1998). Nonetheless, the existing psychometric data mostly are at least adequate, and in many cases more than adequate. Several types of data are summarized below.

Development and Standardization. The development of the SFA followed the conventional strategy of developing a large pool of items, using information from a pilot study to cull these items down to a smaller set, then having a national tryout study to finalize the items and structure. At various points, item response theory procedures were used to assess the dimensionality of the scales and other issues (Schafer, 2001). Following the finalization of the scales, the SFA was standardized on 363 elementary-age students with special needs and 315 general education students. Data on the students with special needs were collected at 112 sites in 40 states and Puerto Rico. The distribution of students'

race/ethnicity closely paralleled the 1990 census data distribution. However, the sample was strongly slanted toward higher SES students. The mean parental education level was between two and three years of college education. The test authors (Coster, Deeney, Haltiwanger, & Haley, 2008) categorize 50% of the parents of the students with special needs and 65% of the parents of the general education students as "high" SES, although it is not clear exactly how this classification was made. Although the size of the total sample is substantial, the number of students per grade ranges mostly from 35 to 60, with one grade by disability status sample size of 20. Given that the criterion cut scores were derived based on the measured performance of general education students at particular grade or age levels, the very modest number of students at each grade level in the standardization sample is a cause for concern.

Reliability. Internal consistency of the SFA's scales appears to be very good. Coefficient alphas ranged from .92 to .98 for the students with special needs in the standardization sample. A sample of 29 students with special needs retested between two and four weeks apart produced stability coefficients ranging from .90 to .99 for the primary scales, although some of the optional scales showed coefficients as low as .80 (Schafer, 2001). Notwithstanding the positive reliability data, conclusions about internal consistency and stability are tentative given the small amount of data and data that are all from the test authors' research. Given that the SFA is a judgment-based instrument, it is surprising that the original publication did not include any data on interrater agreement. Indeed, in a separate publication, one of the scale's authors (Coster et al., 1999) defends this lack of data based on the difficulty of having two respondents with "equal knowledge" of the student. One study (Davies, Soon, Young, & Clausen-Yamaki, 2004) found moderate interrater agreement between teachers and occupational therapists (participation, .70; task supports, .68; activity performance, .73).

Validity. There is scant empirical evidence regarding the validity of the SFA, and the evidence raises some questions about the instrument. Two studies investigated the SFA's structural validity, i.e., the degree to which the instrument's purported structure holds up to empirical investigation. Analysis of data (principal axis factoring, oblique rotations) from two national samples of students with disabilities ($N's = 266, 341$) produced two substantially correlated factors ($r = .60, .51$ for the two data sets), labeled by the researchers (Coster et al., 1999) as *cognitive/behavioral function* and *physical function*. Nearly all of the items in both analyses had high cross loadings (>.40), suggesting that there is not a simple structure to this scale. Taking a different tact, Hwang and Davies (2009) analyzed the items comprising the activity performance scales using Rasch goodness-of-fit criteria and concluded that 15 of the 18 scales were unidimensional. Additional research is needed to clarify the structure of the SFA.

Beyond the question of internal structure, evidence for validity is largely in the form of content analysis. During the development of the instrument, expert panels were used to evaluate item content using recognized, acceptable procedures for content analysis. Schafer (2001) notes that the manual presents some data on each of four hypotheses that would support construct validity, but that evidence is small such that further research is needed. Hwang, Davies, Taylor and Gavin (2002), using a sample of 64 children ages 6–14 without disabilities ($N = 29$), with learning disabilities (LD, $N = 18$), and with cerebral palsy (CP, $N = 17$), found significant correlations ($r = 0.56 - 0.72$) between the classroom edition of the Vineland Adaptive Behavior Scales (VABS) and comparable scales of the SFA. These researchers also found that the SFA scores were able to correctly classify group membership for large proportions of these students (93% of students without disabilities, 56% of students with LD, and 88% of students with CP). However, the Hwang et al. results raise more questions than answers. First, the test authors depict their test and its value as measuring something *other than* adaptive behavior. So, the substantial correlations with the VABS do not provide support for the authors' claims and weaken the argument that the SFA

provides a useful alternative to the more commonly used adaptive behavior scales – at least in terms of divergent validity with adaptive behavior scales. Second, the SFA's ability to distinguish between groups of students with and without disabilities (particularly between those with cerebral palsy and those without) has value, but the SFA is not presented primarily as a diagnostic instrument (see section "Clinical Uses" below).

Information on an important aspect of the SFA's validity is missing, namely, what some refer to as "consequential validity," i.e., what difference does the use of the test actually make (Schafer, 2001). Given the test authors' accent on the SFA's value in intervention planning for individual students, some evidence for the test's value on this function is needed. Partially addressing this issue, Silverman and Smith (2006) adapted the SFA to make it more able to assess the effects of using assistive technology. Research results showed that the use of the adapted SFA vs. the original SFA produced clinician's interpretations regarding assistive technology that were more in line with experts' interpretations. This study, though valuable, focuses on a narrow objective (assistive technology interpretations) and specifically studies an *adaptation* of the SFA, not the published version. To be fair, very few tests that purport to be useful in treatment planning provide empirical data to validate those claims; the SFA is not alone. Nonetheless, the ability to use SFA scores, including scores from individual items, to develop interventions or accommodations is one of the SFA's major claims as stated clearly in the publishers' materials, "...there is an increasing need for a standardized instrument to guide assessment and program planning more systematically. The SFA was designed for this purpose" (Pearson Assessments, 2008, p. 2).

Summary. The SFA is a carefully well-developed instrument, but one for which the standardization may be questionable given the nature of the instrument. Specifically, the instrument relies on cut points based on identifying functional levels at the 95th percentile of typically developing children, but with modest numbers of children at each grade level in the standardization sample. Internal consistency and temporal stability of the primary scales appear to be very good, although caution must be applied here given the relatively modest amounts of data and data largely from the test authors themselves. There is inadequate data (only one study) on interrater agreement, a critical issue for any judgment-based scale, and the available data show only moderate levels of agreement. More research is needed on internal structure of the instrument and also on basic validity indices. Available evidence challenges the test authors' strong claim that the SFA taps something very different from the more typically used adaptive behavior scales.

Clinical Uses

Most researchers and practitioners who focus their work on autism are likely to have little familiarity with the SFA. Although the SFA was designed to "...facilitate collaborative program planning for students with a variety of disabling conditions..." (Pearson Assessments, 2008, p. 1), its reported use in the published literature is nearly entirely with reference to children with very significant motor impairments, e.g., cerebral palsy. The vast bulk of research on the SFA is in the professional occupational therapy literature. As a measure of nonacademic functioning of students with significant motor impairments, the SFA stands up well to other judgment-based systems for use with this population (Sakzewski, Boyd, & Ziviani, 2007).

To be certain, many students with autism do have motor impairments as a part of their overall disability, but unless the given student's motor impairments are very significant, the SFA may not be the best choice for assessing nonacademic functional behavior. Piersel (2001) argues that the SFA really *is* another measure of adaptive behavior and that individual items from the more commonly used adaptive behavior scales could also be used in the idiographic manner that the SFA's authors recommend for using SFA items. Given the much greater research base for scales like the VABS, Piersel

recommends using these instruments rather than the less-well-researched SFA. At least for students with autism whose motoric impairments, if any, are less than severe, Piersel's recommendation seems to be well founded.

See Also

- ▶ Adaptive Behavior
- ▶ Adaptive Behavior Scales
- ▶ Cerebral Palsy
- ▶ Occupational Therapy (OT)
- ▶ Vineland Adaptive Behavior Scales

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School Function Assessment (Test)

- ▶ School Function Assessment

School Harassment

- ▶ Bullying

School Psychologist

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Definition

School psychology is the specialization of the professional practice of psychology that is concerned with children, youth, and families and the schooling process. The field of school psychology combines a unique knowledge base

with that of related fields including clinical and educational psychology in order to focus on the individual study of children's learning and adjustment primarily in educational settings.

School psychologists primarily administer psychological and educational tests and conduct observations and interviews in order to better understand areas of concern and abilities that may be present for a student. School psychologists also consult with parents and educators and develop behavioral and teaching-based strategies to improve academic and socioemotional outcomes and support students with learning and behavioral disabilities.

See Also

- ▶ Educational Psychology
- ▶ Educational Testing

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School to Work Transition Process

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Definition

"'Transition' refers to a change in status from behaving primarily as a student to assuming emergent adult roles in the community. These roles include employment, participation in post-secondary education, maintaining a home, being appropriately involved in the community, and experiencing satisfying personal and social relationships" (Council for Exceptional Children's Division of Career Development and Transition, 1994).

The transition process from school to adulthood, specifically employment, involves the application of educational experiences into successful employment. The educational experiences that are applied in adulthood involve more than employment: both community living and experiencing personal and social relationships impact successful quality of life as an adult.

Historical Background

If one looks back 20 years, students with autism were being educated either in generic disability classrooms or in residential institutions. There were no discussions regarding adults with autism, as many were institutionalized or living at home with their aging parents.

As the awareness of the unique needs of individuals with autism has increased, evidence-based practices have been established and are being integrated into the public school environment, planning for the school to work transition can now be achieved.

Current Knowledge

In 1975, PL 94:142 authorized the Education of All Handicapped Children Act. This Act mandated a free and appropriate public education for all children regardless of disability. In 1990, the Individuals with Disabilities Education Act, PL 101:475 not only reauthorized the PL-94:142 but extended the requirement for education of children with disabilities and required transition services for children with disabilities. The amendment specifically outlined that special education needed to prepare students for employment and independent living.

Even with this law and clear attempts made by educators to offer educational services that impact success as an adult, two-thirds of Americans with disabilities between the ages of 16 and

64 are not employed (Wehman, 2001). Specifically, many individuals with autism spectrum disorders have completed high school and/or college but are unable to make the transition to employment. For individuals with autism spectrum disorders, particular reasons for this failure may include difficulty with social competencies, communication deficits, behavioral issues, and potential comorbid mental health issues.

Difficulty with social competencies is core to the diagnosis of autism spectrum disorders. Individuals with autism spectrum disorders often have difficulty understanding the nuances of typical social behavior and as such struggle with interacting with others. Individuals with autism spectrum disorders also have difficulty with problem solving and coping, which can all translate to difficulty in the workplace. Teachers and vocational rehabilitation specialists often focus on job competencies rather than social competencies. For individuals with autism spectrum disorders, the job competencies may be secondary and the social competencies need to be a primary focus during the school age years.

In addition to challenges with social competencies, individuals with autism spectrum disorders often struggle with communication. They may have difficulty initiating or maintaining a conversation, often will not use facial expressions, body language, or other nonverbal behaviors to complement their social communication interaction. Effective communication is paramount to success in a job placement, as that is what allows for clarification of job requirements, performance, and working effectively with coworkers.

Another area that may negatively impact success in a job placement is behavioral issues. While behavioral issues vary, many individuals with autism spectrum disorders may insist on sameness, regardless of the job at hand, and intense preoccupation with topics or subjects may also interfere with job requirements, as both lead to off-task behavior. Supporting the individual with autism spectrum disorder to self-monitor and control behavioral issues, as well as educating the community to increase understanding and tolerance of these behaviors, is necessary for successful employment of individuals with autism spectrum disorders.

Individuals with autism spectrum disorders may also exhibit comorbid mental health issues. Specifically related to autism in adolescents, there is an increased vulnerability to anxiety disorders and depression (Wehman, Smith, & Schall, 2009). It is essential that individuals with autism spectrum disorders are afforded the appropriate mental health support services to treat such disorders.

Research points to the fact that individuals with autism spectrum disorders can work and obtain a quality of life, but they need support to do so (Wehman et al. 2009). A significant factor to this success will be effective transition planning during the school years. Ideally, transition planning should begin in early intervention, when a young child with autism spectrum disorder begins to be taught important skills that impact social skills, behavior, communication, and independence. These educational themes should be featured throughout a young student's Individualized Education Plan (IEP).

The IEP is the legal document that is a guideline for all transitions. Transition IEPs should include assessments, goals and objectives, and intervention strategies that target priorities for skills that are necessary for success as an adult. The transition IEP team is typically made up of the student, parents, special education teacher, general education teacher, community agency personnel, potential employers, and/or vocational rehabilitation counselors. This team is charged with assessing and developing goals and objectives that will meet transition to employment goals as well as effective implementation strategies to do so.

Prior to developing IEP goals and objectives, there needs to be some level of career awareness for the student with autism spectrum disorder. Typically, career awareness begins in the elementary school years when children are exposed to a variety of "community helpers." In the middle school years, students are exposed to career awareness through the content of some academic subjects such as science or English through which they learn about various careers, for example,

scientists or authors. In high school, there is a more specific focus on career awareness as focus is placed on preparation for post-secondary education or vocational and technical training. Individuals with autism spectrum disorders should receive some type of vocational assessment through which potential jobs can be matched to the individual's strengths and interests. These students should also be exposed to job sampling, which allows them to try out a variety of jobs for brief periods of time to actually experience that job. Another avenue for vocational assessment is performance sampling, which is simulated work done in the classroom. This type of assessment results in a more cursory review for job matching.

For students with autism spectrum disorders, there clearly needs to be goals and objectives in the IEP that focus on social competencies, adaptive skills, and work habits. In the area of social competencies, goals and objectives must effectively address the challenges of social interactions, problem solving, coping, and self-management. Adaptive skills should focus on grooming, mobility, health and safety, and money management. Work habits should be addressed through goals and objectives that highlight productivity, attendance, and accuracy in a job.

Once appropriate goals and objectives have been developed and accepted by the IEP team, focus needs to be placed on successful achievement of these goals and objectives. When preparing a student with autism spectrum disorders for employment, it will be necessary for knowledgeable staff to oversee the implementation of goals. The school environment must either have personnel with expertise in autism spectrum disorders or have access to this expertise through consultation. Successful achievement of goals and objectives will only be reached if strategies meet the unique needs of students with autism spectrum disorders. In addition, for successful achievement of transitional IEP goals, there clearly has to be practice of skills beyond the self-contained classroom.

Educational inclusion allows for an individual with disabilities to be appropriately supported to learn in a general education environment. In inclusion, the student with autism spectrum disorder can gain general knowledge and improve their social interactions through peer modeling and practice. Inclusion provides students with autism spectrum disorder the opportunity to be members of the school community and to improve their independence. Achievement of IEP goals and objectives will be partly based on the appropriate balance of specialized direct instruction and inclusion opportunities.

Alongside educational inclusion as a critical component of the school to work transition process is community-based instruction. Community-based instruction is the systematic teaching of students with autism spectrum disorders within the natural community setting. Community-based instruction enhances the transition of a student with autism spectrum disorder to employment, as skills are taught and reinforced in the actual environment where the student will live and work as an adult (Wehman et al. 2009).

When IEP goals and objectives are implemented through community-based instruction, skills are taught where they are expected to occur. This also allows for immediate generalization into the natural environment. Community-based instruction can be implemented at a community college, work site, stores and restaurants, and recreational facilities. When community-based instruction is not possible, it is important that places outside of the classroom in the school environment be used to foster this natural setting. Places such as the cafeteria, library, office, or school grounds can be used for natural environment instruction.

When community-based instruction is focused specifically on employment, it is essential that the IEP team assess the local community in regard to the availability of jobs. The IEP team will also have to match the job to student interests and capabilities and determine whether instruction needs to begin before the job placement or if on-the-job training can be implemented from the beginning.

There are supports beyond the IEP that are positive factors leading to successful employment for young adults with autism spectrum

disorders. It is important that, as students with autism spectrum disorders approach their 21st birthday and enter a world with no entitlements, community supports are secured. Vocational rehabilitation services are available in all states in the USA. It is important that a relationship is developed with vocational rehabilitation services in order to prepare for the transition from school supports to post-21 supports. This may specifically be noted in transitioning from school staff to a job coach who can be available for the individual with autism spectrum disorder once they have graduated and are at a specific job placement.

Another important support that needs to begin prior to the 21st birthday of an individual with autism spectrum disorder and should be part of the transition from school to work is the development of appropriate supports on the job site. The good news in 2011 is that the general public is much more familiar with autism spectrum disorders than it was in 2000. As part of this general public awareness, coworkers, supervisors, and employers have the potential to have some knowledge base regarding autism spectrum disorders before the student is employed. It is important that this awareness be expanded upon and include specific information about a particular student with autism spectrum disorder so that appropriate supports can be provided by these coworkers, supervisors, and employers. Not only will this continue to increase understanding and tolerance for the unique characteristics of autism spectrum disorders, but it will also allow a coworker or supervisor to provide support that potentially a job coach would have provided. Job coaches need to be faded, and as such, if the natural supports in the work site can support the individual with autism spectrum disorder, the more successful they will be.

Future Directions

Increased awareness of the supports that individuals with autism spectrum disorders need to achieve successful employment can be viewed as a positive prognostic indicator for the future. It is evident that the payoff of appropriate education of students with autism spectrum disorders will be a new generation of successfully employed individuals. The pressure must be felt during an individual with autism spectrum disorder's entitlement years of education to effectively prepare that individual for adulthood.

See Also

- ▶ Individualized Transition Plan (ITP)
- ▶ Transitional Living
- ▶ Transition Planning

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School-Aged Children

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Definition

The school-aged period encompasses the years between early childhood and adolescence, during which many children step out into the world outside the family for the first time. The characteristic symptoms and clinical signs of autism spectrum disorders are typically detected prior to the school-aged period, during early childhood. The diagnostic criteria for autistic disorder listed in the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR, 2000) specify that the onset of symptoms occurs prior to the age of 3 years (DSM-IV-TR, 2000). There is significant focus on the identification of children on the autism spectrum during the early childhood years. However, not all children with autism spectrum disorders are identified prior to school enrollment. Moreover, the school-aged years present children with autism spectrum disorders with ongoing challenges. The presence of an autism spectrum disorder affects the trajectory and completion of the key developmental tasks of the school-aged years and often requires specialized attention in a number of domains, including mental health, medical, and educational settings.

Historical Background

The school-aged years were once conceptualized by Freud and others as a period of latency, during which sexual drives are suppressed and energies are diverted to the skill mastery challenges of school and peer relationships. Psychologist Erik Erikson identified the actualization of "Industry versus Inferiority" as the critical developmental accomplishment of the school-aged years. Industry refers to a child's increasing competence in a variety of realms that is expected over the course of childhood. Though brain size does not change significantly after the age of 7, the school-aged period is a time of continued maturation of brain processes. Typically developing children become capable of higher level cognitive tasks. They become more adept at mathematics and concrete reasoning, they begin to develop a fund of knowledge about the world, they learn to read and to write, and they begin to develop moral reasoning as well. Their motor skills become more precise and they are able to complete more intricate motor tasks. Social development is marked by the growing importance of peers and the capacity to develop friendships. School-aged children are eventually able to follow rules and to engage in team-based play. The completion of developmental achievements in the cognitive, motor, and social domains allows for a greater independence from parents. If these developmental tasks are not completed, feelings of inferiority and self-doubt may emerge (Combrink-Graham & Fox, 2007).

Autism spectrum disorders characteristically impact all the developmental domains. Significant impairments in social interactions and language development are pathognomonic of classic autistic disorder and occur with varying severity in other spectrum disorders. Intellectual disabilities are also common in children with autism spectrum disorders as are unusual body movements and subtle motor abnormalities such as toe walking and poor coordination. Children with spectrum disorders may require additional supports and interventions to navigate the developmental tasks of childhood (DSM IV-TR, 2000).

In the context of the civil rights movements of the mid-twentieth-century United States, advocacy for more supports and services for children with developmental disabilities intensified, leading to federal legislation supportive of these aims. In particular, the Individuals with Disabilities Education Act (IDEA) of 1975 is a landmark piece of legislation that has had major implications for the educational opportunities available to children with autism. Prior to the enactment of this legislation, many children

with developmental disabilities were excluded from the school system. IDEA stipulates that all children should have access to a free public education that is appropriate to their needs. IDEA was amended in 2004 to promote the use of evidence-based strategies to improve outcomes. IDEA entitles children to an individualized educational plan (IEP) and promotes placement in the least restrictive educational environment possible to meet a child's needs (Bryan, 2010; Steedman, 2007).

Current Knowledge

The particular psychiatric, medical, and educational needs of children with autism spectrum disorders often become evident during the school-aged years.

Mood and Anxiety Disorders in School-Aged Children on the Autism Spectrum

It may be a challenge to detect mood disorders such as depression in children with impaired language skills. However, there is some research that suggests that depression may occur frequently in autistic persons (Skokauskas & Gallagher, 2010). Comorbid anxiety is common in children with autism spectrum disorders. Despite the presence of social impairment, some children are aware of and distressed by difficulties connecting with others. Anxiety can lead to avoidance behaviors and further isolation from peers and community. There is wide variation in the estimates of the prevalence of anxiety disorders in children on the autism spectrum. As many as 40–50% of children in this population may meet criteria for anxiety disorders, including generalized anxiety disorder, separation anxiety, and simple phobias. It can be difficult to determine whether symptomatology represents a separate and coexisting anxiety disorder rather than a manifestation of the autistic disorder itself. Higher functioning children with autism spectrum disorders may be more likely to experience anxiety. There is some evidence that cognitive behavioral therapy and medications (such as the selective serotonin reuptake inhibitors) may be helpful for the treatment of anxiety disorders in children on the autistic spectrum (White, Oswald, Ollendick, & Scahil, 2009).

Behavioral and Social Problems

Aggression and other self-injurious behaviors are also common in children with autism spectrum disorders and can be particularly disruptive in school environments. These behaviors can also pose a safety risk to the children, peers, families, and other caregivers. Aggression is often a target of psychopharmacologic treatment. The atypical antipsychotic medication risperidone is approved by the Food and Drug Administration for the treatment of aggression in children with autism. Other frequently used medications include other atypical antipsychotic medications, alpha adrenergic agonists such as clonidine, mood stabilizers, and stimulants (Parikh et al., 2008).

Since hyperactivity and inattention can be associated symptoms of autism, the DSM-IV-TR stipulates that a separate diagnosis of attention deficit hyperactivity disorder (ADHD) should not be given if autistic disorder is present. Attentional symptoms are nonetheless frequent targets of psychopharmacologic treatments, and there is some evidence that children on the autism spectrum respond differently to medications typically used for ADHD (Reiersen & Todd, 2008). Children with spectrum disorders may also have deficits in executive functions such as planning and mental flexibility, though they tend to perform comparably to controls on tests of inhibition (Hill, 2004).

Social skills do not improve automatically with age in children with autism spectrum disorders. In fact, impairment may become more pronounced over time with the increasing social demands of the school-aged period. Children may become more acutely aware of their social limitations, resulting in feelings of loneliness and distress. Examples of problems with social interactions exhibited by children with spectrum disorders include fixation on restricted interests and inability to read the interest of peers, difficulty with reciprocal conversation, and abnormalities

of expressive language. Social skills training (SST) programs may be available to school-aged children with autism. More research is needed to determine the most effective methods for social skills building (Williams White & Keonig, 2007).

Medical Disorders

In addition to developmental, behavioral, and mood symptoms, children with autism and autism spectrum disorders appear to be at increased risk for a number of medical problems that can occur during the school-aged years. Diagnosis of these medical issues is often a challenge in this population, as children may present with symptoms that are not typical. More time and effort may be needed to arrive at an accurate diagnosis, particularly for children who are nonverbal or who have significant behavioral disruptions. Common medical disorders seen in children with autism spectrum disorders include seizures, sleep disorders, and gastrointestinal disorders (Goldson & Bauman, 2007). As many as one third of children with autism will have a seizure at one point in their lives. Children with co-occurring intellectual disabilities appear to be more likely to have seizures. Though the incidence of seizures is highest in early childhood and in adolescence, seizures can occur at any time during childhood (Volkmar & Nelson, 1990). While a sizable minority of typically developing children will experience sleep problems, two thirds of children on the autism spectrum have sleep difficulties, including insomnia, hypersomnia, enuresis, and nightmares. Poor sleep has been linked to behavioral difficulties and poor school performance (Richdale & Schreck, 2009). Gastrointestinal disorders – such as constipation, diarrhea, and abdominal pain – occur frequently in the general child population; the relative prevalence of these issues in children with autism spectrum disorders has not been clearly established. Gastrointestinal problems may present with behavioral and sleep disturbances in school-aged children with autism (American Academy of Pediatrics [AAP], 2009).

Educational Needs and Accommodations

The educational environment presents a number of opportunities and challenges for children with autism spectrum disorders. Educational programs can provide the foundations for continued education, the development of life and independent living skills, the cultivation of social skills, and employment. Collaboration between parents, teachers, school administrators, and medical and mental health providers is paramount, particularly when developing the individualized educational plan (IEP). The IEP should define specific goals for the academic year and identify a system of modifications and supports to help the child achieve those goals. There are a variety of educational approaches available; interventions should be targeted toward children's specific and individual needs. Evidence-based interventions in schools might include applied behavioral analysis, positive behavioral supports, and assistive devices and technology. The child should be placed in the least restrictive educational environment, and there has been a move toward the inclusion classroom, in which special education services are embedded in the regular classroom. Parents, teachers, and school administrators must work together to determine the appropriate balance of inclusion instruction and separate special education instruction for each child (Noland, Cason, & Lincoln, 2007). Children with autism may process information differently and may benefit from the use of pictures and concrete teaching tools. They also frequently benefit from structured environments and clear expectations (Mukuria & Obiakor, 2008).

Future Directions

Children with autism spectrum disorders often require a number of specialized services during the school-aged years in order to meet their medical, psychiatric, and educational needs. More data about appropriate interventions in these realms are needed. Care coordination between primary care and specialty providers may facilitate accurate diagnosis and effective

treatment of medical conditions. Further efforts to clarify the prevalence and presenting symptoms of certain medical disorders may help inform future diagnostic and treatment guidelines for children with autism spectrum disorders. In particular, the relationship between autism and gastrointestinal and neurologic disorders is an area of active research. Many psychopharmacologic agents are commonly used to treat psychiatric symptoms in this population, but definitive evidence of benefit is not yet available for many medications. Management of long-term medication side effects such as obesity and metabolic derangements should also be a focus of clinical and research attention. More information about the impact of nonpharmacologic interventions such as social skills training would be valuable. There has been a growing emphasis on using scientifically based treatments in the classroom setting, and more data on the implementation and effectiveness of these interventions is also needed.

See Also

- ▶ Applied Behavior Analysis
- ▶ Atypical Antipsychotics
- ▶ Individual Education Plan
- ▶ Individuals with Disabilities Education Act (IDEA)
- ▶ Latency

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University of Chicago, B.A. 1949
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University of Chicago, Ph.D. Clinical Child Psychology 1964

Major Appointments (Institution, Location, Dates)

Professor: Department of Psychiatry, University of North Carolina, Chapel Hill, 1964–2005
Codirector and Director of Division TEACCH, University of North Carolina, Chapel Hill, 1972–2005
Editor, *Journal of Autism and Developmental Disorders*, 1974–1998
Editor, Current Issues in Autism Series, Plenum, 1983–1998

Major Honors and Awards

2006 American Psychological Foundation Gold Medal Award for Life Achievement in the Application of Psychology
2006 International Society for Autism Research Lifetime Achievement Award
2005 Autism Society of North Carolina Lifetime Achievement Award
1993 The North Carolina Award: the highest honor that is awarded citizens of NC
1985 American Psychological Association Distinguished Professional Contributions to Public Service
1985 O. Max Gardner Award from the UNC Board of Governors for great contributions to the welfare of the human race
1977 American Psychological Association Award for Distinguished Contributions to the advancement of knowledge and service
1972 American Psychiatric Association Gold Achievement Award (with Robert Reichler, M.D.)

Landmark Clinical, Scientific, and Professional Contributions

Dr. Schopler conducted some of the first research to use scientific methodology in the study of autism. He continued to promote the importance of quality research in the field of autism throughout his career, especially in his role as editor of the *Journal of Autism and Developmental Disorders*. He insisted that intervention strategies were founded upon sound research so that individuals with autism and their families could select effective interventions and avoid being manipulated by unsupported claims (Reichler and Schopler, 1971; Schopler, 1965, 1966, 2001).

Dr. Schopler was a lifelong advocate for incorporating the parent perspective in autism research and treatment. His research was central to the transition from seeing autism as psychogenic in nature (the refrigerator mother theory) to a scientifically based understanding that autism is developmental in nature (Schopler, 1971, Schopler & Reichler, 1971).

Dr. Schopler along with Robert Reichler, M.D. directed the 5-year NIMH-funded Child Research Project beginning in 1967. This was a landmark study demonstrating that parents are a central component to the treatment of children with autism (Schopler & Reichler, 1971). Results of the study became a model for parent-professional collaboration at a level that was unheard of at the time.

Dr. Schopler was one of the first researchers to document the positive response of children with autism to structured intervention approaches. His research led the field of autism away from unstructured psychodynamic interventions that

were predominant at the time and toward interventions based on an understanding of the learning styles of individuals with autism (Schopler, Brehm, Kinsbourne, & Reichler, 1971; Schopler, Mesibov, & Hearsey, 1994).

Dr. Schopler was the cofounder of Division TEACCH along with Robert Reichler, M.D. TEACCH (an acronym for Treatment and Education of Autistic and related Communication handicapped CHildren) was the first comprehensive statewide program for the treatment of individuals with autism and their families. Under his leadership, Division TEACCH provided accessible services to families in the state of North Carolina. TEACCH integrated provision of a range of services including assessment, parent training, and community-based school, vocational, and residential programs (Mesibov, Shea, & Schopler, 2005).

Dr. Schopler was the cocreator of the Childhood Autism Rating Scale (CARS) (Schopler, Reichler, & Renner, 1988), one of the first standardized diagnostic assessment instruments for autism. Since its original publication, the CARS has been a mainstay of diagnostic assessment. Dr. Schopler began his career with a commitment to evidence-based clinical practice and closed his career by continuing this pursuit, contributing to the development of the most recent version of the CARS, the CARS-2-HF (Schopler, Van Bourgondien, Wellman, & Love, 2010).

Dr. Schopler contributed to the development of the Psychoeducational Profile (PEP) (Schopler & Reichler, 1979) and the Adolescent and Adult Psychoeducational Profile (AAPEP) (Mesibov, Schopler, Schaffer, & Landrus, 1988). These two assessment instruments were based on the premise that understanding an individual's pattern of strengths and weaknesses is essential to selecting successful intervention goals and strategies. The PEP is now in its third edition (Schopler, Lansing, Reichler, & Marcus, 2005), and the AAPEP has been updated as the TEACCH Transition Assessment Profile (Mesibov, Thomas, Chapman, & Schopler, 2007). Both instruments have been translated into several languages and are used by autism programs worldwide.

Throughout his career, Dr. Schopler was devoted to increasing the accessibility of services in North Carolina and around the world. He never tired in his efforts to support parents who have often been the driving force behind service development. His ability to develop collaborative relationships with parents and professionals has led to multiple replications of the TEACCH model that continue today (Schopler, 2000).

Short Biography

With no doubt, Eric Schopler was an individual who had a lasting impact on the field of autism research and intervention. Dr. Schopler was the author of over 200 books and articles about autism. He was the cofounder of the internationally recognized autism treatment program, Division TEACCH. He was the recipient of numerous awards and honors, but above all else, he valued his collaborations with parents and their children with autism. This collaboration between parent and professional was the hallmark of his career. It set him apart from most of the respected professionals of his day who espoused a psychodynamic approach to autism. Dr. Ruth Christ Sullivan, parent and first president of the Autism Society of America commented on his uniqueness as a professional, "Here was a young professional mingling with parents as equals. At the time you could be chastised or ostracized for mingling with parents" (Sullivan, 2005).

Dr. Schopler's sensitivity to the dangers of marginalizing groups began with his childhood in Germany. He was born in Furth, Germany, in 1927. In 1938, his parents, Ernst Schopler and Erna Oppenheimer Schopler, escaped Nazi persecution by emigrating to the United States with Eric and his siblings. A child at the time, Dr. Schopler did not recall direct abuse by the Nazi government, but he recalled friends and teachers who suddenly left or disappeared. Out of his struggle to understand what had happened to his family and all European Jews, a cognitive framework developed that made him ever watchful for abuses of power, particularly within members of his own field, psychology.

He observed just such an abuse with regard to the parents of children with autism and other severe disorders. As a social worker at the Bradley child psychiatric hospital in Providence, RI, Dr. Schopler observed how parents were blamed for their child's disorder. Dr. Schopler found this conclusion to be unsupported by empirical observation. His own observation of the children at Bradley and at the University of Chicago's Research Center for Childhood Schizophrenia made clear that their unusual and frustrating behavior was due to developmental phenomenon such as the way in which they used their senses (Schopler, 1965, 1966). He could identify no way in which the children's behavior was associated with parenting. In his research on parents, he found no evidence that parents of children with autism had higher rates of thought disorders than parents of typical children (Schopler & Loftin, 1969). His conclusion, therefore, was that blaming parents served a purpose unrelated to a true understanding of autism. In his article Parents of Psychotic Children as Scapegoats (Schopler, 1971), Dr. Schopler used the theories of Gordon Allport to identify how mental health professionals had marginalized and undermined the parents of psychotic children (Allport, 1954). Parents of children with autism were, in Dr. Schopler's view, being treated in much the same way that Allport described the treatment of the Jewish community and African-Americans during the 1950s. To Dr. Schopler, the purpose of scapegoating parents was to blame an innocent and powerless group for the failures and frustration of professionals who were unsuccessful in treating autism.

Dr. Schopler's experiences from childhood through graduate school initiated two complementary threads in his career: (1) commitment to empowering disenfranchised parents by establishing the validity of their perspective and their usefulness in treatment, and (2) the means to accomplish the first goal was to ensure that intervention was based on sound empirical observation. The role of the parent was to be a lens through which research could be translated into useful practice rather than treatments devised by researchers which were often irrelevant to the lives of children with autism (Schopler, 2005a). With this mindset, Dr. Schopler arrived at the University of North Carolina at Chapel Hill and joined the Department of Psychiatry where he met a like-minded psychiatry resident, Robert Reichler, M.D. The pair initiated the Child Research Study which demonstrated the efficacy of structured treatments in autism and the need to include parents as cotherapists in their child's treatment. When the study was completed, Drs. Schopler and Reichler had established the empirical evidence to begin the TEACCH program. Dr. Schopler would be the first to remind admirers that TEACCH was not his idea. The idea was generated by the parents participating in the Child Research Study. Parents provided that "lens" which would guide the application of this important research. They also provided the energy and commitment to convince the North Carolina legislature to fund TEACCH. But collaboration was still at the heart of this effort. It is unlikely that TEACCH could have been created without the evidence provided to the legislature by Dr. Schopler, Dr. Reichler, and even the endorsement of Dr. Leo Kanner.

Under his leadership, TEACCH continued to grow, but Dr. Schopler's efforts had an impact far beyond the border of North Carolina and Division TEACCH. In 1974, he took on the position as editor of the *Journal of Autism and Childhood Schizophrenia* (later the *Journal of Autism and Developmental Disorders*) at the request of its outgoing editor, Leo Kanner. He was committed to developing this fledgling journal into a major outlet for soundly completed research. His research standards were high. Dr. Schopler refused, however, to lower the standards of scientific study simply to fill the pages of a journal devoted to a young field. Dr. Schopler used this new role to continue his efforts at marrying research to family needs. He initiated a "parents speak" section in which parents would occasionally weigh in on issues important to the journal. He also added the "Ask the Editor/Expert" section of the journal which invited parents to raise practical questions to be addressed by the editor (Schopler, 1974).

Dr. Schopler's commitment to high scientific standards and awareness of the needs of parents and their children were the foundation for many debates within the scientific and clinical literature. Having begun his career by challenging the leaders of his field, he did not shy from an argument now that he was one of the leaders. In the early days, psychodynamic theories and treatments of autism were an obvious focus of criticism for a researcher endorsing empirical methods. Later controversial topics such as facilitated communication were the object of swift critiques by Dr. Schopler (1992). He was watchful for research claims that exceeded the scope of intervention and played upon the hopes of parents by offering the hope of incredible gains where no evidence for gains of this magnitude could be found (Schopler, Short, & Mesibov, 1989). As the field developed, however, his critiques often took a different tone. Instead of invalidating a proposed intervention, he became a voice for moderation. He often weighed in on arguments by reminding researchers and clinicians of the need for individualization. He recognized from both his professional and personal history the dangers of dogmatically adhering to one approach (Schopler, 1989). He endorsed research that explored the mechanisms that could predict which individuals with autism might respond to an intervention and which might not. He commented on the complexity of this type of discourse and the need to gather many types of data including data that was not easy to quantify (Schopler, 2005b).

Long past his death in 2006, Dr. Schopler's influence continues to grow. His participation in teaching and mentoring young professionals has had an impact on many of the leading researchers and clinicians of our time. The authorship of "over 200 books and articles" is often quoted. It is less frequently noted that his writings have been cited nearly 10,000 times, clear evidence that his work will continue to be read far into the future. His commitment to training others in the TEACCH model has led to replications of the program worldwide. But one of his most lasting contributions is probably one of the least noticed. In large part because of his work, no parent (whose child is seen by a competent professional) will be treated as a scapegoat for their child's autism. Encouraging parent participation in their child's treatment is now the norm. Today, most parents of young children are unaware that that the position of parents was ever different than it is now. This is a gift parents today receive from Dr. Schopler and the parents with whom he collaborated. As mentioned earlier, Dr. Schopler's most valued professional experiences were with individuals with autism and their families. The thanks of parents who knew him most eloquently express Dr. Schopler's commitment to individuals with autism. In a remembrance offered at Dr. Schopler's memorial, Mary Lou Warren recounted when she and her husband first met Dr. Schopler as participants in the Child Research Study in 1967 (Warren, 2006). In just a few sentences, she captures Dr. Schopler as an individual and his core contribution to the field of autism:

> I remember the first time that Frank and I saw Eric. He came out of his office to greet us on our first visit to Trailer 18, just outside the doorway of the Psychiatry wing. He was dressed in a plaid shirt and khaki pants and had mud on his shoes. And I remember asking myself, "Could this be the doctor?!" I was not quite prepared for this, because what I'd been used to was white coats, stiff upper lips, and blank stares. Later that day as we walked down the sidewalk to our car, I had tears in my eyes as I looked at Frank and said, "My God! We have finally found someone who wants to help us."

See Also

- ▶ American Psychological Association
- ▶ Childhood Autism Rating Scale
- ▶ Mesibov, Gary
- ▶ Refrigerator Mother
- ▶ Structured Teaching

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Scoliosis

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Synonyms

Curvature of the spine; Spinal curvature

Definition

Scoliosis is an orthopedic condition when there is lateral curvature of the spine. It can be congenital (present at birth) secondary to malformations of the vertebrae (bones in the spine) or ribs and may be associated with genetic syndromes. Scoliosis can also develop with neuromuscular conditions like cerebral palsy, spina bifida, and muscular dystrophy where there is imbalance of the muscular forces on the spine. The most common type of scoliosis is idiopathic. This means it occurs for unknown reasons most commonly with growth spurts like in adolescence. Clinically significant idiopathic scoliosis is more common in girls. It seems to run in families. On physical examination, one shoulder or hip may appear higher than the other, and there may be asymmetry to the back on bending forward at the waist in patients with scoliosis. It may be associated with leg length discrepancy. Specialized x-rays are necessary to document the curvature and if there is compensatory curvature in the opposite direction (S curve). Treatment depends on the age of the patient and the cause of the scoliosis. Idiopathic scoliosis with curves with less than a 20° angle on x-ray measurement is monitored during growth. Angles over 25° typically are managed with bracing to prevent further curvature. Braces can be taken off for sports. Bracing is much less helpful for scoliosis in younger children and due to neuromuscular disorders. Curves over 40° may require surgical correction. There are several different surgical approaches that involve fusing the bones of the spine together and/or using rods to help straighten the back.

Milder scoliosis can lead to back discomfort over time. If it is associated with neuromuscular disorders, there may be other significant symptoms associated with mobility, positioning, and orthopedic health. Severe scoliosis with curves approaching 100° may impact breathing. Therapies such as chiropractic manipulation and electrical stimulation have not been demonstrated to prevent progression of scoliosis. While physical therapy may be helpful for symptoms of neuromuscular disorders, it does not prevent progression of scoliosis either.

See Also

► Rett Syndrome

References and Readings

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SCQ

► Social Communication Questionnaire

Screening Measures

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Definition

Autism screening is the process of administering a brief assessment to determine the level of risk for autism. This is usually done by giving parents a brief questionnaire or checklist about their child's development, including social, language, motor, and cognitive development but can also be done by direct clinical observation. If concerns about a child's development arise from the screening instrument, the child is referred for a more in-depth, diagnostic and developmental evaluation.

Historical Background

Autism spectrum disorders (ASDs) are severe disorders of development; the Centers for

Disease Control reported prevalence rates as 1 in 110 in 2009 (Bertrand et al., 2001; Chakrabarti & Fombonne, 2001; Fombonne, Zakarian, Bennett, Meng, & McLean-Heywood, 2006). Evidence of neurobiological abnormalities in the first year of life (Courchesne, 2004) as well as retrospective evaluation of infant behavior (Baranek, 1999; Osterling & Dawson, 1994) suggests that symptoms of ASD may be present by 12 months. Parents first report concerns around 17–18 months on average, although recent data suggests that parents first express concerns around 14–15 months, with some stating concerns before 11 months (Chawarska et al., 2007). Despite parents' early concerns, most children are not diagnosed with ASD until age 4 or even later, especially in children of urban and/or low socioeconomic status (Fombonne, Simmons, Ford, Meltzer, & Goodman, 2001; Howlin & Asgharian, 1999; Mandell, Listerud, Levy, & Pinto-Martin, 2002; Pinto-Martin, Dunkle, Earls, Fliedner, & Landes, 2005; Tonge et al., 2006; Wiggins, Baio, & Rice, 2006; Williams & Brayne, 2006; Zwaigenbaum et al., 2007). Recently published guidelines (Filipek et al., 2000; Glascoe, 2005; Johnson & Myers, 2007) report that the positive effects of early diagnosis far outweigh the negative effects and that families express the desire to be informed as early as possible. Screening instruments that alert doctors to the possibility of ASD are important and necessary and will have a tremendous impact on public health and the welfare of affected children and their families. Pediatric screening is often the only evaluation children receive until they begin preschool or kindergarten (Glascoe, 2005). Therefore, what is needed is a brief, but relatively sensitive, screening instrument for use in physicians' offices that will alert them to the need for further evaluation in children with early signs of autism. There is clear evidence that early detection of and intervention for ASDs can lead to substantially better prognosis; thus, the American Academy of Pediatrics currently recommends that all children be screened for autism at their 18- and 24-month well-child visits.

Current Knowledge

Autism screeners fall into two different levels. Level 1 screening instruments are broad-based and used to identify children at risk for ASDs in the general population. Level 2 screening instruments are more specific tools used to screen children who are at increased risk for ASDs (e.g., children with previous developmental concerns, younger siblings of children with ASDs). Level 1 screening instruments are designed to be implemented by general providers, without specialized knowledge about ASDs. Typically, level 1 screening instruments are conducted by pediatricians during well-child visits. Therefore, these screening instruments must be brief and easy to administer. Level 2 screening instruments generally take longer to complete and are typically utilized by practitioners with specific training on ASDs. Level 2 screening instruments include parent report and sometimes include direct observation of the child. Some screening measures have both level 1 and level 2 components and thus can be used in a variety of settings. When evaluating screening instruments, two constructs are important: sensitivity and specificity. Sensitivity is the proportion of children correctly identified by the screening instrument as having an ASD, while specificity is the proportion of children correctly identified by the screening instrument as not having an ASD. High sensitivity is important for level 1 screening instruments in order to maximally identify all children at risk for an ASD. Specificity may be less important for level 1 screening instruments because children who show concerns based on the screening instrument are likely to benefit from evaluation and intervention whether or not they have an ASD. However, for level 2 screening instruments, specificity is more highly valued since diagnosis becomes important, and distinguishing between ASD and other developmental disabilities is necessary. In addition to sensitivity and specificity, many instruments report their positive predictive value (PPVs). This figure is the proportion of children screening positive who turn out to be true cases. This figure is very sensitive to base

rates. Conditions with low base rates tend to have low PPVs. In addition, there is always a trade-off between sensitivity and PPV; instruments that pick up most cases (high sensitivity) also tend to pick up more false positive cases, resulting in lower PPVs. Because of the trade-off with sensitivity, and because of the variation in PPV with base rate, PPV is not always reported.

Broad Developmental Screening Tools

Broad developmental screening tools are designed to assess risk for any developmental disorder and are not specifically designed to assess risk for ASDs. A thorough examination of all such measures is beyond the scope of this entry (see Glascoe, 2000 for a review); however, two common broad developmental screening tools are discussed. The Parents' Evaluation of Developmental Status (PEDS) (Glascoe, 2001) is a screening instrument designed for use in children between birth and 8 years of age. The PEDS contains 10 items which assess parent concern in developmental domains such as fine and gross motor skills, receptive and expressive language, and self-help skills. Based on the reported parental concerns, the child is classified as being at low, moderate, or high risk for development issues. The PEDS showed sensitivity ranging from .74 to .79 and specificity of .70 to .80 across a broad age range. The Ages and Stages Questionnaires (ASQ) (Bricker, Squires, & Mounts, 1999; Squires, Bricker, & Potter, 1997) is a screening instrument designed for use in children from 4 to 60 months. There are eleven different forms specific to the skills expected of the various age levels assessed. There are 30 items divided into five areas: communication, gross motor, fine motor, problem solving, and personal social. The ASQ showed sensitivity of at least. 72 for all ages except 4 months, which was at .51, and 20 months, which was at .65. Specificity on the ASQ was at least .81 for all age groups. Despite strong psychometric properties as broad developmental screening tools, there are limited data on whether the PEDS and the ASQ are targeted enough for the identification of children at risk for an ASD.

Autism-Specific Screening Tools

Checklist for Autism in Toddlers (CHAT; Level 1)

Developed in the United Kingdom (UK), the CHAT (Baron-Cohen et al., 1996, Baron-Cohen, Wheelwright, Cox et al., 2000; Baron-Cohen, Allen, & Gillberg, 1992) is a screening tool developed for pediatricians to use at the 18-month checkup for children. The CHAT consists of nine yes/no questions to be answered by the child's parent. These questions ask if the child exhibits specific behaviors, including social play, social interest in other children, pretend play, joint attention, pointing to ask for something, pointing to indicate interest in something, rough and tumble play, motor development, and functional play. The CHAT also includes observations of five brief interactions between the child and the examiner, which enable the clinician to compare the child's actual behavior with the parental reports. The specificity of the CHAT is excellent; however, the sensitivity is quite low (20–38% depending on criteria used).

Early Screening of Autistic Traits Questionnaire (ESAT; Level 1)

The ESAT (Dietz, Swinkels, van Daalen, van Engeland, & Buitelaar, 2006; Swinkels et al., 2006) screening tool consists of 14 yes or no items completed by parents at their child's 14-month visit. It covers the domains of pretend play, joint attention, interest in others, eye contact, verbal and nonverbal communication, stereotypes, preoccupations, reaction to sensory stimuli, emotional reaction, and social interaction. Children failing three or more items are considered at risk for ASD. Sensitivity of the ESAT is greater than.9 but specificity is considerably lower.

Communication and Symbolic Behavior Scales Developmental Profile Infant-Toddler Checklist (CSBS-DP-IT Checklist; Level 1)

The CSBS-DP-IT Checklist (Wetherby, Allen, Cleary, & Kublin, 2002) is a 24-item parent-report questionnaire shown to have both high sensitivity and specificity. There are three subdomains: social and emotional communication, receptive and expressive speech, and symbolic behavior.

Because the CSBS-DP-IT Checklist was originally designed to detect children with a variety of communication delays, it tends to be sensitive to autism as well. If used as such for research purposes, the use of the CSBS-DP-IT Checklist yields three natural contrast groups (ASD, LD, and DD), while for clinical purposes, it has the potential to identify a wide range of children who may benefit from early treatment. A recent study by Pierce et al. (2011) reported a PPV of.75 for any developmental delay when used in pediatric well-child visits as 12 months of age. While sensitivity is unknown at this age, and it remains highly probable that a 12-month-old screening will not pick up the majority of ASD cases, it is promising as a screening at 12 months, which would then need to be followed by additional ASD screening at one or two additional time points.

Pervasive Developmental Disorders Screening Test, Second Edition (PDDST-II; Levels 1 and 2)

The PDDST-II (Siegel, 2004) consists of three stages designed to be administered in different settings by clinicians of increasing knowledge about ASDs. The first stage consists of 22 yes or no items and is intended for use by pediatricians in primary care settings for children 12–48 months. Further evaluation is recommended for children with five or more items answered as "yes." According to the author, using these criteria, sensitivity is.92 and specificity is.91 in an "at-risk" sample (Siegel, 2004). The second stage of the PDDST-II is a 14-item measure that is intended for use in developmental clinics. The cutoff is still five items in the second stage, with a sensitivity of.73 and specificity of.49. The third and final stage consists of 12 items and is intended for use in autism clinics. The cutoff for this stage is a score of 8, with sensitivity of .58 and specificity of .60. Sensitivity and specificity have not yet been reported for the PDDST-II in a large population-based sample.

Modified Checklist for Autism in Toddlers (M-CHAT Levels 1 and 2)

One of the most commonly used autism screening measures in the United States is the M-CHAT (Kleinman et al., 2008, Robins, Fein, Barton, & Green, 2001), which is nationally recommended by the American Academy of Pediatrics (AAP). The M-CHAT consists of two stages of screening. The first stage is a 23-item yes or no parent questionnaire that screens for signs of an ASD in children aged 16–30 months. This is a level 1 screening instrument and has been widely used by pediatric offices across the nation and internationally. The second stage of screening is a follow-up interview (which can be done on the phone or in person) for children who screen at risk for an ASD during the first stage. The interview is completed by following a script, although it involves some clinical judgment. Although follow-up studies are still under way to get a firmer idea of sensitivity, existing data suggest a sensitivity of about .80, while PPV varies from .28 to .79 for ASD in younger and older toddlers with and without existing developmental concerns and from about .72 to .98 for the presence of any diagnosable developmental delay (Pandey et al., 2008).

Social Responsiveness Scale (SRS; Level 2)

The SRS (Constantino et al., 2006) is a 65-item rating scale that measures the severity of autism spectrum symptoms as they occur in natural social settings. The SRSs is completed by a parent or teacher in just 15–20 min and provides a clear picture of a child's social impairments, assessing social awareness, social information processing, capacity for reciprocal social communication, social anxiety/avoidance, and autistic preoccupations and traits. It is appropriate for use with children from 4 to 18 years of age. The SRS can be used as a level 2 screener in clinical or educational settings, an aid to clinical diagnosis, or a measure of response to intervention. SRS scores are particularly helpful in identifying the severity of social impairment based on five treatment subscales: receptive, cognitive, expressive, and motivational aspects of social behavior, as well as autistic preoccupations.

Screening Tool for Autism in 2-Year-Olds (STAT; Level 2)

The STAT (Stone, Coonrod, & Ousley, 2000) is an interactive measure that is designed to

differentiate between autism and other developmental disorders and is therefore intended for children 24–35 months old already identified as at risk for an ASD. The STAT is administered within the context of play and takes about 20 min to complete. The STAT consists of 12 items that were derived from three measures: the Play Assessment Scale (Fewell, 1991), the Prelinguistic Communication Assessment (Stone, Ousley, Yoder, Hogan, & Hepburn, 1997), and the Motor Imitation Scale (Stone, Ousley, & Littleford, 1997). Items assess behaviors in four social-communicative domains that do not require language comprehension: play, requesting, directing attention, and motor imitation. Sensitivity of the STAT is estimated to be 0.92 and specificity is 0.85 (Stone, Coonrod, Turner, & Pozdol, 2004).

Childhood Autism Rating Scale (CARS; Level 2)

The CARS (Chlebowski, Green, Barton, & Fein, 2010, Schopler, Reichler, & Renner, 1988) is a behavioral rating scale designed for the identification of autism in children. It consists of 15 items, each rated on a scale of 1−4. The CARS is based on clinical judgment of observed behavior and parent report. A total score is calculated by adding the scores of the individual items. Scores of 30–36.5 suggest mild to moderate autism, and score of 37–60 indicate severe autism. Scores of 25−30 are consistent with PDD-NOS. Sensitivity of the CARS is high, while the specificity is somewhat lower as the CARS has been found to overidentify autism.

Gilliam Autism Rating Scale 2 (GARS-2; Level 2)

The GARS-2 (Gilliam, 2006) is a symptom severity behavioral checklist that assists teachers, parents, and clinicians in identifying and diagnosing autism in individuals ages 3 through 22. The 42 items on the GARS-2 are almost identical to the first edition and are based on the definitions of autism adopted by the Autism Society of America and the *Diagnostic and Statistical Manual of Mental Disorders: Fourth Edition-Text Revision* (DSM-IV-TR) and are grouped into three subscales: stereotyped behaviors, communication, and social interaction. Raw scores combine to give a composite standard score termed the autism quotient. Autism quotients of 90 and above indicate likely autism, while scores below 70 indicate that autism is unlikely. Scores between 70 and 90 suggest unclear classification. With these cutoffs, the GARS tended to underdiagnose autism, with a sensitivity of .48 (South et al., 2002).

Social Communication Questionnaire (SCQ; Level 2)

The SCQ (Berument, Rutter, Lord, Pickles, & Bailey, 1999) is a 40-item screening questionnaire designed for parents to complete about their child aged 4 years and older, with a mental age of at least 2 years. There are both current and lifetime versions available to detect signs of an ASD in children. A cutoff score of 22 is used to differentiate autism from other ASDs, and a cutoff score of 15 is used to differentiate ASDs from other developmental disorders. Sensitivity of the SCQ is .85 and specificity is .75.

Future Directions

Continued research to refine the screening instruments for increased accuracy, including better sensitivity and specificity, in identification of children at risk for ASDs is warranted. Furthermore, additional research regarding the utility of broad developmental screening in detecting children at risk for ASDs is necessary to determine whether an autism-specific screening instrument is necessary. Finally, future research will help clarify the most appropriate time points for autism screening.

See Also

- ▶ Ages and Stages Questionnaire, Second Edition
- ▶ Checklist for Autism in Toddlers (CHAT)
- ▶ Childhood Autism Rating Scale
- ▶ Gilliam Autism Rating Scale (GARS)
- ▶ Infant/Toddler Checklist

- ▶ Modified Checklist for Autism in Toddlers (M-CHAT)
- ▶ Pervasive Developmental Disorders Screening Test (PDDST)
- ▶ Screening Tool for Autism in Two-Year-Olds (STAT)
- ▶ Social Communication Questionnaire
- ▶ Social Responsiveness Scale

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Screening Test for Auditory Processing Disorders

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Synonyms

SCAN-A (adults); SCAN-C (children)

Description

The Screening Test for Auditory Disorders (SCAN) is a screening tool used to determine if

a child (or adult) should be evaluated for central auditory processing (CAP) disorders. The SCAN-C is a CAP screening instrument for children (Keith, 1986, 2000a, 2000b), while the SCAN-A is used for adolescents and adults (Keith, 1994). The revised SCAN-C was designed for children from 5 to 11 years of age and consists of four subtests: Filtered Words, Auditory Figure Ground (speech-in-noise), Competing Words, and Competing Sentences (Keith, 2000a, 2000b). The Filtered Words subtest consists of 1,000-Hz low-pass filtered monosyllabic words with a filter roll-off of 32 dB/octave. The listener must repeat the word she/he perceives. The Auditory Figure Ground subtest consists of monosyllabic words recorded at +8 signal-to-noise ratio with a multi-talker babble background. The listener must repeat the stimulus words in the presence of the background noise. The Competing Words subtest consists of monosyllabic word pairs presented to both ears (dichotically) with simultaneous onset times (Keith, Rudy, Donahue, & Katbamna, 1989). As a directed listening task, the listener is first asked to repeat both words that are perceived, repeating the word heard in the right ear first. Then a second test list is given and the listener must repeat both words that are perceived, repeating the word heard in the left ear first. The Competing Sentences subtest consists of sentence pairs that are unrelated in topic which are presented to both ears (dichotically) with simultaneous onset times (Keith, 2000b). The listener is asked to repeat only the sentence heard in the right ear. Then a second test list is given and the listener is asked to repeat only the sentence heard in the left ear. These subtests are prerecorded and can be administered under headphones in a quiet room. The raw scores on each of the SCAN subtests are converted to standard scores, percentile ranks, and confidence intervals. The screening is easy to administer and score. Total test time is approximately 20 minutes.

Historical Background

The SCAN was developed to be a screening test for CAP in children and was first introduced in 1986. The goal of this screening test was to help assess auditory maturation and identify children who may benefit from more involved CAP testing and specific auditory rehabilitation. The original SCAN-C was developed for children between the ages of 3 and 11 years and included three subtests: Filtered Words, Auditory Figure Ground, and Competing Words. Keith and colleagues (1989) demonstrated that the SCAN Competing Words subtest was highly correlated with other tests of dichotic listening (Staggered Spondaic Words (SSW) and Competing Sentences Test (CST)). These researchers also demonstrated that language abilities may affect performance on the SCAN. Subsequent research indicated that the original SCAN-C test-retest reliability may have been poor, with children performing better on the second administration of the screener than the first administration (Amos & Humes, 1998). In addition, researchers showed that children performed more poorly in a quiet room compared to an audiologic booth (Emerson, Crandall, Seikel, & Chermak, 1997). These, along with other factors, led to the development of the revised SCAN-C which included an additional subtest (Competing Sentences), new test instructions to make them easier for young children to understand, test materials recorded on compact discs rather than audiocassettes, and fewer word pairs for the Competing Words subtest to make the test more efficient. Research completed by Keith (2000b) indicated improved test-retest reliability and no significant differences in performance between test environments (quiet room vs. audiologic booth).

Psychometric Data

Normative data exist on a wide age range (5–11 years) with a total sample size of 650 children. Normative data indicate a systematic improvement in performance with increase in age. Test-retest reliability was high for children between the ages of 5 and 7 years. Children included in the normative sample were all able to take the test in English without test modifications, had normal and symmetric hearing from the

octave frequencies between 500 and 4,000 Hz, and had intelligible speech with few articulation errors. Children were excluded from the standardization sample if they were receiving special education services or services related to gifted and talented programs (Keith, 2000b).

Like other tests of central auditory processing, early research completed on the SCAN included children who spoke English as their primary language, were in regular education classrooms (without special education services), and demonstrated normal hearing and normal middle ear function (Amos & Humes, 1998; Emerson et al., 1997; Keith, 2000b; Keith et al., 1989). Furthermore, it should be noted that researchers have found that children with language problems might score poorly on the SCAN (Keith et al., 1989). This is likely due to the fact that the test stimuli on the SCAN have a high linguistic load.

Clinical Uses

The SCAN-C is often used in school systems as well as audiological practices to determine if a more thorough CAP evaluation is warranted. It is often administered by a speech-language pathologist in a quiet room in the school setting, and referrals are made to audiologists for further CAP testing as necessary. Clinically, the person administering the SCAN should take into consideration the cognitive, hearing, speech, and language abilities of the individual being tested as these factors may affect screening outcomes. Thus, the SCAN-C is not typically administered to children with autism, and performance on this screener should be interpreted with caution in this population.

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Screening Tool for Autism in Toddlers

▶ Screening Tool for Autism in Two-Year-Olds (STAT)

Screening Tool for Autism in Two-Year-Olds (STAT)

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Synonyms

Screening tool for autism in toddlers; STAT

Description

The STAT is an interactive, play-based screening instrument for autism that contains 12 items tapping the core deficit areas of socialization and communication. Items are organized into four

domains: play (two items), requesting (two items), directing attention (four items), and motor imitation (four items). The items selected for inclusion are those that were found to discriminate between 2-year-old children with autism and developmentally matched comparison samples (Stone, Coonrod, & Ousley, 2000). Although the STAT was designed for use with children between the ages of 24 months and 36 months, preliminary evidence for its utility with children as young as 14 months has been obtained (Stone, McMahon, & Henderson, 2008), and ongoing research is being conducted to evaluate its use with 3-year-old children.

The STAT was designed for use by a broad range of community service providers working with young children, such as early intervention providers, birth-to-three personnel, preschool teachers, psychologists, speech-language pathologists, and health-care professionals. It can be used in clinical, educational, and home settings. It takes about 20 min to administer and was designed to be scored live. Training on the STAT is available through participation in 1-day workshops or completion of a web-based tutorial (see http://kc.vanderbilt.edu/triad/training/page.aspx?id=821).

The STAT User's Manual contains information about the purpose and use of the STAT, describes its development and psychometric properties, and provides general information, guidelines, and tips regarding the administration and scoring of each item. The STAT Materials Kit contains all of the play materials needed for the screening, such as a ball, toy car and truck, puppet, baby doll, bubbles, balloons, and many others. The STAT Test Protocol contains detailed instructions regarding the number of trials allowed for each item and the specific wording of verbal directions and prompts, along with scoring criteria and examples for each item.

Administration of the STAT involves setting up situations to elicit key social and communication behaviors. The play items on the STAT assess the child's participation in a turn-taking game and his/her functional play with a doll. The requesting items involve presenting desired objects in closed containers and observing whether and how the child asks for help or more, either verbally or nonverbally. The directing attention items involve creating unexpected events and observing whether and how the child shares interest or enjoyment in the event with the examiner. The imitation items assess the extent to which the child attempts or succeeds in imitating simple actions demonstrated by the examiner. Multiple trials can be given for most items, and the child's item score reflects his/her best performance on the item. Specific scoring criteria are used to determine whether the child's performance on each item is a pass, fail, or refuse. The average number of fails for each of the four domains is summed and compared to a cutoff score to identify the child's risk for autism.

Administration of the STAT was designed to be developmentally sensitive and to optimize the child's interest and attention. Language demands are minimal. Although instructions, prompts, and materials are standardized, the sequence in which items are administered can be adapted to the needs of the child. Likewise, items can be administered on the floor or at a table as needed to engage the child and elicit his/her best performance.

Historical Background

Development of the STAT began in the mid-1990s, after a growing empirical literature at the time indicated that (a) autism could be diagnosed accurately at age 2 and (b) behaviors in the social and communication domains were the most prominent characteristics at that age. It was developed at Vanderbilt University by Wendy Stone, PhD, a professor of pediatrics, and Opal Ousley, PhD, a psychology graduate student at the time. The purpose of the STAT was to facilitate the early identification of autism by directing children in need of autism-specialized services to assessment centers with the necessary experience and expertise to diagnose autism at young ages. The STAT was designed as a second-stage screener for use in referral (vs. primary care) settings. That is, the purpose of the STAT was to identify children at specific risk for autism

from more heterogeneous groups of children for whom there were developmental concerns.

The first STAT Training Workshop was conducted in 1999, and the first published study describing the STAT appeared in 2000 (Stone et al., 2000). Subsequent publications have provided additional information about its psychometric properties for 2-year-olds (Stone, Coonrod, Turner, & Pozdol, 2004) and for children under 24 months (Stone et al., 2008). The web-based STAT Training Tutorial (Kobak, Stone, Ousley, & Swanson, 2011) became available in 2009.

The development and refinement of the STAT is ongoing. Current projects are examining its utility for screening in 3-year-olds, the use of a continuous scoring system for each item, and the inclusion of ratings for social engagement and atypical behaviors.

Psychometric Data

Use of the STAT with 2-Year-Olds

The psychometric properties of the STAT were reported in 2004 (Stone et al., 2004). The results, described below, demonstrate strong psychometrics with respect to screening properties, test-retest reliability, interobserver agreement, and concurrent validity with the ADOS.

Screening Properties. The screening properties of the STAT (i.e., sensitivity, specificity, positive predictive value [PPV], negative predictive value [NPV]) were evaluated on a sample of 52 children, 26 with autism and 26 with developmental delay and/or language impairment (DD/LI). Participants were referred for diagnostic evaluations from a variety of clinical settings between 1997 and 2000. Eligibility criteria were the following: chronological age between 24 and 36 months (i.e., between 2 years, 0 months, 0 days and 2 years, 11 months, 29 days), absence of severe sensory or motor impairments, and absence of identified genetic disorders. All data were collected during the course of the child's diagnostic evaluation, which was conducted by a team of clinicians that included a licensed psychologist and a licensed speech-language pathologist. Autism diagnoses were made by the team psychologist, based on criteria provided in DSM-IV (APA, 1994). The STAT was administered by trained examiners who were independent from the diagnostic team and were blind to the results of the diagnostic evaluation. Likewise, the team clinicians were blind to the results of the STAT screening.

Development and validation samples were created to include equal numbers of children with autism and children with DD/LI. There were no diagnostic group differences for chronological age, mental age, or maternal level of education in the development or validation sample. Signal detection using the development sample identified a score of 2 or higher as the optimal cutoff for autism risk. Applying this cutoff score to the validation sample resulted in a sensitivity of .92, specificity of .85, PPV of .86, and NPV of .92, providing strong support for its screening properties using this scoring algorithm.

Concurrent validity was assessed by comparing STAT risk category (at risk vs. not at risk) with diagnostic classification (autism vs. nonspectrum) on the Autism Diagnostic Observation Schedule (ADOS; Lord et al., 2000) in a sample of 82 children. The STAT and ADOS were administered by different examiners who were blind to the results of the other's evaluation. Cohen's kappa for agreement between STAT risk category and ADOS classification was .95. Only two children were identified incorrectly by the STAT; both were identified as high risk by the STAT but did not meet ADOS criteria for autism (i.e., false positives).

Interobserver agreement for STAT risk category was evaluated by having two examiners score the STAT independently for 29 children (14 with autism, 2 with PDD-NOS, and 13 with DD/LI). Interobserver agreement was 1.00 using Cohen's kappa.

Test-retest reliability for STAT risk category was examined by having 21 children (nine with autism, six with PDD-NOS, and six with DD/LI) participate in two STAT screenings approximately 2 weeks apart (mean delay = 20 days,

range = 4–44 days). Different examiners administered the STAT at each time point to reduce any potential familiarity bias. Test-retest reliability was .90 using Cohen's kappa.

Use of the STAT with Children Under 2 Years Old

A preliminary investigation of the utility of the STAT for children under 24 months of age was published in 2008 (Stone et al., 2008). This study included 71 children (44 male, 27 female) who received the STAT between 12 and 23 months of age and a follow-up diagnostic evaluation after 24 months. The average length of time between the initial and follow-up visits was 15 months. All children were at elevated risk for autism by virtue of having an older sibling with an autism spectrum diagnosis ($n = 59$) or being referred for evaluation for concerns about autism ($n = 12$).

The STAT was administered and scored in the same manner as for the 2-year-old samples (Stone et al., 2004), without any procedural or scoring changes. Signal detection analysis with the entire sample revealed that the STAT cutoff score of 2 demonstrated high sensitivity (1.0) but low specificity (.40) for this age group. The optimal cutoff score for this young sample was 2.75; this cutoff yielded a sensitivity of.95, specificity of .73, PPV of .56, and NPV of .97. However, it was also observed that false positives were highest (38%) for the 12–13-month-old age group. When the sample was limited to children 14 months and older, STAT screening properties for a 2.75 cutoff improved to a sensitivity of .93, specificity of .83, PPV of .68, and NPV of .97. These results provide preliminary support for the use of the STAT in children between 14 and 23 months of age, using a cutoff score of 2.75. Replication with an independent sample is currently under way.

Clinical Uses

The STAT can be used by a variety of service providers in a diverse array of settings to facilitate early identification and early intervention for children with autism. A "screen-positive" result on the STAT can indicate the need for referral to professionals who have specialized training and experience working with young children with autism. For example, in state birth-to-three systems, service coordinators can screen children with the STAT to identify those at risk for autism, so that timely referrals can be made to diagnosticians and interventionists with specialized experience and training. In community-based intervention settings, such as speech-language clinics, clinicians can use the STAT to screen children on their caseload to determine their need for further diagnostic evaluation for autism. In diagnostic assessment settings, children on the waiting list can be screened with the STAT so that they can be routed to the clinicians with the most experience and training in assessment and early diagnosis of autism.

The STAT also works well when used in conjunction with first-stage (i.e., population-based) developmental screening tools that may be administered in primary care settings. Children who fail general developmental screens can be given the STAT to identify those who may benefit from further evaluation for autism.

In addition to providing a cutoff score to identify autism risk, the interactive nature of the STAT affords the opportunity for other clinical uses. The STAT provides a standard setting for obtaining a rich sample of behaviors that represent core social and communicative deficits in autism. During a 20-min STAT screening, clinicians can obtain important information about the child's strengths and needs in the areas of object play, turn-taking, communication, and imitation. This information can then be used to identify specific intervention goals and to design targeted teaching activities. For example, special educators have used the STAT to prepare preliminary educational plans for children who will be entering their school system at age 3. Similarly, children's performance on the STAT can be used to formulate and initiate individualized teaching activities during the often-long waits

between the suspicion of autism and the child's formal diagnostic evaluation.

The STAT can also be used as a component of a larger assessment battery. For example, it is a central component of a program designed to train pediatricians in community practice settings how to conduct autism assessments (i.e., the STAT-MD program). In this program, pediatricians learn how to administer and score the STAT, as well as how to conduct developmentally sensitive parent interviews and use incidental observations to form diagnostic impressions within a DSM-based framework (Warren, Stone, & Humberd, 2009). The STAT is also being used along with parent report measures in a formative research project to develop a streamlined autism assessment for use in the US National Children's Study.

Research projects have also capitalized on the standardized yet brief behavioral sample afforded by the STAT. For example, the STAT total and directing attention scores have been found to differentiate between groups of toddlers at high and low risk for autism (Stone, McMahon, Yoder, & Walden, 2007). The STAT has also been used successfully as a context for coding social-communicative behaviors such as initiating joint attention, positive affect sharing, and repetitive behavior (McDuffie, Yoder, & Stone, 2005; Yoder, Stone, Walden, & Malesa, 2009). As well, the STAT has been used to screen children under 24 months for eligibility for participation in research projects (Carter, Messinger, Stone, Celimli, Nahmias, & Yoder, 2011).

See Also

- ▶ Early Diagnosis
- ▶ Screening Measures
- ▶ Social Communication

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Scripting

- ▶ Echolalia
- ▶ Movie Talk

Scripts

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Synonyms

Social scripts

Definition

Scripts are written, audio, and/or pictorial examples of phrases or sentences that children with disabilities can use in specific social or academic situations. The individual is explicitly taught the script through modeling, prompting, and reinforcement and then prompted to use the script in the specific situation for which it was developed. Following successful use of the script, a script-fading procedure should be implemented to fade the use of the script over time. Scripts can be used to increase social initiations (e.g., "what do you want to play?"), provide suggestions to improve conversational skills (e.g., "my favorite movie is"), or request assistance (e.g., "help please").

The use of scripts has improved the communication and social interaction skills that are prevalent in individuals with autism spectrum disorder (ASD; Ganz, Kaylor, Bourgeois, & Hadden, 2008). Individuals with ASD benefit from the use of scripts in both academic and nonacademic settings, including home, workplace, and community. Scripts have been shown to be effective with children who have minimal language and reading skills (Krantz & McClannahan, 1998), for nonreaders using an audio taped script and script-fading procedure (Stevenson, Krantz, & McClannahan, 2000), as well as for those with extensive verbal skills, but poor social skills (Krantz & McClannahan, 1993). Social scripts can reduce the stress associated with social interactions and assist the child by helping them understand the perspective of others and by providing them with age-appropriate social language. Including informal language, slang, or child-specific terms in the social script may help the conversational exchange appear more natural (Kamps et al., 2002).

See Also

► Social Stories

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SCZD15

► SHANK 3

SDA

► Structured Descriptive Assessment

Secondary Handicapping Conditions

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Synonyms

Comorbidity

Definition

Secondary handicapping conditions involve additional characteristics of other disabilities or disorders that may affect an individual to a lesser degree than the primary disability or disabling conditions, leaving marked impairment on the lives of individuals. Secondary conditions have been defined as "those physical, medical, cognitive, emotional, or psychosocial consequences to which persons with disabilities are more susceptible by virtue of an underlying condition, including adverse outcomes in health, wellness, participation, and quality of life" (Hough, 1999, p. 186). Individuals on the autism spectrum are likely to experience additional deficit areas or secondary handicapping conditions as a result of comorbidity of one or more of the following conditions, disabilities, or disorders related to vision, depression, tuberous sclerosis, general anxiety disorder, Tourette's syndrome, obsessive compulsive disorder, bipolar disorder, attention deficit hyperactivity disorder, Fragile X syndrome, intellectual/cognitive disabilities, seizure disorder, epilepsy, sensory integration, oppositional defiance disorder, depression, neuroinflammation disorders, immune disorders, nonverbal learning disorders, motor clumsiness, and gastrointestinal distress/bowel disease.

See Also

- ▶ Attention Deficit/Hyperactivity Disorder
- ▶ Comorbidity
- ▶ Depressive Disorder
- ▶ Epilepsy
- ▶ Fragile X Syndrome
- ▶ Gastrointestinal Disorders and Autism
- ▶ Nonverbal Learning Disabilities (NLD)
- ▶ Obsessive-Compulsive Disorder (OCD)
- ▶ Seizure Disorder
- ▶ Tourette's Syndrome

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Second-Generation Antipsychotics (SGAs)

▶ Atypical Antipsychotics

Second-Generation Sequencing

▶ Next-Generation Sequencing

SecreFlo

▶ Secretin

Secretin

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Synonyms

SecreFlo

Definition

Secretin, a digestive polypeptide hormone secreted in the upper part of the small intestine, stimulates the pancreas to secrete water and bicarbonate, thus neutralizing hydrochloric acid that passes from the stomach into the duodenum. It is most commonly used in a synthetic form to evaluate pancreatic function.

In the late 1990s, extensive media coverage was given to a single case in which a 3-year-old child with autism who received intravenous secretion as part of a pancreatic assessment for gastrointestinal issues showed improvements in speech and behavior soon afterward. A subsequent case study series of three young children with autism who also received secretin as part of gastrointestinal evaluations reported improvements in language and social abilities in addition to the amelioration of gastrointestinal issues (Horvath et al., 1998). Based largely on the single case anecdotal report, the three-case series, and compelling anecdotal evidence, media reports publicized secretin as a treatment for autism. However, the case series had significant methodological limitations, and no empirical evidence supported the treatment. Concern over the widespread off-label use of secretin as a treatment for autism was expressed in the medical and research community (Volkmar, 1999).

In response to the media frenzy and escalating off-label use of the hormone, a series of randomized, double-blind studies investigated the effects of secretin on children with autism. Sandler et al. (1999) randomly assigned 56 children diagnosed with either autism or PDD-NOS to receive either secretin or placebo saline infusions. They were assessed at baseline, immediately after infusion, and for 4 weeks postinfusion. The main findings were twofold: first, scores on the 16 outcome measures or assessment domains were not significantly improved with secretin treatment versus with placebo. Second, both secretin and placebo groups had significant decreases from baseline in autism symptoms over the 4-week period. Similarly, Coniglio et al. (2001) assessed 57 randomly assigned participants at baseline, 3, and 6 weeks postsecretin or placebo administration by parent report and clinical behavior testing. While a marginally significant improvement was seen at 3 weeks posttreatment for secretin, at 6 weeks neither group showed significant change in assessment from baseline.

In 2000, Chez et al. undertook a two-part study to further investigate the anecdotal claims of secretin treatment. First, 56 children were administered one dose of secretin and evaluated at baseline and several weeks postinfusion. Overall, the group had minimal improvement in behavior

and language abilities, but not significant gains at a clinical level. Next, 17 of the most responsive subjects and an additional eight new subjects entered a double-blind trial of secretin and placebo with a 4-week crossover. They were evaluated by parent report at baseline, at 4 weeks, and at 8 weeks. Results of the second study did not demonstrate any significant behavioral differences between patients treated with placebo and secretin when the administration was double-blind and placebo controlled. Likewise, no significant improvement was seen in autism behaviors as assessed by parent and teacher report in a study of eight children who received secretin or placebo in a randomized double-blind study, also with a 4-week crossover (Carey et al., 2002). In fact, the majority of changes seen were behavioral improvement after placebo and deterioration after secretin. Taken together, these studies suggest a lack of evidence for secretin as a viable treatment option.

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Section 504 of the Rehabilitation Act of 1973

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Definition

In 1973, President Carter engaged into law the Rehabilitation Act (P.L. 93-112; U.S. Congress, 1973). This Act provided for a number of provisions subsequent in newfangled shields and rights for persons with disabilities. Section 504 of the Rehabilitation Act stated that "no otherwise qualified handicapped individual in the United States shall, solely by reason of his handicap, be excluded from participation in, be denied the benefit of, or be subjected to discrimination under the program or activity receiving Federal financial assistance." According to Section 504, individual with disability means any person who:

1. Has a physical or mental impairment which substantially limits one or more major life activities
2. Has a record of such impairment
3. Is regarded as having such impairment

Students eligible for services under these provisions include some of the following groups:

1. Students with disabilities whose learning is impacted and those with attention deficit disorder, attention deficit/hyperactivity disorder, immune disorders, allergies, learning disabilities, and hearing impairments
2. Those who have been misdiagnosed or labeled with a disability
3. Students with AIDS and other contagious diseases such as hepatitis B and tuberculosis
4. Students who experience temporary disabling circumstances such as those due to injuries

Section 504 essentially mandates that school districts must provide accommodations that include health related services that enables students to attend school. Schools must create a Section 504 accommodation plan to address

how the school will insure that the student is not discriminated against upon the basis of their disability. Unlike IEPs under IDEA, Section 504 Accommodation Plans are unfunded.

See Also

- ▶ Individualized Plan for Employment (IPE)
- ▶ Individuals with Disabilities Education Act (IDEA)

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Secure Employment

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Definition

Secure employment is an employment scheme designed for individuals that are not presently able to perform in competitive employment or supported employment settings. Secure employment is a facility-based program that utilizes a structured environment where individuals are guaranteed employment without the fear of losing employment due to intrusive behaviors. While in secure employment, trained staff work with the individuals to develop greater vocational independence and appropriate behavioral skills necessary for potential integration or reintegration into competitive or supported employment.

See Also

- ▶ Competitive Employment
- ▶ Supported Employment

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Sedative Hypnotic Drugs

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Synonyms

Barbiturates; Benzodiazepines

Indications

Anxiety, Sedation, Sleep disturbances

Mechanisms of Action

Both barbiturates and benzodiazepines exert their primary mechanism of action by interacting with the $GABA_A$ receptor. The $GABA_A$ receptor is a heteromeric receptor containing five subunits, most commonly two alpha subunits, two beta subunits, and one gamma subunit. $GABA_A$ receptor alpha, beta, and gamma subunits can be of several subtypes (alpha1-6, beta1-3, and gamma1-3). Different subunit compositions can lead to different types of $GABA_A$ receptor that have different expression and function throughout the CNS.

Barbiturates

Barbiturates act by a mixture of several mechanisms dependent on the dose employed. The primary mechanism of action is by potentiating the action of the inhibitory neurotransmitter GABA by binding to $GABA_A$ receptor alpha subunits (which are distinct from both the GABA and benzodiazepine binding sites). This leads to an increase in the duration of chloride ion channel opening at the $GABA_A$ receptor which potentiates the action of GABA. Furthermore, barbiturates also block the action of the excitatory neurotransmitter glutamate by blocking glutamatergic AMPA receptors. At higher doses, barbiturates also block the Ca^{2+}-dependent release of neurotransmitters. Taken together, barbiturates exert potent CNS depressant effects via these mechanisms.

Barbiturates have also been shown to bind to other ligand-gated ion channel targets including the neuronal nicotinic acetylcholine receptor, the serotonin $5\text{-}HT_3$ receptor, and the glycine receptor family, suggesting that their therapeutic and side effects may also depend on these other potential mechanisms of action.

Benzodiazepines

Benzodiazepines act primarily by potentiating the action of the inhibitory neurotransmitter GABA by acting on benzodiazepine binding sites which form part of $GABA_A$ receptor complexes modulating GABAergic receptor function in the CNS. This serves to promote the binding of GABA to its binding sites on the $GABA_A$ receptor which increases the conductance of chloride ions across the coupled ion channel leading to membrane hyperpolarization and inhibition. These benzodiazepine-binding sites are situated at the junction between alpha and gamma subunits on the $GABA_A$ receptor. Interestingly, benzodiazepine binding can only occur at those $GABA_A$ receptors expressing alpha subunits with a histidine amino acid residue (alpha 1, 2, 3, 5). For this reason, benzodiazepines have no effect on $GABA_A$ receptors containing alpha 4 or alpha 6 subunits which have an arginine amino acid residue instead of a histidine one. It is notable that different benzodiazepines have differential effects of different $GABA_A$ populations dependent on the subunit composition. For example, those with higher affinity for $GABA_A$ receptor populations expressing alpha 2 and/or alpha 3 tend to show more marked anti-anxiety effects, while those with an affinity to alpha 1 containing $GABA_A$ receptors demonstrate increased hypnotic activity.

Outside of the CNS, benzodiazepines also bind to peripheral benzodiazepine receptors that are not structurally or functionally coupled to the $GABA_A$ receptor but are expressed predominantly in the peripheral nervous system and glia, suggesting immunomodulatory actions. It has also been reported that benzodiazepines also act as weak antagonists at adenosine receptors which may play a role in their anxiolytic, muscle relaxant, and anticonvulsant effects.

Key sites of action for both barbiturates and benzodiazepines include binding sites in the spinal cord (exerting muscle relaxant effects), brainstem (accounting for anticonvulsant properties), cerebellum (inducing ataxia), and corticolimbic brain regions (regulating emotional and behavioral effects).

Specific Compounds and Properties

Barbiturates

Thiopentone and methohexital (very short duration of action) are employed as anaesthetic-induction

agents. Secobarbital (short duration of action), butobarbital (medium duration of action), phenobarbital (long duration of action). Barbiturates are associated with drowsiness, tolerance, increased risk of overdose, and possible physical and psychological dependence with severe withdrawal symptoms.

Benzodiazepines

Chlordiazepoxide (prototype of benzodiazepine class; introduced in the 1930s), diazepam (extensively used; rapid onset of action; *N*-desmethyldiazepam (nordiazepam) is the major active metabolite; long half-life (60 h)), lorazepam (rapid onset of action; half-life of 12 h), temazepam (half-life of 10–15 h), flunitrazepam (potent; short duration of action; half-life of 10–20 h), alprazolam (half-life of 9–16 h), oxazepam (half-life of 12 h), nitrazepam (long duration of action; half-life of 25–35 h), flurazepam (long duration of action (via metabolite)), lormetazepam (medium duration of action; half-life of 10–12 h), loprazolam (short half-life; slow absorption), triazolam (short duration of action; half-life of 3–4 h; sedation at higher doses), zopiclone (binds near but not at the benzodiazepine receptor; half-life of 5–8 h dependent on age of subject; lower degree of side effects compared to other benzodiazepines while retaining sedative hypnotic actions), eszopiclone (s-enantiomer of zopiclone; approved in the USA for long-term insomnia treatment), zolpidem (rapid absorption; short half-life (0.7–3.5 h), low side-effect profile), zaleplon (very short half-life of 1 h; low side-effect profile; reduces sleep onset).

Clinical Use (Including Side Effects)

The term "sedative" originally pertained to therapeutics that allayed anxiety although its more current usage is more often associated with drowsiness or torpor. This originally included barbiturates as a drug class versus what was originally perceived as nonsedative properties of benzodiazepines. This distinction is artificial with both drug classes having similar clinical and pharmacological profiles with marked anxiolytic properties. Hypnotics pertain to the sleep-induced properties of these therapeutics, and as such, sedative hypnotics as a drug class best pertain to benzodiazepines, although other classes such as barbiturates, gamma-aminobutyric-acid (GABA) analogues, and antiepileptic drugs have sedative hypnotic effects. However, the more severe side-effect profiles (including increased risk of death with overdose) of barbiturates have led to their replacement in routine clinical use by benzodiazepines.

The clinical utility of barbiturates has been surpassed by the adoption of benzodiazepines as safer sedative hypnotics. Barbiturates have been employed primarily in the past as anxiolytic and sedative agents with some such as phenobarbital still retaining clinical usage as anticonvulsants. Due to the risk of death with overdose, their clinical use must be carefully monitored particularly with regard to their CNS depressant effects which can mediate side effects as varied as respiratory depression, postural hypotension, confusion, fatigue, and impaired concentration/decision-making.

Benzodiazepines are most commonly employed in the symptomatic control of anxiety and stress-related conditions, although regulatory approval is usually for panic disorder and generalized anxiety. Irrespective of origin, these anxiety symptoms are the primary clinical indication of these therapeutics. While anxiety disorders can be both short and long lasting, benzodiazepines are usually used for the symptomatic management regardless of symptom duration. Given the long half-life of some benzodiazepines such as diazepam, treatment can be taken once daily but patients often prefer the reassurance of twice-daily administration claiming that they perceive anti-anxiety effects directly after each dose. For episodic anxiety, short duration of action benzodiazepines such as lorazepam taken before exposure to the anxiety generating situation exert potent effects while also exerting anti-anxiety effects when

taken during a panic attack. This preventive effect against panic attacks has also been claimed for other benzodiazepine such as alprazolam. However, discontinuation of benzodiazepine treatment often results in relapse or even rebound panic episodes. Benzodiazepines with a short duration of action are also employed adjunctively to relaxation therapy. Overdosage with benzodiazepines is common, but associated deaths are fortunately rare. However, extreme caution must be taken in terms of dose regulation in children, especially in those with preexisting respiratory complaints. Benzodiazepine effects are potentiated in the presence of other depressant drugs such that the consumption of alcohol while being treated with benzodiazepines is not advised. In situations where benzodiazepines and alcohol are concurrent, the patient often falls into a deep sleep but can be aroused following administration of the benzodiazepine antagonist flumazenil or similar drugs.

Hypnotic effects of both barbiturates and benzodiazepines are most commonly employed against sleep disturbances, notably insomnia. The cause of the sleep disturbance should be investigated first and if possible resolved through other means as the utility of long-term benzodiazepines may result in paradoxical sleep disturbances. Often, anxiety/stress can precipitate sleep disturbances, and resolution of these problems will reduce the need for long-term benzodiazepine use. If used for their hypnotic effect, those benzodiazepines with a shorter half-life are preferred to avoid excessive sleeping through the 24-h cycle. Of note, 5–10 mg diazepam once at night or temazepam (which has a half-life of 10–15 h) can induce sleep onset without many residual side effects the next day, while nitrazepam with a longer half-life (25–35 h) is employed to both manage anxiety during the day and induce sleep at night. While the hypnotic use of most benzodiazepines are often utilized prophylactically prior to the patient going to bed, the newer drugs such as zolpidem and zaleplon can be taken on an "as needed" basis if natural sleep onset fails after retiring to bed. This reduces the risk of dependence on these drugs and given their short duration of action reduces the side-effect profile associated with their utility.

Tolerance to moderate doses of barbiturates or benzodiazepines can occur, necessitating an increase in dosage to achieve anti-anxiety effects. However, as the stress/anxiety resolves, stepwise decreases in dosage should also be considered. Long-term clinical studies of barbiturate and benzodiazepine usage in autistic populations are lacking, but withdrawal of medication often results in relapse, suggesting that maintenance ensures continuation of the anti-anxiety effects or at least an avoidance of rebound effects. Dependence can occur at higher doses with drug withdrawal precipitating relapse 2–4 days or 5–10 days postdiscontinuation in the case of short- and long-acting benzodiazepines, respectively. Withdrawal symptoms often include anxiety, apprehension, dizziness, insomnia, confusional psychoses, and anorexia. Physical dependency can precipitate withdrawal symptoms such as muscle weakness, postural hypotension, convulsions, tremor, and nausea and vomiting. As such, it is best to reduce the dose gradually in order to minimize the risk of withdrawal symptoms which often ensue following abrupt termination of benzodiazepine use.

Oversedation of subjects results in the most commonly reported side effects of barbiturates and benzodiazepines: drowsiness, tiredness and torpor which are both dose- and time dependent. Drowsiness is typically observed within the first week of treatment, an effect to which the subject becomes tolerant to rapidly. During the initial phase of benzodiazepine treatment, subjects are advised not to drive given the impairment to both cognitive and psychomotor coordination caused by benzodiazepines. These cognitive impairments are a sustained feature of chronic benzodiazepine treatment with memory function being notably affected. Patients taking benzodiazepines can also encounter paradoxical behavioral responses such as increased aggression, uncharacteristic behavior, acute rage episodes, and intermittent crying. In autistic children,

paradoxical anxiogenic effects have been reported. These paradoxical effects are not unique to benzodiazepines and usually resolve spontaneously after a week of treatment or following dose adjustment. Other undesirable side effects associated with benzodiazepine use include weight gain, skin rash, menstrual irregularities, impairment of sexual function, and respiratory depression. Rare side effects such as blood dyscrasias are also sometimes seen.

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Seeing Essential English (SEE I)

▶ Manual Sign
▶ Sign Language

Seizure

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Synonyms

Convulsion; Epilepsy

Short Description or Definition

Seizures (sometimes called epileptic seizures) are the stereotypical clinical manifestations (signs and symptoms) of excessive and/or hypersynchronous, usually self-limited, abnormal activity of neurons situated in the cerebral cortex. Epilepsy is defined as two or more unprovoked afebrile seizures (Commission on Classification and Terminology of the International League Against Epilepsy, 1981).

Categorization

Although children with autism and epilepsy have many types of movements, the clinical semiology of *seizures* is similar to those in children without autism (i.e., children with pediatric epilepsy alone). The most common type of seizures during childhood, *a partial seizure*, occurs in two categories. *Simple partial seizures* are those in which the first clinical signs and electroencephalographic (EEG) signatures initiate focally in one area of the brain without impairment of consciousness. Simple partial seizures show focal neurological signs such as focal jerking of one hand/arm, sensory change or pain in one limb, or a unilateral contraction of the face.

Partial complex seizures (*psychomotor seizures*) are the more common of two types of partial seizures that manifest as focal neurological signs plus impairment of consciousness. Commonly, for instance, in temporal lobe epilepsy, patients may experience a gustatory sensation, rising epigastric feeling, or some other aura followed by a behavioral arrest. The child does not respond and stare off. Then the patient is tired. Sometimes the children develop jerking movements of limbs contralateral to the seizure focus. *Secondary generalization of partial complex seizures* occurs when seizures spread to the opposite hemisphere and is manifested clinically as *generalized tonic-clonic seizures*.

Clinical Expression and Pathophysiology

Partial epilepsies in childhood with autism often manifest as a frontal lobe or temporal lobe epilepsy. The interictal epileptiform activity until age 10–11 years is unilateral focal or multifocal epileptiform discharges. The ictal manifestations on EEG usually include evolving focal sharp-wave or spike and slow-wave discharges. As children become older (age 10–11 years), epileptiform discharges on EEGs are more frequent in the frontal or centrofrontal regions. Adolescents can have multifocal epilepsy in which the predominant seizure type is a partial complex seizure. However, a majority of seizures in the adolescent are generalized seizures. The generalized tonic-clonic seizures are the most common type of generalized seizures. The seizure may have a prodrome in which a change in behavior is seen. Most seizures began without warning when the patient falls to the floor, cries out, eyes roll back in the head, and the limbs have a rhythmic tonic-clonic-tonic pattern of jerking. The patient may lose bowel or bladder function at the end of the ictal phase. Cyanosis can develop but is usually transient. The generalized tonic-clonic seizures are typical of frontal lobe epilepsy which occurs in adolescents. The EEG correlate is a buildup of low-voltage fast activity which evolves into high-amplitude spike/polyspike or polyspike and wave discharges. Patients are typically sleepy or confused for some period of time after the seizure.

The second most common type, *absence seizures*, is characterized clinically by lapses in consciousness in which one can see a motionless stare, eyelids may droop, or eyes may briefly roll backwards and lasting 10–15 s in children with autism. The children usually resume their full activity after the spell or maybe briefly confused (<30 s). Only rarely, absence seizures are associated with other activity including automatisms, brief clonical movements of arms or eyelids, or loss of postural tone. The onset of absence seizures is associated with EEG onset of regular bilaterally frontal predominant generalized 3-Hz spike and wave discharges which begin and end suddenly in the setting of the background EEG for the child. With either absence or GTC seizures, children can have fragments of discharges interictally which include bilaterally frontal predominant generalized spike and slow-wave discharges.

Atypical absence seizures are lapses in consciousness in which one can see a motionless stare but are associated more with motor signs, particularly changes in tone, and can be more pronounced than in typical absence seizures. These seizures can have monitor focal or lateralizing signs. The onset and cessation of these seizures are less clear and last longer, typically 15–60 s with variable postictal confusion. These patients are more likely to have absence status epilepticus. The clinical onset is associated with similar generalized spike-wave discharges but usually at a frequency of <2.5 Hz. Although atypical absence seizures can be seen in the setting of Lennox-Gastaut syndrome, these seizures are rarer in autism patients with Lennox-Gastaut syndrome.

Tonic and atonic seizures are more common in autism patients but not necessarily always associated with Lennox-Gastaut syndrome. *Tonic seizures* are more common in childhood and represent a continuum of the atonic-tonic seizures. The seizures have tonic spasms of the face or chest/trunk with tonic flexion of the upper

extremities and flexion or extension of the lower extremities. Along with impairment of consciousness, patients can have papillary dilation, tachycardia, apnea/cyanosis, and urinary incontinence followed by a period of postictal confusion. Ictal EEG is low-amplitude very fast activity. Atonic seizures (usually called drop attacks) consist of a sudden loss of postural tone. In some patients, the drop attacks are preceded by one or more clonic jerks. In mild forms, the child may just have a head drop. In severe forms, the patient's whole body may drop to the floor and require a seizure helmet. The atonic seizure usually lasts only a few seconds and has little postictal period. An occasional patient may be out several minutes on the floor. Atonic seizures on the ictal EEH exhibits either generalized polyspike and wave discharges or a sudden electrodecrement (suppression) of the EEG. The synchronization of discharges between hemispheres is important for these seizure types because a corpus callosotomy can be a treatment to abolish these seizures.

Myoclonic seizures (epileptic myoclonus) are relatively rare in autism and usually seen in the most profoundly affected autism-epilepsy patients. The broader term myoclonus refers to certain quick involuntary muscle jerks involving any part of the neuroaxis. Myoclonic seizures in autism can be differentiated both semiology wise and neurophysiologically from movement disorders, hyperreflexia, and rare cases of spasticity. Myoclonic seizures (although can be unifocal, multifocal, or unilateral) are usually bilateral generalized jerks which are either sporadic or rhythmic in nature. Action or sensory myoclonus rarely occurs in autism-epilepsy patients. Commonly, the myoclonic seizures are rapid rhythmic bilateral synchronous jerks (2–8 Hz) of the upper extremities with occasional lower extremity/whole body involvement. The ictal EEG is generalized polyspike and slow-wave discharges associated with the quick jerks.

Status epilepticus is commonly defined as repeated seizures/events without a return to consciousness lasting longer than 30 min in duration. Most types of epileptic seizures can be manifested as status epilepticus. The two major types of status epilepticus, generalized convulsive status epilepticus (major motor seizures, recurrent generalized tonic-clonic convulsions) and nonconvulsive status epilepticus (recurrent nonconvulsive seizures including absence status, partial complex status, and simple partial status) are recognized clinically. Convulsive status epilepticus is the most common medical emergency from neurological disease in autism because brain damage and death can result from the systemic consequences of repeated generalized tonic-clonic seizures. Most persons with generalized tonic-clonic status epilepticus have localized cerebral disturbances as a cause and therefore have secondary generalized partial seizures. Repeated cerebral epileptic activity can disrupt brain structures or otherwise cause permanent neurological or intellectual deficits.

Evaluation and Differential Diagnosis

See ▶ Neurologist.

Treatment

Therapy must be directed at suppressing all ictal activity on EEG. Ictal EEG activity can have a progression from (1) discrete seizures, (2) merging of seizures with waxing and waning of amplitude and frequency with variable locations, (3) continuous ictal activity, (4) continuous ictal activity intermixed with periods of isoelectric EEG, and (5) the PLEDS or GPEDS pattern. The recurrence of frequent generalized tonic-clonic seizures in a row creates a life-threatening systemic condition of hyperpyrexia, failure of cerebrovascular autoregulation, acidosis, and severe hypoxia, causing hypotension, hypoperfusion of the brain, pulmonary edema, electrolyte disturbances, and eventual circulatory collapse. Even after cessation of status epilepticus and correction of systemic abnormalities, sepsis from aspiration pneumonia can be late but life-threatening complication of status epilepticus. Treatment of status epilepticus in autism, consisting of ABC's, correction of

glucose/electrolyte disturbances, control of BP, and oxygenation, benzodiazepines, and a series of routine anticonvulsants, is not different from treatment of status epilepticus in other conditions.

See Also

► Epilepsy

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Seizure Disorder

► Epilepsy

Seizures

► Medical Conditions Associated with Autism

Selective Attention

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Definition

Selective attention refers to the ability to pay attention to a limited array of all available sensory information. Selective attention, as a filter to help prioritize information according to its importance, is adaptive. If attention is too selective, however, it is maladaptive. Excessively selective attention has become known as "stimulus overselectivity," which is prevalent in autism. Its cause or causes are assumed to be brain organic. Because overselectivity has serious implications for impairment of learning at many levels, including social, emotional, and language learning (all key features of autism), it is suggested that an evidence-based treatment should focus on the normalization of attention patterns as early as possible to take advantage of the young brain's plasticity. Behavior analysis can provide such evidence-based treatments. Until a true cure for autism is found, behavior analysis remains the treatment of choice.

Historical Background

Landmark Study

The term "stimulus overselectivity" was coined by Lovaas, Schreibman, Koegel, and Rehm (1971) in their pioneering study investigating abnormal attention patterns in children with autism. Even though some degree of selectivity in attention is considered adaptive, Lovaas et al. (1971) felt that the degree of selectivity observed in their study was excessive, thus their term "overselectivity." In their study, children with autism, with mental retardation, or with typical development were first trained with so-called compound stimuli comprising visual (flood light), auditory (tone), and tactile (blood-pressure cuff) stimulus components that were presented simultaneously at predictable time intervals – in effect adding a fourth, temporal, component. When the child responded in the presence of the compound stimulus, a reward was given but not when the child responded in the absence of it. (Technically speaking, this constituted a successive discrimination paradigm.) During testing, the stimulus components were then presented successively in isolation and random order. The variable of interest was whether the children would respond to the isolated stimulus components after they had responded reliably to the compound stimuli. Generally, the typical

children responded to all three isolated components, the children with mental retardation to two, and the children with autism to only one. (No child responded to the temporal element.) Thus, the children with autism were more selective in their attention to isolated stimulus components than the children in the other two groups. No consistent preference for any particular sensory modality was observed for these three groups.

Over the next four decades, the study by Lovaas et al. (1971) has stimulated a slew of follow-up research studies that employed a variety of different training and testing paradigms, different sensory modalities and stimulus types, and various schemes of experimental control and matching procedures (e.g., by diagnosis, chronological age, mental age, verbal skills, functioning level, and severity of autistic traits). No consistent pattern has emerged though (cf. Ploog, 2010). For example, even though stimulus overselectivity is clearly prevalent in autism, it also occurs in other diagnostic categories (e.g., Down Syndrome); even though there appears to be a correlation between mental age and degree of overselectivity, there is evidence that overselectivity is also independent of mental age, and even though overselectivity is more likely to occur with increased stimulus complexity, overselectivity can also be shown in relatively simple two-stimulus situations. In some cases, it can even be shown that the atypical attention consists of a *lack* of focus and *not of too narrow a focus*. In other words, processing of sensory information appears simply disorganized or haphazard and quite the opposite to the original conceptualization of overselective attention. Despite such inconsistencies, however, there is consensus that children with autism somehow differ from their typically developing peers in their attention patterns. This has led researchers to propose different conceptualizations of attention patterns in autism, which will be discussed in the following section. After that, the implications of atypical attention patterns will be discussed. Finally, possible treatment approaches to remediate or normalize such atypical attention patterns will be discussed.

Current Knowledge

Alternative Conceptualizations

Table 1 is an attempt to provide a way to compare and delimit several of the most common approaches to understanding the atypical attention patterns seen in autism: stimulus overselectivity hypothesis, prioritization deficit hypothesis, weak central coherence theory, and enhanced perceptual functioning theory. The stimulus overselectivity hypothesis (SO) was introduced under historical background.

The prioritization deficit hypothesis (PD) is really an extension of SO, except that instead of limiting the attentional abnormalities strictly to "overselectivity," it includes unfocused, undirected, or chance attention to isolated stimulus features. This extension seemed justified based on studies that implied that, surprisingly, the attention of children with autism was *less* selective than that of typically developing children. In Ploog, Banerjee, and Brooks (2009), for example, children with autism and with typical development were shown to accurately discriminate between spoken sentences on the basis of *what* was being said (content) and *how* it was being said (prosody: question vs. statement). So there was no deficit (nor enhancement) in perception. However, when content was pitched against prosody, the autistic children chose both content and prosody with equal probability, whereas typical children focused their attention strongly on content. Such a finding of reduced selectivity does not seem to be restricted to language stimuli (e.g., Ploog & Kim, 2007, with tactile stimuli, even though a point was being made in their study that, depending on interpretation, the children with autism did in fact exhibit restricted attention). In the language study in particular (including follow-up work), it appeared as if the children with autism, in the context of testing, indiscriminately responded to any stimulus dimension, whereas the typical children assigned higher priority to content, even though all children were perfectly capable of perceiving differences in both content and prosody. In other words, the children with autism did not prioritize the information embedded in the stimuli according to

Selective Attention, Table 1 Comparison of theories in their conceptualizations of atypical attention patterns in ASD

	Approach			
Regarding atypical attention, the theory/hypothesis . . .	SO[a]	PD[b]	WCC[c]	EPF[d]
Distinguishes between local vs. global information	✓	✓	✓	✓
Assigns a role to "meaning"		✓	✓	
Assumes bias/undirected focus rather than true deficit	✓	✓	✓	
Sees atypical attention as cause for other abnormalities	✓	✓		
Posits diminished movement perception				✓
Attempts to account for all sensory modalities:	✓	✓	✓	

[a]Stimulus overselectivity hypothesis
[b]Prioritization deficit hypothesis
[c]Weak central coherence theory
[d]Enhanced perceptual functioning theory

what seemed to be the most relevant information to the typical children – such prioritization being an example of *adaptive* selective attention. Thus, PD essentially broadens the SO notion to encompass maladaptive undirected attention. Early work by Etzel, LeBlanc, Schilmoeller, and Stella (1981) raised the notion of "relevancy" in the development of stimulus control, which is a behavior analytical term to operationalize "attention" (e.g., Reynolds, 1961). In PD, this concept of "relevancy" incorporates the notion of "meaning" when responding to language stimuli. The children with autism appear to select their choices of stimulus components simply on a sensory-perceptual basis, whereas the typical children do so based on a higher cognitive level. This hypothesis is currently being put to a test.

Another conceptualization of atypical attention in autism is captured in the weak central coherence theory (WCC, e.g., Happé & Frith, 2006). The main idea of WCC is that the "cognitive style" in autism is to perceive and process sensory information in a "detail-focused" manner rather than to integrate an array of information in a larger context. As such, WCC is consistent with SO. In contrast, however, WCC is based on the assumption that a deficit in central coherence leads to a failure to extract "meaning." SO does not afford a special status to meaning per se, beyond the overall information that is embedded in the stimuli, whereas PD, as was discussed above, does not posit that atypical attention results in a failure to extract meaning but rather that a failure to extract meaning results in atypical attention. Happé and Frith (2006) pointed out three challenges to early accounts of WCC: First, WCC may result (but not necessarily so) in superior processing of some information possibly because of the sharper focus on local information and because of the exclusion of global, contextual, and semantic information, which might distract from a sharp focus on local information. SO is compatible with this notion; PD is, too, as a chance focus on some stimulus feature or piece of information may result in superior processing of it. This idea may explain the underlying mechanism of the "savant" phenomenon that has been reported in some, albeit rare, cases of autism. Second, WCC may be a bias in selecting some information rather than a true deficit of not attending to certain aspects of sensory information. This, again, is compatible with SO and PD as it has not been possible to show in the literature any modality-specific deficits or limit to the degree of complexity to account for atypical attention. Third, WCC may be a by-product rather than the cause for anomalies in social cognition. In contrast, SO and PD both provide convincing evidence that atypical attention may be the cause for a multitude of deficits seen in autism, without arguing that atypical attention is the cause for autism. In this respect, SO and PD are not compatible with WCC.

Enhanced perceptual functioning (EPF, e.g., Mottron, Dawson, Soulières, Hubert, & Burack, 2006), as the name implies, posits superior

perception in individuals with autism compared to typically developing individuals. Superiority in perception is assumed to occur both in "low-level" and in "complex" cognitive tasks. In elaborating on EPF, Mottron et al. (2006) proposed "eight principles of autistic perception." The three most important ones are the following: First, an enhanced detail perception is assumed. This puts EPF on equal footing with SO, WCC, and PD and can possibly account for superior perception in some areas. Second, EPF proposes diminished movement perception. None of the other theories considered here speak to this issue directly; it is also not clear how this notion might be linked to atypical attention with respect to information that is not characterized by movement per se (e.g., language, tactile perception, and still pictures of visual patterns). However, if one considers movement information as just one specific type of information, SO, WCC, and PD can account for diminished movement perception, just as for any other form of compromised information processing. Third, autistic individuals exhibit increased frequency of lateral glances – a behavior that may be involved in perception of movement. Again, it is not clear how lateral glances would be critical in the development of attention to information other than the visual modality. The other theories considered here do not address this behavior. In conclusion, it seems that EPF is focusing on visual attention, whereas the other theories can incorporate attention within all sensory modalities.

Implications for Autism Spectrum Disorders

In the following discussion of the implications of abnormal attention in autism, the focus will be on a limited selection of key characteristics of autism: impairments in social skills, language, and emotional behavior. In addition, a hypothesis with regard to a contributing cause of stereotypic behavior, also common in autism, will be proposed.

Assuming that a child with autism is not attending to contextual and situational information in the same manner as a typical child would, it should not be surprising if a number of problems develop as a result. Consider a situation in which a child with autism, Andy, would like to play soccer with another child, Brad. Andy sees the ball, likes it, runs toward it, and tries to kick it. But he may not have heard what Brad said because his attention was on the ball, not on other contextual and situational information. Whether Brad said, "Hey, go away! I am waiting for my friend to play with!" or "Hey, that's great! You like soccer, too! Let's play!" represents a critical difference in the way Andy would experience the conclusion of this social interaction. In the first case, Brad would probably take the ball away from Andy and show anger or worse. In the second case, Brad might let Andy have the ball and try to play with him. From Andy's perspective, however, it was impossible to predict what he was going to experience. In one case, the soccer ball will be associated with a pleasant social interaction, in the other case with an unpleasant one. Of course, a social situation does not rest on one piece of information (i.e., the soccer ball) but also on a multitude of other cues (e.g., what is being said, how it is being said, "body language" of the other person, facial expressions, whether only one additional person or several persons enter in the social situation). Even if Andy attended to some of the spoken language (e.g., "Hey"), it would not have been sufficient to allow Andy to negotiate the social interaction with Brad. Under these considerations, it should be obvious that Andy would be very unlikely to develop normal, social behavior.

The previous scenario may also serve as an example to discuss the development of appropriate emotional behavior. Brad may have said "Hey" while smiling or frowning. If Andy was indeed oblivious (not paying attention) to the different facial expressions, he would have missed out on an opportunity to learn that happy and angry faces, displayed by others, are usually correlated with running into an emotionally positive or negative situation, respectively.

Abnormal attention much earlier in life represents an even bigger problem: At birth, most children nurse reflexively but the efficiency with which they do so is subject to learning as the mother provides important feedback for effective suckling. Furthermore, whether the baby nurses

correctly or perhaps bites the mother's nipple produces different consequences. In the former case, the mother might rock the baby, hum soothingly, and the baby is naturally rewarded with milk. In the latter case, the mother might yelp in pain, push the baby back, say "No!" and nursing is interrupted. Typical children learn the consequences of their behavior quite early, readily, and quickly. (A 2-month-old or even younger baby, e.g., can learn to move his limbs in order to make a mobile spin.) But learning the consequences of one's behavior depends critically on attending to a number of cues (e.g., tasting milk in mouth, hearing "no" or the soothing humming, feeling being pushed back or being rocked gently). If a child does not attend to a variety of cues, the direction of any social interaction will be unpredictable and it will not develop appropriately.

Acquisition of language depends critically on being able to attend to multiple cues as well. Either overselective attention (SO and WCC concept) or unfocused, undirected attention (PD concept) would result in an impairment of language development. In the example of the nursing baby, it should be obvious that the baby will not learn the meaning of "no" as a verbal cue not to repeat whatever the baby was doing before hearing "no." (Technically speaking, this is an example of positive punishment.) Here is another example: An infant is on a stroll with his mother. The mother is pointing out a cat and says: "Look at the kitty!" A little bit later, they come across a dog and the mother says: "There's a doggie!" An infant, who pays attention only to the dog and cat animals but not to what the mother says, will not acquire the correct labels. Maybe the infant is not even looking at the animals but instead at the parked cars or the trucks at a construction site next to the sidewalk. But even if the child was attending to the animals *and* to his mother's speech, it would be possible to learn the proper labels only if the infant actually attends to the relevant sounds (i.e., "doggie" and "kitty") in his mother's speech. Such language learning can be explained well by so-called statistical learning (which is the term used by linguists to refer to language learning through classical conditioning; Pavlov, 1927), but it only works if the listener is able to detect the sequential patterns of sounds in speech (e.g., "the" and "a" being followed with high probability by a noun referencing an object in the listener's environment). Finally, with critical deficits in receptive language (i.e., listening), one would expect that development of expressive language (i.e., speaking) would be seriously compromised.

With all these examples, one can appreciate that the child who suffers from abnormal attention (either not being able to process several paths of information simultaneously or not being able to focus on the relevant piece of information) lives in an essentially unpredictable world. Learning in general is severely impaired; social interactions cannot be understood; whatever happens as a result of one's actions is not predictably linked to one's own behavior; language is a meaningless garble of sounds instead of probabilistic patterns; and other people's emotions – with significant consequences for self – will appear random. At the same time, good and bad things will happen to the child without much chance to understand why. Experimental work (as early as Pavlov, 1927) has shown that unpredictable consequences to one's behavior, or random sequences of events that occur independently of one's behavior, might result in erratic and bizarrely stereotyped behavior (experimental "neurosis" [Pavlov, 1927] or "superstition"[Skinner, 1948]). Abnormal attention and the resulting unpredictable consequences and events may therefore contribute to stereotyped behavior that is quite common in autism. (This is not to deny the possibility that engaging in these stereotyped behaviors, such as self-stimulatory behavior, is in itself reinforcing to the child either because of the sensory stimulation it provides or because of the child's ability to produce some predictable outcome.)

Future Directions

Treatment Based on Normalizing Attention Patterns in ASD

WCC and EPF do not directly suggest treatment or remediation strategies. SO and PD do. This is so because both SO and PD base their analyses on

operational definitions of attention that then allow the atypical attention to be normalized directly. There are no claims that any of these treatments result in a removal of the original cause of abnormal attention or other deficiencies (whether such deficiencies are secondary to abnormal attention or not). Rather, remediation strategies should be seen as "crutches" to overcome some of the abnormalities in a given situation. However, if remediation strategies are implemented from early on, chances are that the brain, when it still has great plasticity, can be trained to process information more adaptively despite putative brain-organic differences compared to the typical brain. At the very least, the rate of divergence between typical and abnormal attention and problems resulting from abnormal attention can be minimized while the autistic child is developing. (Note that *despite effective* treatment, IQ scores may still decrease just because the rate of increasing mental age and cognitive functioning, due to effective treatment, is not keeping pace with the rate of increasing chronological age.)

Some behavior analytical treatments focus specifically on so-called pivotal behaviors such as attention to multiple cues (Koegel et al., 1989). Pivotal behaviors are behaviors that when acquired result in changes in other behaviors even if those were not specifically trained. Training of pivotal behaviors is therefore a very efficient way of producing significant, positive, and broad behavior changes without having to train each target behavior individually. Responding to multiple cues is considered a pivotal behavior because an ability to simultaneously pay attention appropriately to multiple bits of information is the basis for learning almost anything (as alluded to before). Pivotal behavior training for changing a person's attention to multiple cues is based on the conceptual framework of SO, which can easily be expanded to incorporate PD accounts of situations when attention seems to be directed toward irrelevant cues – cues that should be low in priority for attention – and not to high-priority cues. Two strategies will be discussed: attentional shaping (also referred to as within-stimulus fading or transfer-along-a-continuum) and training on conditional discrimination tasks.

Attentional shaping (e.g., Ploog & Williams, 1995) is a fading procedure that, from the very beginning of learning a difficult discrimination task, focuses the child on a relevant stimulus dimension. The following serve as an example: It may be difficult for a child with autism to learn to tell apart the letter "E" from the letter "F, if the child only attends to any features of the letters other than the critical one – presence or absence of the horizontal line on the bottom of the letters. Attentional shaping would begin with drawing the child's attention to the feature that is critical for distinguishing between the two letters (i.e., bottom horizontal line). A first step might involve presenting sequentially flash cards with either a big horizontal line on it or a blank card with nothing on it. Once the child mastered this first step (generally not a difficult task even for a child with atypical attention), the next steps are introduced. The exaggerated line is gradually reduced to realistic dimensions and moved toward the bottom of the flash card. Then, the letter "F" is faded in on both flashcards until both letters are presented realistically ("E" being "F" with line vs. "F" being "F" without line). The advance of computer technology has made such training much more feasible – especially if embedded in a fun computer game – because the different steps in training can be automated and individually titrated (including correction procedures) while the child is working on the computer. Attentional shaping can be implemented in any situation as long as the distinguishing (relevant) feature of a discrimination task can be identified. An alternative way of teaching a difficult discrimination task, but possibly more problematic, is what is commonly called "prompting." Applied to the previous example, the adult may point to the letter "E" and reward the child for saying "E" or for selecting it from several choices. Then the prompt (i.e., the pointing finger) may gradually be removed. The reason why such prompting may not be so effective with a child who does not attend to multiple cues is that the child may only attend to the pointing finger but not simultaneously to the finger *and* the letter "E." (After all, the child may be unresponsive to multiple cues.) The two techniques, attentional shaping

and prompting in the manner described here, have been referred to as within- and extra-stimulus prompting (cf. Schreibman, 1975). Generally, the attentional shaping approach has been more effective than other prompting techniques in teaching children with autism because it practically imposes from the very beginning the stimulus feature that was initially neglected or was not given attentional priority by the child. By conducting extended training with attentional shaping methods, the child can learn the pivotal behavior of responding to multiple cues, that is, acquire a generalized skill beyond simply learning a series of individual discrimination tasks (Stokes & Baer, 1977).

The learning of conditional discrimination tasks poses major difficulties to children who are not responsive to multiple cues. However, extended training on these tasks results in a generalized, increased responsiveness because learning to attend to multiple cues is inherent in the task in the following way: A mother might say "Please, pick the red shirt and get dressed!" or "Please, pick the blue pants and get dressed!" Unless the child paid attention to color and the particular clothing item, the child would have difficulties to follow the mother's request. A training procedure to make the child attentive to multiple cues can be implemented conveniently on a computer. For example, the words "RED SHIRT" might flash on the screen (or a person or computer could present the spoken words). After a short delay, pictures of several items will be given as choices to the child: A red shirt, a blue shirt, red pants, and blue pants. If the child picks the correct item (i.e., red shirt), he earns a reward such as a point, later to be exchanged for some preferred activity, or being allowed to view a brief, engaging video clip. Training would proceed with many of similar stimulus sets. Responsiveness to multiple cues can easily be expanded to incorporate three, four, or more cues (e.g., red/blue, big/small, new/old, corduroy/canvas, pants/shorts).

Summary

Selective attention is adaptive, but if it is too selective, disorganized, or undirected, it is considered an abnormal attention pattern that is maladaptive. Abnormal attention is prevalent in autism but not specific to autism. Abnormal attention has been conceptualized as stimulus overselectivity, a prioritization deficit, weak central coherence, or enhanced perceptual functioning. Regardless of conceptualization, abnormal attention has serious implications for normal functioning and learning deficits, including many of the landmark features of autism such as deficits in language development, social and emotional behavior, academic success, abstract cognition, and even possibly stereotypic/self-stimulatory excessive behaviors. Therefore, treatments should focus on normalizing attention patterns in individuals with autism as early in life as possible. Because the ability of normal selective attention is considered pivotal, behavior analytical treatments have targeted a normalization of attention in individuals with autism. As a treatment, attentional shaping is effective in training to direct attention specifically to one or several aspects of the surroundings that were previously neglected. Training on a series of conditional discrimination tasks is effective as a treatment in increasing the overall responsivity to multiple cues.

See Also

- ▶ Attention
- ▶ Behavior Analysis
- ▶ Behavior Therapy
- ▶ Early Intervention
- ▶ Emotion
- ▶ Enhanced Perceptual Functioning
- ▶ Expressive Language
- ▶ Generalization and Maintenance
- ▶ Language Acquisition
- ▶ Pivotal Response Training
- ▶ Prosody
- ▶ Receptive Language
- ▶ Savant Skills (in Autism)
- ▶ Schedule of Reinforcement
- ▶ Self-stimulatory Behavior
- ▶ Stereotypic Behavior

- ▶ Stimulus Overselectivity
- ▶ Tactile
- ▶ Video Games, Use of

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Selective Mutism

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Synonyms

Elective mutism

Short Description or Definition

Selective mutism is a disorder characterized by a "persistent failure to speak in specific social situations (e.g., school, with playmates) where speaking is expected, despite speaking in other situations" (American Psychiatric Association [APA], 2000, p. 125). The diagnostic criteria for selective mutism also require that the disturbance lasts for more than 1 month and interferes with social communication or educational or occupational achievement. Additionally, the failure to speak cannot be the result of a lack of knowledge or comfort with the language expected in the social situation. Selective mutism is also not diagnosed if the disturbance is due to a communication disorder or occurs exclusively in the context of a pervasive developmental disorder, schizophrenia, or other psychotic disorder (APA, 2000).

Categorization

Selective mutism is listed under Other Disorders of Infancy, Childhood, and Adolescence in the fourth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV; APA,

2000). Some scholars have argued that it would be more appropriate to categorize selective mutism under anxiety disorders in the DSM or classify it as a behavioral symptom of certain anxiety disorders rather than a distinct disorder (Anstendig, 1999). Children who develop selective mutism tend to have similar biological and family dynamic characteristics as those who develop anxiety disorders, and cognitive-behavioral and pharmacological treatments for anxiety disorders have been used successfully with children who exhibit selective mutism (Anstendig, 1999). However, there are currently no plans to list selective mutism as an anxiety disorder in the next edition of the DSM (APA, 2010).

Epidemiology

The disorder has been estimated to occur in 0.2–2.0% of youth and tends to be more common in girls than boys (Kearney, 2010). Prevalence rates are often higher in school-based samples compared to clinic-based samples because children with selective mutism may not necessarily be referred for mental health services, as they are not disruptive in school (Cleave, 2009).

Natural History, Prognostic Factors, Outcomes

Selective mutism usually develops during the preschool years but may not be diagnosed until the child is in elementary school (Viana, Beidel, & Rabian, 2009). The disorder does not have a specific, identified cause and likely develops through multiple pathways (Viana et al.). It is associated with a slow-to-warm and shy temperament (Sharp, Sherman, & Gross, 2007). Parents of children with selective mutism tend to have higher rates of anxiety and other forms on psychopathology than control groups (Viana et al., 2009). Some researchers have found relatively high comorbidity between selective mutism and other communication disorders (Viana et al.). For some children, selective mutism may have a chronic course that can lead to problems with peer rejection, academic performance, or social skills (Kearney, 2010). For other children, the disorder may only last a few months (Sharp et al., 2007). Adults are less likely to be diagnosed with selective mutism, probably because they have more control over their environment and can more easily avoid situations that require speaking (Sharp et al.). Many young adults who were diagnosed with selective mutism as children report difficulties with self-confidence, independence, achievement, and social communication skills (Sharp et al.).

Clinical Expression and Pathophysiology

The clinical expression of selective mutism is usually characterized by a child who speaks normally at home with family members and does not speak in other settings, such as school or restaurants. Many children with selective mutism will also present with symptoms of anxiety disorders, particularly social phobia, which may include fearing and/or avoiding social or performance situations. Parents, teachers, and peers may compensate for the child's failure to speak by speaking for the child or allowing nonverbal forms of communication (Kearney, 2010).

The pathophysiology of selective mutism has not been directly examined, although physical symptoms of anxiety (e.g., increased heart rate, shaking, sweating) may be present in some individuals with selective mutism (Kearney, 2010).

Evaluation and Differential Diagnosis

Evaluations for selective mutism may begin with interviewing the child, his or her parents, and the child's teacher. Some children with selective mutism will respond nonverbally (e.g., shaking head) to yes/no questions, which can provide an opportunity to obtain information from the child's perspective (Kearney, 2010). Interviews may include questions related to each of the specific diagnostic criteria for selective mutism, the

settings that involve a failure to speak, the circumstances surrounding the failure to speak, whether the child can be encouraged to speak in certain public settings, symptoms that may surround the child's failure to speak, and how others respond to the child's mutism (Kearney, 2010). Behavior scales specific to selective mutism, anxiety, depression, and oppositional behavior can also be useful for obtaining information from multiple informants. Evaluations for selective mutism can also include direct behavioral observations across settings (Kearney, 2010). In terms of differential diagnosis, if there is reason to suspect that a child's failure to speak is better accounted for by a communication disorder (e.g., specific language impairment), it would be important to conduct a comprehensive speech/language evaluation.

Treatment

Interventions for selective mutism include behavioral strategies such as exposure-based practice, stimulus fading, shaping and prompting, relaxation training, and self-modeling, as well as pharmacological treatments (Kearney, 2010). Exposure-based practice involves a hierarchy of speaking situations in which the child is expected to gradually speak in increasingly difficult or anxiety-provoking situations (Kearney, 2010). Stimulus fading can be incorporated into exposure-based practice by gradually introducing new stimuli (e.g., peers or teachers). Shaping and prompting involve the reinforcement of successive approximations of the desired behavior. Relaxation training focuses on teaching the child how to relax his or her muscles and breathe properly to manage physical symptoms of anxiety. Self-modeling techniques may involve videotaping the child speaking clearly at home and playing the video at school to model the desired behavior in a setting in which speaking does not currently occur (Kearney, 2010). The research base on pharmacological treatments for selective mutism is somewhat limited, but selective serotonin reuptake inhibitors (SSRIs) have shown promise for treating cases of selective mutism that are not responsive to psychosocial or behavioral interventions (Carlson, Mitchell, & Segool, 2008).

See Also

- ▶ Anxiety
- ▶ Anxiety Disorders
- ▶ Separation Anxiety Disorder
- ▶ Social Anxiety Disorder
- ▶ Social Phobia

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Selective Serotonin Reuptake Inhibitors (SSRIs)

- ▶ Antidepressants

Self and Autism

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Definition

The self is notoriously difficult to define – so much so, that some scientists regard it as a fiction. Among the many definitions and illustrations offered by the Shorter Oxford English Dictionary, the following is adequate for the present purposes: a permanent subject of successive and varying states of consciousness…one's nature, character, or (sometimes) physical constitution or appearance.

Bodily, sociocultural, and reflective dimensions of the self are mutually interdependent. Therefore, it is important to address how individuals with autism might be typical or atypical in their bodily grounded sense(s) of themselves, in their experiences of themselves in relation to other selves – including but not restricted to experiences that might draw on *concepts* of self and others – and in their self-reflective awareness or self-consciousness. Here, it will be critical to determine how far they feel both connected to, and differentiated from, the social and nonsocial world.

Historical Background

Although it is only recently that the self has emerged as a focus for autism research, reflections on affected children's self-experience, self-related behavior, and self-other relations have long been a feature of the clinical literature on autism.

In the first description of the syndrome of autism, Kanner (1943) noted how "people, so long as they left the child alone, figured in about the same manner as did the desk, the bookshelf, or the filing cabinet" (p. 246). Kanner's case descriptions provide vivid illustration of these children's qualities of self-awareness as well as their lack of connectedness with other selves. Their seeming imperviousness to other people sometimes extended to a marked failure to respond to others calling the child's own name, or an insensitivity to others' attitudes to the self. For example, Paul G. (Case 4) "… rarely responded to any form of address, even to the calling of his name… It made no difference whether one spoke to him in a friendly or a harsh way" (pp. 227–8). Kanner noted how such abnormality extended to self-expressions in language. For example, When Donald T. (Case 1) stumbled and nearly fell down, he said of himself, "You did not fall down". The mother of Frederick W. (Case 2) reported the following: "When receiving a gift, he" (etc) would say of himself: 'You say Thank you.'". Kanner remarked how it was around the sixth year of life that the children he studied gradually learned to speak of themselves in the first person and the person addressed in the second person.

Alongside these features, Kanner recorded abnormalities in nonverbal aspects of self-/other-awareness. For example, Elaine C. (Case 11) was said to move among other children "like a strange being, as one moves between the pieces of furniture of a room" (p. 241). Yet when it came to the children's attitudes towards objects, it seemed to Kanner that typically autistic children had "a gratifying sense of undisputed power and control" (p. 246) and found pleasure in achievements such as completing puzzles – phenomena that seem to express selfhood. What appeared diminished among the children was self-with-other engagement, for instance, where they failed to orientate toward other people's appreciation of what they had achieved (also Kasari, Sigman, Baumgartner, & Stipek, 1993).

There are many other references to important self-related phenomena in the early literature on autism. For instance, Scheerer, Rothmann, and Goldstein (1945) described an 11-year-old with autism, L, as unable to define the properties of objects except in terms relating to his own use of the objects or to specific situations. L defined an orange as "that I squeeze with," and an envelope was "something I put in with." Mahler (1968)

thought that the children showed incomplete separation of self from other, as exemplified by echolalia and the use of parts of another person's body as an extension of themselves, and she also suggested that they employed self-directed aggression in order to feel alive and whole. Bosch (1970) described how the children often seem to lack a sense of possessiveness as well as self-consciousness and shame, and suggested that a "delay occurs in the constituting of the other person as someone in whose place I can put myself. . .[and]. . .in the constituting of a common sphere of existence, in which things do not simply refer to me but also to others" (p. 89). Clearly a range of clinical phenomena among persons with autism might be bound up with – and perhaps even result from – atypical self-other experience.

There is a final, more recent perspective to consider as background to contemporary scientific studies of the self and autism. This comes from firsthand accounts of self-experience from people with autism. Perhaps most famously, Temple Grandin (1992) wrote of peculiarities in her perceptual experiences but gave little weight to her own emotional or family life, and described how she "had an odd lack of awareness of my oddities of speech and mannerisms until I looked at videotapes" (p. 113). Other quasi-naturalistic studies of people with autism (e.g., Hurlburt, Happé, & Frith, 1994; Millward, Powell, Messer, & Jordan, 2000) extend this perspective to individuals' difficulties in reporting personal events or their own thoughts and feelings.

Current Knowledge

Controlled studies of children and adolescents with autism are especially valuable in determining whether abnormalities in self-other relations and experience are specific to children with autism, and not (for example) a reflection of learning difficulties that also occur among children without autism. They also show whether there is specificity to any deficits, with relative sparing of other aspects of self-awareness.

Relational Self-/Other-Awareness

It is difficult to assess self-/other-awareness among infants and toddlers with autism. Indeed, it is open to question which kinds of social interaction satisfy criteria for relations between a self and others. Certainly, very young (as well as some older) children's lack of responsiveness to their own name being called (e.g., Dawson, Meltzoff, Osterling, Rinaldi, & Brown, 1998) provides *prima facie* evidence for profound limitation in early experience of self vis-à-vis a verbally communicating other person. Beyond this, it is arguable that most phenomena falling under the rather loose rubric of "intersubjectivity" might implicate self and other poles of experience. For example, when Wimpory, Hobson, Williams, and Nash (2000) interviewed parents of children with and without autism aged between two and a half and 4 years about the first 2 years of the children's lives, the children with autism were said to show less intense eye gaze, greeting, turn taking, or directing feelings of anger and distress toward people, and less giving or showing objects to others. One might conjecture that in *each* respect, it is not just behavior toward another person that is restricted in range and character. Prototypically, at least, behavior such as greeting, turn taking, being angry with another person, or showing something to someone else is imbued with self-experience, just as the someone else related-to is experienced as a self whom one greets, with whom one takes turns, and so on.

These reflections illustrate a more general point. There appears to be correspondence between experience of and relatedness toward another person as a self, that is, a center of subjective experience toward whom one feels a range of engaged attitudes, and experience of and relatedness toward oneself. It is striking how, across the lifespan, there seems to be a relative absence of self-other poles of experience and behavior among persons with autism. For example, toddlers and young children with autism show a partial lack of empathy and social referencing as well as joint attention (Charman, Swettenham, Baron-Cohen, Cox, Baird, & Drew, 1997) and older children and adolescents tend to show atypical or absent expressions of greeting

and farewell (Hobson & Lee, 1998). These kinds of orientation toward other persons implicate *oneself* as adopting a stance, for instance, a self-rooted stance of "feeling for" the other, or the self-aware stance of being someone who is arriving into or departing from someone else's presence.

One explanatory approach to such phenomena is to suppose that individuals with autism have a cognitive difficulty in putting themselves in someone else's shoes, perhaps because they lack mental concepts ("theory of mind" e.g., Frith & Happé, 1999). This begs the question, how do we acquire the concept of selves with minds? One precondition is that we need to grasp the kinds of relations that are fitting between ourselves and other selves. One would not have a concept of persons with subjectivity if one always perceived and related to persons as pieces of furniture. Therefore, there may be a deeper and more basic propensity in early human development that structures self-other experience *prior to and more fundamental than* conceptual understanding of people's minds. For example, the human propensity to identify with the attitudes of others may be fragile or partial among many individuals with autism. Through identification, one person is drawn or moved to assume or encompass another's psychological orientation, as in having concern *for* the other. The self not only responds to another individual's bodily expressed orientation from the other person's stance. One also assimilates that orientation so that it becomes a possible mode of relating for the self. One person can reverse roles with another. This appears to be problematic for individuals with autism, at the level of nonverbal as well as verbal interaction.

In conversations, for example, children and adolescents with autism seem to find it difficult to accommodate to and connect with *someone else's* stance in talking. They show a lack of nodding when the conversational partner is talking, as well as limitations in shifting roles from that of a learner to that of a teacher. In a communicative task called the Sticker Test (Hobson & Meyer, 2005), children without autism would often employ a point-to-*themselves* to communicate that a tester should place a sticker on *herself*. They appeared to identify with the tester and presume that she in turn would identify with themselves pointing-to-themselves, and place the sticker on her own (i.e., the tester's) body. Participants with autism seldom adjusted their communication in this mutually coordinated, person-anchored way. Instead, most pointed directly to the tester's body. Such abnormalities in self-other relatedness may be contrasted with certain aspects of the children's relation*ships* that seem relatively intact, for example their attachments and jealousy toward a significant caregiver (e.g., Bauminger, 2004; Rogers, Ozonoff, & Maslin-Cole, 1991).

Self-Conscious Emotions

Feelings such as coyness, embarrassment, guilt, pride, jealousy, or shame are sometimes called "social" or even "complex" emotions. This is on the grounds that they seem to entail sophisticated understandings of self and other people along with relatively high levels of self-consciousness. However, it is far from clear that every one of this heterogeneous group of feelings implicates conceptual thinking, or that they are bound up with similar kinds of self-consciousness.

Hobson, Chidambi, Lee, and Meyer (2006) interviewed parents of children with and without autism who were aged between approximately 6 and 13 years and matched for verbal ability (roughly the level of typically developing 3- to 9-year-olds). Parents felt they could recognize in their children with autism not only emotions such as anger and fear, but also emotional responsiveness to other people's mood states, as well as shyness, non-person-directed pride, and jealousy. Yet seldom could they cite clear instances of emotions focused on the state of the other such as guilt, shame, pity, empathic concern, or embarrassment, each of which normally contributes to self-experience. The children were affected by expressions of feeling in others in an ill-focused manner, rather than showing an organized response to the other person's feelings *as* the feelings of another self with whom they were engaged. These observations were in keeping with results from quasi-experimental studies of

pride, guilt, and coyness/embarrassment. They are compatible with self-reports elicited from verbally fluent children and adolescents with autism, for example, in speaking of embarrassment without mention of an audience.

It seems that there is a dissociation between these individuals' self-consciousness in being observed – they do *not* show a total lack of shyness, for example – and their ability to be affected by and engaged with the attitudes of a particular embodied other person. Correspondingly, in "self-understanding interviews," children with autism were not only restricted in the feelings they expressed about themselves, but they also failed to mention friends or being members of a social group (Lee & Hobson, 1998). There are different kinds of social self-consciousness, and only some are reduced among persons with autism.

Alignment Between Self and Other Through Imitation

Imitation promises to offer special insights into self-other relations and understanding. Imitation could shed light on the degree to which self-other correspondences in bodily expression, gesture, and action can be perceived and matched. It might also reveal how far one person is motivated and able to enrich his or her own behavioral repertoire, and his or her self, through imitative learning.

There is a complex and in part conflicting literature on imitation among children with autism. On the one hand, there are many clinical and experimental reports to indicate that the children find it hard and/or are rarely moved to imitate a range of emotional expressions, bodily movements, and pantomimed actions of other people (e.g., Rogers, Hepburn, Stackhouse, & Wehner, 2003). On the other hand, often they can copy the goal-directed actions of someone else, they are prone to "echo" the behavior of others, and they show responsiveness to being imitated.

The specificity of limitations in self-other imitation among individuals with autism may be illustrated by a study by Hobson and Lee (1999). Here children with autism were able to observe and copy intended actions per se, but rarely did they imitate a *person's* expressive mode ("style") of relating to objects, for example, performing harsh or gentle actions. Moreover, when the demonstrator held a pipe-rack against his own shoulder in order to strum it with a stick, a substantial majority of the control participants positioned the pipe rack against their *own* shoulder before strumming it. Most of the children with autism positioned the pipe rack at a distance in front of them, on the table. The children with autism did not identify with the other and achieve the shift from other-person-centered to self-centered orientation.

Non-reflective and Reflective Self-Awareness

Classic writers on the self stressed the distinction between non-reflective self-awareness and reflective self-awareness, for instance, in thinking that one thinks. This is a level of self-consciousness that Mead (1934) suggested is the developmental result of taking the role of the other in relation to oneself. Yet it remains to establish how far *both* non-reflective and reflective self-awareness are essentially social in nature and/or origins, and which aspects or components are affected in autism.

For example, as Mundy argues (e.g., in Mundy, Gwaltner, & Henderson, 2010), it might be that in autism, critical impairments are to be found in the processing of pre-reflective, self-referenced proprioceptive and interoceptive information (including that concerned with one's own experience of the world) and its coordination with other-person-referenced information. Mundy et al. (2010, p. 415) stress that "joint attention episodes involve at least as much self-referenced processing of internal sensory and affective experiences as they do processing of information about other people's behavior or intentions." Here, it is relevant to note how commonly people with autism report abnormal sensory experiences such as hypo- or hypersensitivity to light, sound, or touch, and they may show insensitivity to pain. Whether such phenomena underpin or reflect atypical development of self-awareness remains uncertain.

A methodological complication here is that if one is accessing a person's *sense* of self through that person's self-reflection (arguably, a social-developmental achievement, at least in part), then a limited ability to *reflect* on the self might contribute to any atypicalities observed. Having said this, there are several lines of evidence to suggest that (notwithstanding earlier studies suggesting otherwise; see Williams, 2010, for a valuable discussion) individuals with autism are able to recognize their own bodies and actions. For instance, many children with autism are able to remove rouge from their faces when they perceive themselves in a mirror (e.g., Dawson & McKissick, 1984), and this *lack* of abnormality probably extends to self-body recognition after a delay (Lind & Bowler, 2009). Or again, Williams and Happé (2009) reported that children with autism were as able as matched children without autism to detect which squares on a computer screen were or were not under their control, and were able to monitor their own actions.

Such findings have led researchers such as Williams (2010) and Lind (2010) to contrast these instances of sparing of the "physical self" among individuals with autism, with impairments in their psychological self. This is a distinction that may be less straightforward than it seems, as illustrated by atypicalities in the children's self-drawings. In relation to the psychological self, there is substantial clinical as well as experimental evidence to suggest that affected individuals have diminished and perhaps atypical awareness of their own thoughts, beliefs, and knowledge or ignorance. Perner, Frith, Leslie, and Leekam (1989) reported that children with autism were less able than comparison children to understand when they themselves did or did not know something on the basis of whether they had relevant visually derived information. Williams and Happé (2010) demonstrated that children with autism were less able to distinguish whether or not they had intended to jerk their leg in a knee-jerk task, even though they appear to understand their own desires (Tan & Harris, 1991).

Such reduced self-reflective awareness might arise through reduced social role taking, in accord with Mead's (1934) theoretical perspective, or from a "dedicated, innately specified cognitive mechanism" (Frith & Happé, 1999, p 2–3) underlying theory of mind. Any theoretical explanation needs to account for the particular qualities of self-reflective awareness that are relatively intact *or* impaired among persons with autism. For example, Frith and de Vignemont (2005) suggest that people with Asperger syndrome suffer from a disconnection between a strong naïve egocentric stance, where the other person is represented in relation to the self, and an allocentric stance detached from interactions with people, where the existence or mental states of other people are represented as independent from the self. One paradoxical phenomenon this approach might explain is how some individuals with Asperger syndrome show a preoccupation with themselves along with a disinclination to compare themselves with others.

Linguistic Expressions of Self-/Other-Awareness

If a child is to adjust his or her language according to situational and communicative context, then that individual needs to *engage with* the perspectives of the language-users they hear and transform language according to speaker-listener roles. This is a motivational as well as a cognitive matter.

Studies of conversational dialogue involving individuals with autism have yielded evidence of limitations in expressing speaker-hearer role relationships, following pragmatic principles governing a dialogue, and foregrounding and backgrounding information, as well as a relative failure to respond to questions, to keep on topic, or to offer new and relevant comments (e.g., Eales, 1993; Tager-Flusberg & Anderson, 1991). The children appear to be limited in their ability to speak *for* the other as a self.

One detail of this picture of special relevance for the self is the difficulty that children with autism encounter in the use of personal pronouns and other deictic terms. From his observations of children with autism, Kanner concluded that personal pronouns "*are repeated just as heard*, with no change to suit the altered situation" (Kanner,

1943, p. 244). As Bosch (1970) pointed out, pronouns may also be used incorrectly in non-echolalic utterances, and sometimes the child with autism might make third-person self-references by naming himself or calling himself "he," or substitute passive constructions for what would normally be expressed in assertive first-person statements. Indeed, echolalia might arise from limitations in self-other differentiation and/or self-conception. Instead of relating the other person's utterance to that person's attitude and then identifying with the other person's stance, children with autism tend to adopt speech forms that correspond with *their* experience of the circumstances in which the words are uttered, and therefore repeat utterances as heard.

Evidence compatible with this account of atypical self- and other-reference comes from studies by Jordan (1989) and Lee, Hobson and Chiat (1994), where in settings such as being the object of a puppet's tickling, or when referring to photographs of themselves, children with autism would sometimes give proper names to themselves or the experimenter sitting alongside, rather than using the pronouns "me" or "you." This appeared to reflect a relatively detached, almost third-person attitude to themselves and the experimenter. Moreover, Loveland and Landry (1986) reported that correct production of I/you pronouns by children with autism was related to the number of individuals' spontaneous initiations of joint attention with an experimenter. This suggests that correct usage may reflect a special quality of engagement and co-reference between self and other. Although it is possible that additional cognitive and perhaps grammatical limitations contribute to the children's difficulties with personal pronouns, it is plausible that this abnormality stems from their difficulties in recognizing and investing in self and other *as* selves who can occupy reciprocal roles in discourse. Similar considerations apply to reported atypicalities in using other deictic terms such as "this" and "that" or "here" and "there" (Hobson, Garcia-Perez, & Lee, 2009), and may even extend to difficulties in adopting multiple co-referential attitudes to objects and events in symbolic play.

The Self and Memory

There is a rapidly growing literature on the self and memory, and this is thoughtfully reviewed and discussed by Lind (2010). Lind considers the bidirectional relationship between memory and the self. On the one hand, developments in self-awareness promote new developments in memory. Having a concept of self might be critical for the development of autobiographical episodic memory. From a complementary perspective, certain kinds of memory support the emergence of temporally extended self-awareness. It remains to establish whether memory-specific deficits such as an impaired capacity for binding together different elements of what is remembered might contribute to limited self-experience among individuals with autism.

Whatever the developmental story, there is evidence to suggest that individuals with autism have impaired autobiographical episodic memory. They appear to have difficulty in reexperiencing themselves as subjects of experience, for instance, when asked to recall personally experienced events from the past. Also they show a reduced advantage for memories related to the self (e.g., for words that they take to describe themselves; Lombardo, Barnes, Wheelwright, & Baron-Cohen, 2007). If individuals with autism are limited in projecting themselves into the future (Lind, 2010), then this amounts to a serious restriction in the experience of personal self-continuity through time.

Neuroscience of the Self

There have been a number of interesting theoretical and empirical contributions on self-other relations in autism from a neuroscientific perspective. For example, Mundy and colleagues (e.g., Mundy, Gwaltner, & Henderson, 2009) have been elaborating a parallel and distributed processing model on the neurological underpinnings of "self and other attention" and its psychopathology in autism. Of possible relevance for mirror neurone functioning, there is evidence both from fMRI findings (Dapretto et al., 2006) and EEG patterns of mu frequency suppression (Oberman, Hubbard, McCleery, Altschuler, Ramachandran, & Pineda, 2005) that there may

be atypicalities among children with autism, although both the evidence from and interpretation of such studies are under challenge (Southgate & de Hamilton, 2008). Other avenues of research include those on the neurofunctional correlates of empathy (Minio-Paluello, Baron-Cohen, Avenanti, Walsh, & Aglioti, 2009) and processing information relevant to the self and others (Lombardo & Baron-Cohen, 2010). Whether such abnormalities point to sources of dysfunction or reflect current functioning that is the developmental outcome of earlier and potentially diverse forms of disorder will be an important topic for future research.

Future Directions

There is much to discover about self-other relations and self-/other-awareness among infants, children, adolescents, and adults with autism. One challenge is common to much autism research, namely, to establish the extent and the nature of heterogeneity within the population who "have" autism. More specifically, are there particular limitations or atypicalities in self-/other-experience that characterize all, or almost all, individuals with autism, or is there variability both at any stage of development, and across time?

A second challenge is to partition out causes and effects of limitations or atypicalities in self/other relations and experience. On the one hand, it may be illuminating to study how lower-level abnormalities in psychological processing and/or neurological functioning might lead to such atypicalities. Once it becomes possible to trace neurofunctional development over time, for example, we should begin to tease out how such development both influences, and is influenced by, self-/other-awareness. From a complementary perspective, it remains to establish how far primary limitations in self-other experience among children with autism might explain their abnormalities in "theory of mind," symbolic play and other aspects of creative and flexible thinking, pragmatics of language, and executive functioning. This latter approach might be extended to address how individuals with autism may be restricted in caring about, feeling responsible for, attempting to restrain, or otherwise *engaging with* themselves. Beyond this, it remains to understand the degree to which certain behavior, such as self-stimulation, repetitive activities, insistence on sameness, ritualistic preoccupations, and so on, could arise from the need to sustain a coherent sense of an otherwise fragile self.

These issues are complicated by our limited knowledge of the various potentially dissociable components of preconceptual self-experience, only certain of which may be altered in children with autism. Experimental studies have much to offer here. So, too, we have seen how the children's concept(s) of self seem to be partial, fragmented, poorly grounded, or fragile. Again we need to know how far this is a developmental implication of more basic abnormalities in self-other relations or a result of later-appearing cognitive impairments. We should discover the degree to which some features of self-awareness are spared. It is often striking how high-functioning adolescents with autism are able to reflect on their restricted self-/other-awareness, and we need to account for such abilities.

Beyond this, we must explore how we might better help individuals with autism achieve optimally firm and satisfying self-experience and acquire robust and enriched self-concepts. It would be tempting to suppose one might "teach" or "train" relevant skills, but it may prove that only through fostering appropriate forms of personal self-other engagement can this goal be achieved.

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Self-advocacy

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Synonyms

Advocacy; Autonomy; Efficacy; Independence; Self-determination; Self-direction; Self-empowerment; Self-reliance

Definition

Self-advocacy refers to the skills of people from within a specific group to integrate knowledge about their civil rights, relevant laws, and their relative adaptive strengths and weaknesses to effectively communicate their perspectives and needs to the overall community (on an individual level to broader social systems). With regard to autism spectrum disorders (ASD), self-advocacy movements developed in reaction to the impingement of civil rights experienced by people with developmental disabilities (Ward & Meyer, 1999). A few advancements that have arisen from these movements include integration with mainstream society, access to education and independent living, and, overall, being recognized as a full and equal member of society. Contemporary notions of self-advocacy refer to people on the autism spectrum (including their families and caregivers) using and developing skills to effectively communicate their overall needs from personal (e.g., a student expressing a need for classroom accommodations to the teacher) to broader social issues (e.g., groups of people with ASD collaborating with organizations and lobbying to develop public policies to prevent discrimination; Turnbull & Turnbull, 1985).

Self-advocacy requires complex organizational skills (e.g., personal decision-making, goal-setting) and understanding of social institutions (e.g., navigating the political system). These skills are seen as crucial to developing a strong sense of agency and empowerment within the ASD population. Direct training in self-advocacy to promote active life participation has been proposed by some as an integral aspect of improving the lives of people with ASD that should begin at a young age (Shogren & Turnbull, 2006). In particular, receiving opportunities to make informed choices and exercise decision-making is regarded as the foundation for self-advocacy (Turnbull & Turnbull, 2001). Some have also argued that self-advocacy requires direct instruction (e.g., workshops) and guided experience to develop necessary skills and enter related leadership roles (Caldwell, 2010). It should be noted that there is some tension between notions of self-advocacy that involve disclosure of an ASD diagnosis to others (Davidson & Henderson, 2010) and concepts of social inclusiveness that disparage the use of labels as a means of oppression and social control (Bagatell, 2010).

See Also

- ▶ Adulthood, Transition to
- ▶ Advocacy
- ▶ Individuals with Disabilities Education Act (IDEA)
- ▶ Legal Education Rights
- ▶ Normalization

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Self-care

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Definition

Self-care is a subset of adaptive skills and activities of daily living that encompass (a) eating/feeding/drinking, (b) personal hygiene/grooming, (c) toileting, and (d) health/medication management. Many individuals with autism need systematic, intensive teaching in self-care skills due to deficits in language and attention skills, interfering behaviors, and/or sensory impairments. Teaching self-care skills should occur naturally during daily routines, in all environments. Assessments are done to determine current abilities, strengths, and likes as well as frustrators and limitations. Targeted skills may be designated by participants of an interdisciplinary team. A longitudinal and functional approach should be taken when planning a self-care skill program. The steps for each self-care skill need to be broken down and clearly defined: (a) specifying the target skill, (b) task-analyzing the skill, (c) systematically instructing the skills training, (d) evaluating progress of the learner, and (e) making program modifications as needed. To teach effectively, it is helpful to define the style in which the individual with autism learns best, whether it is visual, sounds, words, touch, and/or smell. The instructional design should also consider the use of physical and verbal cues, behavioral support, generalization and maintenance, and reinforcement.

Techniques to Assist in Learning Self-care Skills

Visual Aids

Remember kids on the autism spectrum usually learn better with both visual and verbal information. Try very simple illustrations using stick figures and show the step-by-step actions. While we take getting dressed for granted, putting a shirt on is actually a long sequence of complicated movements for any young child. Break the process into its smallest components and illustrate each one. For example, step-by-step illustrations for putting on shoes, brushing teeth, and toileting can be stuck to the relevant wall for your child to follow. You can tap each picture to prompt your child on each step.

Social Stories™

Try using these illustrations in a social story, a powerful technique for learning new skills. Social stories are an excellent way to introduce the concept of a new skill, especially when a child dislikes disruption to routines.

Applied Behavior Analysis

One of the most effective interventions for autistic disorders is applied behavior analysis. It uses a simple ABC model for learning new behaviors:

- Antecedent – a request by the parent or therapist
- Behavior – the child's response (or lack of response) to the request
- Consequence – what happens as a result of the behavior, i.e., praise for success

First, the skill to be learned is broken down into the smallest units for easy learning. For example, a child learning to brush teeth independently may start with learning to unscrew the toothpaste cap. Once the child has learned this, the next step may be squeezing the tube, and so on.

See Also

- ▶ Age Appropriate
- ▶ Daily Living Skills
- ▶ Self-help Skills

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Self-concept

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Synonyms

Self-reflective awareness

Definition

Our concept of self is the idea we have about ourselves as distinct embodied individuals who are continuous and unified subjects of consciousness and agency. One might also consider one's self-appraisals in terms of personality, gender and racial characteristics, or more broadly "identity," as part of one's self-concept.

G. H. Mead (1934) considered the development of both symbolic thinking (closely bound up with concept formation) and reflective self-awareness to arise through social role-taking. Self-experience and self-appraisals are intimately related to one's relations with other people. Therefore, individuals with profound social impairment, such as those with autism, may not acquire a fully developed concept of self.

One influential scheme delineating aspects of the self-concept is that devised by Damon and Hart (1988). This includes self-definition (e.g., "What are you like?"), self-evaluation (e.g., "What do you like most about yourself?"), self in past and future (e.g., "Do you think you'll be the same or different 5 years from now?"), and self-interest (e.g., "What do you want to be like?").

Four categories of "self-as-object" are as follows:

- Physical, which includes an individual's body and material possessions
- Active, concerning activities and abilities
- Social, including attributes related to social interactions and social relations
- Psychological, concerning the individual's emotions, thoughts, preferences, and so on

Three categories of "self-as-subject" are:

- Agency, concerned with the formation, existence or control of the self
- Continuity, reflecting awareness of continuity over time
- Distinctness, concerning contrasts with others

A study of children with autism that involved the (Damon and Hart 1988) "self-understanding interview" reported that children with autism have special limitation in thinking about themselves in social context (Lee & Hobson, 1998). Research in "theory of mind" (Frith & Happé, 1999) and autobiographical memory (Lind, 2010) has provided evidence that often they have partial awareness of their own thoughts or beliefs and are restricted in thinking about themselves as continuous from the past and into the future. In addition, deficits in components of pre-reflective awareness (Hobson, Chidambi, Lee, & Meyer, 2006; see Neisser, 1988; Stern, 1985) may further compromise the establishment of full self-concepts.

See Also

- ▶ Self and Autism
- ▶ Social Cognition
- ▶ Theory of Mind

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Self-contained Classroom

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Synonyms

Life skills classroom; Separate classroom; Special education classroom

Definition

The term "self-contained classroom" refers to a classroom, where a special education teacher is responsible for the instruction of all academic subjects. The classroom is typically separated from general education classrooms but within a neighborhood school. A self-contained classroom is a special education placement that falls near the middle of a continuum of program options that range in restrictiveness, where the general education classroom is least restrictive and a hospital or a homebound placement is most restrictive. Student-to-teacher ratios in self-contained classrooms are usually smaller than in general education classrooms and other less restrictive special education placements such as resource classrooms. Children who are placed in self-contained classrooms often have multiple, intensive support needs and require

a comprehensive and highly structured educational and/or behavioral program. Children who receive the majority of their instruction in self-contained classrooms may be integrated with their peers for music, physical education, and art classes. Even though the concept of self-contained classrooms was derived from the Individuals with Disabilities Education Act (IDEA), there is no federal definition of self-contained classroom, and the term is not mentioned in the law.

Self-contained classrooms have been advocated for a number of different student groups. Many students with autism receive their instruction in self-contained classrooms because these classrooms are led by teachers who have specialized training to instruct this population. Similar arguments have been made for self-contained classrooms for students identified as gifted and talented and students with emotional and/or behavioral disorders.

An alternate definition of self-contained classroom exists. In some contexts, self-contained classrooms are more broadly defined as any classroom where a single teacher teaches all subjects. This definition applies to most elementary school classrooms but is distinguished from team teaching models, where each teacher of a grade teaches a single subject to each class in rotation.

See Also

- ▶ Academic Supports
- ▶ Inclusion
- ▶ Special Education

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Self-determination

▶ Self-advocacy

Self-directed Support Corporation Supports

▶ Entrepreneurial Supports

Self-direction

▶ Self-advocacy

Self-employment Supports

▶ Entrepreneurial Supports

Self-empowerment

▶ Self-advocacy

Selfemra

▶ Fluoxetine

Self-help

▶ Daily Living Skills

Self-help Skills

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Definition

Self-help skills are a subset of a larger repertoire of daily living skills, sometimes called activities of daily living (ADLs). Specifically, the term "self-help" usually refers to the following areas of independent behavior:

- *Eating/feeding and drinking*: Skills may include holding and using utensils properly, drinking without spilling, eating a variety of foods, proper use of a napkin, table manners, and other mealtime routines.
- *Grooming*: This area includes skills such as brushing hair, shaving, and dressing (e.g., selecting clothing, putting clothes on and off without assistance, and managing fasteners).
- *Personal hygiene*: Skills include those such as bathing, brushing teeth, washing hair, and applying deodorant.
- *Toileting*: Skills related to toileting include managing clothing, cleaning oneself, as well as overall bowel and bladder management.

These may be considered the primary critical skill areas in the first 10 years of life and form the foundation for other skills to follow (Anderson, Jablonski, Thomeer, & Knapp, 2007).

Self-help skills are a set of basic skills needed in order for a person to live independently (Volkmar & Wiesner, 2009) and to succeed both in work and leisure as well as socially. Individuals with autism spectrum disorders (ASD) often have difficulty acquiring self-help skills and may need targeted instruction in this area of development. Critical areas of self-help and the importance of specific skills may fluctuate with age and setting. For example, for a young child, it will be important to focus on basic feeding, eating, dressing, and toileting skills; whereas, a child in elementary school may be focused on lunchtime routines in several environments (e.g., home and school cafeteria) and independent use of a school backpack. Puberty and the teen years bring on new hygiene and self-care issues such as using deodorant, shaving, and managing monthly menstrual periods (Sicile-Kira, 2006). As demands fluctuate, the professionals who are identifying and assisting with the development of these skills (e.g., educators, psychologists, occupational therapists) may be multiple and will also change over time (Anderson et al., 2007).

The attainment of basic self-help skills is critical in order for individuals to participate as independently as possible in home, community, school, and work settings. Individuals with ASDs often show significant deficits in adaptive skills relative to their age and cognitive ability, and the gap between cognitive ability and adaptive skills frequently increases with age (Minshawi, Ashby, & Swiezy, 2009). Specific deficits have been noted in speaking, dressing, reading, the ability to comply with requests, socialization, play skills, and toileting (Scheuermann & Webber, 2002). In addition to reducing dependence on caregivers, possessing adequate self-help skills is critical for maintaining health and social acceptance (Anderson et al., 2007; Scheuermann & Webber, 2002). Scheuermann and Webber (2002) identified toileting, eating, dressing, personal grooming, and hygiene as the most essential self-help skills for increasing social acceptance, noting that peer rejection is often higher if individuals appear dirty or disheveled.

Historical Background

Deficits in adaptive behaviors such as self-help skills have historically been included in

definitions of mental retardation and developmental disabilities. One of the earliest definitions to allude to deficits in self-help skills was Tredgold's (1937) definition of mental deficiency, which he defined as "a state of incomplete mental development of such a kind and degree that the individual is incapable of adapting himself to the normal environment of his fellows in such a way to maintain existence independently of supervision, control or external support" (p. 5).

The American Association for Intellectual and Developmental Disabilities (AAIDD) has included a criterion of adaptive deficits in each of the five iterations of the definition of mental retardation it has published since 1961 (Bierne-Smith, Patton, & Kim, 2006). Similarly, the definition of mental retardation in the most recent edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR; American Psychiatric Association, 2000) also includes the criterion of adaptive deficits related to self-help skills. Interestingly, the current DSM definitions of autism and Asperger's syndrome do not require deficits in adaptive behavior other than social skills for diagnosis. In fact, the diagnostic criteria for Asperger's syndrome specifically state that the individual must not demonstrate deficits in age-appropriate self-help skills.

However, the legal definition of a developmental disability (which includes autism spectrum disorders), as defined by the Developmental Disabilities Assistance and Bill of Rights Act of 2000 (P.L. 106-402, pp. 7–8), does include deficits in self-help skills:

> (A) IN GENERAL—The term "developmental disability" means a severe, chronic disability of an individual that—
>
> (i) is attributable to a mental or physical impairment or combination of mental and physical impairments;
>
> (ii) is manifested before the individual attains age 22;
>
> (iii) is likely to continue indefinitely;
>
> (iv) results in substantial functional limitations in 3 or more of the following areas of major life activity:
>
> (I) self-care, (II) receptive and expressive language, (III) learning, (IV) mobility (V) self-direction, (VI) capacity for independent living, (VII) economic self-sufficiency; and
>
> (v) reflects the individual's need for a combination and sequence of special, interdisciplinary, or generic services, individualized supports, or other forms of assistance that are of lifelong or of extended duration and are individually planned and coordinated.

Given the inclusion of adaptive deficits in the legal definition of developmental disabilities as noted above, there has recently been a push to closely examine the adaptive functioning of individuals on the autism spectrum who do not also meet criteria for an intellectual disability (i.e., those with average cognitive ability). Research has shown that even those individuals with ASDs who have average cognitive ability often exhibit significant deficits in adaptive behaviors including self-help. Thus, there has been a movement to consider adaptive functioning in addition to cognitive ability when determining services for individuals with ASDs (Chawarska & Volkmar, 2005; Shea & Mesibov, 2005).

Changes in federal law regarding special education have recently acknowledged the importance of self-help skills as a part of the more global functional skills repertoire. These functional skills are needed for persons with ASD to function as independently as possible in life. The reauthorization in 2004 of the Individuals with Disabilities Education Act (IDEA) included new requirements that a student's Individualized Education Program (IEP) target both functional and academic skills. Functional goals are those outside the academic realm that include everyday routines in life. Because functional skill needs will vary from child to child, self-help skills may be addressed in an IEP, depending on the unique needs of the individual child (Howey, 2008).

Current Knowledge

Challenges to Skill Acquisition

While the majority of children learn self-help skills such as bathing and dressing with ease, as noted above, many children with autism have great difficulty with this process and often require formal instruction in the area of self-help (Scheuermann & Webber, 2002). Adults and

adolescents with ASDs frequently exhibit significant deficits in self-help skills compared to their cognitive skills. For example, standardized scores for daily living skills on measures of adaptive behavior typically average anywhere from 15 to 30 points lower than IQ scores for individuals with ASDs who have average cognitive ability (Shea & Mesibov, 2005). When compared to nondisabled children who have similar cognitive skills, children with autism spectrum disorders often have significantly lower scores on standardized measures of adaptive behavior (Chawarska & Volkmar, 2005).

The fact that children with ASDs have difficulty learning self-help skills is not surprising when the specific characteristics associated with autism are taken into account. Sensory issues can negatively impact learning self-help skills such as bathing or eating. Additionally, difficulties with sequencing and understanding social expectations may make learning self-help skills more difficult or less motivating (Shea & Mesibov, 2005). Furthermore, Volkmar and Wiesner (2009) suggest that because children with autism tend to be more rigid and dependent upon specific contexts for learning, they have difficulty generalizing skills to new situations (e.g., learning to bathe and dress at home is a different skill than learning to bathe and dress at grandma's house or in gym class). Thus, whereas a neurotypical child may only have to learn a skill once, a child with autism may have to learn the same skill many times in many different situations.

This challenge with needing step by instruction can often be due to issues with praxis. Praxis is the ability one has to think of and plan new motor acts; it is also called motor planning. Functional praxis is based on adequate foundation skills in the areas of sensory processing, neuromuscular control, and motor control (Cook, 1991). Cognition also plays a part in one's ability to conceive, sequence, and perform a new motor skill (Tomchek, 2001). Impairments in praxis are often noted in individuals with autism. Persons with autism may have motor planning issues related to motor skill but may also have other, less clearly understood factors contributing to praxis issues (Tomchek).

Another challenge in learning self-help skills that may relate specifically to children with autism spectrum disorders is the role of language and socialization. Anderson et al. (2007) state that typically developing children are often motivated to learn new self-help skills in order to gain approval from parents, peers, or others. Because many children with autism may not seek social reinforcement, they may be less motivated to practice and learn these skills. Additionally, while neurotypical children will often learn self-help skills naturally through observation, interaction, and caregiver modeling, this may be ineffective with a child who has an ASD. Rather, children with autism are more likely to require step-by-step formal instruction and tangible reinforcement in order to learn basic self-help skills. Furthermore, studies have shown that even when adolescents with autism know how to perform certain self-help skills, when left to function independently, they often simply *do not* do them, perhaps because many individuals with autism are not motivated by factors such as social acceptance (Shea & Mesibov, 2005).

Commonly Used Assessment Tools

It is clear that from an early age, adaptive behavior, including self-help skills, is considered to be a critical area of development. In fact, Part C of the IDEA Amendments of 2004 mandate that states must provide services to children under age 3 who need early intervention services if they experience delay(s) in cognitive, physical, communication, social or emotional, or adaptive development. To this end, many curriculum-based and criterion-based measures include adaptive behavior/self-help skills as one of the primary developmental domains assessed.

For both children and adults, self-help skills are routinely included in broader measures of adaptive or independent behavior. Four commonly used assessment measures are highlighted below:

*Adaptive Behavior Assessment Scale-Second Edition (*ABAS-II): The ABAS-II provides a complete assessment of adaptive skills for persons from birth to 89 years. It covers the broad domains of conceptual, social, and

practical and examines 10 specific skill areas, including self-care (feeding, personal hygiene, dressing). The ABAS-II has 5 rating forms, each of which is designed for a specific age range and respondent. A General Adaptive Behavior score is provided in addition to domain and skill area scores (Harrison & Oakland, 2003).

*Vineland Adaptive Behavior Scale-Second Edition (*Vineland-II): The Vineland-II is a measure of adaptive behavior in individuals from birth to 90 years. It examines personal and social skills considered necessary for everyday living across the four domains of communication, daily living skills, socialization, and motor skills. Within the daily living skills domain, specific focus is on personal care such as brushing teeth, feeding, toileting, dressing and bathing. The Vineland-II forms include the Survey Interview, Parent/Caregiver Rating, Teacher Rating, and Expanded Interview; the measure provides an overall Adaptive Behavior Composite and domain scores as well as an optional Maladaptive Behavior Index (Sparrow, Cicchetti, & Balla, 2005).

Scales of Independent Behavior-Revised (SIB-R): The SIB-R is a comprehensive, norm-referenced tool that assesses 14 areas of adaptive behavior and 8 areas of maladaptive or problem behavior. One of the primary domains is Personal Living, which allows examination of eating, toileting, dressing, and self-care. The measure can be administered via interview or by checklist procedure and is appropriate for individuals from infancy through 80+ years. There are three versions of the SIB-R available for use: Full Scale, Short Form, and Early Development Form. The SIB-R provides a Broad Independence score as well as a cluster score for Personal Living (Bruininks, Woodcock, Weatherman, & Hill, 1996).

Pediatric Evaluation of Disabilities Inventory (PEDI): The PEDI is a clinical assessment tool used to assess the functional skills and performances of children from the ages of 6 months to 7.5 years old. It can also be used to determine the skills of children older than this age whose functional skills may be below those expected of a 7.5-year-old child with no disabilities. The PEDI measures abilities in three domains: self-care, mobility, and social function. Specific to self-care, the PEDI focuses on mealtime skills and utensil use, dressing, basic hygiene skills, and bowel and bladder management. The PEDI also includes a Caregiver Assistance Scale, which provides information regarding the level of help a child needs to complete a domain specific activity or skill. Information for the PEDI may be obtained via structured interviews, observations of the child, or professional judgment of therapists and or teachers (Haley, Coster, Ludlow, Haltiwanger, & Andrellos, 1992).

Teaching Self-help Skills and the Use of Evidence-Based Interventions

Though children with autism spectrum disorders do not appear to learn and generalize the use of self-help skills as naturally as typically developing children, with formal instruction, many individuals with ASDs learn these skills quite well. In fact, self-help skills can be acquired relatively quickly with appropriate instruction because these skills often play to the strengths (and are less dependent on the weaknesses) of many children with autism. Specifically, learning self-help skills may involve concrete thinking, fixed sequential actions, and little necessary social interaction (Anderson et al., 2007).

As mentioned before, children with autism may have greater difficulty generalizing skills to different contexts and settings. Therefore, whenever possible, self-help skills should be taught in the same way and same environment as they will be performed. Furthermore, it is important to involve teachers, parents, and any additional caregivers in self-help skill training in order to ensure the child is taught the skill in the same way across contexts (Scheuermann & Webber, 2002). Because any delay in the acquisition of self-help skills will most likely become more significant with age, it is important to begin teaching adaptive skills such as dressing and undressing, personal care, and toileting as early as preschool in

order to promote independence in adolescence and adulthood (Volkmar & Wiesner, 2009). Self-help skill acquisition may be "put off" as teaching self-help skills takes time and effort on the part of the teachers (this may often be the individual's parents) and the learner. Resources are available to assist parents and other caregivers in teaching self-help skills; for example, Baker and Brightman (2004) provide strategies designed specifically to improve independence skills, including self-help, for children ages 3 to preadolescence. Sicile-Kira (2006) lists several strategies that help adolescents with autism to acquire basic self-help skills including the use of schedules, picture icons, task analysis, and video modeling.

Selected strategies that may be effective for teaching self-help skills are highlighted below; these intervention techniques have been effective for teaching a variety of skills to individuals with ASD (National Professional Development Center on Autism Spectrum Disorders, 2011).

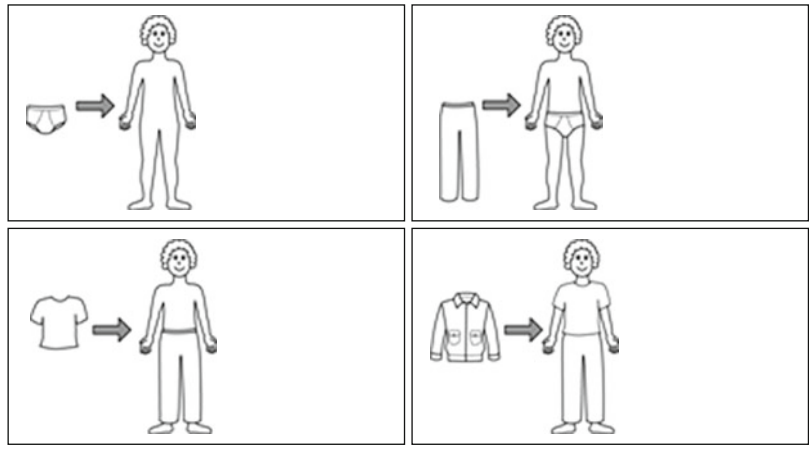
Behavioral Approaches

One method of teaching self-help skills that has had well-documented success is applied behavior analysis (ABA). Board Certified Behavior Analysts (BCBAs) work with caregivers to develop structured programs to teach children necessary skills using principles of behavior analysis and reinforcement (Anderson et al., 2007). ABA utilizes many behavioral techniques, such as discrete trials to teach self-help skills to children with autism. Discrete trials involve breaking complex tasks or concepts into simpler, more concrete tasks. In this method, the therapist may give the child a prompt or cue that signals what the child should do. When the child performs the desired response correctly, she/he is given a reward, which in ABA is referred to as a reinforcer (Volkmar & Wiesner, 2009).

Another behavioral method of teaching self-help skills is called chaining. Chaining is similar to discrete trials in that it involves breaking a complex task into many basic tasks. The main difference between discrete trials and chaining is that in chaining, each small task serves as the prompt or signal to begin the next task and that each subsequent task serves as a reinforcer for the task that preceded it. There are two types of chaining: backward chaining and forward chaining. In backward chaining, the last task in the complex sequence is the first basic task that is taught; thus, teaching starts at the end and moves backward to the beginning of the complex task. First, the child is physically guided through all of the steps of the chain. The next time, physical guidance will be used until the last step of the chain. At that point, the parent or therapist will wait for the child to perform the task independently or with reduced prompting. When the child completes the task, reinforcement is given. Once the child has mastered the final task independently, she/he is ready to learn the second to last task in the chain. The next time through the chain, physical guidance will be stopped just before the second to last task. Then the child will independently complete the final two tasks. This continues until the child has mastered the entire chain independently. In forward chaining, the opposite occurs. Training begins with the first "mini-task" and subsequent tasks are completed with physical guidance. Once the child masters the first task in the chain, she/he is then required to complete the first two tasks in the chain before receiving physical guidance and so on until the entire chain is learned (Anderson et al., 2007).

Visual Supports

Progress can be further increased by using visual aids whenever possible in order to make the skills even less abstract (Kluth & Shouse, 2009). Visual supports have a strong evidence base (Hume, 2008) as practical, usable interventions for persons with ASD. Visual supports refer to objects, pictures, text, or a combination thereof provided to help a person understand and remember a concept or a task. Geis and Tomchek (2001) noted children with autism use their visual channels more effectively to process their world. Examples of visual supports include picture schedules, simple text checklists for routines, and charts combining words and symbols as behavioral reminders. Symbols for a dressing



Self-help Skills, Fig. 1 Picture sequence of dressing routine

routine for a child could include the following pictures sequences for the daily routine (Fig. 1):

Sicile-Kara (2006) noted that picture icons were valuable in teaching routines to adolescents on the autism spectrum. Specific attention should be given to ensure that nonverbal teens know what the icons/symbols mean prior to their use in a dressing or self-care routine.

Social Narratives

Social narratives describe situations based on social and physical cues or teach specific social skills or behaviors. They can be individualized to meet the needs of the learner and may include pictures to assist the individual in gaining specific skills or responding appropriately (Collet-Klingenberg & Franzone, 2008).

Perhaps the most widely known protocol, Carol Gray's Social Story, is a comprehensive intervention used to explain a concept or skill to a person with autism using a specific format. A Social Story™ describes a situation, skill, or concept in terms of relevant social cues, perspectives, and common responses in a specifically defined style and format. The goal of a Social Story™ is to share accurate social information in a patient and reassuring manner that is easily understood by its audience; it is hoped that an individual's improved understanding of events and expectations may lead to more effective responses (the Gray Center, "What are Social Stories™?").

Video Modeling

Though it was noted above that children with ASDs often do not learn as readily from models as many typically developing children do, there are some types of modeling that are effective for teaching self-help skills to children with autism. One of these is video modeling (Charlop-Christy, Le, & Freeman, 2000). Video modeling involves videotaping a model exhibiting a skill. The recording is then shown to the child with autism, who then learns to imitate the model. Children with autism are more likely to imitate actions they see in videos than those they see in person, perhaps because imitating live models has a greater social component. Additionally, the model in the video never alters his/her performance of the task as a live model will do, which can appeal to the child's preference for sameness. There is a particular type of video modeling that is gaining favor called video self-modeling. In video self-modeling, the child is videotaped completing the task. The child can then watch the video and observe himself/herself completing the task; thus, the child serves as his/her own model. This technique is effective if the child is able to complete a task periodically, but is not consistent (Anderson et al., 2007). Additionally, it is theorized that by serving as his/her own model, the child may be more confident in his/her ability to correctly complete the task because the video serves as proof that she/he has been successful in it before (Buggey, 2009).

Peer-Mediated Instruction and Intervention

Peer-Mediated Instruction and Intervention (PMII) is an evidence-based practice that is best characterized by its use of competent peers to facilitate the learning and display of appropriate behaviors by the child with a less complex set of skills (Neitzel, 2008). Peer-mediated strategies are built upon careful prompting and shaping of child behaviors by typical peers embedded in child-initiated interactions within natural contexts (Rogers, 2000) and can be implemented with preschool-aged children as well as older students. PMII has been shown to have positive effects on academic, interpersonal, and personal-social development (Maheady, Harper, & Mallette, 2001). Briefly, with PMII, once a particular skill is targeted as a need for the child with ASD, a skilled peer is selected and taught the necessary steps to model or teach the targeted skill with adult guidance and supervision. The peer then models the targeted skill in specific settings and situations.

Future Directions

Clearly, the acquisition of self-help skills should be viewed as a critical and necessary step in the overall development of individuals with autism spectrum disorders. An individual's ability to perform basic self-help skills has a strong influence on school, work, and social success. In addition, consideration of self-help skills may impact future decisions with respect to independent living arrangements as well as educational and vocational placements in adulthood. Thus, while it remains important to address an individual's needs in core areas of autism such as communication, behavior, and social skills, it is equally important to focus on developing self-help skills from a young age in order to allow children with ASDs to grow into independent adults with full lives.

See Also

- ▶ Adaptive Behavior
- ▶ Applied Behavior Analysis
- ▶ Behavior Analyst Certification Board
- ▶ Behavior Modification
- ▶ Behavior Plan
- ▶ Board Certified Associate Behavior Analyst
- ▶ Daily Living Skills
- ▶ Developmental Milestones
- ▶ Differential Reinforcement
- ▶ Functional Life Skills
- ▶ Guided Compliance
- ▶ Learning Styles
- ▶ Modeling
- ▶ Motivation
- ▶ Positive Behavioral Support
- ▶ Reinforcement
- ▶ Self-care
- ▶ Social Stories
- ▶ Structured Teaching
- ▶ Video Modeling/Video Self-modeling
- ▶ Vineland Adaptive Behavior Scales
- ▶ Visual Supports

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Self-injurious Behavior

▶ Stereotypic Behavior
▶ Stereotyped Movement Disorder

Self-injurious Behavior (SIB)

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Definition

Self-injurious behavior (SIB) is behavior in which the individual inflicts injury on themselves. The range of potential self-injurious behavior is quite staggering and disconcerting. SIB may include head banging (the most

common form) on walls, floors, or tables; finger, hand, or wrist biting; hair pulling; eye poking or gouging; hitting self; and scratching self. Many individuals display multiple types of SIB. SIB is "one of the most dangerous and debilitating behavior problems in the entire field of developmental disabilities" (Volkmar, Sloman, & Samaha, 2009, p. 157).

SIB is a serious concern for caregivers of individuals with autism. The behavior may cause emotional reactions in families and service providers that are incompatible with reasoned practical intervention. Furthermore, SIB may lead to secondary health problems such as bruising, bleeding, infection, and head trauma that serve as setting events for more maladaptive behavior and in extreme cases may cause further neurological impairment. Compared with individuals with autism who do not exhibit SIB, individuals with autism who do exhibit SIB are more likely to be placed in residential treatment settings (Borthwick-Duffy, Eyman, & White, 1987).

SIB should not be confused with "non-suicidal self-injury" (NSSI), a syndrome recently proposed for inclusion in the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association, 2000). Whereas the purpose of neither syndrome of behaviors is resultant death, NSSI usually consists of repeated superficial self-injury with sharp objects done by typically developing adolescents between ages 15 and 19. SIB consists of the wide array of behaviors noted above done by individuals with developmental disabilities.

Current Knowledge

In the Diagnostic and Statistical Manual of Mental Disorders, SIB is not a defining feature of autism. It may not occur in an individual diagnosed with autism, and it is not limited to people with autism but may also present in individuals with mental retardation with or without a diagnosis of autism and in people with specific genetic disorders such as Lesch-Nyhan syndrome. Nonetheless, the prevalence of SIB in autism is much greater than in typically developing children (Dominick, Davis, Lainhart, Tager-Flusberg, & Folstein, 2007) and individuals with other developmental disabilities (Bodfish, Symons, & Parker, 2000). SIB is more common in the severe and profound levels of mental retardation (Handen & Gilchrist, 2006). Furthermore, the rate of SIB across individuals can range from thousands of times per day to once every few weeks. Generally, SIB seems to diminish as language development improves. Amelioration of SIB typically includes a variety of applied behavior analysis interventions and sometimes psychopharmacology.

Applied Behavior Analysis

The first step in applied behavior analysis is determination of variables controlling the behavior, a functional analysis. The controlling variables for SIB are as varied as the types of SIB, and there appears to be no causal relationship between a specific type of SIB and specific controlling variables. Many variables maintain problem behavior (Martin & Pear, 2007), and these variables may develop, shape, or maintain SIB (Durand & Crimmins, 1988; Minshawi, 2008).

Functional Analysis

Some SIB is maintained by social positive reinforcement. For example, typical caregiver reactions might include attention in the form of hugging, getting close to the person, reprimands, or verbal attempts to sooth the person (Iwata et al., 1994). This is identified when functional analysis consistently shows that social attention follows behavior or when the person with autism smiles at, looks at, or approaches caregivers just behavior emitting SIB.

Some SIB is maintained by social negative reinforcement. In this scenario, antecedents to the SIB might be occasions where caregivers present demands that the person considers aversive. This may include instructions to complete a task or chore, say something or do schoolwork that is specifically difficult for the individual.

Following this, the person may emit SIB that is reinforced (negative reinforcement) when the instruction or demand is withdrawn. Often, SIB is disruptive to the setting and results in such demands being withdrawn or postponed. SIB also causes some caregivers to stop making demands (Volkmar, & Wiesner, 2009). This is identified when functional analysis consistently shows SIB occurs when the person is presented with demands that are withdrawn following the SIB.

Some SIB is maintained by internal sensory positive reinforcement, sometimes referred to as automatic reinforcement. For example, SIB may lead to sensations or perceptions that include odd visual patterns, repetitive sounds, and tactile or kinesthetic sensations (Guess & Carr, 1991). Some individuals with autism have sensory deficits that include high thresholds for pain, and there is speculation that some SIB is reinforced because it is experienced as pleasurable self-stimulation rather than aversive pain (Boucher, 2009). This is identified when functional analysis consistently shows that SIB occurs when the individual with autism is alone, in the absence of external positive reinforcement or escape/avoidance conditions. Caregivers may report that the SIB is unrelated to any task or situation or that it occurs when there is a lack of external stimulation. The section on neurobiological research below briefly addresses such models for SIB.

Conversely, some SIB seems elicited by antecedent stimuli rather than maintained by reinforcing consequences. Although the sensory organs of individuals with autism are not compromised, some individuals with autism appear hypersensitive to stimulation (Dawson & Toth, 2006). Sometimes this is referred to as sensory dysfunction that includes auditory, tactile, or visual defensiveness. Therefore, SIB may be elicited by loud, high-pitched, or sudden noise (e.g., other children squealing, fire alarms, or loud music); certain textures of clothing or food; or lights that blink, shine directly in a person's face, or have high wattage. Such SIB may appear highly emotional in nature and is identified when functional analysis consistently shows that SIB occurs when specific stimuli or circumstances present or in settings paired with those stimuli. Conceptually, there are occasions when this is consistent with the logic of negative reinforcement described above. However, this is not social negative reinforcement but rather internal sensory negative reinforcement. For example, if playground noise at school recess elicits SIB by a child, it might be reasonable to assume that the noise is aversive to the child. Thus, when stimuli paired with going to playground are presented, such as after a specific class or walking down the hallway in line toward the playground, the child with autism may emit SIB that causes adults to disallow the "fun" playground opportunity, when in fact the SIB is negatively reinforced by escape/avoidance of the noisy playground.

Treatment

The second step in applied behavior analysis is manipulation of the variables that function to control the SIB and/or shaping desirable behavior that serves the same function, thereby decreasing the strength of SIB. The treatment is selected based on the functional assessment described above as well as the individual characteristics of the individual with autism, including IQ level. Typically, procedures are combined and highly individualized (Kahng, Iwata, & Lewin, 2002; Volkmar et al., 2009).

If SIB is maintained by social positive reinforcement, then that reinforcement contingency is altered. One potential procedure is simply ignoring the person when they emit SIB, known as extinction. This is a deceptively complicated procedure because it is very difficult for caretakers, especially parents, to wholly ignore SIB. If caretakers occasionally give attention to SIB, whether or not it is intentional, then the SIB may become stronger because intermittent reinforcement can be more powerful than continuous reinforcement. Iatrogenic effects may also include temporary increase in the rate of SIB at the outset of treatment (an extinction burst) and spontaneous recovery when the individual is not in the same setting where extinction was implemented. An alternative procedure allows

caretakers to give attention to the person when they are not engaging in SIB, called differential reinforcement of zero responding (DRO). In this case, social attention is presented only if the SIB does not occur during a specified period. Typically, the length of time chosen is the average time interval between behavior occurrences. For example, if a child emits SIB four times per hour, the procedure is arranged to provide social attention every 15 min that the child does not emit SIB. Then, the schedule of reinforcement is thinned and social attention is presented every 20 min that the child does not emit SIB, and so forth. A disadvantage of extinction and DRO procedures is that they do not teach appropriate behavior, and sometimes the overall rate of reinforcement remains low if SIB continues. A third alternative is a procedure where caretakers give social attention for behavior that is incompatible with SIB, a response that cannot be emitted at the same time as SIB. This is differential reinforcement of incompatible behavior (DRI) or differential reinforcement of alternative behavior (DRA). For example, if functional analysis reveals that SIB is emitted when faced with challenging academic requirements, teachers may give social attention whenever the child requests help in that context. The hope is that as requests for help increase, SIB decreases.

If SIB is maintained by social negative reinforcement, once again the functional contingency between the behavior and consequence is altered. In some cases, caretakers simply insist, or persist, when presenting demands such that the SIB does not function to allow escape from demands. Sometimes, this procedure is impractical because the SIB compromises the individual's health. An alternative is similar to the DRI procedure described above. If a child exhibits SIB when demands are presented, shaping the child to sign "no" and then withdrawing the demands contingent upon the signed "no" may reduce SIB because the function of "no" is identical to the function of SIB. The potential disadvantage is the remaining problem of a child who escapes demands. In some cases, cost-benefit analysis will reveal that the advantages of reduced SIB outweigh the disadvantages of escape from work. The DRI procedures described here are consistent with data illustrating the negative correlation between language development and SIB. Among individuals with autism, as functional communication improves in rate and quality, SIB decreases.

SIB maintained by internal sensory positive reinforcement can be challenging to manage because the functional relations between SIB and its consequences may be difficult to identify, particularly among individuals with communication deficits. Enriching the quality and intensity of surrounding environments may attenuate the function of SIB that is reinforced by auditory or visual outcomes. Blocking may disrupt the reinforcement relationship between SIB and tactile stimulation. For example, if functional analysis of a child's SIB determines that the reinforcer for scratching face is tactile stimulation in the absence of external positive reinforcement or escape/avoidance conditions, gloves on the child's hands may reduce scratching because it no longer functions to produce the tactile consequence.

If SIB is elicited by antecedent stimuli rather than maintained by reinforcing consequences, then structural changes in the environment may be warranted. Sometimes changes in the environments are practical and inexpensive. For example, if SIB is elicited by the sound of the old electric pencil sharpener, a cost-benefit analysis may reveal that the most parsimonious solution is a new sharpener with a less abrasive sound or moving the sharpener to a different location. Similar to functional communication training described above, SIB may be weakened by teaching the individual with autism an adaptive response such as signing, "I don't like that noise," and then eliminating the sound contingent upon that communication. In this manner, the signed communication replaces the function of the SIB. Systematic desensitization incorporates gradual exposure to stimuli that elicit SIB. For example, if the hustle and bustle of the local mall elicits SIB, then numerous short trips to the mall, with incremental increases in the length of each visit, may help habituation to the mall.

Punishment

Sometimes, punishment is used when SIB is recalcitrant or severe, although there are disadvantages to punishment procedures. The presentation of punishing stimuli (positive punishment) contingent upon SIB has included water mists, visual screening, aversive tastes and odors, and electric shock. The removal of reinforcing stimuli (negative punishment) contingent upon SIB has included timeout and response cost (the removal of enjoyable items and tokens or opportunities to engage in preferred activities). One advantage of punishment is that it can be used even if functional analysis fails to determine the function of the SIB, particularly SIB maintained by internal sensory positive reinforcement. However, the disadvantages of punishment are well documented. Punishment does not teach appropriate behavior, so one form of SIB may be weakened only to be replaced by another form of SIB that serves the same function. Sometimes punishment elicits emotional responses (sad mood, fear, anger) that are incompatible with learning. Individuals who receive punishment may learn to avoid the people who administer the punishment and the settings where it is administered. Timeout may work for some children with autism, but timeout may be ineffective if the behavior of the individual with autism is negatively reinforced by escape from social interaction or positively reinforced by internal sensory events or the opportunity to engage in stereotypic behavior.

Neurobiological Research and Psychopharmacological Treatment

Neuroleptics have long been used for treatment of SIB, as well as aggression and stereotypical/repetitive behavior. Risperidone is the most commonly used atypical antipsychotic that targets dopamine-blocking agents (Chavez & Chavez-Brown, 2006). Potential side effects include fatigue/sedation, increased appetite, and corresponding weight gain and drooling. Recently, the efficacy of olanzapine indicates some improvement of SIB, but side effects such as dystonic reaction (distorted twisting/movement of part or all of the body) limits its usefulness in children (Handen & Gilchrist, 2006).

Neurobiological models have evaluated the potential relevance of the endogenous opioid peptide hypothesis, which suggests that SIB results in increased levels of beta-endorphin levels. The outcome is elevated pain threshold and tolerance of, or reward by, pain. This is consistent with the suggestions that some SIB is maintained by internal sensory positive reinforcement wherein SIB is reinforced because it is experienced as pleasurable. Naltrexone is an opioid antagonist that may decrease SIB in some individuals (ElChaar, Maisch, Augusto, & Wehring, 2006). Potential side effects include drowsiness, decreased appetite, and aggression.

Some have suggested that SIB is really a manifestation of internal compulsive thoughts, consistent with obsessive-compulsive disorder (Boucher, 2009). An outcome of this proposal is limited research indicating the efficacy of selective serotonin reuptake inhibitors (SSRIs) such as Zoloft and Prozac (Aman, Arnold, & Armstrong, 1999).

See Also

- ▶ Challenging Behavior
- ▶ Neuroleptics
- ▶ Reinforcement

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Self-management Interventions

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Definition

Self-management interventions are multicomponent behavioral strategies that emphasize the monitoring and regulation of behaviors and reinforcements (rewards). The core elements of self-management interventions involve (a) self-observation of a targeted behavior, (b) self-recording, and (c) delivery of a reinforcer. The identified person in treatment (e.g., client, child, or adult) is given a central role in managing behavior change. The client is taught to observe or monitor (self-monitor) and track (self-record or self-manage) his or her own behaviors by using a recording method (tallying the occurrence of a target behavior on paper or with a counter device). When treatment goals are met, the client is expected to obtain a reward (reinforcement). An emphasis on systematically promoting the client to independently engage in these skills is an integral aspect of the intervention. Although behaviors are referenced as the outcome of change, self-management interventions have been examined and used for therapeutic changes in mood and cognitions. A review of the literature suggests they are potentially efficacious for increasing adaptive behaviors and reducing unwanted behaviors.

Historical Background

Self-management interventions have a long history as a set of therapeutic methods to promote and maintain behavior change. Self-management interventions also have been referred to as

self-monitoring (e.g., Kazdin, 1974), self-control procedures (Nelson & Hayes, 1981), or self-reinforcement systems (e.g., Mahoney, 1970). These interventions have been used to target changes in behaviors (verbal and nonverbal) as well as emotions and cognitions. However, the argument in the field has been that internal, unobservable thoughts and emotions may be difficult to self-monitor due to challenges with substantiating the accuracy of internal processes. Therefore, overt, observable behaviors have been proposed to be more amenable to self-management interventions.

Most of the instrumental research and development in self-management interventions began in the late 1960s to early 1970s (Kazdin, 1974; Mahoney, 1970; cf. Korotitsch & Nelson-Gray, 1999). The principles and methodology of self-management interventions developed from the field of behavioral psychology. It is strongly rooted in behavior modification principles and, later, cognitive-behavioral theories (Mahoney, 1970). Since then, it has evolved and widely been adapted as a psychotherapeutic method for a range of clinical populations and conditions. Self-management interventions are often used in clinical settings and can be used alone as the primary therapeutic tool or integrated within a larger treatment package (e.g., Cognitive-Behavioral Therapy).

Self-management procedures are grounded on the notion that the client takes on the role of the "behavioral engineer" (Mahoney, 1970). Historically, self-monitoring has been used for both assessment or information gathering and intervention purposes. Self-management for assessment purposes emphasizes the accuracy of a client's self-monitoring to obtain and provide data on targeted behaviors (e.g., for diagnostic or treatment development purposes). In contrast, self-management interventions are often based on a triad of skills – self-monitoring, self-recording, and self-reinforcement (or for some pediatric populations, parent- or teacher-delivered reinforcement) – for the explicit purposes of behavioral change. The emphasis is on discerning the expression of target behaviors rather than accuracy of self-recording. Much of the early work on self-management interventions included not only clinical applications but component analyses of the various variables involved in self-management interventions (cf. Kazdin, 1974; Mahoney, 1974). Since then, more of the contemporary research on self-management interventions with people with autism spectrum disorder (ASD) involves direct clinical application (e.g., Lee, Simpson, & Shogren, 2007).

Rationale or Underlying Theory

Mechanisms for Behavioral Change. Self-management interventions have been hypothesized to emphasize the active role of the client in promoting and maintaining change. The client's role in directing change is pivotal and is an integral mechanism in this intervention (Mahoney, 1972). Clients determine whether behaviors will be increased or decreased to obtain a desired outcome (reward). As a result, emphasis is placed on self-management procedures to be gradually transitioned from therapist management of contingencies to the client (Mahoney, 1970). Particular emphasis is placed on the client to learn to discriminate when the target behaviors occurred to obtain the reward. By doing so, the client develops self-awareness through contingency management skills (i.e., the notion that reward is only obtained contingent upon the expression of target behaviors). Some clients with poor impulse control can learn this association even if parents and teachers remain in control of the reinforcement.

Initiating Behavioral Change. At the very foundation of self-management intervention principles is the notion that self-monitoring achieves significant changes in behaviors, referred to as the "reactivity effect" (Kazdin, 1974; Korotitsch & Nelson-Gray, 1999). The premise is that self-monitoring alone leads to reactive behavioral effects and is a widely accepted aspect of self-management interventions. The client's enhanced self-awareness of behavioral expression is proposed to be pivotal to initiating behavioral change. Kanfer (1970) asserted that self-regulation is achieved

by the active process of the client's own observations, evaluations, and obtainment of rewards. Awareness of one's own behaviors is proposed to promote the acquisition of adaptive behaviors. Self-awareness helps people recognize and appreciate new contingency relationships within their environment to develop adaptive behaviors (Mischel, 1973).

Maintenance and Generalization of Behavior Change. These instrumental concepts underlying self-management have led to subsequent hypotheses that self-management interventions facilitate clients to independently manage their symptoms while decreasing their reliance on the administration of intervention by clinicians (Harrower & Dunlap, 2001; Koegel, Koegel, Hurley, & Frea, 1992). Self-management procedures are considered to be economical and easy to transport, making it relatively easy to use the intervention across a variety of settings. These factors have been hypothesized to promote generalization of behavioral change in ASD (Koegel et al., 1992). Also, it has been speculated to increase self-regulation of symptoms and has been referred to as a pivotal area that can elicit change in a variety of other symptom domains related to ASD (Koegel, Koegel, & McNerney, 2001). The emphasis on increased client self-sufficiency in managing the treatment of symptoms seems to be especially pertinent in using this intervention for children with ASD and their families.

Goals and Objectives

The primary goal of self-management interventions is the development, maintenance, and generalization of adaptive behavioral change. The goal is to facilitate an awareness of the interaction between one's behavior and the surrounding environment, including contingency management of rewards (Mahoney, 1970). In the treatment of ASD, generalization of desired changes across contexts that extend beyond the treatment setting is also an aim (Koegel et al., 1992). Another goal is to increase independence of symptom management by children (and families of children) or adults.

Treatment Participants

Self-management intervention research has been conducted with a wide range of ages and for a variety of presenting issues in both typically and atypically developing populations. The youngest age group in which this intervention has been targeted in ASD has been with preschool children (Newman, Reineck, & Meinberg, 2000); however, it has been applied more frequently with school-aged children (Lee et al., 2007). Children as young as 3 years of age appear to accurately self-monitor behaviors with brief training provided by a clinician. The intervention has been used and appears to be effective across children and adolescents with varying ASD diagnoses (i.e., autism, Asperger's disorder, and pervasive developmental disorder-not otherwise specified), functioning levels, and for treating a range of social, communication, and behavioral impairments (Apple, Billingsley, & Schwartz, 2005; Pierce & Schreibman, 1994; Wilkinson, 2005). Some targeted behaviors have included independence skills such as completing daily living tasks (e.g., schedules), school performance, social skills, conversation skills, play skills, and managing challenging behaviors such as disruptive and repetitive behaviors. For example, in youngsters with ASD, self-management intervention was used to successfully increase behavioral variability in the play-related behaviors of three young children (preschool to 6 years of age) diagnosed with autism and mild cognitive impairments (Newman et al., 2000). In another study, school-aged children with ASD (ages 7, 12, and 13 years) demonstrated an increase in independent, appropriate (i.e., functional) toy play and a decrease in self-stimulatory behaviors that maintained in unsupervised and new play settings with the implementation of self-management intervention (Stahmer & Schreibman, 1992). Youngsters with ASD (ages 5 and 6) demonstrated appropriate school performance behaviors in their classrooms and decreased off-task behaviors (e.g., running out of the classroom; Koegel, Harrower, & Koegel, 1999). Self-management intervention as part of a video modeling treatment package effectively increased initiations of

compliment giving in three young children with ASD (ages 4–5) in comparison to video self-modeling alone (Apple et al., 2005). Children with ASD (ages 6 and 11) demonstrated increased appropriate verbal responses and decreased disruptive behaviors and social-communicative responses across clinical, home, and community settings with self-management intervention (Koegel et al., 1992).

In contrast, there are only a few research studies examining self-management interventions in adults with ASD. In one study, nine young adults diagnosed with high-functioning ASD (IQ above 80) between the ages of 17–25 years demonstrated a significant improvement in appropriate, self-initiated question-asking skills with the implementation of a self-management treatment package (Palmen, Didden, & Arts, 2008). Further research in the application and efficacy of self-management interventions across the age span is necessary.

Treatment Procedures

Self-management interventions often involve the following fundamental treatment elements: (a) identifying and explicitly defining goals for behavioral change (to promote self-monitoring), (b) developing skills for the client to monitor and record the occurrence or nonoccurrence of identified behaviors (self-recording), and (c) facilitating the client to obtain rewards once the targeted behaviors have been demonstrated (self-reward). There exists variability in the implementation of self-management interventions, but most incorporate the basic elements presented above to some degree. For example, Newman and colleagues (2000) used all three elements of self-management intervention by having the children self-monitor their play behaviors with the experimenters, "record" when they displayed flexible play by taking tokens from a jar, and then trading in these tokens to obtain a reward. In another study, children viewed appropriate social initiations on a video and then learned to monitor and self-record initiations in the classroom setting with their peers by placing a check mark in a box that was printed on laminated paper for one child or pressing a button on a wrist counter for the other children (Apple et al., 2005). The children selected their reward before beginning the self-management session for the day and approached their teachers once they had accumulated the designated number of points. Traditionally, self-management interventions are provided in an individual therapy setting that involves the client and the clinician across a range of settings such as the clinic or naturalistic environments within the community (e.g., Koegel et al., 1999). There is some preliminary evidence that it can also be implemented in a group treatment setting (e.g., Palmen et al., 2008).

More specific procedures for self-management among youth involve (1) identifying a range of child-preferred rewards and allowing children to designate items they would like to earn; (2) presenting them with a clear, individualized description of the targeted behavior using child-friendly language; (3) informing children of the number of "points" (target behaviors) necessary to obtain the reward; (4) teaching them to use self-management recording materials and track points through modeling and role playing (i.e., Self-Monitoring Training); (5) presenting children with opportunities to engage in targeted behaviors; (6) prompting them to mark a point once the target behavior was demonstrated; and (7) immediately presenting them with the selected reward once the agreed-upon number of points are achieved. Self-monitoring training (i.e., discrimination training) is often provided within self-management interventions. This involves a clinician teaching the client to be aware of behaviors by distinguishing desired targeted behaviors from undesired behaviors. Both types of behaviors are usually modeled by the clinician, and the client is asked whether such behaviors would warrant a point on the self-management sheet. The length of time providing the training appears to vary based on functioning levels and complexity of targeted behaviors. Training can be brief and has been accomplished in a 1-h period provided twice a week (e.g., Stahmer & Schreibman, 1992).

Promoting independence with self-management skills is an overarching goal of this intervention method. In combination with the basic therapeutic elements, most interventions emphasize gradually facilitating the individual to develop autonomy with the intervention. Clinicians incrementally decrease their involvement in implementing the intervention as clients demonstrate reasonable success with both self-management skills and treatment goals. One primary method has been for clinicians to gradually fade prompts provided to the client. These prompts, which can be verbal (e.g., reminders to mark the occurrence of a target behavior immediately after it occurred) or nonverbal (e.g., physically helping the child track responses by placing a tally mark on a sheet of paper), eventually transition from direct (e.g., a verbal reminder to check off a point each time the target behavior occurred) to indirect prompts (e.g., a brief reminder provided once at the beginning of the session for the client to as many "points" as possible). The frequency of prompts provided by the clinician and the degree of involvement in implementing the intervention are eventually tapered off. In one study, children were initially coached in using wrist counters to track their points (or responses) and reminded to press the counter each time the children asked an appropriate question. Gradually, such reminders and assistance were decreased as the children demonstrated success with using the self-management tools and asking appropriate questions during conversations (Koegel et al., 1992). Also, the frequency or duration of the target behavior necessary to obtain a reward is gradually increased. The rationale behind this process is to incrementally increase the targeted behavior in a manageable way to promote feelings of success in the client, maintain rapport, and preserve treatment motivation. In addition, the process involves extending the length of time before self-reinforcement occurs in order to promote maintenance of targeted behaviors in a naturalistic manner. Stahmer and Schreibman (1992) initially had children receive a point for demonstrating appropriate play behaviors for 30 seconds, which incrementally increased to 20 minutes in order to obtain a point. Koegel and colleagues (1992) initially rewarded children for obtaining 1 point for asking an appropriate question at the beginning of treatment. Eventually, children needed to obtain 30 points to obtain the reward.

There is preliminary evidence that recording and tracking one's *own* behaviors results in increased behavior change in comparison to being provided with *external* prompts that targeted behaviors have occurred. A study by Newman and Ten Eyck (2005) demonstrated that children's social initiations increased dramatically when they kept track of their initiations by taking a penny out of a bowl compared to a condition in which the children with ASD were externally provided with a penny by adults for initiating social behaviors. In fact, it seems that complex social behaviors in children with ASD such as social-communicative initiations are significantly improved using self-management intervention (e.g., Apple et al., 2005) in comparison to other methods such as video self-modeling. There is strong evidence that recording accuracy does not seem to be crucial for treatment effects to occur (Lee et al., 2007). Children may occasionally forget to self-record after engaging in the targeted behaviors. Some researchers have remarked that this phenomenon may be indicative of the targeted behaviors becoming integrated into the children's natural behavioral repertoire (Koegel et al., 1992; Newman et al., 2000). Conversely, there did not seem to be significant instances of children purposefully recording behaviors when they did not occur in order to obtain a reward. Therefore, the expectation for self-recording seems to be that clients should demonstrate reasonable accuracy during treatment.

The identification and use of highly motivating rewards is an integral aspect of this treatment. In the literature, these have included access to highly desired snacks or drinks, toys, activities (e.g., playing video games), or small prizes such as stickers. Rewards are conducted through some form of a preference assessment. This process involves the clinician identifying child-preferred items or activities by conducting a direct observation or gathering input from caregivers or from the children themselves. For example, in one study, children were provided with a prize bag

that contained a range of child-preferred prizes (e.g., stickers, figurines, small toys; Apple et al., 2005). Highly motivating rewards can be reserved for self-management intervention in order to ensure reinforcing properties. Reinforcement immediately following the self-management intervention appears to be successful particularly when self-management skills are just developing. Most studies of youngsters with ASD used contingent rewards immediately following a self-management session (e.g., Apple et al., Koegel et al., 1999). In one study of an adult with mild cognitive impairment, delayed reinforcement by accumulating a certain number of points to exchange for motivating items at the end of the week was effective, but somewhat less powerful in initially maintaining complex behaviors (e.g., Moore, 2009).

Materials used to monitor behaviors consist of visual cues such as checklists with questions related to the occurrence of the target behavior (e.g., Did I stay in my seat?) or check boxes printed on paper for children to mark the occurrence of the desired behavior. Materials to record points consist of writing instruments such as pens, markers, or crayons (e.g., Stahmer & Schreibman, 1992). Other materials to designate points included stickers or tokens (e.g., Newman et al., 2000). Devices such as timers or wrist watch counters have been used in an attempt to provide more discrete self-monitoring and decrease the need for clinician-delivered prompts. For example, a young adult with ASD used a digital watch to keep track of the time intervals (e.g., 5 min) in which he engaged in appropriate on-task behaviors when completing classroom assignments (Moore, 2009). After the watch beeped when 5 min had passed, he marked whether he demonstrated on-task behaviors during that time interval by placing tally marks on a sheet of paper. In many studies, wrist counters have been used for children to track their targeted behaviors (e.g., Koegel et al., 1999). Overall, self-management materials appear to be manageable and successfully used across ages and functioning levels and can be tailored to meet the unique needs of each person while still maintaining treatment efficacy.

Several variables contributing to enhanced treatment effects have been identified. Treatment effects were enhanced when motivation for change within the client was high (Lipinski, Black, Nelson, & Ciminero,1975); immediate self-recording after each target behavior occurred rather than after a long delay (Mahoney, Moore, Wade, & Moura, 1973); clients were aware of explicit performance standards/goals and provided with feedback (Kazdin, 1974); and positive self-reinforcement by obtaining a reward for engaging in the targeted behavior rather than retracting rewards for the absence of behaviors was used (e.g., giving oneself a punitive consequence by removing access to preferred items as used in a cost-response strategy; Humphrey, Karoly, & Kirschenbaum, 1978). Additionally, younger children may need more guidance and explicit rehearsal of behaviors, facilitation procuring and obtaining rewards, and support from adults or other support people to learn and successfully use self-management procedures (Lee et al., 2007). A combination of the above variables appears to have greater effects than self-monitoring alone or another single component of self-management intervention by itself (Kazdin, 1974).

Efficacy Information

Much of the literature on self-management interventions in ASD has been conducted using single-case research design. Single-case research models use rigorous and systematic methodology to closely examine behaviors when specific variables are manipulated (e.g., implementation of treatment) with a small number of participants (more scientifically rigorous studies include at least three participants). At this time, no large group design studies exist examining this intervention in ASD. Positive treatment effects of self-management interventions have been long established as either the sole treatment intervention or within the context of other treatment methods across studies. Lee and colleagues (2007) conducted a meta-analysis on 11 single-case studies to examine the effectiveness of self-management interventions among preschool and

school-aged children with ASD. They concluded that, overall, self-management interventions are effective in promoting and maintaining positive behaviors. The average effect size was approximately 82% based on single-case design meta-analysis using percentage of nonoverlapping data (PND). PND is one type of meta-analyses to measure the effect size to synthesize single-case research. Higher PND scores reflect greater treatment efficacy with scores ranging from 0% to 100%. Efficacy criteria range from ineffective (scores below 50%), questionable (50–70%), effective (70–90%), to highly effective treatments (90% or greater). The percentage of data points in the treatment phase that do not overlap with the highest value of data in the baseline phase (pretreatment) is calculated. Treatments employing self-management strategies were effective regardless of age group (preschool children vs. school-aged children), emphasis on specific self-management components (self-monitoring vs. self-reward components), or self-management materials (paper sheet vs. tokens). A trend for increased efficacy was observed in programs that were individualized for the children, coparticipants (e.g., adults or peers) provided support in monitoring the children's target behaviors, and self-management was conducted in natural settings (e.g., the home). Most studies also demonstrated maintenance effects (behavioral gains maintained even with the removal of self-management procedures) and generalization effects (behavioral gains demonstrated in novel settings or activities). For example, Stahmer and Schreibman (1992) demonstrated that prior to treatment, the three children with ASD in their study engaged in approximately less than 40% of appropriate toy play during each session. With intervention, all three children increased the percentage in which they demonstrated appropriate play to an average of 88% for child 1, 80% for child 2, and 96% for child 3. Generalization effects were evident in a novel setting once self-management procedures were faded. Two of the three children demonstrated appropriate play at levels similar to that during treatment after a 1-month follow-up (greater than 80% of appropriate play each session). In another study, two children with ASD demonstrated appropriate schoolwork performance during baseline (prior to treatment) approximately for 55% across sessions (Koegel et al., 1999). During intervention, levels of performance increased to approximately 95% for both children and maintained at this high level even after clinician involvement had been completely removed.

Outcome Measurement

Outcome measurements vary across studies and depend on the treatment targets. In general, given that many of the self-management treatment studies in ASD are based on single-case research design paradigms, outcome variables tend to be based on observable behaviors that have been recorded using frequency- (event recording) or interval- (duration) based variables gathered through direct observation or videotaped recordings. Frequency data refer to measuring the number of times behaviors occurred during a designated period of time. Interval recording systems measure the total number of intervals during which the targeted (e.g., 10-sec interval) behaviors occurred within a specified overall time period (e.g., 10 min). Data are based on either the entire session or representative timed samples or data probes (e.g., last 10 min of a session). The manner in which this data is calculated varies and has consisted of frequency counts, rates, or percentages. Behaviors are carefully and specifically operationalized to accurately capture changes over time. Reliability data are typically reported in the literature to ensure that raters (typically at least two raters for a specified portion of the data) were both accurate and reliable in measuring behaviors. In one study, outcome measures consisted of the percentage of play opportunities in which children demonstrated appropriate, varied play (Newman et al., 2000). Children with ASD were presented with ten opportunities to play during each session. Each instance of varied play was totaled for the session and divided by the total number of opportunities presented and then multiplied by 100 in order to obtain a total percentage of opportunities the

children engaged in varied play per session. Koegel and colleagues (1992) examined the frequency of appropriate and inappropriate verbal responses using an event recording system. The total number of these responses was summed for each data probe. The presence of disruptive behaviors was measured using an interval recording system. Each instance of disruptive behavior that was present during a 30-sec interval (from a 15-min data probe) was calculated and then divided by the total number of intervals to obtain the percentage of 30-sec intervals in which disruptive behaviors were observed during each session. Additionally, a few self-management intervention studies also measured the occurrence of targeted behaviors in typically developing children to serve as a marker for the expected frequency or percentage of behaviors expected (e.g., Koegel et al., 1999).

Qualifications of Treatment Providers

Self-management interventions with the ASD population are typically provided by trained professionals with advanced degrees in psychology or education and training in evidence-based practices with the ASD population. Also trained professionals provide ongoing supervision and training in self-management interventions to support staff (e.g., school aides or teachers), parents, or behavioral clinicians without advanced degrees in order to provide treatments that can be maintained by various people in the child or adult's life.

See Also

- ▶ Behavior Modification
- ▶ Cognitive Behavioral Therapy (CBT)
- ▶ Habit Reversal

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Self-Recognition

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Definition

Self-recognition refers to recognizing the "self" as separate from others. The term self encompasses various modalities (e.g., physical, emotional, psychological) which are unique and representative of an individual. Generally, attributes of self are categorized as either physical or psychological. Physical aspects of the self (e.g., face) typically refer to material embodiments of the self and awareness of personal agency, whereas psychological characteristics include multiple cognitive constructs such as personality traits and subjective perspectives (Gillihan and Farah 2005). The ability to self-recognize can be used as an index of self-awareness as well as an early developmental marker. A face is among the earliest and the most common embodied representations of one's self. Self-face recognition occurs between 18 and 24 months and is considered crucial for the development of a self-concept and successful social behavior as it signals the emergence of sophisticated levels of self-awareness. The differentiation of self and others progresses continuously over the first 24 months, culminating in a clear identification of self-image and self-awareness (Lewis 1991). Impaired or inhibited emergence of self-recognition is linked with developmentally delayed disorders such as Autism Spectrum Disorder (ASD).

Historical Background

Self is foundational to the term Autism. The word Autism is derived from the Greek word "autos" meaning "self." Leo Kanner first applied this term to children demonstrating complete self-focus and who were seemingly indifferent to social interaction (1943). Researchers have since considered individuals with Autism to have an "absent self" or reduced self-awareness in order to explain the observed impairments (Blakemore and Frith 2003).

Early research on visual self-recognition suggests children with ASD do not have impaired bodily self-recognition and are capable of acknowledging their own reflection (Dawson and McKissick 1984). Self-recognition is classically examined through a mirror paradigm originally developed by Gallup (1970) to investigate self-concept in nonhuman primates. Variations of this paradigm have been used to empirically study self-recognition in infants and children. The protocol involves secretly marking an infant's nose and observing their response upon placing the infant in front of a mirror. A response directed at the mark infers self-recognition. At approximately 2 years of age, young children are able to recognize themselves and exhibit a definite recognition of their reflection by touching their noses. Children with ASD have shown

variable ability in this task compared to typically developing children (TD) (Dawson et al. 1984). However, impaired ability in this task is not considered to be a deficit of the disorder since it has not been found to be related to ASD characteristics. Dawson and McKissick (1984) demonstrated that language, motor, and social deficits were not related to self-face recognition. Moreover, some studies that report significant self-recognition impairments in children with ASD also found that their sample exhibited mental ages below their chronological age. Therefore, variable or absence of self-recognition in the mirror task can be thought to be a reflection of a developmental delay and not a specific inability characteristic of ASD (Dawson and McKissick 1984; Ferrari and Matthews 1983). This suggests self-focused observations in ASD may be a related to other "self" domains such as more abstract or cognitive representations of self.

A reduced sense of self in children with ASD is evident in cognitive aspects of self such as self-awareness and self-referencing. For example, while observations of embarrassment and coyness during the mirror task usually appear around 2 years of age in TD children (Amsterdam and Greenberg 1977), similar self-conscious reactions were reported missing in children in ASD who performed the same task. These findings are congruent with research reporting a reduction in the use of self-referencing pronouns in ASD children. Concurrent with the ability to recognize one's self in a mirror is the onset of personal pronoun use (e.g., "I" and "me"; Preyer 1889). The use of personal pronouns in children with ASD has been shown to be reduced and is thought to be indicative of a failure to self-reference (Fay 1979). A lack of self-awareness reactions and use of personal pronouns points to an underdeveloped or impaired cognitive sense of self in ASD. Such impairments early in development are thought to be related to an increased difficulty distinguishing between self and other and subsequently increased social impairments (Kanner 1943). More recent research has focused on how the ability to distinguish between self and others differs in children with Autism.

Current Knowledge

The multidimensional nature of self-recognition lends itself to be examined from both a behavioral and neurological perspective. While some aspects of self-awareness are atypical in ASD, others appear to be intact. Abstract representations of self, such as identifying personal feelings and conceptual ideals, are more affected than awareness of one's physical self. The formation of a secure and balanced self-representation is important to social understanding (Decety and Sommerville 2003). Researchers have investigated self-recognition in ASD at various stages of development at both the behavioral and neural level.

Behavioral

Studies implementing various self-referencing paradigms have reported aberrant self-recognition ability in children with ASD from a young age. A reduction in the use of self-reference has been well characterized. Studies examining verbal expressions of self have found that individuals with ASD have specific difficulties identifying personal experiences, mental states, and emotions (see Capps et al. 1995; Frith and Happé 1999). Retrospective studies on individuals with ASD and their siblings demonstrated a reduction in self-reference, such as name orientation, based on the examination of first birthday home videos. Longitudinal behavioral studies following infant siblings at high risk for ASD (i.e., siblings of children with ASD) have found orienting to one's name in the videos was a behavioral marker that differentiated between those children who were later diagnosed with ASD and those who did not. The authors suggest these early observations are a sign of reduced social motivation and are unrelated to developmental delays alone (Zwaigenbaum et al. 2005). This attenuated tendency to self-reference is seen throughout development and into adulthood. In a study looking at self-reference and memory performance, adults with ASD did not perform as well during the

memory task condition that involved words presented in a self-related manner (i.e., "Does the word describe you?") compared to the control group (Toichi et al. 2002). Additional longitudinal studies are needed to track participants throughout development.

Expanding upon the mirror task, a revised digital version of the paradigm uses previously recorded video to examine self-recognition. This delayed self-recognition (DSR) task tests whether children recognize their past self as opposed to their present self in a modified version of Gallup's mirror paradigm. A sticker is placed on a child's head in secret and is later shown a video of the sticker being placed on their head. The majority of children with ASD showed no difficulty realizing that a sticker was actually on their head nor did they significantly differ in prompts to acknowledge the sticker. The DSR task demonstrates children with ASD have no impairment recognizing between their current and past self (Lind and Bowler 2009). This finding is also congruent with research on self-recognition of agency in ASD. Agency refers to the person causing or generating an action. In an action-monitoring task, Williams and collogues (2008) showed that children with ASD performed similarly to typically developing individuals by showing stronger self-reference when following and recalling their own actions compared to the actions of the experimenter. Both the DSR and agency monitoring studies suggest bodily self-recognition is unimpaired in ASD.

While physical attributes of self-recognition are intact in ASD, it is unclear if the neural bases of these processes are being employed the same way as in TD individuals. For example, individuals with ASD may employ alternative cognitive mechanisms, such as matching representations of like images to achieve the same results. Another caveat in many self-recognition studies is testing age. Due to the relatively older age at diagnosis, it is difficult to compare early developmental constructs in children with ASD that occur in the first few years of life. As of yet, no known self-recognition research has been reported on infants at high risk for Autism. Numerous neuroimaging studies, however, have examined the neural mechanisms in children and adults.

Neuroimaging

While specific brain region involvement may vary depending on different self-referential processes, the right prefrontal cortex plays a large role in self-recognition (Lou et al. 2004; Keenan et al. 2000). Self-face recognition research implicated the right hemisphere with various psychological aspects of the self (i.e., trait attributes, judgment of self, self-reflection) (Platek et al. 2006; Uddin et al. 2005). While it appears that self-referencing, particularly self-face recognition, is lateralized in the right hemisphere (RH), the left hemisphere (LH) is likely to play an important role. Several functional Magnetic Resonance Imaging (fMRI) studies have shown bilateral activation during different operationalizations of self (Kircher et al. 2000). Research on split-brain patients (where the corpus callosum is severed and communication between the two hemispheres has been lost) also report discrepant findings in regards to hemispheric differences when examining self-processing (Keenan et al. 2003). The relatively few self-face studies in ASD provide some evidence to suggest that self-face recognition tasks elicit activity in similar cortical regions as neurotypical individuals. However, the patterns of activity within these regions differ.

Neuroimaging research on self-recognition in ASD has largely focused on neural processes distinguishing between self- and other-faces. Self-face recognition paradigms typically included morphed versions of a participant's face with that of a familiar or unfamiliar other's face to varying degrees. Participants are asked to identify at what point the stimulus looks more like themselves than the other person's face (Uddin et al. 2006). Several imaging techniques using a similar paradigm have supported RH specialization for self-face recognition in control participants (Keenan et al. 2000) and altered RH patterns of activity in individuals with ASD

(Gunji et al. 2009). In particular, the right inferior frontal gyrus (IFG) appears to be involved in self and other face distinction and to show reduced activity in individuals with ASD. The right IFG is part of the Mirror Neuron System (MNS) and is thought to contribute to successful understanding of other's intentions as well as self-recognition (Uddin et al. 2005). More specifically, in an fMRI study by Uddin and colleagues (2008) children with ASD exhibited different activation patterns in the right IFG, compared to the TD group. TD children exhibited almost equal activation to self and other face processing, while ASD only exhibited significant activation when viewing their own faces (Uddin et al. 2008). The authors suggest that this dissociation may point to a neural substrate for self-focused and decreased other focused social motivation. They also propose that the shared representation for self and others seen in TD children may be a neural mechanism by which we understand others and reduction of activity in the IFG during other-face processing may indicate reduced social understating in children with ASD. Kita and colleagues (2010) likewise reported right IFG activation in a self-recognition near-infrared spectroscopy study. Control and ASD participants exhibited higher levels of oxygenated hemoglobin in the right compared to left IFG when viewing self-face stimuli. They also reported that an increase in IFG activation was inversely related to ASD symptom severity, such that lower activity was related increased ASD symptom severity (Kita et al. 2010).

Neuroimaging studies have also found individuals with ASD have difficulties during cognitive self-referential tasks such as mentalizing. High-level inference-based mentalizing involves cognitive representations of self and other and recruits similar neural systems in regards to physical self and other representation. In an fMRI study by Lombardo (2010) TD and ASD participants made reflective judgments about themselves and a nonclose other (i.e., president). Neurotypical adults more strongly recruited the ventral medial prefrontal cortex (vMPFC) when mentalizing about themselves. In contrast, the ASD group activated the vMPFC equally when mentalizing about self and other. Further, the magnitude of self and other distinction in the vMPFC was negatively correlated with social impairments in the ASD participants. This study suggests that specific dysfunctions in cortical midline structures of the brain, such as MPFC, may alter patterns of activity when mentalizing (Lombardo et al. 2007). Uddin et al. (2008) found the reverse dissociation during a face recognition task, suggesting that differences between neurotypical and ASD differ depending on the nature of the self-referential process.

Other studies have also reported a dissociation between self and other perception in individuals with pervasive developmental disorder (PDD) (i.e., ASD). In an electrophysiological study (Gunji et al. 2009), atypical patterns of self- and other-recognition were demonstrated in children with PDD compared with TD children and adults. The TD groups made a distinction between self and familiar stimuli, but the children with PDD did not. (Gunji et al. 2009).

The dual nature of self, simultaneously being similar and different from other individuals is central to the development of social cognition (Lombardo and Baron Cohen 2010). Neural activation related to distinguishing between self and other appear to be atypical in ASD, suggesting that altered self- and other-recognition may be linked to deficits in social cognition in the disorder.

Future Directions

Self-recognition research in Autism has primarily focused on specific self-representation processes. Neuroimaging in particular have used task-related MRI to examine self-recognition mechanisms and networks. Future research should explore the basic mechanisms and the levels at which different domains of self (i.e., physical and psychological) relate to one another. The relationship between patterns and levels of activation that involve the MNS and higher mentalizing systems should also be explored in the same sample. Presently, there are few longitudinal

studies, more are needed to examine developmental changes in self- referencing and recognition. It would also be interesting to investigate different cultural perspectives of self and how interdependent or independent views of self modulate self-recognition mechanisms.

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Self-reflective Awareness

▶ Self-concept

Self-regulation

▶ Mutual Regulation

Self-reliance

▶ Self-advocacy

Self-stimulatory Behavior

▶ Stereotypic Behavior
▶ Stereotyped Movement Disorder

Self-talk

▶ Private Speech

Semantic Fluency

▶ Verbal Fluency

Semantic Memory

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Definition

The concept of semantic memory, along with episodic memory, forms part of the declarative memory system, the operation of which is open to conscious awareness. It encompasses an individual's stock of general knowledge. Although traditionally thought of as storing information in an abstract, propositional manner that transcends the perceptual features of the information it represents, more recent formulations acknowledge some enduring representation of the original sensory or perceptual information. Semantic memory is organized in a way that permits flexible goal-directed retrieval and utilization of the stored information, and its operation is accompanied by a particular state of conscious awareness that does not involve the self reexperiencing the past. In this respect, it contrasts both with episodic memory, in which conscious awareness involves the self, and with procedural memory, which is not accessible to conscious awareness.

Historical Background

Most authorities now agree that human memory can be divided into "non-declarative" systems, such as sensory or procedural memory, whose operation is relatively inaccessible to conscious awareness, and "declarative" systems, which represent the conscious act of "remembering something." A major distinction within the declarative memory system is that between semantic and episodic memory (see Gardiner, 2008 for review). The term "semantic memory" emerged from the literature on experimental, laboratory-based studies of memory in the 1960s and 1970s and was systematically

elaborated in a chapter by Tulving (1972). Tulving has become the scientist most famously associated with the term "semantic memory" and its relation to other memory systems, in particular episodic and procedural memory (see Tulving, 1985 for review). Although dividing memory along these lines is not universally accepted (see Squire, 1987 and Jacoby, 1988 for alternative accounts), it is largely to the work of Tulving that we owe the idea of a separate, semantic memory system that handles and organizes our store of factual general knowledge about the world.

Tulving (1972) defined semantic memory as "...the memory necessary for the use of language. It is a mental thesaurus, organized knowledge a person possesses about words and other verbal symbols, their meaning and referents, about relations among them and about rules, formulas, and algorithms for the manipulation of these symbols, concepts and relations" (p. 386). Tulving (1985) contrasts this semantic memory system with the episodic memory system, which stores events as situated in time, rich in perceptual and contextual detail and related to a sense of the experiencing self. In a later account, Tulving (2001) refers to semantic memory as a store of "timeless facts" that are accompanied by *noetic conscious awareness*. This awareness is not tied to a particular time or place and does not involve a sense of the self as knower even though it may contain propositions about the self (I am a psychologist, I have a cat, etc.). Episodic memory, by contrast, involves "mental time travel" where the self travels back in time to recreate the temporal and spatial context of the recollected episode and is accompanied by *autonoetic conscious awareness*, which is associated with a specific place and time and involves a sense of self as the knower of the recollected information.

The reasoning that led Tulving (1972) to argue for separate semantic and episodic memory systems rests on a number of observations and distinctions that are still relevant to attempts to characterize the structure of the human information processing system and which are also relevant to an understanding of autism spectrum disorder (ASD). A key distinction between episodic and semantic memory lay in the way information was stored in the two systems. Whereas Tulving argued that episodic information is stored in terms of the perceptual attributes of items information and the relation of directly experienced items to each other in space and time, information in semantic memory is more abstract and propositional in nature. Although a representation in semantic memory may contain elements of the original, perceptual features of the information on which the memory is based (e.g., registering that water is a liquid), the way this information is represented is biased more toward the logical implications of the proposition "water is a liquid" than to any perceptual experience of wetness or fluidity that might be encountered in a direct experience of drinking a glass of water.

In the four decades since the term became current in discussions of memory, research has been aimed at further characterizing the structure and function of the semantic memory system. Some investigators have attempted to confirm or challenge the semantic/episodic distinction at both a behavioral and a neural level. Of more relevance to the study of ASD, however, is research that has concentrated on how information in the semantic memory system is organized.

It is of considerable advantage to an organism if its store of knowledge (facts, propositions, etc.) can be organized and linked together in various ways. Such organization means that each stimulus, object, or event is not seen in isolation but that groups of stimuli can be treated similarly, thus achieving savings in information processing load. One form such organization can take is for objects and events to be grouped into categories or concepts, which in turn can be further grouped hierarchically. For example, HAT, COAT, SHOE, and SCARF can all be thought of as "items of clothing," just as CAR, BICYCLE, BOAT, and TRAIN can be grouped under the heading "modes of transport." These two superordinate categories further contrast with "animals" and "fruit" in being artifacts rather than natural kinds. Words can also be related associatively, for example, by tending to occur together. So BED, PILLOW, BLANKET,

SNOOZE, and NIGHT can be thought of as "going together" because they are all strongly associated with the word "SLEEP."

Attempts to formulate theories of concept formation and representation have come from philosophy, neurology, experimental psychology, and neuroscience (see Murphy, 2002, Chapter 1 for review). *Classical concept theory* proposes that all higher-order concepts can be fully defined by feature combinations that are individually necessary and jointly sufficient to define an exemplar of that concept. Accordingly, we might say that birds are warm-blooded, have feathers and wings, lay eggs, and can fly. However, classical concept theory encounters a number of difficulties, both at a logical and a psychological/neuropsychological level. For example, penguins are birds, yet they do not fly, raising the question of what constitute necessary defining features of the category "bird." Also, researchers have grappled with the question of how an abstract, multidimensional concept such as "bird" can be represented in the brain, given that it derives from an aggregate of different perceptual features from different sensory modalities (appearance, sound, feel, etc.). In an attempt to overcome some of these objections, *prototype theory* argues that concepts comprise averaged-out representations of a range of instances of members of the concept or category, weighted by their frequency of occurrence in the real world. Thus, a prototype of a bird might add "can fly" to the properties listed earlier but not posit this as a necessary condition for being a bird (e.g., think of ostriches or penguins). More recently, theorists such as Barsalou (2008) have argued that the organization of representations of the world is grounded in our physical, embodied experience of that world and that this organization will ultimately reflect the features of the situated, embodied groundedness that engendered them. For example, Marques (2006) asked participants to verify statements such as (1) *a dog can bark*, (2) *a bee can buzz*, and (3) *a horse has hooves*. They found that verification time increased when a statement followed 1 in a different modality (statements 1 and 3 involve a switch from audition to vision) than when it followed 1 in the same modality (statements 1 and 2 both involve audition). They concluded that this demonstrated the lasting effects of perceptual modality on conceptual reasoning.

Although much of the discussion around prototype and grounded theories of conceptual representation does not explicitly consider how concepts are actually represented in the brain, the question of how such representations are implemented is a growing area of research. Of particular relevance to ASD is research into the extent to which representations in semantic memory are amodal and completely abstracted from their initial sensory and perceptual origins or unimodal, tied to modality-specific representational systems or multimodal, retaining features of all modalities involved in the laying down of the representations (see Gainotti, 2006 for review).

Some researchers such as Lambon Ralph and Patterson (2008) argue for there being an "amodal semantic hub" at which categories are represented across all modalities that contributed to the generation of that category. Other researchers, such as Damasio (1989) argue that the multimodal, multisensory activations generated when an object is encountered are coded hierarchically in the nervous system in a way that generates higher-order representations that continue to retain some of the original sensory/perceptual information. What Damasio terms "higher-order convergence zones" become more or less hierarchically organized in ways that reflect the organism's experience of objects in the real world.

From this brief overview, we can see that the original notion of semantic memory, that of a consciously accessible, organized set of pieces of information about the world that is separate from but interacts with our recollection of the personally experienced past, is still current, if not entirely uncontroversial. The information it contains is, to a greater or lesser extent, abstracted from the sensory information that initially gave rise to it, and when it is retrieved, it is accompanied by a state of conscious awareness that does not involve the self in reliving past episodes.

Current Knowledge

One of the most enduring discoveries in the science of autism spectrum disorder (ASD) is the observation by Hermelin and O'Connor (1970) that the disorder consists of a difficulty with the meaningful encoding of stimuli. That observation was made at a time when the concept of semantic memory was beginning to emerge in the mainstream experimental psychology literature. In the intervening four decades, much more has been learned both about the organization and functioning of human memory in general and about the patterning of other psychological functions in ASD, yet the core of Hermelin and O'Connor's observation – that being on the autism spectrum implies a difficulty in keeping an abstract, verbally mediated, systematically organized store of knowledge that can be drawn upon to guide action – continues to have considerable validity.

The three aspects of semantic memory outlined in the *Historical Background* section each have their implications for the operation of the system in individuals with ASD. There is now a considerable weight of evidence to support the idea that individuals from all parts of the autism spectrum experience some difficulties with the structural organization of the semantic memory system. Although early studies of categorization abilities in children with intellectual disability (ID) and ASD revealed intact basic and superordinate categorization skills, electrophysiological signatures of superordinate categories were found to be atypical. Moreover, whereas children with ASD and ID have been shown to be unimpaired in sorting a set of shapes under appropriate shape headings, they were impaired in sorting a set of objects into the categories of trees, beds, human figures, animals, tools, and vehicles. Moreover, their ASD group was impaired on a class-inclusion task where they had to answer questions like "are all the circles red?" (See Bowler, 2007, Chapter 7 for a more detailed review of this work).

A further set of findings have shown that memory in ASD is less influenced by meaningful relations among studied items. This is especially true in tasks such as free recall, where the test procedure provides few clues to the studied material. One measure of sensitivity to the semantic structure of studied material is the extent to which words from the same category are clustered together at recall even though they were randomly distributed through the study list. The overwhelming majority of studies of children and adults with ASD show diminished categorical clustering of items in free recall. Children with ASD and significant intellectual disability (ID) also make less use of sentence structure and categorical relations to aid their free recall of lists of words. For example, children without autism show better recall of the sentence *where is the ship* than the random string *wall long cake sand*. Recall by children with ASD, matched with the non-ASD children on digit span, has shown no difference between the two types of material. Studies have also shown that children without ASD recall more words from a list where each word is the name of an animal than from lists where each word came from a different category. Children with ASD matched with the typical children on verbal mental age showed no advantage for the animals list, an observation that also holds for higher-functioning adults with ASD. This difficulty in exploiting categorical semantic relatedness also extends to the recall of incidentally encoded context. When high-functioning adults with ASD are asked to study words inside a rectangle when there are also conceptually related or unrelated words outside the rectangle, they do not show enhanced free recall of words that are studied in conjunction with semantically related words. Comparison participants without ASD, by contrast, show enhanced recall when both words (inside or outside the rectangle) are related (see Bowler, 2007, Chapter 7 for a detailed review of these studies).

Difficulties with exploiting structural semantic relations to aid recall appear at first sight to be contradicted by demonstrations of intact illusory memories in individuals with ASD (see Bowler, Gaigg, & Lind, 2011 for review). These studies typically ask participants to study lists of words that are strong associates of a non-studied word (such as the BED, PILLOW, BLANKET... example given earlier) and then test recognition

of studied words and non-studied words including the strong associate SLEEP. However, as Bowler et al. (2011) observe, tasks requiring the exploitation of hierarchical semantic relations differ in their computational demands from those that require a grasp of associations between pairs of items. Bowler et al. draw a parallel between the kind of reasoning involved in illusory memories and the processing of what Halford (1992) has termed *binary relations*, in which two items of information must be processed simultaneously. Exploiting hierarchical semantic relations to aid recall involves *ternary relations*, in which successive studied words (say APPLE, HORSE, PEAR) need not only to be compared to each other but also to the higher-order categories under which they are subsumed.

One reason why relational complexity may be difficult for individuals with ASD is that it may result from a bias or preference for item specific rather than relational processing. When adults with ASD and typical participants are asked to recall lists of items made up of categories, each of which is represented by between 2 and 16 exemplars, ASD participants' recall of the smaller categories is impaired, suggesting that they are less likely to notice the links between items from categories represented by small numbers of items widely spaced in the study list (imagine studying a list of 42 words and encountering *apple* among the first few words and *pear* among the last few). Orienting participants to relations among items by sorting them into categories at study aided recall in both groups of participants but was less effective for the ASD group. Orienting them to specific features of items by asking participants to rate each item's pleasantness was more effective in enhancing recall in the ASD group. These findings suggest a bias in ASD toward processing individual item features and away from relations among items. This in itself will militate against the kinds of complex relational strategies needed to recruit hierarchical category structure in the aid of recall (see Bowler et al., 2011 for further elaboration).

The explanation of difficulties in recruiting semantic relatedness to aid recall in terms of processing complexity helps to flesh out the observation by Minshew and colleagues (Minshew, Johnson, & Luna, 2001) that individuals with ASD experience greater difficulties with complex but not simple memory tasks. But both accounts beg the question of how and why such difficulties with complexity might come about. An answer to this question may well be provided by a reconsideration of how Tulving (1972) originally described the laying down of semantic memory traces. He emphasized the abstract, propositional nature of semantic traces, which were not closely tied to the original sensory-perceptual information that gave rise to them. We have already seen that more recent theorists have taken different perspectives on the extent to which semantic memories are distanced from their sensory, perceptual, and embodied origins, but all acknowledge some level of abstraction from the sensory data (see Gainotti, 2011). The bias seen in ASD toward item-specific processing is consistent with the view that the principles governing the organization of semantic memory in this population may well reflect a greater contribution from sensory and perceptual data.

One theory of conceptual representation that has been researched in the context of ASD is prototype theory, which, as we have seen, proposes that abstract representations of semantic categories are built up as averages of the features of the examples of members of that category. The balance of existing experimental evidence suggests that at least a subset of individuals on the autism spectrum have some ability to abstract perceptual prototypes (Molesworth, Bowler, & Hampton, 2005) but can take longer to do it. This last finding can be explained in terms of the *enhanced perceptual functioning* (EPS, Mottron, Dawson, Soulières, Hubert, & Burack, 2006) account of ASD, which argues that individuals with ASD, although as capable as typical individuals of generating global, abstract representations of stimuli, continue to hold lower-level perceptual representations of learned material. The presence of these lower-level representations is argued to affect both the speed and extent to which prototypical representations are

abstracted. The EPS may also help to account for why individuals with ASD appear to organize stored information in a different way from typically developed individuals. Bowler, Gaigg, and Gardiner (2008) asked participants with and without ASD to recall a list of 16 unrelated words presented over 15 trials, with the words presented in a different order on each trial. One of the principal aims of the study was to ascertain the amount of *subjective organization* engaged in by participants, i.e., the extent to which the structure of each participant's recall became similar across trials and, as a consequence, differed from the order of the presented words. An index was also calculated of the degree to which subjective organization converged among individuals across trials. Bowler et al. (2008) found that whereas their ASD participants showed only slightly diminished subjective organization, the extent to which this organization converged across individuals over trials was significantly less than in the comparison participants. This suggests that as a group, the ASD participants were organizing the studied material differently from each other, whereas the typical group was showing increasing similarity in their organization of the material. Taken together with the EPS theory and with the observations on diminished clustering in recall of categorized lists mentioned earlier on, this finding suggests that the way that ASD individuals organize items in memory may be more diverse and not as biased toward abstract, semantic aspects as in typical individuals. Memory organization in ASD might rely to a greater extent on perceptual features of studied material, such as rhyme, number of syllables, or form of the word in the case of written studied material. Such conjectures have yet to be tested empirically.

A final, important aspect of semantic memory system centers on the kind of conscious awareness that accompanies its operation. Both familiarity and the noetic conscious awareness or experience of "timeless facts" referred to by Tulving can be measured in recognition memory experiments by asking participants to make an additional "remember/know" judgment once they have identified a test word as having been encountered in the study phase. Participants are told to make "remember" responses when they have the experience of reliving the studied episode (reflecting autonoetic consciousness) and "know" responses when they have a strong sense of having encountered the word previously (reflecting noetic awareness) but without distinct recollection of the episode. A large number of studies have now demonstrated diminished episodic "remembering" accompanied by undiminished semantic "knowing" in high-functioning adults with ASD. Moreover, a series of manipulations that are known to enhance or diminish the level of "remember" or "know" responses in the typical population yielded similar effects in an ASD group, suggesting that processes underlying these responses, although quantitatively different, are qualitatively similar in the two groups. These findings suggest that individuals with ASD utilize their semantic memory system to compensate for episodic difficulties, an observation that is borne out by studies of autobiographical memory, where individuals with ASD characteristically report autobiographical events in terms that suggest items of factual knowledge rather than personally experienced, relived events (see Bowler et al., 2011 for review). However, the research reviewed earlier, showing enhanced perceptual involvement in semantic memory representations, suggests that the semantic memories of ASD and non-ASD individuals may be qualitatively similar only up to a point.

Insofar as semantic memory consists of a stock of knowledge about the world, individuals with ASD without accompanying intellectual impairment appear to have an intact store of factual material. Where they appear to differ is in the way that this information is recorded and manipulated. Semantic memories in ASD appear to be tagged with more of the sensory and perceptual information from the original source of the memories, which seems to promote a more item specific rather than a relational approach to processing the material. This has important consequences in any task that requires the flexible deployment of semantic relations for its successful resolution.

Future Directions

Future research needs to address the following points:

1. Establish the basis on which individuals with ASD organize information in semantic memory.
2. Determine the brain bases of such organization both in terms of processing at encoding and retrieval and in terms of storage.
3. Work out the implications of atypical encoding, storage, and retrieval on the way semantic information is utilized in adaptive functioning.
4. Investigate ways to overcome any negative consequences of atypical operation of the semantic memory system.

See Also

- ▶ Declarative Memory
- ▶ Enhanced Perceptual Functioning
- ▶ Episodic Memory
- ▶ Explicit Memory
- ▶ Free Recall
- ▶ Memory
- ▶ Memory Assessment
- ▶ Memory Development
- ▶ Procedural Memory
- ▶ Recognition

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Semantic Pragmatic Deficit Disorder

▶ Semantic Pragmatic Disorder

Semantic Pragmatic Deficit Syndrome

▶ Semantic Pragmatic Disorder

Semantic Pragmatic Disorder

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Synonyms

Pragmatic communication disorder; Pragmatic language impairment; Semantic pragmatic deficit disorder; Semantic pragmatic deficit syndrome; Semantic pragmatic language disorder; Social communication disorder

Short Description or Definition

"Semantic pragmatic disorder" is a term that describes individuals with a communicative profile characterized by relatively intact structural language (phonology, morphology, syntax) but with abnormalities in language content and use. Communicative behaviors commonly observed in semantic pragmatic disorder are listed below (Rapin, 1996):

- Verbosity
- Comprehension deficits for connected speech
- Word finding deficits
- Atypical word choices
- Phonology and syntax unimpaired
- Inadequate conversational skills
- Speaking aloud to no one in particular
- Poor maintenance of topic
- Answering besides the point of the question

Categorization

In the mid-1980s, two taxonomies of developmental language disorders were independently published, one in the USA (Rapin & Allen, 1983) and the other in the UK (Bishop & Rosenbloom, 1987). Both described a subtype of developmental language disorder in which the primary impairment was in language content and use. Rapin and Allen termed this language profile "semantic pragmatic deficit syndrome," and Bishop and Rosenbloom used the term "semantic pragmatic disorder." Since the early 2000s, there has been a transition to the alternate label of pragmatic language impairment (or PLI), particularly in the UK, after evidence that semantic and pragmatic deficits do not always occur in combination (Bishop, 1998).

Semantic pragmatic disorder contrasts with specific language impairment, in which there is primary impairment in the structural aspects of language, and with autism spectrum disorders, which includes a raft of behavioral difficulties such as social impairments and restricted and repetitive behaviors. However, a number of studies have shown that the diagnostic boundaries between these conditions are not clear-cut; some children with SLI exhibit pragmatic difficulties, and some children with semantic pragmatic disorder present with one or more autistic features (Bishop & Norbury, 2000). Although semantic pragmatic disorder is not included in either the DSM-IV-TR or ICD-10 classification systems, it remains a relatively common diagnosis for language-impaired children in North America, Europe, and Australasia. The DSM-V proposes a new diagnostic entity, Social Communication Disorder, with diagnostic criteria that is highly similar to descriptions of Semantic Pragmatic Disorder.

Epidemiology

There has been no epidemiological study of semantic pragmatic disorder in the general population, and therefore, the incidence and prevalence of the condition remain unclear. However, it is estimated that these children make up

a significant minority of the language disordered population, with a large study in the UK finding that 25 of 242 children (10.3%) displayed characteristics of semantic pragmatic disorder (Conti-Ramsden & Botting, 1999).

Natural History, Prognostic Factors, and Outcomes

One study has chartered the adult outcome of individuals diagnosed with semantic pragmatic disorder in childhood (Whitehouse, Line, Watt, & Bishop, 2009; Whitehouse, Watt, Line, & Bishop, 2009). The pattern of communication difficulties observed in childhood was found to persist to adulthood, and the adults with semantic pragmatic disorder had enduring difficulties with language use but presented with relatively intact language and literacy skills. The adults with semantic pragmatic disorder were more academically able than a comparison group of adults with specific language impairment, and all had obtained some form of tertiary education. However, while the vast majority of these adults demonstrated a range of independent behaviors, few had experienced close friendships or romantic relationships.

Clinical Expression and Pathophysiology

There is considerable debate as to whether semantic pragmatic disorder is best viewed as a subtype of developmental language disorder or an extension of pervasive developmental disorder (Boucher 1998). Evidence that some children have poor pragmatic language ability without additional autistic symptomatology (Botting & Conti-Ramsden, 1999) has led to suggestions that semantic pragmatic disorder may fit a profile intermediate between specific language impairment and autism (Bishop and Norbury, 2002).

Little research has investigated underlying biological mechanisms that may be associated with a diagnosis of semantic pragmatic disorder. Woodhouse et al. (1996) examined head circumference in 11 children with semantic pragmatic disorder and found that all had a head circumference that exceeded the 90th percentile for their age, a finding that draws parallels with the widely observed acceleration in head circumference growth among children with autism (Redcay & Courchesne, 2001).

An increasing number of studies have investigated biological associations with pragmatic language skills either among individuals with autism and their relatives or within the general population. Family studies indicate that pragmatic difficulties appear to be a heritable trait and are often observed among relatives of autism probands to the exclusion of any other autistic-like trait (Landa et al., 1992; Whitehouse, Barry & Bishop, 2007; Whitehouse, Coon, Miller, Salisbury, & Bishop, 2010). Molecular genetic studies have started to pinpoint loci associated with pragmatic language ability, such as the short arm of chromosome 5, which was found to be associated with scores on the social communication subscales of the Children's Communication Checklist in a general population sample of 10 years of children in the UK (St Pourcain et al., 2010). Recent studies have also indicated an association between exposure to increased levels of prenatal testosterone and pragmatic language difficulties among otherwise typically developing children (Whitehouse, Coon et al. 2010), though this finding was not replicated in a different cohort (Knickmeyer, Baron-Cohen, Raggatt, & Taylor, 2005).

Evaluation and Differential Diagnosis

Three methods are commonly utilized to diagnose semantic pragmatic disorder.

Standardized Assessments: There are a small number of standardized assessments of childhood pragmatic language ability. The Test of Pragmatic Language (Phelps-Teraski & Phelps-Gunn, 1992) and Test of Pragmatic Skills (Shulman, 1985) are two of the more widely used assessments, requiring children to formulate appropriate utterances in relation to pictorial and/or verbal prompts. Ability is then compared to age-relevant norms. However,

it is been argued that standardized assessments of pragmatic language ability lack true ecological validity for assessing communication in context (Bishop, 1998).

Observation in Naturalistic Contexts: A number of procedures have been developed for the observation and assessment of an individual's pragmatic function in context. These range from a broad assessment, in which a stretch of conversation is rated on several aspects of communicative function (Prutting & Kirchner, 1989), to a more fine-grained analysis, which involves coding each utterance in a conversation (Bishop & Adams, 1989). Inter-rater reliability for both approaches is known to be high for trained raters. However, this procedure is limited by the often time-consuming process of sample collection, transcription, and analysis. Furthermore, the "snapshot" approach creates uncertainty as to whether the absence of a particular behavior means that this behavior does not occur or whether it occurs rarely but was not observed at the time of sampling.

Ratings: A third assessment method is to obtain ratings of pragmatic language ability from someone who has observed the behavior of the individual over a prolonged period. This approach holds the advantages of being relatively brief and providing a more representative account of an individual's typical ability, including behaviors that occur rarely or are difficult to elicit in test situations. However, ratings are often prone to subjective interpretation, and findings should necessarily be viewed with this in mind. One widely used assessment for evaluating semantic pragmatic disorder is the Children's Communication Checklist (Bishop, 1998) and its revised version, the Children's Communication Checklist 2nd edition (Bishop, 2003), which have good validity in differentiating between children with specific language impairment, autism, and semantic pragmatic disorder. Adult- (Whitehouse & Bishop, 2009) and self-report (Bishop, Whitehouse, & Sharp, 2009) versions of this checklist have been developed. Other rating scales of pragmatic language include the verbal pragmatic rating scale (Bloom et al., 1999) and the adolescent pragmatics screening scale (Brice, 1992). However, these scales do not provide norms and have not been validated for differential diagnoses of semantic pragmatic disorder.

Treatment

Communication difficulties are central to SPD, and thus, the primary intervention strategy is speech-language pathology. Single-case studies have provided the bulk of empirical data in this area, and, while not without the limitations, these studies suggest that speech-language pathology is effective in remediating pragmatic language difficulties, including poor speech prosody, limited communicative intent, verbosity, impaired turn taking, and reduced nonverbal communication. Findings from these studies emphasize the importance of a thorough assessment of communicative strengths and weaknesses and the provision of intervention targeted to the specific areas of need (Adams, 2001; Adams, Lloyd, Aldred & Baxendale, 2006; Adams & Lloyd, 2007). Findings suggest that intensive therapy (i.e., multiple sessions per week) over a period of at least 8 weeks may provide the most significant benefit. While there is some indication that improvement in pragmatic language following speech-language therapy may endure beyond the period of direct intervention, there have been no long-term follow-up studies.

See Also

- ▶ Autism
- ▶ Pragmatic Language
- ▶ Social Communication Disorder
- ▶ Specific Language Impairment

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Semantic Pragmatic Language Disorder

▶ Semantic Pragmatic Disorder

Semantic-Pragmatic Language Disorder

▶ Pragmatic Language Impairment

Send-Out Room

▶ Resource Room

Sensation Avoiding

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Synonyms

Sensory avoiding

Definition

Sensation avoiding is the tendency to avoid sensory stimulation. According to Dunn's Model of Sensory Processing, persons who tend to avoid sensation have a low neurological threshold for sensation (meaning that they notice stimuli very easily), and actively attempt to manage the stimulation (Dunn, 2001). Thus, sensation avoiders may be very rigid, ritualistic, and rule-bound in an attempt to control and limit stimulation in the context of daily life and reduce the amount of unpredictable stimulation. Sensation avoiders may also actively attempt to terminate a sensation, for example, by covering one's ears, leaving a room, or avoiding crowded places. Dunn's conceptualization of sensation avoiding has been supported with standardized measures of people's responses to sensory events in daily life (Infant/Toddler Sensory Profile, Sensory Profile, Adolescent/Adult Sensory Profile), and physiological responsiveness to stimuli. On the Sensory Profile, children with autism spectrum disorders demonstrate patterns of sensation avoiding more than their peers without autism (Ben-Sasson et al., 2009).

Persons with autism who are sensation avoiding have a low tolerance for stimulation. This means that even very-low-intensity levels of sensation may be overwhelming and may interfere with everyday functioning. For example, a sensation avoider may have a negative emotional response to sensory input that someone may not normally find bothersome or even notice. Although sensation avoiding can occur for any and all sensory systems in persons with autism, extreme sensitivities to auditory stimuli are commonly reported based on parental observation and first-hand accounts from persons with autism. For example, many persons with an autism spectrum disorder have reported hypersensitivity to the "buzz" of florescent lights or "whir" of ceiling fans. Selective feeding ("picky eater"), thought to be due to extreme sensitivities to tactile stimuli and texture, is also commonly reported in persons with autism.

Interventions do not typically target changing one's way of processing information. Rather, strategies are used that enable improved performance in daily activities regardless of sensory processing patterns. Strategies to support someone who demonstrates sensation avoiding include

creating environments with decreased stimulation, reducing unpredictable stimuli that occur during activities, and respecting one's need for control over their environment, perhaps through routines and rituals.

See Also

- ▶ Sensation-Seeking
- ▶ Sensory Impairment in Autism

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Sensation-Seeking

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Synonyms

Sensory seeking

Definition

Sensation-seeking is the tendency to pursue sensory stimulation and excitement. According to Dunn's Model of Sensory Processing (2001), sensation seekers generally have a high threshold for sensation (meaning that they require a lot of stimuli to notice), and actively seek out stimulation. Thus, sensation seekers can be very active and fidgety, can appear excitable and engaged, and can enjoy a variety of stimuli in their environment. For example, a child who is sensation-seeking might wiggle excessively in his chair at school to provide extra movement, hum, or make other noises to add auditory stimuli to his environment, or be excited and engaged by the variety of decorations, music, and smells of a holiday party. Differences in physiological responses (e.g., heart rate) to new stimuli have been reported in sensation seekers versus non-sensation seekers in the literature.

Individuals with Autism Spectrum Disorders (ASDs) are often reported to have unusual responses to sensory stimulation, including sensation-seeking behaviors. Persons with autism who are sensation-seeking have a high tolerance for stimulation and derive pleasure from sensation. Thus, they demonstrate a craving for stimulation, and an interest in sensory experiences that are more intense or prolonged than what might be typically expected. Sensation seekers are typically under-responsive to environmental stimuli compared to others; thus, they require increased sensation to maintain an optimal level of arousal to participate in daily activities.

The empirical evidence for sensation-seeking in persons with ASD is mixed. Studies using caregiver questionnaires show lower or similar occurrence of sensation-seeking behaviors in toddlers with autism spectrum disorders compared to typically developing peers. However, older children, youth, and adults with autism tend to experience increased sensation-seeking behaviors compared to typically developing peers. While previous research indicated that sensory processing patterns are relatively stable across the life span, a recent meta-analysis indicated that sensory-seeking behaviors may peak in early to mid-childhood (6–9 years). Also some evidence exists that sensory-seeking

behaviors may be more prominent in persons with autism ("autistic disorder") than in persons with a diagnosis on the broader spectrum (i.e., ▶ Asperger Syndrome, ▶ Pervasive Developmental Disorder Not Otherwise Specified). Overall, the literature in this area is sparse and is less consistent in sample selection, diagnostic information, and the methods used. There is also a dearth of information on adolescents and adults with autism spectrum disorder.

Interventions do not typically target changing one's way of processing information. Rather, strategies are typically used that enable improved performance in daily activities regardless of sensory processing patterns. Strategies to support someone who demonstrates sensation-seeking include creating environments that provide increased stimulation. Providing opportunities for increased sensory experiences within the context of everyday activities is important so that the sensation seeker does not have to stop engaging in the activity to obtain the extra sensory input they crave.

See Also

- ▶ Sensation Avoiding
- ▶ Sensory Impairment in Autism

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Sensitivity and Specificity

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Synonyms

True negative rate; True positive rate

Definition

Sensitivity is the proportion of true positives that are correctly identified by a test or measure (e.g., the percentage of children with autism who are correctly identified as having autism). Sensitivity is calculated by:

True Positives / (True Positives + False Negatives)

*A false negative rate (β) is calculated by 1 – sensitivity, or False Negatives / (True Positives + False Negatives)

Specificity is the proportion of true negatives that are correctly identified by a test or measure (e.g., the percentage of children without autism who are correctly identified as not having autism). Specificity is calculated by:

True Negatives / (True Negatives + False Positives)

*A false positive rate (α) is calculated by 1 – specificity, or False Positives / (False Positives + True Negatives)

See Also

- ▶ Epidemiology
- ▶ Screening Measures

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Sensorimotor Development

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Historical Background

Arguably the most influential figure in the field of developmental psychology, Jean Piaget authored seminal work on the development of children's intelligence. He posited that cognitive and intellectual changes are the result of development, an active process that the child brings about through interactions with her environment. This process encompasses a series of successive qualitative changes of cognitive structures or schemata created by the child through experience. Piaget's background as a biologist shaped his thinking about the process as a continuous exchange between the individual and the physical world; in other words, "intelligence finds itself entangled in a network of relations between the organism and the environment" (Piaget, 1952, p. 19). Piaget's body of work emerged based on extensive, meticulously detailed documentation of his own three children's behavior from birth through adolescence (Piaget, 1951, 1952).

The Sensorimotor Stage (Birth to 2 Years)

Piaget (1952) described four stages of cognitive development, the first of which is sensorimotor development. This is the period from birth to approximately 24 months of age that begins with a few reflexes and ends with the appearance of language and symbolic representation of the world. Knowledge in this stage can only be derived from interactions with the physical world, and development proceeds from this exploration. Infants' sensorimotor intelligence proceeds through six increasingly complex stages, each one building on the achievements of the last. In this stage, infants and toddlers do not yet possess the full power of symbolic representation, or language, so must rely on their direct experiences with objects. By around age 2, the child's capacity to represent action in the mind increases, allowing for conceptual thought, thus lessening the dependence on physical and sensory experience.

Substage I: The Use of Reflexes (0–1 Month)

Infants are born with several reflexes, or general action patterns such as sucking, grasping, and looking. Each reflex constitutes an "organized totality" that includes perceptions, coordinated movements, and a need; it is more than just a "summation of movements" (Piaget, 1952, p. 38). These reflexes differ from simple reflexes (i.e., blinking) in that they are modified with experience. At first, there is no differentiation among stimuli; for example, newborn infants will suck on a blanket and on a nipple with equal vigor. After several weeks, infants adjust their sucking to the specific object in their mouth.

Substage II: Primary Circular Reactions (1–4 Months)

When action schemes incorporate new objects, infants move into the second substage of sensorimotor development. In this period, reflexes expand into larger coordinated behaviors, primarily centered on the infants' own bodies. Piaget described systematic thumb sucking and tongue protrusion; looking, hearing, and phonation; and prehension in this substage. Out of the single behaviors of grasping objects and sucking objects grows the integration of these two actions, grasping an object and bringing it to the mouth to suck. The ability to thumb suck at will is one of the *first acquired adaptations* that

develops during this period. Turning to find the source of a voice is another primary circular reaction, reflecting coordination between hearing and vision. The term *primary circular reactions* refer to such behaviors. Reactions are primary because they focus on the infants' own bodies, and they are circular because they form "cycles of movements that repeat an interesting sensation discovered by chance" (Muller, 2009, p. 208).

Substage III: Secondary Circular Reactions, or the Procedures Destined to Make Interesting Sights Last (4–8 Months)

One of the notable changes in this period is that the child's behavior becomes increasingly oriented toward the environment, beyond her own body, including people, animals, objects, and events. At this time, infants begin to reproduce interesting actions, such as banging, shaking, and waving, especially when these actions cause an interesting visual effect or sound. "Everything thus goes back to movements of legs or feet, arms or hands, and it is these 'circular' movements of prehension which become differentiated in movements directed at shaking, swinging, displacing, rubbing, etc." (Piaget, 1952, p. 178). Infants begin to understand that the interesting events are related to their physical activity and thus reproduce the actions. Another characteristic of this period is the shift toward intentional, goal-directed behavior. During this period, infants still lack the concept of object permanence (see Substage IV).

Substage IV: Coordination of Secondary Schemata (8–12 Months)

Infants begin to use means to attain ends that are not attainable directly. For example, they will push aside a pillow to reach a toy, or pull a string to obtain an object attached to one end. The main achievement of this period is *object permanence*, the awareness that objects exist when they are no longer in sight. During this period, infants begin to search for objects that disappear, indicating that they understand that objects still exist after they disappear from view. The fragility of this mental representation, however, is exemplified in the *A-not-B error*. Once infants have searched for a hidden object at one location (A), when the location is moved (B) they continue to search for it at location A. Not until around the first birthday is the infant able to inhibit search at the previous location and look for the object at the new location.

Substage V: Tertiary Circular Reactions, or the Discovery of New Means Through Active Experimentation (12–18 Months)

Beginning at 12 months of age, infants begin to explore their worlds more actively, "experimenting" with objects, intent on seeing how they behave in new situations. Once making such discoveries, they are repeated, but these *tertiary circular reactions* differ from the previous kinds in that the infant varies the actions slightly each time. In this stage, rather than applying the same schemata to problems, they now find new means through trial and error. In contrast to secondary circular reactions, in which infants attempt to recreate a certain event, tertiary circular reactions aim to "ferret out new phenomena" (Piaget, 1952, p. 274) in the process.

Substage VI: Invention of New Means Through Mental Combinations (18–24 Months)

In this final stage, the child begins to invent as well as discover. Rather than relying on trial-and-error experimentation, the child begins to be able to devise solutions to simple problems through representation (thinking), independent of immediate experience. In effect, the experimentation happens in thought. This development of mental representation fosters another hallmark of this period, *deferred imitation*, whereby children form mental representations of events so enduring that they can repeat others' behavior hours or even days after it was first observed.

Current Knowledge

Sensorimotor Development in Autism

Measurement of sensorimotor development in autism was first undertaken in order to assess intellectual functioning in severely affected

nonverbal children (Curcio, 1978). The Ordinal Scales of Psychological Development had recently been published (Uzgiris & Hunt, 1975) based on Piagetian stages of sensorimotor development in the first 2 years, and was the instrument of choice for many researchers conducting studies in this domain. The resulting studies reported no deficits in children with autism in most areas of sensorimotor development (with the notable exception of gestural imitation) compared to mental-age-matched peers. Furthermore, a relative strength in object permanence skills was often observed in the children with autism (Dawson & McKissick, 1984; Morgan, Cutrer, Coplin, & Rodrigue, 1989; Sigman & Ungerer, 1981, 1984; Wetherby & Gaines, 1984).

A hypothesis from the literature on typical infant development posited that intentional communication arises in the first year concurrent to the development of Stage IV sensorimotor skills. In other words, the discovery that goals can be met by way of intermediate actions and that other people can act on behalf of the child is necessary before the infant can engage in intentional communication, including actions such as protodeclarative (i.e., showing, pointing to share interest) and protoimperative gestures (i.e., pointing to request) (Bates, Camaioni, & Volterra, 1975). Thus, a number of studies were conducted to examine the relationship between sensorimotor skills and communication abilities in children with autism. While some studies found a positive correlation between them (Abrahamsen & Mitchell, 1990; Curcio, 1978), others reported cognitive skills well beyond the children's language skills (Sigman & Ungerer, 1981; Wetherby & Gaines, 1984) and thus no clear relationship between the two. Relatively small samples of children of varying ages and ability level as well as different measures of language or pre-linguistic functioning may have contributed to the disparate findings.

See Also

- ▶ Object Permanence
- ▶ Piagetian Stages

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Sensorimotor Play

► Play

Sensory Aphasia

► Wernicke's Aphasia

Sensory Avoiding

► Sensation Avoiding

Sensory Diet

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Definition

The term "sensory diet" was coined by an occupational therapist, Patricia Wilbarger, following the work of Dr. A. Jean Ayres' theory of sensory integration. This term refers to the need for an individual to have varied sensory experiences throughout the day, similar to a nutritional diet, to maintain an optimal level of arousal or alertness to meet environmental and task demands.

Historical Background

For well over 40 years occupational therapists providing intervention for children with sensory processing disorders (SPD) or sensory integrative disorders (SID) have advocated for the use of varied sensory experiences to help a child develop more functional and adaptive skills (Ayres, 1971, 1973). Characteristically, children who display SPD or SID have very limited variety in their responses to sensory experiences and have difficulties when faced with the need to produce a graded response to a specific situation. Ayres (1973) described a group of children with SID who responded in a defensive manner to seemingly non-noxious or nonirritating sensory experiences. These children, in particular, seemed to need graded sensory experiences to help them produce functional responses. An example can be seen when a young girl becomes overly distressed to the point of crying when having her hair combed or a boy starts gagging when he smells raw carrots. Children with SPD or SID benefit from varied sensory experiences to help produce a functional and graded adaptive response to a situation. Ayres' concept of providing graded sensory experiences coupled with child-directed play activities formed the foundation for the concept of a sensory diet.

The term "sensory diet" has been attributed to the occupational therapist Patricia Wilbarger (1984) and then further described by Patricia and her daughter, also an occupational therapist, Julia Wilbarger (1991). They used the term "sensory diet" to describe the use of varied sensory experiences with a graded and child-directed approach to foster organized responses to situations. Following Ayres' concepts of sensory defensiveness, they postulated that a "sensory diet" would help a "child feel calm, alert, and organized most of the time using special activities" in a manner similar to eating well-balanced meals on a regularly scheduled basis (Wilbarger & Wilbarger, 1991, p. 6). These sensory experiences help the child maintain an organized response to functional activities. Although originally applied primarily to children with a sensory defensive profile, the concept of a sensory diet

was expanded and used with other children (Williams & Shellenberger, 1994) and with adults (Kinnealey, Oliver, & Wilbarger, 1995).

Rationale or Underlying Theory

For an individual to maintain an optimal level of alertness to effectively respond to environmental situations requires regular and varied sensory experiences or a sensory diet (Wilbarger, 1995). The rationale offered includes research addressing deprivation studies and resultant behavioral issues. The concept of a "diet" reflects the need for a variety of sensory experiences and for those experiences to be provided throughout the day in a manner similar to a nutritional diet. The sensory diet is not the same for each person but instead is tailored to meet the unique needs of the individual (Williams & Shellenberger, 1994). Specific areas of the brain respond selectively to various forms of sensory information, but if the brain is deprived of a specific form of sensory information, that portion of the brain will undergo neuroplastic changes to process different information (Merabet & Pascual-Leone, 2010). The sensory diet is provided to enrich the brain and foster appropriate processing of sensory information to allow the individual to be alert and adaptive within his or her environment. Individuals who are overly aroused or defensive to a specific form of sensory information often present with maladaptive responses or avoidance.

Goals and Objectives

The goals of a sensory diet follow the overarching goals of sensory integrative therapy, to help the individual produce functional and adaptive responses to the environment (Dunn, 2007). To meet this goal, the first concern would be to have the individual achieve and then maintain an optimal level of arousal or alertness needed for the activity (Williams & Shellenberger, 1994). From Wilbarger's (1984) concept of a sensory diet, the first sensory systems addressed are proprioceptive, tactile, and vestibular. These follow Ayres' (1972a) classic approach to sensory integrative therapy. The sensory diet includes activities that are designed and structured for the client throughout the day to enhance the level of alertness or arousal needed to meet the functional task. During play activities, the level of alertness or arousal would tend to be higher than during naptime or during meals. The goals are individually developed and reflect a client-centered approach (Pfeiffer, Koenig, Kinnealey, Sheppard, & Henderson, 2011; Wilbarger, 1995). Instead of prescribing the same sensory experience for every client, the occupational therapist determines what pertinent goals the client or, in the case of very young children and infants, the family wants to achieve. A careful analysis of the individual's response to current sensory systems and variations in levels of alertness and arousal throughout the day is completed through an interview, and then goals are mutually established. Individuals vary substantially in sensory preferences, and assuming that everyone would benefit from the same sensory experience would be similar to assuming everyone enjoys dark chocolate. Following the interview process, the sensory diet is developed to meet the agreed upon goals. An example can be seen with a child who had difficulties going to bed at night and became very distressed, hyperverbal, and active. Using a weighted blanket to provide deep pressure and then adding slow rocking in a rocking chair helped this child develop the routine of being calm before the event of going to bed instead of viewing this transition as a challenge. The parents had requested occupational therapy services to help with the daily routines related to preparation for going to bed, and the use of the sensory diet was an effective means to meet this specific goal.

Treatment Participants

The sensory diet was initially used for infants and children who presented with a defensive response style to non-noxious sensory experiences (Ayres, 1972a; Wilbarger, 1984, 1995) but was then extended to children with other SPD or SID profiles (Williams & Shellenberger, 1994) and to

adults (Kinnealey et al., 1995). The sensory diet has also been used with individuals who are diagnosed with autism spectrum disorders (ASD). The recognition of unusual responses to sensory stimuli for individuals who have ASD has been included in the diagnostic criteria in the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR American Psychiatric Association, 2000). Evidence of SPD in individuals diagnosed with ASD has been provided by several authors (Baranek, 2002; Dunn, Myles, & Orr, 2002; Kern et al., 2006; Kientz & Dunn, 1997; Minshew & Hobson, 2008; Tomchek & Dunn, 2007), and the incidence of SPD for this population varies from 42% to 88% (Baranek, 2002).

Treatment Procedures

The first step is identification of the individual's responses to various sensory experiences and the person's level of alertness or arousal throughout the day. There are reliable instruments available to assist with the identification of sensory responses as similar or dissimilar to peers such as the Sensory Profile (Dunn, 1999), Infant/Toddler Sensory Profile (Dunn, 2002), Adolescent/Adult Sensory Profile (Brown & Dunn, 2002), School Companion Sensory Profile (Dunn, 2006), and the Sensory Processing Measure (Miller-Kuhanek, Henry, Glennon, Parham, & Ecker, 2008). An interview would then identify the patterns of alertness or arousal during the day. The types of task during that portion of the day would be compared to the typical level of arousal needed to meet the task demands and to assess the fit of these factors (Nackley, 2001; Wilbarger, 1995). For example, a child who is very active and disorganized at the beginning of the school day would have difficulties with the social expectations of sharing toys or playing an interactive game with peers. This child may need additional sensory experiences to help his level of arousal to slightly diminish to a more appropriate level to allow social participation with peers. Information about the individual's ability to transition between various activities should be included in the interview process (Wilbarger, 1995).

The second step in the treatment procedures is identification of beneficial sensory experiences that either increase or decrease the level of arousal for the individual as needed to meet task demands (Wilbarger, 1995; Williams & Shellenberger, 1994). These sensory experiences can be grouped into large categories of sensory input, but the form of the sensory experience may be different for each individual. The three general categories of sensory experiences used in the sensory diet are deep pressure (proprioceptive), movement (vestibular), and touch (tactile). The sensations of vision, sound, taste, and smell are also used when creating a sensory diet with careful consideration for individual differences. This concept is illustrated with the sense of smell and how a specific odor may be very calming for one individual but distressing to another individual. When looking at the form of the sensory input, it is important to consider the use of this sensory input within the individual's daily life (Nackley, 2001). For example, deep pressure (proprioceptive input) may be helpful in modifying the level of alertness to allow individuals to meet task demands, but the form of the deep pressure is often different. For an individual, it is best provided through the use of a weighted vest that is snuggly fitted (VandenBerg, 2001). Another individual, who also finds the use of proprioceptive input helpful, prefers the use of squeezing a resistive squeeze ball throughout the day to assist with level of alertness (Nackley, 2001).

The third step in developing the sensory diet is developing a plan where the preferred sensory experiences can be provided throughout the day (Nackley, 2001; Wilbarger, 1995). These have been referred to as a "sensory tune-up" and reflect the need to provide the individual with opportunities throughout the day to use sensory input to adjust the level of alertness in preparation for the task demands. Wilbarger (1995) discussed the need to use preferred sensory input prior to transitions between activities in addition to regularly scheduled periods. Specific forms of sensory experiences tend to have longer lasting impact on the level of arousal or alertness. Vestibular-based activities that are alerting, spinning in a revolving chair or on a scooter board, can

have effects lasting several hours, and this form of sensory input should only be used following recommendations of a trained occupational therapist. Proprioceptive input can also produced longer lasting results of 1–2 h in duration. Changes in noise and lighting can produce an immediate response in the level of alertness, but the duration tends to be shorter. Wilbarger (1995) notes the visual and auditory sensory input can also evoke emotional responses and that should be considered when completing the interview process. Nackley (2001) provided a description of how the sensory diet could be structured throughout the school day and coupled with daily tasks.

Efficacy Information

Large randomized controlled trials using a sensory diet have not been completed. The current research addresses use of sensory integration treatment from which a sensory diet was derived. Although numerous studies exist using sensory integration strategies to produce changes, the results have been mixed (May-Benson & Koomar, 2010). Often the heterogeneity and small numbers of participants resulted in potential type II errors, and the use of inappropriate measures did not reflect the foundation of sensory integration and the use of a sensory diet, that being an individually designed intervention to help the person respond adaptively and appropriately to task and environmental demands. Recent literature using Goal Attainment Scaling (GAS) as an outcome measure has demonstrated significant improvements when using sensory integration treatment (Mailloux et al., 2007; Pfeiffer et al., 2011). Goal Attainment Scaling (GAS) is a method to foster client participation in the goal setting process that is meaningful and relevant (Pfeiffer et al.). In an investigation comparing the use of sensory integration services to fine motor intervention services for children with ASD, superior gains were reported by parents on GAS scores for those children receiving sensory integration services. Additionally, gains were identified in reduced autistic mannerisms, as measured by the Social Responsiveness Scale for the children receiving sensory integration treatment.

When a sensory diet has been used in conjunction with other sensory strategies, positive results were reported (Hall & Case-Smith, 2007). A small study of 10 school-aged children with SPD using a combination of a sensory diet with a therapeutic listening program produced significant gains in sensory processing scores and handwriting skills.

Outcome Measurement

Recent literature has provided a clearer direction for research on the efficacy of sensory integration treatment of which the sensory diet is derived (Parham et al., 2011). The fidelity measure for Ayres Sensory Integration intervention was developed to insure that therapeutic methods used in an investigation accurately represent the philosophy and principles of this approach. The sensory integration approach described by Ayres (1969, 1971, 1972a, 1972b, 1973, 1982) served as the foundation for the sensory diet (Wilbarger, 1984). This fidelity measure identified the need to engage in collaborative goal setting with family members and teachers along with discussing the influence of sensory integration on the individual's participation in functional activities. The use of GAS has shown promise in supporting the principles outlined by Ayres and the fidelity measure. Investigations using GAS have reported improvements following sensory integration (Pfeiffer et al., 2011; Schaff & Nightlinger, 2007).

Qualifications of Treatment Providers

The fidelity measure of Ayres Sensory Integration intervention stipulates that the therapist receive post-professional training in sensory integration with a minimum of 50 educational hours in theory and practice. The sensory diet was developed from the theory of sensory integration, and these standards should be applied.

Occupational therapists are the professionals most frequently pursuing advanced training in the theory and practice of sensory integration beyond the post-professional basis. The entry-level occupational therapist has completed courses within the professional preparation to understand the neuroanatomy, neurophysiology, and occupation base of sensory integration theory and practice.

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Sensory Experiences Questionnaire

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Synonyms

SEQ

Description

The recently expanded Sensory Experience Questionnaire (Version 3.0; SEQ; Baranek, 1999; Baranek, David, Poe, Stone, & Watson, 2006) is a caregiver report assessment intended to be used by researchers and clinicians to characterize the sensory features in children ages 2–12 years with autism spectrum disorder (ASD) and/or developmental disabilities (DD) in social and nonsocial contexts. The questionnaire takes about 15–20 minutes to complete by a parent or a caregiver and can also be administered in a structured interview format if necessary. The SEQ (Version 3.0) has 105 items that measure the frequency of sensory behaviors across sensory response patterns (i.e., hyporesponsiveness, hyperresponsiveness, sensory seeking, and enhanced perception), modalities (i.e., auditory, visual, tactile, gustatory, and vestibular), and social or nonsocial contexts. The first 97 items measure the frequency using a 5-point Likert scale ranging from 1 (almost never) to 5 (almost always.) Each of the 97 items is assigned a three-letter code reflecting the assigned sensory pattern, sensory modality, and social or nonsocial context of that item. The last eight items ask broader questions about the child's sensory behaviors and allow the caregiver to elaborate with a qualitative response. The scores are calculated based on the 97 quantitative items, excluding control items, with the qualitative answers providing further contextual information. A higher score indicates a greater frequency or intensity of sensory behaviors. Scores may be calculated in the form of a total score, individual sensory pattern (i.e., hyporesponsiveness, hyperresponsiveness, sensory seeking, and enhanced perception) score, individual modality (i.e., auditory, visual, tactile, gustatory, and vestibular) score, and social context score. An updated scoring algorithm is currently in development for the SEQ (Version 3.0).

Historical Background

The Sensory Experience Questionnaire, formerly known as the Sensory Supplement Questionnaire (SSQ), was developed by Grace Baranek in 1999. It has been through four revisions (Versions 1.0, 2.0, 2.1, and 3.0) to better meet research needs and the evolving conceptual model. The revisions have included refining items, expanding the number of items, adding control items, and increasing the types of sensory patterns represented. The items based on sensory features included in the SEQ (Version 3.0) were developed from

a review of existing literature on sensory features in children with autism including empirical studies (Ayres & Tickle, 1980; Baranek, Foster, & Berkson, 1997; Baranek, Parham, & Bodfish, 2005; Ben-Sasson et al., 2009; Dahlgren & Gillberg, 1989; Iarocci & McDonald, 2006; Lord, Rutter, & Le Couteur, 1994; Rogers & Ozonoff, 2005; Stone & Hogan, 1993), parental report studies (Kientz & Dunn, 1997; Lord, 1995; Ornitz, Guthrie, & Farley, 1977; Rogers, Hepburn, & Wehner, 2003; Stone & Hogan, 1993), expert clinical reports (Greenspan & Wieder, 1997), conceptual models of sensory processing (Ayres, 1989; Baranek, Reinhartsen, & Wannamaker, 2001; Dunn, 1997; Miller, Reisman, McIntosh, & Simon, 2001), and consideration of neuropsychological theories of autism describing core features (Mundy & Neal, 2001; Ozonoff, South, & Provencal, 2005; Rajendran & Mitchell, 2007; Volkmar, Lord, Bailey, Schultz, & Klin, 2004; Waterhouse, Fein, & Modahl, 1996).

Psychometric Data

Throughout the development of the SEQ, the psychometric properties of the versions have been assessed on an ongoing basis to ensure its reliability and validity. The overall internal consistency (reliability) of the SEQ (Version 1.0) (21-item version) is .80 (Cronbach's alpha) (Baranek et al., 2006) and the test-retest reliability is .92 (intraclass correlation coefficient) (Little et al., 2011). Reliability analysis (internal consistency) of the subscales for the SEQ (Version 2.1) yields the following psychometrics (Cronbach's alpha): hyperresponsiveness = .73, hyporesponsiveness = .75, sensory seeking = .80, social = .69, nonsocial = .78 (Little et al., 2011).

A known-groups validity study with 258 caregivers of children ages 5–80 months found that the SEQ (Version 1.0) discriminated well between children with autism and those with other DD, as well as those with typical development (Baranek et al., 2006). Prevalence of overall sensory symptoms for the autism group was 69% (versus 38% for the DD group) based on the items sampled. Sensory symptoms were inversely related to mental age such that more developmentally mature children across the groups demonstrated fewer atypical sensory features. Children with autism in this study had increased levels of overall sensory features as well as increased patterns of hyporesponsiveness compared to children with other developmental delays in both social and nonsocial contexts. Children in any of the clinical groups (those with autism as well as those with developmental delays) showed increased levels of hyperresponsiveness compared to typically developing children. This study demonstrated the SEQ's ability to discriminate unique sensory patterns in children with autism from comparison groups.

Walz and Baranek (2006) using the SEQ (Version 1.0) demonstrated the SEQ's validity for characterizing sensory response patterns in children with Angelman's syndrome through 18 years of age. In a longitudinal analysis of sensory processing, Baranek et al. (2008) demonstrated that the SEQ (Version 1.0) was sensitive to maturational changes when examining developmental trajectories of sensory processing in 13 boys with fragile X syndrome from ages 9 months through 5 years.

In Boyd et al. (2010), the SEQ (Version 2.1) was used in combination with other sensory measures to examine the association between sensory features and restricted, repetitive behaviors in children with autism (n = 67, mean age = 51.69 months) and developmental delays (n = 42, mean age = 49.45 months). The sensory measures including the SEQ were used to validate three sensory constructs (i.e., hyporesponsiveness, hyperresponsiveness, and sensory seeking) through a factor analysis. Model fit was assessed using standard fit measures: chi-square = 32.4 (31), RMSEA = .021, and CFI = .997. A major finding of the study was the significant association between the hyperresponsive sensory construct and the presence of repetitive behaviors in children with ASD and DD and primarily nonsignificant associations with the other sensory patterns. The SEQ (Version 2.1) was able to be used with a combination of sensory measures to validate sensory patterns and effectively assess their unique association with repetitive behaviors.

To further assess the relationship between the sensory patterns (i.e., hyporesponsiveness, hyperresponsiveness, and sensory seeking) and social communication in children with autism ($n = 72$, mean age = 52.3 months) and developmental disabilities ($n = 44$, mean age = 48.1 months), Watson et al. (2011) used the SEQ (Version 2.1) in combination with other sensory measures to determine children's sensory pattern construct scores and other measures of social-communicative symptoms of autism and language, social, and communication skills. A primary finding of the study was a positive association between hyporesponsiveness and social-communicative symptom severity for both the autism and developmental delay group. Hyperresponsiveness was not associated with social-communicative symptom severity for either groups, and sensory seeking was only associated with social-communicative symptom severity in the autism group. The SEQ (Version 2.1) was able to be used in a combination with sensory measures to assess their unique association with social communication as well as other language and communication skill measures.

The factor structure of the SEQ (Version 3.0) is currently being assessed using a national sample of 1,307 children with autism spectrum disorder (Ausderau, Sideris, Little, & Baranek, in preparation). A factor analytic model with four substantive factors of hypothesized sensory response patterns (i.e., hyporesponsiveness, hyperresponsiveness, sensory seeking, and enhanced perception) and method factors of sensory modalities (i.e., auditory, visual, tactile, gustatory, and vestibular) and social context were tested. Correlations between the substantive factors were freed, but fixed to zero between the method factors, as well as between the method factors and the substantive factors. The structure was tested as a confirmatory factor analysis. Model fit was assessed using standard fit measures: chi-square = 16,153.86 (3,630) ($p < .01$), RMSEA = .051, and CFI = .698. Factor loadings for the items on the latent variables were generally strong and provided support for each of the hypothesized sensory content factors. Between-factor correlations ranged from .19 to .77, which implies that these factors are distinct and they covary significantly. The study confirmed the factor structure for the recently expanded SEQ (Version 3.0).

Additional psychometric analyses and publications are currently in process using the SEQ (Version 3.0) with the large national sample.

Clinical Uses

The SEQ is meant to be used alone or in combination with other diagnostic tools by researchers and clinicians. It can be used to characterize sensory features in children by sensory pattern, modality, and social context. The SEQ can also be used to assist in discrimination of sensory responses that are specific to children with autism and developmental delay. Clinicians can identify and quantify the frequency of a range of sensory features in children that may require further evaluation and/or intervention. The characterization of the sensory features may also assist clinicians in treatment planning. The SEQ is also designed to monitor changes in sensory features over time as a result of maturation or intervention.

The SEQ can be used by researchers to screen for inclusion into certain research studies, to characterize sensory features in children with autism or developmental delay, and to assess the stability of sensory features over time as related to sensory pattern, modality, and social context. It also provides an assessment tool to relate sensory features of children to a variety of outcome variables such as children's adaptive skills or parental strain.

See Also

- ▶ Autistic Disorder
- ▶ Enhanced Perceptual Functioning
- ▶ Hyperresponsiveness
- ▶ Hypo-arousal
- ▶ Sensation Avoiding
- ▶ Sensation-Seeking
- ▶ Sensory Impairment in Autism
- ▶ Sensory Processing
- ▶ Tactile Defensiveness

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See Also

▶ Evaluation of Sensory Processing
▶ Sensory Experiences Questionnaire
▶ Sensory Integration and Praxis Test
▶ Sensory Processing
▶ Tactile Defensiveness
▶ Touch Sensitivity

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Sensory History

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Definition

As part of a comprehensive occupational therapy evaluation for a child with underlying sensory processing challenges, the examiner may perform standardized assessments to evaluate motor performance and motor planning abilities. Using such instruments at the SIPT (Sensory Integration and Praxis Tests), the examiner will be able to identify additional deficits in sensory processing. The examiner will also obtain a sensory history with the caregivers or client to evaluate the impact of sensory processing deficits on activities of daily living, leisure skills, and social interactions. This will allow the examiner to more fully understand sensory processing abilities and behavioral consequences to proceed with an intervention plan appropriate to the individual.

Sensory Impairment

▶ Deaf-Blind

Sensory Impairment in Autism

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Definition

Sensory impairments are used in two ways in the context of autism. They may indicate a dual disability of autism plus a sensory impairment as, for example, autism and visual impairment, autism and hearing loss, or autism and a sensory-motor impairment. There is nothing in the etiology of autism that protects against comorbidities and clearly the sensory impairment will interact with the autism to produce a person-specific range of difficulties and a particular developmental path. Individuals with dual or

even multiple diagnoses of this kind will not only have more difficulties to overcome but may have fewer compensatory strategies available to them. In addition, it will be harder to find appropriate support in education, social care, and vocational training, where key staff need to be knowledgeable about autism as well as the sensory impairment.

However, a separate sensory disorder is fairly uncommon in autism. The term "sensory impairment" is more commonly used to apply to sensory issues that many believe are central to autism itself. These are sensory processing problems, which are not severe enough to reach criteria as a separate sensory disorder. Sensory Processing Disorder (SPD) is currently still not accepted as a separate diagnostic category in its own right but is currently being considered for inclusion in DSM-V, due in 2013. In autism, sensory impairments have been identified with the condition since it was first identified, but they have never featured in the diagnostic criteria. In spite of growing research interest in this issue, and the recognition of the key role sensory processing problems may have in autism, it has been the consensus that sensory problems were neither universal in, nor unique to, autism. The proposals for DSM-V, nevertheless, have accepted two subcategories of sensory processing disorder as "associated features" of Autism Spectrum Disorders; these categories are "sensory over-responsivity" and "sensory under-responsivity."

All forms of sensory input processing have been suggested as being impaired in autism, although only a limited range of senses has been studied. The nature of the difficulties has been defined as hyposensitivity or hypersensitivity in particular sensory domains although there are also said to be issues with the latency and timing of responses to sensory input. The most studied have been auditory and visual processing, although some research suggests the proximal senses (touch, taste, smell) are most affected in autism. There has also been considerable debate about the existence of a problem with multisensory integration in autism. Pain is a sense, the processing of which is also said to be disturbed in autism and clearly this is very important in development and learning. However, there has been little research and some equivocal results.

There are a plethora of anecdotal reports of sensory processing difficulties in autism but not a great deal of scientific evidence. The key issues are to establish whether there are sensory processing difficulties that are universal in, and/or unique to, autism and then to investigate the nature and possible causes for them. It is important, for the understanding of autism, to know whether sensory issues are prime, leading to other problems, for example, in perception, or whether they are secondary to other problems such as in attention. It is also important to understand these difficulties in order to develop the most helpful remediation and compensation strategies and to evaluate them.

Historical Background

Dual Autism Plus Sensory Impairment Diagnoses

Hearing Impairment: The sensory processing problems associated with autism sometimes mean that infants may be unresponsive to sounds – especially social sounds like speech. As a result, it is common for hearing impairment to be first investigated as a possible cause for the differences in development noted by parents. This may arise from a genuine confusion of the symptoms of autism with deafness or it may be a simple precaution to rule out this sensory impairment before an autism diagnosis. If the child is found to have a significant hearing impairment but also has autism, clinicians and parents may believe the hearing loss is the cause of all the child's problems and it may be many years before the dual disability is fully acknowledged. This can mean that the child misses out on the most appropriate forms of education and support. The teaching of communication forms such as sign or symbol language may be less successful than in children with a sole hearing impairment because parents and staff have not recognized that the child will not learn to communicate just by being given the means to do so; in autism, the child needs to be taught directly about communication first. In such situations, it is

common for the child to become frustrated and to develop secondary problems of social isolation and challenging behavior, making developmental progression even more problematic.

As long as the autism is recognized, and strategies put in place to teach and support the child in "autism-friendly" ways, there are many symbiotic features in hearing impairment and autism that mean that placement in services for the hearing impaired can be successful for the child with the dual problem. In countries like the UK, schools for the deaf, and peripatetic teachers of the deaf, were one of the earliest special educational services developed and parents get regular in-home support. The growth of inclusion has been very successful for most children with hearing impairment, however, and cochlear implants have meant many now receive education through oral means. Much support has switched to mainstream schools, where the majority of such children are now educated. The children who have been least successfully integrated, and remain in the special schools, are those with multisensory impairments and comorbid conditions. Increasing numbers of children in these schools now have autism. Initially, they were children who had dual diagnoses but, as schools developed expertise in working with children with autism, numbers of children with autism alone attend these schools. Staff expertise in using visual methods of instruction, having a clear and calm structure and concentrating on teaching communication, have all been helpful for these pupils with autism.

Visual Impairment: The symptoms of autism are often missed in children with the dual disability because of some overlap in the development of autism and blindness. In children who are congenitally blind it is clear that visual social signals (like eye contact, visual joint attention, imitative smiling, and facial expressions) will be absent. This can lead to an asocial pattern of development that is akin to that of autism (Pring, 2004), and even the repetitive stereotypies are often seen as what are called "blindisms." Children who are just blind, however, will develop compensatory behaviors such as auditory and tactile joint attention, but this does not happen if they also have autism. Once again, services for the visually impaired have been the earliest to develop in many countries because the differences in development are marked and it is clear that parents and teachers will need knowledge, training, and support to help the child develop in the best way for him/her. No one expects the blind child to act as if she/he can see; it is accepted that education and other services must adapt to the needs of the child.

In that way, the child with the dual disability of autism and visual impairment in a setting for the visually impaired will at least have the advantage of staff who accept the difference and foster the child's attempts to do what best suits them, but in other respects this is not a good environment for the child with autism. Auditory processing and tactile difficulties mean that most children with autism learn best from visually mediated structure and do not do well where touch guidance or verbal instruction (speech) is used, without visual support. Specific (e.g., nonsocial tactile) alternatives to visual mediation need to be developed. Technological aids are beginning to transform the teaching of communication and other academic skills to people with visual impairment (especially if there is some residual sight) and these have been helpful for those with autism as well. However, it is best if staff are trained to distinguish blind from autistic development and can develop strategies to support the dual disability.

Sensory-Motor Impairment and Cerebral Palsy: Severe forms of cerebral palsy such as spasticity and athetosis will usually be diagnosed early and so differences in development caused by autism may at first be missed in the concentration on the physical problems of controlling movement. Parents may attribute all difficulties to the cerebral palsy and it is not until the child joins groups of others who have cerebral palsy without autism that the autistic differences are recognized. In services that rely on methods of physical manipulation to engender movement in children with cerebral palsy, the autism may make it harder for the child to benefit from the therapy because of difficulties with being touched and the continual need for others to assist with everyday life. If the methods used are more functionally based (as in Conductive Education) then the physical

arrangement of the environment to encourage independent movement may suit the child with autism so the dual disability is not so much of a problem. Cerebral palsy, however, will make it harder for the child to show independent actions and so the child is more dependent on communication to get needs met. This is a problem in the dual disability in that communication is a core difficulty in autism. Yet, the fact that the child needs to communicate may provide extra communicative pressure to help the child acquire communication skills, as long as staff are skilled in preventing frustration and the development of challenging behavior. The core difficulty in cerebral palsy is control of motor movements, but there are also often additional cognitive problems that interfere with development. The interaction with autism adds to the complexity and makes it even harder to determine and meet individual needs.

In less severe forms of sensory-motor impairment, the effects may be subtler but also more difficult to understand and allow for. Ataxia (where the child is generally clumsy and has problems in balance) may exacerbate sensory processing problems characteristic of autism. However, the child with a dual disability may benefit from the support of a skilled physiotherapist or occupational therapist, whereas the "minor" motor problems of the child with autism alone may be neither understood nor treated.

Dyspraxia (a problem in the planning and control of voluntary movements) is often found as comorbid with autism. Unless dyspraxia is understood, the child who can perform actions when they are "triggered" but not when directed to (because that involves planning), is likely to be misunderstood as deliberately noncooperative. In the context of autism, especially, dyspraxic difficulties are often seen as a matter of motivation and will, and so are never addressed as a motor problem, where help is required.

Sensory Processing Impairments in Autism

The Personal Perspective: Problems in sensory integration in autism have been long recognized and many people with autism themselves describe their condition almost solely in terms of these sensory difficulties. In this view, supported by some professionals, (e.g., Shanker, 2004), it is because of problems in integrating senses, and hypersensitivity to certain sensory domains, that individuals with autism quickly become overwhelmed by sensations, making it difficult to make sense of the world around them. In other words, sensory problems lead to perceptual problems. This does not account for cases of apparent hyposensitivity – a lack of responsiveness to sensory stimuli. One suggestion is that when thresholds are low, there is a biological reaction to overstimulation of "shutdown," when there are very high thresholds. Eventually, a balance is reached and the person can function again, until whatever hormonal or neural response, causing the lowering of the sensory threshold, begins again. This would mean fluctuating sensory reactions. If such a cycle of over- to under-sensitivity is a reality, it would be difficult to adjust to the environment itself but necessary to give the person as much proximal control as possible (headphones to wear to block out or dampen unpleasant noise, hats or colored lenses in glasses to reduce glare, soft clothing to wear, and the freedom to remove shoes when necessary) so they are able to manage their own environment as far as possible. All this comes from anecdotal accounts of people with autism themselves, albeit compellingly and vividly described. Even accepting the validity of the experiences, the mechanisms underlying them are speculative and some people seem to be relatively permanently over- or under-sensitive with respect to certain stimuli, rather than going through such cycles.

An alternative view of what is occurring in autism is that the central core difficulties are at the psychological level, making it a failure in perception that causes individuals with autism to perceive all the overwhelming details of sensory stimuli instead. There are no easy answers to this "chicken and egg" dilemma. It may rest with neurological testing eventually to make this decision. What is clear at a practical level is that both processes are important. When the environment

is adapted to reduce sensory overload, the person with autism seems better able to think and make sense of it. Alternatively, when people with autism are taught to be better at chunking information and at forming concepts and categories, they are better able to make sense of their world and not be so overwhelmed by sensory stimuli.

The Beginnings of a Scientific Approach: Attempts have been made to classify the sensory responses in autism so they can be quantified and two important questions addressed: (1) Is there a pattern of stimuli responsiveness that is characteristic of all individuals on the autism spectrum? (2) Do individuals on the autism spectrum differ from typical peers or individuals with other disorders in their responses to sensory stimuli? Dunn (1999) produced a Sensory Profile from a questionnaire to parents or carers, where responses are given on a Likert scale of frequency (always, sometimes, seldom, never) to questions about particular reactions to everyday sensory stimuli. Dunn measures 125 items grouped into nine factors (ten, if the category "other" is included) and 14 Sections. Scores are compared with a standardized "regular" mean and responses are classified as:

- "Typical" – at or above 1 standard deviation below the mean.
- "Probable difference" – between 1 and 2 standard deviations below the mean.
- "Definite difference" – more than 2 standard deviations below the mean.

The sections are further grouped into "sensory processing," "modulation," and "behavioral/emotional":

Sensory sections adapted from Dunn (1999)

Sensory processing	Modulation	Behavioral/emotional
1. Auditory processing	1. Sensory processing related to time/endurance	1. Emotional/social
2. Visual processing	2. Modulation re body position & movement	2. Behavioral outcomes of sensory processing
3. Vestibular processing	3. Modulation of movement re activity level	3. Thresholds for responding
4. Touch processing	4. Modulation of sensory input affecting emotions	
5. Multisensory	5. Modulation of visual input affecting emotions and activity level	
6. Oral-sensory		

Alongside these are 9 (10) factors:

1. Sensation-seeking
2. Emotionally reactive
3. Low endurance/time
4. Oral sensory sensitivity
5. Inattention/distractibility
6. Poor registration
7. Sensory sensitivity
8. Sedentary
9. Fine-motor/perceptual
10. Other

The purpose of the sensory assessment is to build a sensory profile of the individual. This scale is relatively objective (reporting norms, levels of reliability, and validity) allowing comparison of individuals with autism to others and, within the scale, to identify particular patterns of sensory disturbance. This profile is based on a broad range of sensory processing that might be affected in autism although it does not include proprioceptive sensations, which allow one to get feedback on actions and monitor the position of one's body in space. People with autism describe difficulties in this kind of processing and it would help account for some of the problems in making goal-directed actions in some individuals with autism and in being aware of one's own intentionality.

Nor does it mention the processing of pain, for which there is conflicting evidence. Anecdotal reports, of a high pain threshold or an extreme delay in registering pain, are not supported by the little scientific evidence that exists (Nader, Oberlander, Chambers, & Craig, 2004). An absence of, or delay in experiencing, pain would make it very difficult for the child to connect the actions that lead to an injury

with the experience of pain and so the child might well repeat dangerous actions regardless of consequences. However, failure to report pain may be due to social or communication differences or fear of the "sensory and social onslaught" that comes from comforting. There is certainly anecdotal evidence of recklessness in some individuals with autism but the lack of responsiveness to social restraint may be key to that. It is possible that there is a synesthesia effect in autism in that other sensations, which are typically benign, may cause pain. Thus, some taste, touch, and auditory sensations have been reported as painful by adults with autism.

There are other profiles, used by practitioners to help their understanding of what may be happening in individuals, to plan effective programs for learning and to help avoid challenging behavior. Bogdashina's (2003) sensory profile includes as additional items, "literal" perception, "Gestalt" perception (inability to distinguish background from foreground information), inconsistent/fragmented/distorted perception, sensory agnosia, delayed perception, and vulnerability to sensory overload. These categories have good face validity for those who live and work with those with autism but the items are often hard to operationalize, so comparisons across scorers and individuals are hard to establish. Bogdashina describes different perceptual styles as "monoprocessing," "peripheral," "systems shutdown," "compensatory," "resonance," and "daydreaming." She goes on to describe different cognitive styles as "subconscious," "unconscious," and "preconscious." Finally, Bogdashina talks of some particular sensory processing issues which have been said to characterize (or at least be common within) autism: these are "synesthesia" "central auditory processing disorder" (CAPD), "scotopic sensitivity" or "Irlen syndrome" (a disorder whose existence is controversial), and "sensory integration dysfunction." Many of these supposed sensory disabilities are tied to particular treatment approaches, so caution is needed to establish their validity as concepts before evaluation of treatments is undertaken.

Current Knowledge

Dual Diagnoses of Sensory Impairment and Autism

More children with sensory impairments are receiving a dual diagnosis of autism with a sensory disorder, although the confusion over early signs remains. Children with "pure" sensory impairment continue to be more likely to be educated in mainstream environments and special schools retain those with multiple, more complex disorders. As Jordan (2011) has argued, specialist education for children with autism is not about location but primarily about the knowledge and skills of staff. More teachers of the visually and hearing impaired are recognizing their need for additional training in understanding and working with children with autism, when faced with the dual disability. There has been no evaluation of the different placements for such dual diagnosed children; it might be expected that where a hearing impairment is involved the school for hearing impaired children (with additional training and resources) would be successful whereas there would need to be greater adjustments in the teaching of children with the dual diagnosis of autism and visual impairment compared to those with visual impairment alone. However, this is an empirical question that has not yet been addressed.

Sensory Dysfunction within Autism

Evidence for a Sensory Dysfunction as Part of Autism: Early studies suggested that children with autism could be distinguished from children with developmental delay and typically developing children on the basis of abnormalities in sensory functioning. Some showed differences in early sensory-motor behavior (under 1 year) that could distinguish those who were later typically developing, intellectually impaired, or had autism (Baranek, 1999). Most of the studies have compared the scores of children with autism with those of typically developing children or children with other disorders (or both) on Dunn's Sensory Profile. Most have found significant differences, on at least some categories. However, many of the findings are contaminated

by using children from a wide age range, when there are known age differences in sensory modulation with age. Participants also need to be matched for developmental age (or there need to be two comparison groups) since those with intellectual impairment also show differences in sensory modulation from the typical. Rogers and Ozonoff (2005) review the evidence and conclude that there are some differences between children with autism and typical children (and sometimes other groups as well) but little consistency on the nature and extent of these differences. The most consistent finding is of greater under-responsiveness in children with Autism Spectrum Disorders.

The full form of the sensory profile contains items that pertain to core areas of autism so it is not surprising that differences in these areas would occur. The short form is better in that it excludes social, communication, and motor responses. Dunn (2002) has produced a short form specific to toddlers and infants and this has been used, with other measures, in a comprehensive study by Ben-Sasson et al. (2007), which sought to address some of the methodological weaknesses of the earlier studies. They used comparison groups matched for chronological and mental age and not only the Dunn toddler profile but other parent-report scales and direct observations. They found consistency in parent reports across different measures but a poor correlation between parental report and direct observations. The most consistent finding was in the extremity of the responses in the autism group compared with controls with a high frequency of unresponsiveness to sensory stimuli and high levels of avoiding behavior, as well as low levels of sensory seeking behavior. In interpreting their findings, however, they point to the fact that many of the scales, as with the full sensory profile, use social stimuli (e.g., avoids eye contact) to judge sensory responses and, by definition, these will be different in autism.

Crane, Goddard, and Pring (2009), using the Adult Adolescent Sensory Profile (AASP), a shorter self-report questionnaire, found that the scores of adults with autism differed significantly from the typical in four areas. Those with autism scored more highly on "low registration," "sensory sensitivity,"' and "sensory avoiding" but had lower scores on "sensory seeking." The most extreme differences were in "sensory avoidance." There were correlations between the scores and IQ but no correlation with age or degree of autism. Thus, there appears to be some support for sensory differences in autism that persist in time, but there is little evidence that the sensory differences lead to autism in any way.

Interventions for Sensory Dysfunction in Autism: Dawson and Watling (2000) reviewed research evidence of the effectiveness of different treatments to address the sensory problems in autism. They examined the three areas where most treatment has been undertaken: (1) auditory integration therapy, (2) sensory integration therapy, and (3) occupational therapy for sensory dysfunction (as distinct from occupational therapy directed at building functional skills). Auditory integration therapy is directed at the presumed deficits in auditory processing in autism. The aim is to get the child to "relearn" how to listen by taking him/her through specially selected sounds presented through earphones several times a day over a period of a few weeks. Many claims have been made about the effects on behavior and even reduction (sometimes "cure") of autistic symptoms. However, as Dawson and Watling report, in all bar one of the studies, the children who had undergone AIT did no better than "placebo" controls. The one study showing beneficial effects was the least satisfactory in its methodology.

Sensory integration therapy is a program of controlled sensory experiences involving vestibular, proprioceptive, and somatosensory activities. The activities themselves include swinging, deep pressure touch, and tactile stimulation. There were few methodologically sound studies of sensory integration therapy, most reports being of very small case studies over short time frames. In addition, the more rigorous the research design, the smaller the beneficial effect noted.

Finally, although occupational therapists are heavily involved in treating children with autism for sensory integration problems, Dawson and Watling could find no scientific evaluation of their work.

Sensory Impairment in Autism, Table 1 Summary of findings of sensory processing in autism at neurophysiological level

Auditory	Tactile	Visual	Multisensory	Higher Multisensory
There are many inconsistent findings but there is good evidence of significant differences in speech sound processing. Some evidence of atypical processing in the primary auditory cortex	The results suggest some specific hypersensitivities in autism. There were enhanced responses to low-level vibration. Some hypersensitivity to vibration and heat but not to light touch	Better responses to detail when stimuli are simple but general impairment with complex stimuli. Also some problems with spatial discrimination. Face recognition is impaired but depends on familiarity, attention, gaze direction, fixation and type/complexity of stimuli. Children with autism better than typically developing at processing detailed high spatial frequency stimuli and worse at rapid low frequency processing. Differed in emotional responses to faces in amygdala and cortex	Some differences in the processing of visual auditory illusions, which suggests individuals with autism may be less efficient at multisensory integration. Problems in autism when auditory and visual stimuli presented together – leading to delay in processing at the second stage	Most significant difference found is in the integration of audio and visual information in the reception of speech. Individuals with autism appear to depend more on the auditory perception of phonemes, divorced from their lip patterns and training has little effect on this. Practically this could lead to problems in speech perception in noisy environments where lip patterns would normally serve as a discriminatory cue. Findings suggestive of problems in autism in the connections between cortical and subcortical regions of the brain

Neurophysiological Support for Sensory Dysfunction in Autism: If sensory dysfunction is a core part of autism, one would expect to find it in studies of the neurology of sensory processing as well as in behavior (Table 1). Maro, Hinkley, Hill, and Nagarajan (2011) have recently reviewed these findings. They look at studies that have concerned auditory, tactile, visual, and multisensory stimuli and used measures such as EEG (electroencephalography), MEG (magnetoencephalography), and fMRI (functional Magnetic Response Imaging).

These findings, therefore, suggest that behavioral differences in responses to sensory information are reflected in neurophysiological differences. The results are not consistent enough for a definitive picture to emerge but there is evidence of some differences. Maro et al. (2011) interpret these findings with caution. They point out that other mechanisms, such as attention, which are known to be affected in autism, may influence these findings. There is evidence of problems with attention shift in autism but only with those who have additional learning difficulties. It also appears that individuals with autism can overcome their difficulty in switching attention to speech tones away from other complex tones by direct instruction to attend to them. Similarly, problems with selectively attending to certain stimuli in autism vary according to the intensity and complexity of the stimuli and it is only in complex situations that individuals with autism are less able than others to respond to a sound source. Thus, the difficulty may lie with inhibiting reactions to other stimuli as much as with attention to the target stimulation.

Conclusions Regarding Sensory Dysfunction and Autism: This is an area of great mismatch between practice and established science. There is a wealth of anecdotal evidence of sensory processing problems in autism but very few scientific "facts" have been established. It appears

that sensory processing is neither uniformly good nor bad in autism, but rather depends on the nature and complexity of the signal, the background stimulation and the directions given. The uncertain picture at the behavioral level is mirrored at the neurophysiological level, although specific difficulties in connecting vision with sound, especially in relation to speech, do seem to be firmly established.

Future Directions

Dual Sensory Impairments and Autism

The current situation, described above, where children with "pure" sensory impairments are increasingly educated within the mainstream is likely to continue. With technological advances in the treatment of sensory impairments and in providing tools to access the mainstream curriculum, however, those with more complex multisensory impairments and/or dual diagnoses may also come to be included in the mainstream, so that the existence of schools and services specific to particular sensory impairments becomes problematic. There will still be a need for qualified staff to support and educate families, vocational, and social care staff and to provide peripatetic support to schools, but it may become difficult for staff to gain experience (and therefore, expertise) in the sensory impairment. This in turn will affect the services available to individuals with autism and a comorbid sensory impairment. It will no longer be a matter of adding autism training to staff already experts in sensory disability but perhaps a need for "de novo" training in such dual disabilities. Since such dual disabilities are relatively rare, such services may need to be centralized and with that will come accessibility issues and the possible reemergence of residential segregated schooling. Lifelong support may also deteriorate as relevant expertise becomes scarce.

Sensory Processing Disorder and Autism

The present dearth of scientific evidence on the nature and extent of sensory dysfunction as part of autism is likely to change in line with the changes in DSM V. Diagnoses, even of just "associated features" of autism, cannot just rely on anecdotal evidence. The current sensory profile assessment tools will need to be adapted so they have greater validity, especially when some research suggests that parents of children with autism are not accurate reporters of their child's sensory experience. Adult profiles circumvent this problem but have the additional problem of only being accessible to those above a certain level of intellect and ability to communicate. Some research already suggests that low- and high-functioning individuals with autism (in terms of adaptive skills) differ in sensory responsiveness and those who have least sensory problems are liable to do best in acquiring academic and adaptive skills, including communication. It may be that the validity of behavioral sensory profiles will need to be validated against neuropsychological "direct" testing of sensory processing in individuals with autism and others.

Whatever profile is used, the terms need to be operationalized to give greater reliability. A priority will be areas where there is already some good evidence of sensory difficulties: auditory and tactile stimuli. Once valid and reliable tools for measuring sensory processing are available, the validity (or otherwise) of sensory processing differences in autism will need to be established by good scientific comparison studies across the senses of vision, hearing, taste, touch, smell, proprioception, vestibular sensation, and pain. Multisensory integration will also need to be studied, through carefully constructed tasks that clearly depend on such integration, as will unusual phenomena such as synesthesia.

However, finding (or refuting) differences in sensory processing in autism is only the start. Any such differences will need to be interpreted and investigated in terms of their relationship to other possible confounding variables: the role of attention shift and selective attention differences in autism; the differences in communication, emotion processing, social referencing, and processing of cognitive complexity. Once a clearer picture emerges of the nature of the differences in autism processing, there needs to be an analysis of the extent to which

"differences" can be equated with "difficulties," which might then be candidates for remediation. Only once the clear targets for treatment have been set does it make sense to evaluate treatments (or perhaps develop new treatments for evaluation). Treatments could then be evaluated in terms of their research rationale as well as efficacy, in line with good practice (Jones & Jordan, 2008). Occupational therapy needs to develop as a profession to include this kind of evaluation of practice if it is to demonstrate its value beyond the level of anecdote.

See Also

- Auditory Integration Therapy
- Auditory Processing
- Blindness
- Deafness
- Dyspraxia
- Evaluation of Sensory Processing
- Face Perception
- Sensory Diet
- Sensory Processing Measure
- Touch Sensitivity

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Sensory Integration (SI) Therapy

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Definition

Sensory integration therapy, guided by sensory integration theory originated by Dr. A. Jean Ayres (1979), is commonly utilized by occupational therapy practitioners (additional information found under A. Jean Ayres in the "See Also" section below). Although many professionals outside the field of occupational therapy have declared that their intervention techniques are "sensory integration," their practices do not correspond to the theoretical principles researched by Dr. Ayres and her occupational therapy colleagues, nor do they result in an adaptive or purposeful response and improved engagement in occupation (Roley, Mailloux, Miller-Kuhaneck, & Glennon, 2007). As a result of this encroachment on the term sensory integration, the successor trustee of Dr. Ayres estate (Baker/Ayres Trust) trademarked the term

Ayres Sensory Integration® (ASI) thus allowing consumers to be assured that they are acquiring the sensory integration services intended. In order for occupational therapists to identify their use of ASI, the term OT/SI is recommended.

Sensory processing difficulties are noted in many diagnostic categories, as well as in children with no other clinical or developmental concerns. However, there is a high incidence of sensory processing impairments in children on the autism spectrum. For this specific population of individuals, Ayres Sensory Integration intervention is different from simply providing sensory activities as a reward for appropriate behavior or desired performance during discrete trial programs, moving an individual into a "time-out" room which houses sensory equipment, or providing strategies throughout the day to keep the child calm and focused (i.e., sensory diet). In fact, it is well understood by occupational therapy practitioners that ASI is done within the context of play and that engagement in the play experience is its own reward because the play is meaningful to the child. As the aim of occupational therapy is to support an individual's participation in life through engagement in occupation (American Occupational Therapy Association [AOTA], 2008), the therapeutic intervention outlined by the occupational therapy practitioner using an Ayres Sensory Integration approach is child specific based on the child's sensory processes and how these processes are barriers to, or facilitators of, participation and engagement in life activities identified as priorities by the family and team. Two specific areas of attention with this population include:

- Praxis: the process of action performance requiring ideation, planning, execution, and sequencing (May-Benson, 2004)
- Modulation: maintaining a functional state of alertness and regulating the degree, intensity, and nature of responses to a sensory event (Miller, 2006)

It is also important to note that occupational therapy practitioners utilize an ASI approach in combination with other theoretical frameworks. An official statement by the American Occupational Therapy Association (AOTA, 2010, p. 4) regarding intervention for individuals on the autism spectrum cites: "Effective interventions also address contextual factors such as structure, consistency of routine, sensory environments that optimize attention and arousal, and caregiver skills that contribute to occupational performance. Research evidence indicates that the occupational therapy intervention process should be individualized, intensive, and comprehensive; include the family; and facilitate active engagement of the individual" (Tomchek & Case-Smith, 2009). This document goes on to highlight the underlying sensory processes that should be assessed for this population: "sensory modulation, self-regulation, praxis, and motor imitation" (p. 4). Additionally, Ben-Sasson et al. (2007) emphasize that in order to accurately identify the needs of very young children on the spectrum, occupational therapists need to assess multiple components of the child's sensory functioning across varying contexts in order to fully understand and support the impact on the child's performance and the family's life.

Historical Background

Ayres original theory of sensory integration (Ayres, 1972, 1979) described what was referred to as a scientific theory. That is to say that as more research is conducted, technology becomes available to scientifically measure the underlying theoretical constructs, and outcome information is obtained, the theory would evolve to inform practice. This concept has also been described as the scientific evolution of the sensory integration frame of reference (Schaaf & Davies, 2010).

Ayres began her work in this area in the 1950s, coined the term sensory integration in the 1960s, and culminated her work with the publication of the Sensory Integration and Praxis Tests (SIPT; 1989). While there has been some change in the terminology used to describe the diagnostic categories identified through this comprehensive assessment tool (refer to the Sensory Integration and Praxis Tests in the "See Also" section for full review), the intervention strategies utilizing Ayres basic tenets have not changed. The theory

espouses that improving sensory integrative functions leads to adaptive responses (purposeful actions in response to an environmental demand) allowing the child to engage more fully in everyday life tasks or occupations (i.e., play, learning, daily living tasks).

Rationale or Underlying Theory

Dr. Ayres work, based on neuroscience, psychology, education, biology, and occupational therapy, hypothesized that underlying difficulties with integrating sensory information can lead to learning and behavior difficulties (Ayres, 1972). The three major postulates of sensory integration theory are:

1. Learning is dependent on the ability to take in and process sensation from movement and the environment, and use it to plan and organize behavior.
2. Individuals who have a decreased ability to process sensation also may have difficulty producing appropriate actions, which, in turn, may interfere with learning and behavior.
3. Enhanced sensation, as a part of meaningful activity that yields an adaptive interaction, improves the ability to process sensation, thereby enhancing learning and behavior.

The basic assumptions of the theory are that the nervous system is plastic, sensory integration develops, the brain functions as an integrated whole, adaptive interactions are critical to sensory integration, and people have an inner drive to develop sensory integration through participation in sensorimotor activities. Lane and Schaaf (2010), in their article examining the neuroscience evidence supporting or refuting the implementation of OT/SI, stated (p. 375): "OT/SI is based on the belief that engagement in individually tailored activities, rich in the needed sensory stimuli, will improve the ability of the brain and nervous system to process sensory information, enhance the organization and integration of sensation, and, as a result, have a positive impact on the child's ability to participate in daily life activities (Ayres, 1972, 1979)." After reviewing the neuroscience literature, Lane and Schaaf go on to state: "There is little question that the nervous system is plastic and that sensory input is an important mediator of this plasticity. Motor activity and interest in task also appear to be important contributors, and active engagement is seen to enhance the effects. Moreover, these studies indicated that neuroplastic changes were developmental, dynamic (reactive), and task specific. In this regard, these data provide indirect support for the use of OT/SI, which is built on the premise that active engagement in meaningful, sensorimotor activities at the just-right challenge and in a playful or meaningful context has a positive impact (by means of neuroplasticity) on processing in the nervous system (Ayres, 1972)."

Goals and Objectives

Despite the intervention chosen, the goals and objectives of occupational therapy intervention are the same. According to the AOTA's statement on the scope of services for individuals on the autism spectrum (2008, p. 4):

> Assessing the outcomes of service is an integral part of the occupational therapy process and is important for determining future actions and for evaluating occupational therapy services provided for the individual, organization, or population. This assessment involves monitoring the client's responses to intervention, reevaluating and modifying the intervention plan, and measuring intervention success through outcomes that are important to the client within the dynamic physical and social environments and cultural contexts where functioning occurs. Progress is noted through improvement in the client's occupational performance, adaptation, participation in desired activities, satisfaction, role competence, health and wellness, and quality of life and through prevention of further difficulties and facilitation of effective transitions. Occupational therapy practice for individuals with an ASD is consistent with the WHO's (2001) *ICF*g and the National Research Council's 2001 recommended practices for educating individuals with an ASD.

For OT/SI specifically, the intent of therapeutic intervention is to assist the individual in receiving, processing, correctly interpreting, and integrating sensory information as a foundation for improving functional participation in life's

tasks. It is important to note that these underlying skills, rather than simply training of a child's functional difficulties, are the focus of this intervention approach. The maturation and development of these underlying substrates of dysfunction are then measured via praxis (motor planning) and modulation abilities which impact functional participation, learning, and behavior. In addition, since the sensory processes of a child on the spectrum also affect the family's routines and social participation (Bagby, Dickie, & Baranek, 2012), this area also needs to be supported by the occupational therapy practitioner. For example, Bagby, Dickie, and Baranek's research identified that chosen activities for the family are often influenced by the child's tolerance to sensory experiences, the amount of planning that needs to occur prior to participation in life's activities is significant, and the ability to create family memories is often compromised as parents need to split up during family outings.

Treatment Participants

Occupational therapy practitioners, with advanced training in ASI, will often refer to their intervention as OT/SI to indicate utilization of this specialty approach. This approach is a dynamic exchange between the OT/SI practitioner and the child/individual with sensory processing concerns. Additionally, the collaboration with family and school personnel is critical for the generalization of treatment outcomes.

Treatment Procedures

In addition to Ayres writings (1972, 1979), sensory integrative interventions have been described and discussed in texts intended to improve the clinical reasoning skills of clinicians (Bundy, Lane, & Murray, 2002; Fisher, Murray, & Bundy, 1991) and numerous articles in the occupational therapy literature. Schaaf and Miller (2005) highlight how astute observation of the child's ability to process and utilize sensory information is a key skill of the well-trained therapist.

In order to clearly delineate the components of this intervention approach, a group of occupational therapy researchers (Sensory Integration Research Collaborative [SIRC]) detailed the required elements of intervention (Parham et al., 2007, 2011). While the original intent was to provide a mechanism to assure fidelity (truthfulness) to the theoretical principles during the intervention phase of research studies, the secondary benefit was that occupational therapy practitioners were provided with a framework to understand what is and what is not Ayres Sensory Integration intervention.

The Ayres Sensory Integration Fidelity Measure (Parham et al., 2011, pp. 135–136) outlines the following components for this occupational therapy approach:

- The therapist should have post-professional training in sensory integration which includes a minimum of 50 education hours of SI theory and practice (e.g., post-professional SI or SIPT certification or university course) and ongoing supervision (minimum of 1 h per month) by an expert with at least 5 years experience providing occupational therapy using SI intervention.
- The occupational therapy assessment report should include information-related occupational therapy principles (AOTA, 2008) including historical information, reason for referral, an occupational profile, and performance patterns.
- The occupational therapy assessment report should include information related to specific sensory patterns and processes, including sensory modulation and discrimination, postural ocular control, visual-perceptual skills, fine and gross motor skills, motor coordination, praxis, organizational skills, and the influence of sensory integration and multisensory processing on performance, as well as an interpretive summary describing the effects of sensory integration and praxis on the referring difficulties.
- The physical environment in which the ASI intervention should occur includes adequate

space for the flow of the intervention including vigorous physical activity; equipment and materials which can be flexibly arranged to adjust to the rapid changes which occur during the course of intervention and the varying size of the child; no less than three hooks for suspended equipment (with adequate spacing for full orbit); availability of rotational devices (to allow for 360° of rotation) and bungee cords; mats/cushions/pillows for safety; a variety of equipment for sensory experiences, e.g., bouncing equipment, therapy balls, a variety of swings, scooters, ramps, climbing equipment, weighted objects, ball pit, barrel, spandex fabric, vibrating toys, tactile material, visual targets, and props to engagement in play; and a quiet space.

- Communication with parents and teachers to support goal setting as well as to allow for discussion of the potential influence of sensory integration and praxis on performance in valued activities; the child and family's participation in home, school, and community; and how the therapist defines the areas to be addressed that will improve engagement.
- During the intervention process, the therapist should:
  - Ensure the child's physical safety by anticipating physical hazards and be in close physical proximity during activities.
  - Present the child with tactile, vestibular, and proprioceptive opportunities to support the development of self-regulation, sensory awareness, and/or movement in space.
  - Help the child attain and maintain appropriate levels of alertness and an affective state that supports engagement in activities.
  - Collaborate on activity choices with the child.
  - Support and challenge postural control, ocular control, and/or bilateral development through the use of postural, resistive whole-body, ocular-motor, oral, or bilateral challenges, as well as projected action sequences.
  - Challenge praxis (ability to conceptualize and plan novel motor tasks) and organization of behavior in time and space.
  - Tailor the activity to the just-right challenge by increasing the complexity of the challenge when the child responds successfully.
  - Ensure that activities are successful and, thus, the child is making an adaptive response to the presented challenges in sensory modulation or discrimination; postural, ocular, or oral control; or praxis.
  - Support the child's intrinsic motivation to play by creating a setting which supports play as a way to fully engage the child in the intervention.
  - Establish a therapeutic alliance which promotes and establishes a connection with the child and conveys a sense of working together in a mutually enjoyable partnership (vs. basic pleasantries or feedback on performance such as praise or instruction).

Efficacy Information

Unequivocal evidence on the effectiveness of Ayres Sensory Integration remains elusive for a variety of reasons. This is not to say that occupational therapy practitioners do not see improvement in the children they serve, as there are numerous reports of progress via parental observations, improvement and mastery of identified goals and objectives, and small-scale studies with positive outcomes. However, gold-standard research outcomes have not been documented.

One difficulty with performing high-quality, empirically sound research is the confusion over what is and what is not Ayres Sensory Integration intervention. Several meta-analyses have been performed to review the literature on this topic, yet the actual interventions did not align consistently with the principles of ASI intervention. An early review by Ottenbacher (1982) found significant positive effects in motor outcomes for children with learning disabilities and mental retardation as compared to no treatment; Polatajko, Kaplan, and Wilson (1992) found that the sensory integration intervention showed the best gains in motor performance for children

with learning disabilities but that the SI intervention was no more effective than other interventions; Vargas and Camilli (1999) reported moderate effects in motor performance compared to no treatment but little difference as compared to other more traditional occupational therapy approaches (i.e., perceptual-motor approach); Hoehn and Baumeister (1994) reexamined some of the Polatajko, Kaplan, and Wilson's studies and found some positive outcomes but did not substantiate an SI approach as providing a more positive outcome than alternative approaches; and Baranek (2002), who looked specifically at sensory-based interventions for children on the autism spectrum, found that the small sample sizes and weak designs need to be considered when viewing the positive outcomes. In the most recent review, May-Benson and Koomar (2010) systematically reviewed, evaluated, and synthesized the findings of 27 articles on the effectiveness of sensory integration interventions found in the literature from 1972 through 2007. "Outcome areas examined were as follows: motor performance, sensory processing, behavioral outcomes, academic and psychoeducational outcomes, and occupational performance" (p. 406).

Since the last systematic review, several small studies related to the population of children on the autism spectrum have occurred. For example, a group of 37 children on the spectrum was studied in a design comparing sensory integration (SI) intervention to a fine motor intervention (Pfeiffer, Koenig, Kinnealey, Sheppard, & Henderson, 2011). While both groups improved on Goal Attainment Scaling, the SI group showed more significant improvement in the three domains of sensory processing, motor skills, and social functioning. Additionally, the SI group demonstrated fewer autistic mannerisms (as measure by a subscale of the *Social Responsiveness Scale*) than the fine motor group after the interventions. In another small study, Smith, Press, Koenig, and Kinnealey (2005) reported positive effects of a sensory integrative approach on decreasing self-stimulating behaviors. Despite these efforts, large-scale, randomized control effectiveness studies have yet to be completed.

Another difficulty in designing research studies on the effectiveness of ASI is the underlying concept that the process is dynamic exchange between child and practitioner with the intervention specific to each child's particular combination of difficulties, thus operationalizing the variables within a research design presents a significant challenge. In an effort to address this and other methodological challenges, as well as definitively outline what are the core components of ASI, a team of researchers developed a fidelity measure for sensory integration research (Parham et al., 2007, 2011). This measure outlines both structural and process elements necessary for the intervention to be congruent with Ayres theory and thus designated as Ayres Sensory Integration. For research purposes, this measure allows for the manualization of the intervention – i.e., the precise description of the intervention components which are then consistently administered in order to have confidence that the outcome is the result of the intervention and the intervention can be reproduced in subsequent studies.

The Ayres Sensory Integration Fidelity Measure, which outlines the following components of providing ASI, has been found to have strong content validity for the structural and process elements, thus representing the essential features of ASI intervention (Parham et al., 2011). Additionally, the process components are reliable and valid when scored by experts in ASI, but not when scored by practitioners without advanced training.

Structural elements (Parham et al., 2011, p. 135):

1. Therapist qualifications
2. Components of the evaluation/assessment report
3. Physical environment
4. Communication with the parent or teacher

Process elements (Parham et al., 2011, p. 136):

1. Ensure physical safety.
2. Present sensory opportunities.
3. Help the child attain and maintain appropriate levels of arousal.
4. Challenge postural, ocular, oral, and bilateral motor control.
5. Challenge praxis and organization of behavior.

6. Collaborate in activity choice.
7. Tailor the activity to present the just-right challenge.
8. Ensure that activities are successful.
9. Support the child's intrinsic motivation to play.
10. Establish a therapeutic alliance.

With this ASI Fidelity Measure, along with a manual outlining ASI's philosophies, principles, and strategies which is currently under development, it is hoped that more scientifically sound research on the efficacy and effectiveness of Ayres Sensory Integration is in the near future.

Outcome Measurement

See "Goals and Objectives" as functionally related outcomes are child specific.

Qualifications of Treatment Providers

There has been much discussion related to the qualifications of the treatment provider as it relates to Ayres Sensory Integration. As this theoretical approach was created by an occupational therapist for occupational therapists, the model of intervention is presented in all entry-level curricula for occupational therapists. However, there is variability between academic institutions in how the information is presented, to what extent the information is discussed and/or practiced, and the qualifications of the teacher within this area of practice. Additionally, as some physical therapists with a pediatric specialty also utilize this approach, the qualifications of the treating practitioner needed to be highlighted. The qualifications, while originally designed for research purposes, serve as a guideline for practitioners aspiring to provide professionally responsible ASI intervention. The Ayres Sensory Integration Fidelity Measure outlines the therapist qualifications to include (Parham et al., 2011, p.135):

- Post-professional training in sensory integration – certification in SI/SIPT: minimum of 50 education hours of SI theory and practice (e.g., post-professional SI or SIPT certification or university course)
- Supervision by an expert with at least 5 years experience providing occupational therapy using SI intervention (minimum of 1 h per month)

Years ago, there was a specialty certification that was offered by Sensory Integration International, the organization originally created for the advancement and dissemination of Dr. Ayres' work. After the passing of Dr. Ayres, and some internal difficulties, this organization ceased offering these courses. Currently, there is only one training series in order for therapists to be certified in the administration and interpretation of the Sensory Integration and Praxis Tests (SIPT), offered jointly by the University of Southern California's Division of Occupational Science and Occupational Therapy and Western Psychological Services (USC/WPS) and approved by the Successor Trustee of Dr. Ayres' estate (holder of the trademark term Ayres Sensory Integration®).

This certification includes a series of four, 5-day courses:

- Theoretical foundations of sensory integration
- Technical and logistical administration of the SIPT as well as other commercially available measures of sensory processing
- Interpretation of the SIPT's standardized information and interfacing that information with other nonstandardized observations and reports of the child's performance in order to develop appropriate intervention plans
- Intervention planning based on the theory of sensory integration, including practical applications and clinical reasoning strategies

Please note, however, that the USC/WPS website does not list therapists who were certified by the original organization sanctioned to offer the Certification of the Administration and Interpretation of the SIPT. As a result, parents and professionals should not limit themselves to only those therapists registered with USC/WPS organization.

See Also

- Ayres, A. Jean
- DeGangi-Berk Test of Sensory Integration
- Occupational Therapy (OT)
- Sensory Diet
- Sensory Integration and Praxis Test
- Sensory Processing
- Sensory Processing Assessment
- Sensory Processing Measure
- Sensory Processing Measure: Preschool (SPM-P)
- Test of Sensory Functioning in Infants

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Websites with Additional Information

www.siglobalnetwork.org
www.spdfoundation.net/
www.thespiralfoundation.org/

Sensory Integration and Praxis Test

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Synonyms

SIPT

Description

The *Sensory Integration and Praxis Tests* (SIPT; Ayres, 1989) is a series of 17 subtests designed to measure sensory integration processes that underlie learning and behavior in children from 4 through 8 years, 11 months. This comprehensive, standardized assessment tool is considered the gold standard tool for evaluating sensory integration and praxis (motor planning) functions. Administration of the entire test generally takes 2½ h to complete, the examiner must follow specific procedures when administering the test (including what instructions can be provided to the child), and the child must be able to attend for long periods of time and follow the verbal directions. As a result, it may not be an appropriate testing instrument for all children on the autism spectrum.

There are 17 subtests within the SIPT, each yielding a standardized score by which the child's score is compared to those of typically developing children on praxis abilities and a variety of sensory processes, including tactile (touch), vestibular (movement/balance), proprioceptive/kinesthetic (where are the body parts in space and how do they work together), and visual (Table 1). The test focuses on how the child recognizes, discriminates, and perceives the sensory experience. It does not, however, have a specific scoring mechanism to identify if the child over- or underresponds to various sensory experiences (referred to as sensory modulation, sensory underreactivity, and sensory overreactivity). For modulation type of information, please see the links below in the "See Also" section for the *Sensory Processing Measure*, *Sensory Processing Measure – Preschool*, and/or soon to be published *Sensory Processing Assessment*.

All SIPT results are scored via computer program, and while administering all 17 subtests is ideal, any combination can be implemented and still maintain the integrity of the standardized score. Following scoring, the computer generates a detailed report explaining the SIPT results. However, as the secondary purpose of the SIPT is to provide a foundational understanding of the child in order to outline appropriate intervention approaches, the ability to correctly implement and interpret the information provided by the SIPT is vital. Specialized training in the SIPT is not only strongly suggested and professionally responsible, but the therapist's name and professional qualifications are required in order to purchase the SIPT. Years ago, this specialty certification was offered by Sensory Integration International which was the organization originally created for the advancement and dissemination of Dr. Ayres' work. After the passing of Dr. Ayres, and some internal difficulties, this organization ceased offering these courses. Currently, there is only one training series in order for therapists to be certified in the administration and interpretation of the SIPT, offered jointly by the

Sensory Integration and Praxis Test, Table 1 The 17 SIPT subtests

Test name	Description
Space Visualization	This test evaluates visual space perception and mental manipulation of objects in space. Motor performance is not required – therefore, deliberately visual and not visual-motor
Figure Ground	This test requires the child to select a foreground figure from a competing background
Standing and Walking Balance	This test evaluates the child's ability to balance on one or both feet, both statically and dynamically, with eyes open and closed
Design Copying	This section evaluates visuopractic and visuoconstruction skills. It assesses both accuracy and approach in copying designs
Postural Praxis	This part of the test evaluates the child's ability to imitate positions or postures demonstrated by the examiner
Bilateral Motor Coordination	This test measures the ability of the child to move both arms and both feet together in a smoothly integrated pattern
Praxis on Verbal Command	This test measures the child's ability to motor plan body postures from verbal directions without visual cues
Constructional Praxis	This test measures the child's ability to relate objects to each other in three-dimensional space. It involves visual spatial understanding and motor planning a course of action to replicate simple and complex block structures Constructional Praxis involves ideation, conceptualization, space perception, and planning
Postrotary Nystagmus	This test evaluates the integrity of a relatively discrete vestibular-ocular reflex following rotation. It is the only test of the SIPT that is reflexive rather than performance based
Motor Accuracy	This test is a visuomotor test which assesses eye-hand coordination in a wide variety of positions relative to the body, including crossing the body's midline
Sequencing Praxis	This test is designed to measure the child's ability to repeat a series of hand and finger movements following demonstration by the examiner
Oral Praxis	This test measures the child's ability to plan and execute tongue, jaw, and lip movements following demonstration by the examiner
Manual Form Perception	Part I – involves identifying the visual counterpart of a geometric form held and manipulated in the hand
	Part II – involves feeling a shape, without the aid of vision or visual cues with one hand and finding the matching shape among a line of blocks manipulated with the other hand, without the aid of vision and visual cues
Kinesthesia	This test assesses the capacity to perceive joint position and movement
Finger Identification	This test measures the ability to identify which finger or fingers are touched by the examiner with vision occluded
Graphesthesia	This test evaluates the ability to translate tactile input into a motor response. It assesses the integration between tactile and visual input and fine motor planning
Localization of Tactile Stimuli	This test assesses the child's ability to localize a specific tactile stimulus, applied to the hand or arm, with vision occluded

University of Southern California's Division of Occupational Science and Occupational Therapy and Western Psychological Services (USC/WPS) and approved by the Successor Trustee of Dr. Ayres' estate (holder of the trademark term Ayres Sensory Integration®).

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- Interpretation of the SIPT's standardized information and interfacing that information with other nonstandardized observations and reports of the child's performance in order to develop appropriate intervention plans
- Intervention planning based on the theory of sensory integration, including practical applications and clinical reasoning strategies

Please note, however, that the USC/WPS website does not list therapists who were certified by the original organization sanctioned to offer the Certification of the Administration and Interpretation of the SIPT. As a result, parents and professionals should not limit themselves to only those therapists registered with the USC/WPS organization.

Historical Background

The SIPT, years in development, was intended to help clinicians clinically understand the aspects of sensory processing and praxis abilities which contributed to irregularities in learning and behavior. The theoretical model of sensory integration was the basis of the tool. This model highlighted how there are neurological processes which organize sensation from within one's own body and from the environment upon which an individual relies in order to use the body effectively to meet the demands of a given situation. It was theorized at the time that the body's receptors not only needed to accurately receive sensory stimuli but needed to efficiently process and organize this sensory information – i.e., select the needed information to make a response, inhibit information not needed, compare and synthesize the current information with past information stored within the brain, and relate the information to the current demand for action. The ability to flexibly and constantly perform this type of integration of information is necessary to perform functionally within an ever-changing environment. More specifically, the ability of a child to correctly receive, recognize, and integrate sensations from the body allows the child to "know" his/her body and develop plans for how to use the body for successful engagement in life's developmental tasks. When the child successfully plans and carries out an action, we call this action an "adaptive response" for a given situation or environmental demand.

The SIPT was designed to assess how the child perceives sensory information (tactile, proprioceptive/kinesthetic, vestibular, and visual) and how the body is able to plan or "do" requested motor actions.

Psychometric Data

In addition to the intent to create a reliable measurement and analysis of data by accepted statistical processes, the guiding principle in determining the procedures ultimately outlined in the SIPT was the "capacity of each measure to discriminate between dysfunctional and nondysfunctional children of normal intelligence" (Ayres, 1989, p. 161).

The standardization procedures began by ensuring a nationally representative sample based on the 1980 U.S. Census Bureau data, including age, sex, ethnicity, rural/urban, and geographic location within the USA. Approximately 2,000 children were part of the standardization sample and testing occurred during the 1984–1985 school year. No children were included if there was an identified motor impairment (i.e., cerebral palsy) or severe visual handicap, and a number of children from Canada were included as it was expected that the tool would be utilized in that country.

Preliminary analyses examined age- and gender-related differences (multivariate analysis of variance [MANOVA]). Additionally, item data were examined to determine appropriate points to discontinue or stop the test without changing the outcome if the entire test had been completed (Pearson product–moment correlations and multiple discriminant analyses). Thereafter, statistical computation of group means and standard deviations was completed whereby separate norms were developed for each of the 12 age groups for girls and boys. Next, major SIPT scores were determined based on the extent by which they could discriminate between normal and dysfunctional performance.

Sensory Integration and Praxis Test, Table 2 SIPT factor and cluster analyses

Factor analyses (Ayres, 1989)	Factor analysis (Mulligan, 1998, p. 258)
• Bilateral integration and sequencing • Praxis on verbal command • Somatosensory and oral praxis • Visuopraxis • Somatopraxis	• Dyspraxia • Visual-perceptual deficit • Somatosensory deficit • Bilateral integration and sequencing deficit "Mulligan demonstrated that these four factors were highly correlated with one another, and proposed that they all relate to one underlying construct she names general practic dysfunction."
Cluster analyses (Ayres, 1989)	Cluster analyses (Mulligan, 2000, p. 258)
• Group 1: Low Average Bilateral Integration and Sequencing • Group 2: Generalized Sensory Integrative Dysfunction • Group 3: Visuo- and Somatodyspraxia • Group 4: Low Average Sensory Integration and Praxis • Group 5: Dyspraxia on Verbal Command • Group 6: High Average Sensory Integration and Praxis	• Cluster 1: Generalized Sensory Integration Dysfunction and Dyspraxia – Severe • Cluster 2: Dyspraxia • Cluster 3: Generalized Sensory Integration Dysfunction and Dyspraxia – Moderate • Cluster 4: Low Average Bilateral Integration and Sequencing • Cluster 5: Average Sensory Integration and Praxis

A wide variety of studies were conducted to investigate construct, content, and criterion-related validity:

- Construct validity: the extent to which the test assesses the theoretical construct
- Content validity: the extent to which the test items provide a representative sampling of performance on important aspects of the construct
- Criterion-related validity: the extent to which performance on the test can be used to predict the child's current or future performance on important aspects of the construct (Ayres, 1989, p. 181)

A detailed analysis of the SIPT's construct occurred via factor analyses (tests are grouped together with one underlying, common theme) and cluster analysis (children are grouped if they are alike). This initial information, as well as subsequent analyses, are presented in Table 2.

This information is important as the utility of a tool is whether the test can successfully and accurately identify clinically important groups of children who would be in need of different types of remediation or support.

Mulligan's (1998) confirmatory factor analysis utilizing the SIPT scores of more than 10,000 children and cluster analyses (2000) provide clinicians with additional information useful in identifying deficits and planning interventions. Additionally, Davies and Tucker (2010) and Mailloux et al. (2011) provided additional perspectives on these analyses for practitioners to plan specific intervention strategies.

Clinical Uses

The SIPT is the only standardized assessment tool specifically designed to identify various types of sensory dysfunction. As stated above, however, sensory modulation issues are not specifically identified. As sensory modulation is an important component of sensory processing within the population of children identified as on the autism spectrum, other assessments might be more useful. Additionally, if the child to be evaluated is unable to follow only the stated directions or attend for a long period of time, this assessment tool might not be appropriate.

See Also

▶ Ayres, A. Jean
▶ Evaluation of Sensory Processing
▶ Occupational Therapy (OT)

- ▶ Sensory Diet
- ▶ Sensory Integration (SI) Therapy
- ▶ Sensory Processing
- ▶ Sensory Processing Assessment
- ▶ Sensory Processing Measure
- ▶ Sensory Processing Measure: Preschool (SPM-P)
- ▶ Test of Sensory Functioning in Infants

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Sensory Integration and Praxis Tests (SIPT)

- ▶ Touch Sensitivity

Sensory Processing

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Definition

Sensory processing is a general term that describes the way that the central and peripheral nervous systems manage incoming sensory stimuli and allows for an organized and adaptive response to the presented sensory information (Lane, Miller, & Hanft, 2000). Through sensory registration, the peripheral nervous system detects the input and relays the specific information to the brain. Sensory integration allows the organization of input from the different sensory systems to lead to an appropriate, adaptive response (Tomchek, 2010). Sensory integration incorporates sensory modulation which allows us to notice important sensory information and to ignore irrelevant sensory stimuli. Deficits in sensory modulation may result in inattentiveness, sensory seeking behaviors, or avoidance of sensory input. Additionally, individuals with deficits in sensory modulation may also exhibit difficulty regulating their state of alertness and arousal, and fluctuations within these states may be evident. Maintaining a regulated emotional state may be challenging for some individuals with sensory processing deficits as well. Emotional lability may be noted or even a flattened affect. Adults with sensory processing difficulties may ultimately display sensory defensiveness as well as difficulties with discrimination, motor planning, and motor performance (May-Benson, 2011).

Individuals with sensory processing deficits exhibit difficulty managing input from one or more of the sensory systems. The visual system within the context of sensory processing refers to the way the brain interprets visual information, separate from visual activity. Individuals with deficits in visual sensory processing may exhibit difficulty with distinguishing relevant visual information embedded in a rival background, such as reading from a chalkboard or whiteboard. Some individuals who may seek more intensive visual information may look at objects from an unusual perspectives or angles or engage in finger gazing.

Auditory (sensory) processing refers to the way in which the brain manages auditory stimuli, though separate from hearing. Individuals with deficits in auditory sensory processing may exhibit difficulty filtering out background noise while trying to listen to a classroom lecture. Exaggerated reactions to loud or unexpected noises may also be evident. Some individuals

will cover their ears to such noises and may even avoid settings in which loud noises naturally occur. Other children with auditory sensory processing difficulties may seek noises and may even engage in repetitive noise making to provide themselves with this type of input.

The olfactory and gustatory systems refer to the systems of taste and smell, respectively. Deficits in either one of these systems may affect food selectivity, an area of concern for some children with autism spectrum disorders. Some children may seek out intensive smells or tastes that are not typically part of a child's diet. Others may avoid smells or tastes that can limit an overall adequate food repertoire with a balanced diet. Some individuals may avoid environments that offer a distinct or unusual smell, ultimately impacting social participation if an individual avoids a cafeteria, restaurant, or family kitchen.

The tactile system refers to the sense of touch. Tactile perception allows us to have knowledge of tools and materials through touch alone. The sense of touch allows us to know where we were touched, an important component of maintaining social boundaries. Individuals who seek tactile stimuli may crave materials with a heightened or unusual texture or tactile surface. Some individuals may display inefficient tactile awareness and may ultimately exhibit difficulty with motor performance and tool usage. They may require visual support to assist with their performance. Individuals who are overreactive to tactile input may display exaggerated or heightened responses to tactile input and may avoid materials with an unusual tactile surface. These individuals may be extremely selective about what clothes to wear and having their hair combed or washed. Additionally, some individuals will avoid social situations in which unexpected touch opportunities may occur.

The vestibular system refers to the system of balance, reacting to head movement in relation to gravity. With head movement, eye, head, and postural reactions are integrated. Individuals who seek out vestibular input may crave more intensive movement opportunities, including spinning, rocking, and jumping. Some individuals may use repetitive rocking as a means of calming or self-regulation. Individuals who are hyperresponsive to vestibular input may dislike movement in which their heads are inverted, avoid swings, and get carsick easily. Some individuals display gravitational insecurity in which they are uncomfortable if their feet leave the ground or their balance is displaced.

The proprioceptive system is triggered by movement or stretch and provides information on body-in-space awareness. Individuals with deficits in proprioceptive functioning may "crash" onto furniture or the floor, trail their hand along the walls and furniture as they are walking, or seek deep hugs. They might not notice if they are sitting too close to someone and may also exhibit grading motor force and pressure while performing motor actions. Their movements can be clumsy as they bump into furniture and objects in their environment. Individuals with deficits in proprioceptive functioning may use their vision as a means of providing increased feedback for body-in-space awareness and overall motor performance.

Overall motor planning and performance is dependent on adequate processing of sensory information and deficits in any of these areas can impact motor execution. Some children may display difficulty with motor imitation, tool usage, and overall initiation.

Historical Background

A. Jean Ayres, the clinician who first postulated sensory integration theory, described sensory and motor challenges in children with learning disabilities (Ayres, 1963, 1965). Her early work expanded to identify different patterns of sensory integration dysfunction to conceptualize ways to understand sensory responses. Ultimately, sensory integration theory purports that motor performance, learning, and adaptive behavior are impacted by adequate processing and overall organization of sensory input (Baranek, Wakeford, & David, 2008). Sensory integration therapy involves child-guided play addressing responsiveness to sensory input (Cascio, 2010). Particular emphasis on tactile, vestibular, and

proprioceptive input is incorporated into the interventions. Sensory integration therapy has been highly critiqued in the literature as an effective method of intervention (Hoehn & Baumeister, 1994).

Current Knowledge

Further studies on sensory processing and how to conceptualize its influence on behavior continue to advance our understanding of this topic. Brown and Dunn (2010) outline four potential patterns of sensory processing based on Dunn's Model of Sensory Processing (Dunn, 1997) that examines the relationship between neurological thresholds and behavioral responses. Dunn's model addresses a continuum and a level of interaction between the neurological thresholds and the behavioral responses as a way of understanding an individual's response to sensory information around them. The neurological thresholds are described as low or high, and the following four patterns of behavioral responses are identified: registration, seeking, sensitivity, and avoiding. *Registration* refers to the extent to which an individual misses sensory information. *Seeking* refers to the extent that an individual acquires sensory information. *Sensitivity* refers to the degree that an individual is aware of sensory information, and a*voiding* refers to the degrees by which an individual is bothered by sensory information.

Some individuals with a high neurological threshold may crave more intensive sensory experiences and may look to such heightened sensory input as frequent movement experiences to satisfy their need to acquire sensory input. These individuals may be perceived as risk taker or impulsive with poor personal boundaries. Some individuals with hyporesponsiveness may display sluggish or delayed reactions to sensory input. These individuals may exhibit difficulty recognizing or attending to sensory input in their environment and ultimately exhibit a more passive or even delayed response. Some individuals may use visual feedback to provide themselves with increased body-in-space awareness or may even engage in self-stimulatory behaviors to provide themselves with increased input.

Children and adults with a low neurological threshold may exhibit hyperresponsive reactions to sensory information and may display exaggerated and prolonged responses to sensory stimuli. Individuals may learn to avoid situations that provide sensory input that may be perceived as unpleasant or display unusual responses to these types of sensory input. Engaging in repetitive actions may be evident and used as a means of calming an overaroused nervous system. Fluctuations in alertness and arousal may also be noted, impacting focus and attention and even general social interactions. Ayres (1972) described fight-flight-or-fright responses to sensory input as well, resulting in exaggerated responses to sensory stimuli, freezing in place to a specific sensory trigger with delayed responses, or even aggressive behaviors in the presence of sensory input.

Sensory processing is addressed by many different disciplines as difficulties in this area can manifest itself in different domains, including social participation, learning, play, and activities of daily living. Occupational therapists, physical therapists, speech and language pathologists, social workers, psychologists, and physicians may all work together to facilitate the child's performance in a variety of environments for successful participation. Environmental modifications may be necessary to promote participation in different settings, including headphones for a loud cafeteria or a study carrel in a visually stimulating classroom.

While environmental modifications and activity adaptations offer a way to facilitate participation for those individuals who demonstrate deficits in sensory processing, some clinicians address changes within the individual child. Sensory integration is based on the premise that activities that offer needed sensory stimulation will promote the brain's ability to process sensory information more effectively (Ayres, 1972, 1979). Lane and Schaaf (2010) examined neuroplasticity and found that sensory input, motor performance, and motivation all affect neuroplasticity and subsequently support occupational therapy/sensory integration interventions.

Future Directions

Continued focus on evidence-based practice has prompted practitioners seek to demonstrate the overall effectiveness of interventions for sensory processing difficulties, particularly in regard to sensory integration therapy. Psychophysical, neuroanatomical, and neurophysical measures have yielded much information on somatosensory processing (Cascio, 2010) and may provide additional methods of effective intervention strategies, particularly in relation to tactile deficits. Miller, Coll, and Schoen (2007) noted a reduction in the amplitude of electrodermal responses to sensory stimuli for children with sensory modulation disorders when a sensory integrative approach was incorporated into occupational therapy intervention. There is general agreement that the interventions aimed at sensory processing require further examination and research (Baranek, 2002) and may ultimately show positive effects (Benson & Koomar, 2010). Efforts to investigate empirically those specific sensory intervention procedures used with those with autism (e.g., weighted vests) and those used as part of multielement component interventions (e.g., brushing program) will continue to shed light on both the process of intervention and the potential outcomes that are predicted by those treatments. Additional work investigating the functional relationship between particular sensory deficits and the prediction and attainment of specific outcomes will also support the evidence-based use of these procedures.

See Also

- Ayres, A. Jean
- DeGangi-Berk Test of Sensory Integration
- Evaluation of Sensory Processing
- Hyperresponsiveness
- Low Registration
- Occupational Therapy (OT)
- Praxis
- Tactile Defensiveness
- Touch Sensitivity

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Sensory Processing Assessment

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Synonyms

SPA

Description

The *Sensory Processing Assessment* (Baranek, 2010), currently in revision/development, is an observational assessment which provides objective data regarding a "child's approach, avoidance, and/or seeking behaviors with novel sensory toys, orienting and habituation responses to social and non-social sensory stimuli, and generation of novel action strategies with toys" (p. 2). This 15-min, play-based tool is currently being utilized in several research projects but is not yet published in final format. The design, for children between 9 months and 6 years of age, was intended for use with children on the autism spectrum and other developmental delays to assist with identifying patterns of sensory processing. It was thought that this tool could be utilized as a counterpart of the Sensory Experiences Questionnaire (SEQ; refer to the "See Also" section below) which is a parent report assessment tool.

There are four parts to this assessment tool with identified descriptors as to what the examiner should observe in order for the child to obtain a specific score:

- Novel Sensory Toys – rates hyperresponsiveness and sensory seeking
- Sensory Habituation – observes responses to repeated stimuli
- Sensory Orienting Trials – rates hyporesponsiveness
- Stereotyped Behaviors Checklist – items marked as observed or not

Historical Background

The author, Grace Baranek, Professor and Associate Chair of Research at the University of North Carolina – Chapel Hill's Division of Occupational Science and Occupational Therapy, has a long-standing and very well-respected history of research in the area of autism spectrum disorders. The Sensory Experiences Project (SEP), funded by the National Institute for Child Health and Human Development, focuses on the research on the sensory features/processes of children on the autism spectrum, developmental delay, and/or typical development for children 2 through 12 years old. This research is conducted under the University's PEARLS project (Program for Early Autism Research, Leadership, and Service) whose intent is improve early identification markers and contribute to the evidence with regard to best practices in intervention.

Psychometric Data

Preliminary studies of reliability and validity have been completed. As this assessment tool is not yet published, full detail of the psychometric data is not yet available.

Clinical Uses

The intended use of this assessment tool is to augment traditional diagnostic and developmental assessment in order to identify patterns of sensory processing which may have implications for diagnosis or intervention. As this tool is not yet published, a full description of its clinical use is not yet available.

See Also

- Ayres, A. Jean
- Evaluation of Sensory Processing
- Occupational Therapy (OT)
- Sensory Diet
- Sensory Integration and Praxis Test
- Sensory Integration (SI) Therapy
- Sensory Processing
- Sensory Processing Assessment
- Sensory Processing Measure
- Sensory Processing Measure: Preschool (SPM-P)
- Test of Sensory Functioning in Infants

References and Readings

A full list of Dr. Baranek's research publications produced as a result of the SEP can be found at: http://www.med.unc.edu/ahs/ocsci/sep/research-articles

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Sensory Processing Measure

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Synonyms

Sensory Processing Measure, Preschool Edition; SPM; SPM-P

Abbreviations

ART	Art Class
ASD	Autism Spectrum Disorder
BAL	Balance and Motion
BOD	Body Awareness
BUS	School Bus
CAF	Cafeteria
DC:0-3R	Diagnostic Classification of Mental Health and Developmental Disorders of Infancy and Early Childhood, Revised
DMIC	Diagnostic Manual for Infancy and Early Childhood
HEA	Hearing
MUS	Music Class
PHY	Physical Education Class
PLA	Planning and Ideas
REC	Recess/Playground
SES	Socioeconomic Status
SI	Sensory Integration
SOC	Social Participation
SPD	Sensory Processing Disorder
TOT	Total Sensory Systems
TOU	Touch
U.S.	United States
VIS	Vision

Description

The *Sensory Processing Measure* (SPM) is a standardized assessment tool published by Western Psychological Services (www.wpspublish.com) that provides information about the sensory and environmental issues that may impact a child's performance in school, home, and community settings (Parham, Ecker, Miller Kuhaneck, Henry, & Glennon, 2007). The design of the SPM allows a practitioner to consider whether a child's performance is being hindered by sensory processing or sensory integration difficulties. The SPM's three integrated rating scales (Home Form, Main Classroom Form, and School Environments Form) are designed to elicit information about the sensory processing, praxis, and social participation of primary school children ages 5–12 years (Miller Kuhaneck, Henry, Glennon, & Mu, 2007a,

2007b; Parham, & Ecker, 2007). With the SPM in part being grounded in Ayres Sensory Integration (SI) theory (Ayres, 1972, 1979, 2005), it provides norm-referenced standard scores for two higher level integrative functions (praxis and social participation) and five sensory systems; those being visual, auditory, tactile, proprioceptive, and vestibular functioning (see Table 1) (Parham et al., 2007). Within each sensory system, the SPM offers clinical information on a number of processing SI vulnerabilities including underresponsiveness, overresponsiveness, sensory-seeking behavior, and perceptual problems (Parham et al.).

The SPM Home Form (made up of 75 items) (Parham & Ecker, 2007) is completed by a child's parent or caregiver while the SPM Main Classroom Form (consisting of 62 items) (Miller Kuhaneck et al., 2007a) is filled out by a child's main classroom teacher (see Table 1). The SPM School Environments Form (containing 10–15 items per school environment) (Miller Kuhaneck et al., 2007b) is completed by other school staff who work with and know a child in those relevant school contexts (e.g., school bus driver, physical education teacher, librarian). The SPM Home and Main Classroom Forms each take approximately 15–20 min to be completed by respondents and about 5–10 min to be scored by practitioners (Parham et al., 2007). The SPM forms are written at an 8th grade reading level, but in the event that parents have poor reading skills, it is possible to complete the Home Form by interviewing the respondent(s).

All forms of the SPM have items that are answered by respondents using a 4-point Likert-type scale (Never = 4, Occasionally = 3, Frequently = 2, Always = 1) (Parham et al., 2007). The SPM AutoScore™ feature (forms containing a sheet of carbon paper) permits the transfer of respondents' answers to a scoring worksheet that allows for easy calculation of the subscale scores. The clinician adds up and transfers the raw subscale scores to the SPM Profile Sheet. Prior to giving the SPM AutoScore™ proforma to the parent or teacher, the Profile Sheet must be detached so that it can be used later in scoring the scale.

Sensory Processing Measure, Table 1 Sensory processing measure (SPM) forms and scales

SPM subscales	Number of items
Home Form	
Social Participation (SOC)	10
Vision (VIS)	11
Hearing (HEA)	8
Touch (TOU)	11
Body Awareness (BOD)	10
Balance and Motion (BAL)	11
Planning and Ideas (PLA)	9
Total Sensory Systems (TOT)	56
Main classroom form	
Social Participation (SOC)	10
Vision (VIC)	7
Hearing (HEA)	7
Touch (TOU)	8
Body Awareness (BOD)	7
Balance and Motion (BAL)	9
Planning and Ideas (PLA)	10
Total Sensory Systems (TOT)	42
School Environments Form	
Art Class (ART)	15
Music Class (MUS)	15
Physical Education Class (PHY)	15
Recess / Playground (REC)	15
Cafeteria (CAF)	15
School Bus (BUS)	10

Note: The SPM Home and Main Classroom scales yield norm-referenced standard scores. The SPM School Environments scales yield Total Scores that are interpreted by means of a cutoff criterion. The TOT scales include VIS, HEA, TOU, BOD, and BAL items, plus several items representing taste and smell processing

Source: Parham, L. D., Ecker, C., Miller Kuhaneck, H., Henry, D. A., & Glennon, T. J. (2007). *Sensory Processing Measure (SPM): Manual*. Los Angeles, CA: Western Psychological Services, p. 4. Reproduced with permission from publisher

The eight sensory processing scores (Social Participation [SOC], Vision [VIS], Hearing [HEA], Touch [TOU], Body Awareness [BOD] (proprioception), Balance and Motion [BAL] (vestibular function), Planning and Ideas [PLA] (praxis), and Total Sensory Systems [TOT]) generated by both the SPM Home and Main Classroom Forms are converted from raw scores into T-scores as well as their corresponding percentile ranks. The T-scores for these two forms are then identified for interpretive purposes as falling into

one of three categories: the *Typical* range (T-score of 40–59 indicating a child's behavioral and sensory functioning are similar to that of typically developing peers), the *Some Problems* range (T-score of 60–69 indicating that a child exhibits mild-to-moderate difficulties in his or her behavioral or sensory functioning), or the *Definite Dysfunction* range (T-score of 70–80 indicating that a child is presenting with significant sensory processing problems that are likely having an impact on his/her daily functioning) (Miller Kuhaneck et al., 2007a; Parham & Ecker, 2007).

"The VIS, HEA, TOU, BOD, and BAL scales are referred to as the *sensory systems scales* because they address a child's ability to process direct sensory inputs. The SOC and PLA scales, on the other hand, represent higher level integration functions that are strongly influenced by sensory inputs while encompassing other cognitive and contextual factors. The TOT scale is a composite of all the sensory system scales, plus additional items that reflect taste and smell inputs" (Parham et al., 2007, p. 19). One advantage of using the SPM is that for the first time, an Environment Difference score permits direct comparison of a child's sensory functioning at home and at school. While the scales on the SPM Home and Main Classroom Forms are identical, the items themselves are specific to each specific environment. Individual item responses indicate how sensory difficulties present themselves in these two different settings.

With the SPM, the School Environments Form is provided on an unlimited-use CD. This allows the SPM user to look at the child's functioning in six specific school environments outside of the main classroom: Art Class (ART), Music Class (MUS), Physical Education Class (PHY), Recess/Playground (REC), Cafeteria (CAF), and School Bus (BUS) (see Table 1) (Miller Kuhaneck et al., 2007b). Each school environment has its own Rating Sheet, which can be printed from the CD provided with the purchase of a test manual (Miller Kuhaneck et al.). Each rater can complete his or her 15-item Rating Sheet (10 items for the School Bus setting) in less than 5 min.

The SPM School Environments Forms yield no T-scores. Instead, these forms yield a total score for each relevant school environment that is interpreted against an established cutoff criterion. Scores at or above the cutoff point indicate that the child is experiencing a high number of sensory processing problems in that specific school environment (Miller Kuhaneck et al., 2007b). Whether a practitioner uses one or all six Rating Sheets, the SPM School Environments Form must always be administered in conjunction with the SPM Main Classroom Form (Parham et al., 2007). In other words, the SPM School Environments Form should not be used in isolation. As reported in the SPM manual, the SPM School Environments Form items include behavioral indicators of sensory modulation dysfunction, difficulties with regulation of arousal, and praxis deficits that may be influencing educational performance, as well as the ability to participate fully in the educational environment and maintain relationships with peers (Miller Kuhaneck et al., 2007b).

Historical Background

The SPM came about with the cooperation of two groups of occupational therapy researchers in the United States who were each completing separate studies with the goal of generating a scale that would provide a link between home and school environments in the identification of SI problems. The SPM Home Form originated from the *Evaluation of Sensory Processing* by Parham and Ecker (2002) while the SPM Main Classroom and School Environments Form evolved from the *School Assessment of Sensory Integration* by Miller Kuhaneck et al. (2007a). "The goals underlying this combination of assessment instruments were to maximize the clinical utility of the measures and share a common standardization effort. By so doing, it was the test authors' intent to create an integrated collection of parallel test materials regarding sensory processing and sensory integration that could be used across multiple settings" (Watson & Woodin, 2007, p. 3). The test authors set out to reformat the

scales so that they were more efficient and user friendly. A research version of each instrument was created to be used in the standardization of the SPM.

The theoretical basis of the SPM was derived from Ayres's theory of SI (1972). The SPM manual reports that disorders of SI are believed to include the following: not using sensory information, sensory-seeking behaviors, being overwhelmed by sensory stimuli, difficulties with sensory discrimination, and sensorimotor problems. It is suggested that children who exhibit impediments with sensory processing may have difficulties in other areas of functioning such as planning and organizing their body movements.

Psychometric Data

Given that the SPM is a relatively new scale, limited psychometric data has been reported about it by external researchers and reviewers (Brown, Morrison, & Stagnitti, 2010; Henry, 2007; Henry, Ecker, Glennon, & Herzberg, 2009; Kuhaneck & Henry, 2009a, b). The information reported in this section focuses on the recent reliability and validity data reported in the SPM manual published in 2007 (Parham et al., 2007). The SPM Home Form and Main Classroom Form were standardized on a sample of 1,051 typically developing children ages 5–12 years in kindergarten through to grade 6 from approximately 76 sites across the United States (Henry, 2007). All of the children in the sample were assessed with the SPM Home Form (completed by the child's parent or caretaker) and Main Classroom Form (completed by the child's primary school teacher). No children included in the standardization sample were attending full-time special education programs; however, "no attempt was made to exclude children with mild academic or behavioral difficulties" (Parham et al., 2007, p. 47).

Demographic data about the standardization sample were compared by age and against the 2001 American Census population estimates with regard to gender, race, geographical distribution, and educational attainment of parents (Henry, 2007). In the SPM manual, it was noted that "whites are slightly overrepresented, where as Blacks and Asians are slightly underrepresented. . .in terms of U. S. geographical distribution, the Midwest is overrepresented compared to Census figures, whereas the South and West are underrepresented" (Parham et al., 2007, p. 47). A subsample of 306 children from the SPM standardization sample was used to develop scores for the School Environments Form (Miller Kuhaneck et al., 2007b).

Types of reliability data often reported include internal consistency, test-retest/time sampling reliability/temporal stability, interrater/interscorer reliability, intrarater/intrascorer reliability, alternate form reliability, and split-half reliability (American Educational Research Association [AERA], American Psychological Association [APA], & National Council on Measurement in Education [NCME], 1999). For the SPM Home Form subscale scores, internal consistency Cronbach alpha coefficients ranged from .77 to .95 (median = .85) while for the SPM Main Classroom Form subscale scores, internal consistency Cronbach alphas ranged from .75 to .95 (median = .86) (Parham et al., 2007). The SPM VIS, HEA, and TOU subscales had the lowest internal consistency estimates ranging from .75 to .84 for the total sample. "Although acceptable, this is concerning as vision, hearing and touch would be areas where the identification of sensory issues would be most observable. Social Participation, Planning and Ideas, and the Total Sensory Systems Score all demonstrate excellent reliability" (Cruce, 2007, p. 2). The SPM School Environments scores yielded internal consistency values that ranged from .82 to .91 (median = .89) (Parham et al., 2007). "Internal consistency for the School Environments Form also was strong" (Cruce, 2007, p. 2).

Test-retest reliability data were collected on 77 children ages 5–12 in a 2-week follow-up using both the SPM Home and Main Classroom Forms. As would be expected, temporal stability was high with all composites having correlation coefficients above .94 (Cruce, 2007). For the SPM Home Form subscale scores, test-retest

reliability coefficients ranged from .94 to .98 (median = .97) while for the SPM Main Classroom Form subscale scores, test-retest reliability coefficients ranged from .95 to .98 (median = .97) (Parham et al., 2007). "Additionally, standard errors of measurement and confidence intervals calculated at 95% appear to be quite acceptable" (Cruce, 2007, p. 2).

Types of validity often reported for tests include face validity, content validity, criterion-related validity, and construct validity (AERA, APA, & NCME, 1999; Anastasi & Urbina, 1997). Two subtypes of criterion-related validity frequently included are concurrent validity and predictive validity while subtypes of construct validity often reported include factor analysis validity, discriminant validity, convergent validity, divergent validity, diagnostic validity, and rating scale validity (Fawcett, 2007; Wolfe & Smith, 2007a). Many scales are now using a combination of Classical Test Theory methods (e.g., factor analysis) and Item Response Theory approaches (e.g., Rasch analysis) to examine the construct validity of a measure (Wolfe & Smith, 2007b).

Limited evidence of validity was reported in the SPM manual. Content validity for the SPM forms was initially examined using the *Evaluation of Sensory Processing* (Johnson-Ecker & Parham, 2000; Parham & Ecker, 2002) and the *School Assessment of Sensory Integration* (Miller Kuhaneck, Henry, Glennon, & Mu, 2007) in their original form. The items from the two original scales were examined and those items that were redundant or not aligned with Ayres's SI theory (1972, 1979) were discarded. The item sets were then subjected to several rounds of expert review and were retained only if they were judged to adequately represent the intended sensory function construct, social participation, or praxis (Parham et al., 2007). "These earlier developmental phases generate confidence in the content validity of the current SPM items and scales" (Parham et al., 2007, p. 57).

A research version of the SPM was subjected to confirmatory and exploratory factor analyses to examine its construct validity. "Results of the factor analyses provided support for the basic scale structure of the SPM" (Watson & Woodin, 2007, p. 3). Item-scale correlations are reported for the Home Form and the Main Classroom Form. According to Watson and Woodin (2007), the item-scale correlations provide "robust support for the Home Form as a measure that can be scored and interpreted according to its separate scales. In contrast, questionable results were attained for the Main Classroom Form in terms of high interscale correlations between the BOD (proprioception) and BAL (vestibular) scales. This finding should be considered when interpreting results from these scales in individual cases" (p. 3). The standard errors of measurement varied between 1.29 and 4.40 points (Parham et al., 2007).

Convergent validity (a subtype of construct validity) was examined by comparing the SPM to the Sensory Profile (Dunn, 1999), and the results indicated adequate overlap in areas where the tests displayed similar content. "Findings indicated that the SPM Home Form yielded strong and consistent relationships with the scores on the Sensory Profile" (Watson & Woodin, 2007, p. 3). No comparable measure was available to investigate the convergent validity of the SPM Main Classroom Form. Therefore, the relationship between the SPM Main Classroom Form and the independently completed SPM School Environments Forms was examined. "Findings of strong relationships between these forms provide support for the stability of measurement of these forms" (Watson & Woodin, 2007, p. 3).

Discriminant validity (a subtype of construct validity) was evidenced by the SPM's ability to differentiate between two groups of children with known differences, those with typical development from those with formally diagnosed clinical disorders. It was reported in the SPM manual that a sample of 345 children (separate from the standardization sample) receiving occupational therapy intervention was used to verify that the SPM subscales were able to differentiate between typical children from those with clinical disorders (Parham et al., 2007).

The SPM authors used Rasch analysis (Bond & Fox, 2001) to investigate its rating scale validity structure. With Rasch analysis, two sets of scores are generated, one for children (person

ability scores) and the other for the SPM items (item difficulty scores), expressed by means of a common numerical metric called a logit score (Bond & Fox, 2001). The use of a common logit allows instrument developers to examine the functioning of items with respect to different ability levels of participants. In other words, "the Rasch method illuminates how the categories of the SPM item rating scale operate together to measure vary amounts of sensory processing dysfunction" (Parham et al., 2007, p. 69). The rating scale validity results indicated that each of the SPM's four rating scale categories (Never, Occasionally, Frequently, Always) "is the most probable response for a distinct level of the underlying sensory processing dysfunction. . .none of the categories are redundant. . .the category sequence of increasing behavioral frequency is properly aligned with the continuum of increasing sensory pathology" (Parham et al., p. 69).

Parham et al. (2007) investigated the moderating effects of demographic variables (including age, gender, ethnicity, and socioeconomic status [SES]) on the SPM scale scores. "An effect size metric was used to determine if the demographic moderator variables were associated with any clinically meaningful differences between groups in the SPM raw scale scores" (Parham et al., p. 47). The analysis of the demographic moderating effects did not yield any significant results. "Actual differences in SPM scores due to age, gender, ethnicity, and SES were small and not likely to have any meaningful impact on interpretation of [SPM] test results" (Parham et al., p. 49).

Clinical Uses

As outlined in the SPM manual, it has three primary uses: (1) providing clinicians with information regarding a child's sensory integrative functioning in order to create strategies that enhance performance in school and at home; (2) evaluating a child's performance in a variety of different environments, allowing comparison and discussion regarding the differences; and (3) examining the behaviors indicative of sensory modulation dysfunction and dyspraxia, as well as the related areas of arousal, attention, and social participation (Parham et al., 2007). Watson and Woodin (2007) state that "the SPM will be useful in determining the types of interventions that would be most appropriate for a child as a means of measuring program effectiveness, building team collaboration regarding intervention strategies, fostering program planning, and developing Individualized Educational Plans (IEPs)" (p. 3). In summary, the SPM scales can be used in a range of educational, clinical practice, and research settings.

Dr. Ayres (1972, 1979) first coined the term *sensory integration dysfunction* as part of her theory that deficits in processing sensation from the body and the environment lead to sensorimotor and learning problems in children. More recently, the term *sensory processing disorder* (SPD) has been proposed. It is estimated that SPD affects the lives of 1 in 20 children and adults (Ahn, Miller, Milberger, & McIntosh, 2004). SPD is recognized by both the *Diagnostic Manual for Infancy and Early Childhood* (DMIC) of the Interdisciplinary Council on Developmental and Learning Disorders (2005) and the *Diagnostic Classification of Mental Health and Developmental Disorders of Infancy and Early Childhood, Revised* (DC:0-3R) (Zero to Three, 2005). Three primary diagnostic groups have been categorized within the SPD category to describe children who have difficulty regulating and organizing responses to sensory input: *sensory modulation disorder*, *sensory discrimination disorder*, and *sensory-based motor disorder* (Ayres, 2005; Miller, Anzalone, Lane, Cermak, & Osten, 2007; Miller Kuhaneck, Ecker, Parham, Henry, & Glennon, 2010).

Sensory modulation disorder has three subtypes: *sensory overresponsivity*, *sensory underresponsivity*, and *sensory seeking* (Roley, Blanche, & Schaaf, 2001; Dunn, 2010). Children with *sensory overresponsivity* register sensations too intensely and for a longer duration than typically developing children and may react to sensory input by pulling away, screaming, or avoiding input (Robinson & Magill-Evans, 2009). Children with *sensory underresponsivity* tend not to respond to input and may be

withdrawn or seem to be in their own world (Dunn, 2010). *Sensory seeking* describes children who tend to crave intense or an unusual amount of sensory input. They may be constantly on the move, bang their heads against windows or walls, or fall repeatedly in an effort to gain appropriate sensory information (Miller Kuhaneck et al., 2010). The other two diagnostic groups include sensory discrimination disorder or difficulty deciphering or interpreting qualities of sensory information and sensory-based motor disorder, in which children tend to appear uncoordinated because of faulty processing of sensory input (Dunn, 2010). A diagnosis of SPD is not made unless the condition significantly affects a child's daily life (Baranek, David, Poe, Stone, & Watson, 2006).

The SPM forms can be used by a variety of health and education professionals (including occupational therapists, psychologists, teachers, social workers, counsellors, physiotherapists, speech-language pathologists, nurses, pediatricians, and physicians, among others) to evaluate the sensory processing issues of school-age children (Henry, Ecker, Glennon, & Herzberg, 2009). For example, the SPM's unique multienvironment approach lets practitioners investigate why a child who functions well in a highly structured classroom with a predictable daily routine may have problems at home or at a playground in the local community park where the environment is variable and the routine is not predictable.

The SPM can be used to determine whether a child is presenting with signs indicative of SPD. One study by the Sensory Processing Disorder Scientific Work Group (Ben-Sasson, Carter, & Briggs-Gowan, 2009) suggests that 1 in every 6 children experiences sensory symptoms that may be significant enough to have a negative impact on some aspect of everyday life functions. A significant number of children diagnosed with autism spectrum disorder (ASD) (and related disorders) present with signs of SPD (e.g., child who does not like to eat foods with certain textures or smells, does not like to wear clothes made of certain types of material, does not like to wear socks or shoes, does not like to be hugged, does not like to handle certain types of materials such as Playdoh™, and/or does not like having his or her hair brushed or washed) (Baranek, Parham, & Bodfish, 2005; Kientz & Dunn, 1997; Leekam, Nieto, Libby, Wing, & Gould, 2007; Tomchek & Dunn, 2007; Watling, 2000; Watling, Deitz, & White, 2001), and the SPD would be a measure suitable to assess this group of children. "Children with autism are expected to show elevated scores on the SPM SOC and PLA scales. . .these deficits in participation and praxis may be caused or exacerbated by processing deficits in specific sensory systems" (Parham et al., 2007, p. 33). Parham et al. also noted that "with moderate to severe autism, it is not uncommon to see all SPM scales elevated in the Definite Dysfunction range" (p. 33).

The SPM can be used to assess children presenting with suspected sensory processing challenges as well as children with confirmed diagnoses including genetic disorders, developmental disabilities, learning disabilities, neurological problems, behavioral issues, or psychosocial problems (Baker, Lane, Angley, & Young, 2008; Robinson & Magill-Evans, 2009). It states in the SPM manual that it was not designed for use with students with severe sensory impairments such as blindness or deafness or children with severe motor impairments (Parham et al., 2007). It can be used in conjunction with other assessment tools to provide a comprehensive overview of a child's daily functioning or can be used as a stand-alone tool. Similarly, the SPM can be used to document children's progress or clinical change after being involved in an intervention program (e.g., preintervention and posttest intervention).

Watson and Woodin (2007) stated that the "SPM has an adequate normative base, provides data across multiple settings in home and school environments, is easy to administer and score, and provides adequate to moderate evidence of reliability, validity, factor structure, and discriminant validity" (p. 3). In conclusion, the SPM appears to be a useful, informative, and psychometrically sound scale that clinicians can use with confidence to assess school-age children including those diagnosed with ASD.

See Also

- Occupational Therapy (OT)
- Sensation Avoiding
- Sensation-Seeking
- Sensory Diet
- Sensory Experiences Questionnaire
- Sensory Impairment in Autism
- Sensory Integration (SI) Therapy
- Sensory Processing
- Sensory Processing Assessment
- Sensory Sensitivity Questionnaire: Revised
- Sensory Stimuli
- Standardized Tests

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Sensory Processing Measure, Preschool Edition

▶ Sensory Processing Measure
▶ Sensory Processing Measure: Preschool (SPM-P)

Sensory Processing Measure: Preschool (SPM-P)

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Synonyms

Sensory Processing Measure, Preschool Edition; SPM; SPM-P

Abbreviations

ASD	Autism Spectrum Disorder
BAL	Balance and Motion
BOD	Body Awareness
DIF	Environment Difference
HEA	Hearing
PLA	Planning and Ideas
SI	Sensory Integration
SOC	Social Participation
SPD	Sensory Processing Disorder
TOT	Total Sensory Systems
TOU	Touch
VIS	Vision

Description

The *Sensory Processing Measure – Preschool* (SPM-P) (Miller Kuhaneck, Ecker, Parham, Henry, & Glennon, 2010) is a set of scales that allows the assessment of praxis, social participation, and sensory processing issues present in preschool-age children (2–5 years of age). The SPM-P consists of the Home Form (Ecker & Parham, 2010) and the School Form (Miller Kuhaneck, Henry, & Glennon, 2010) that are published Western Psychological Services (www.wpspublish.com). The SPM-P is a companion instrument to the *Sensory Processing Measure* (SPM) (Parham, Ecker, Miller Kuhaneck, Henry, & Glennon, 2007) that is designed for use with children ages 5–12 years. The SPM-P has the same theoretical basis and subscale structure as the SPM. "These commonalities facilitate a seamless transition between the two assessments for children who need to be followed over the longer term" (Miller Kuhaneck et al., 2010, p. 3). It should be noted that the coverage of 5-year-olds is common to both the SPM and SPM-P; for 5-year-olds who have not yet started kindergarten, then the SPM-P should be used, whereas the SPM should be utilized for 5-year-olds who have already enrolled in kindergarten/grade one.

Similar to the SPM, the SPM-P is contextualized within Ayres sensory integration (SI) theory (Ayres, 1972, 1979, 2005). "The theory holds that children with compromised sensory processing may be unable to learn efficiently, regulate their emotions, or function at an expected level in daily activities" (Miller Kuhaneck et al., 2010, p. 3). As well, sensory processing problems lead to difficulties in higher level integrative functions, such as praxis (the ability to plan and organize movement) and social participation (Dunn, 2010). Ayres SI theory outlines assessment principles related to sensory function, three of which are incorporated into the SPM-P: (1) it includes *assessment of sensory systems* since it includes subscales that examine the tactile, visual, auditory, proprioceptive, and vestibular sensory systems; (2) it incorporates *assessment of sensory integration vulnerabilities* by providing information about the weaknesses in each sensory system including under-responsiveness, over-responsiveness, sensory-seeking behavior, and perceptual problems; and (3) it allows *assessment across multiple environments* since the clinician can compare a child's sensory processing functioning across the home, preschool, and community contexts (Miller Kuhaneck et al., 2010).

The SPM-P Home Form consists of 75 items designed to be completed by a child's parent or caregiver. The SPM-P School Form also contains 75 items meant to be completed by a child's preschool teacher or child care provider. According to the SPM-P manual, a respondent "must have observed the child in the preschool or day care setting on a daily basis for at least 1 month prior to completing the School Form" (Miller Kuhaneck et al., 2010, p. 5). Both forms take approximately 15–20 min to complete and 5–10 min to score. The SPM-P forms are written at an 8th grade reading level, but in the event that parents have poor reading skills (e.g., English as a second language), it is possible to complete the Home Form by interviewing the respondent(s).

The SPM-P Home and School Forms have items that are answered by respondents using a 4-point Likert-type scale based on the frequency of a specific behavior occurring (never = 4, occasionally = 3, frequently = 2, always = 1). "Each form is an AutoScore™ Form that transfers the rater's responses to a Scoring Worksheet via carbon paper. The

Scoring Worksheet makes it easier to calculate the SPM-P scores" (Miller Kuhaneck et al., 2010, p. 3). Prior to giving the SPM-P Home or School Forms to respondents to fill out, the Summary Score Sheet must be removed and saved for later use when scoring the items. Based on the SPM-P scoring structure, "a higher raw score always indicates a higher level of problems or dysfunction than does a lower raw score" (Miller Kuhaneck et al., 2010, p. 14).

The SPM-P Home and School Forms generate eight norm-referenced standard subscale scores: social participation (SOC), vision (VIS), hearing (HEA), touch (TOU), body awareness (BOD) (refers to proprioception), balance and motion (BAL) (refers to vestibular function), planning and ideas (PLA) (refers to praxis), and Total Sensory Systems (TOT) (Miller Kuhaneck et al., 2010) (see Table 1). The SOC and PLA subscales have items that represent higher level SI functions that are impacted by sensory input but also include other cognitive and environmental factors. "The VIS, HEA, TOU, BOD, and BAL scales are referred to as the *sensory systems scales* because they address a child's ability to process direct sensory inputs. . .the TOT scale is a composite of all of the sensory systems scales, plus additional items that reflect taste and smell inputs" (Miller Kuhaneck et al., 2010, pp.13-14). The SPM-P items that make up the SOC, VIS, HEA, TOU, BOD, BAL, PLA, and TOT scales (see Table 1) provide information about a number of processing SI vulnerabilities including under-responsiveness, over-responsiveness, sensory-seeking behavior, and perceptual problems (Miller Kuhaneck et al., 2010).

The standard scores (referred to as T-scores) for each subscale derived by both the SPM-P Home and Main Classroom Forms facilitates the classification of a child's sensory processing functioning into one of three categories for clinical interpretation purposes: (1) the *typical* range (a T-score of 40–59) indicating a child's behavioral and sensory functioning are similar to that of typically developing peers; (2) the *some problems* range (a T-score of 60–69) indicating that a child exhibits mild-to-moderate difficulties in his/her behavioral or sensory functioning; or (3) the *definite dysfunction* range (a T-score of 70–80) indicating that a child is presenting with significant sensory processing problems that are likely having an impact on his/her daily functioning. "In addition, an Environment Difference (DIF) score allows direct comparison of the child's sensory functioning between home and preschool/day care environments" (Miller Kuhaneck et al., 2010, p. 3).

Sensory Processing Measure: Preschool (SPM-P), Table 1 SPM-P forms and scales

SPM-P subscales	Number of items
Home Form	
Social Participation (SOC)	8
Vision (VIS)	11
Hearing (HEA)	9
Touch (TOU)	14
Body Awareness (BOD)	9
Balance and Motion (BAL)	11
Planning and Ideas (PLA)	9
Total Sensory Systems (TOT)	58
School Form	
Social Participation (SOC)	10
Vision (VIC)	10
Hearing (HEA)	10
Touch (TOU)	10
Body Awareness (BOD)	10
Balance and Motion (BAL)	10
Planning and Ideas (PLA)	10
Total Sensory Systems (TOT)	55

Note: The TOT scales include the VIS, HEA, TOU, BOD, and BAL items, plus several items representing taste and smell processing

Source: Miller Kuhaneck, H., Ecker, C., Parham, L. D., Henry, D. A., & Glennon, T. J. (2010). *Sensory Processing Measure – Preschool (SPM-P): Manual*. Los Angeles, CA: Western Psychological Services, p. 4. Reproduced with permission from publisher

Historical Background

The SPM was published in 2007 and the more recent companion SPM-P was published in 2010. When developing the SPM-P, the authors strived to develop items equivalent to the SPM. "The SPM-P authors selected items from the SPM and the *evaluation of sensory processing* (Johnson-Ecker & Parham, 2000) item set that

could be adapted for use with preschoolers" (Miller Kuhaneck et al., 2010, p. 38). The two sensory processing instruments are designed to provide an assessment continuum for children ages 2–12 years who require longer term follow-up and monitoring.

Psychometric Data

Given that the SPM-P is a relatively new scale being published in 2010, limited psychometric data has been reported about it by external researchers and reviewers. The information reported here focuses on the reliability and validity data reported in the SPM-P manual published in 2010 (Miller Kuhaneck et al., 2010). The SPM-P Home Form and Main Classroom Form were standardized on an American sample of 651 (319 boys and 332 girls) typically developing children ages 2–5 years (Miller Kuhaneck et al., 2010). The sample group corresponded to percentage distribution of categories in relation to gender, age, race, parents' education level and geographical regions from the American 2007 census. The SPM-P authors noted that in comparison to the 2007 census data on ethnicity, a larger percentage of Whites were included in the norming sample compared to Asians, Blacks, and Hispanics (who were underrepresented). In relation to the American Census geographical regions, the children in the sample from the Midwest were overrepresented, whereas the other three regions (North, South, and West) were underrepresented.

The norms for the SPM-P subscales are age-stratified to control for developmental differences between younger and older children with separate norms provided for 2-year-olds and 3–5-year-olds. Two-year-olds were included only if they attended a child care center where a staff member knew them well enough to complete the SPM-P School Form. Five-year-old children were only included in the standardization sample if they had not started kindergarten. None of the children included in the standardization group had special needs or were receiving early intervention services.

To investigate the potential moderating effects of the demographic features of the normative sample, the SPM-P authors used an effect size metric. This metric was used to investigate whether any of the "demographic moderator variables were associated with any clinical meaningful differences between groups in the SPM-P raw scores" (Miller Kuhaneck et al., 2010, p. 38). The effect size data supported the idea of using age-stratified norms and "differences in SPM-P scores due to gender, ethnicity, and SES were small and not likely to have any meaningful impact on the interpretation of test results" (Miller Kuhaneck et al., 2010, p. 40).

Types of reliability data often reported include internal consistency, test-retest/time sampling reliability/temporal stability, inter-rater/interscorer reliability, intra-rater/intrascorer reliability, alternate form reliability, and split-half reliability (American Educational Research Association [AERA], American Psychological Association [APA], & National Council on Measurement in Education [NCME], 1999; Anastasi & Urbina, 1997). For the SPM-P Home Form subscale scores, internal consistency Cronbach alpha coefficients ranged from .75 to .93 (median = .92), while the for the SPM-P School Form subscale scores, internal consistency Cronbach alphas ranged from .72 to .94 (median = .82) (Miller Kuhaneck et al., 2010). "Five of eight Home scales and four of eight School scales have alphas of .80 or greater" (Miller Kuhaneck et al., 2010, p. 45).

Test-retest reliability data were collected on 49 healthy children (23 males and 26 females) ages 2–5 years within a 2-week follow-up period using both the SPM-P Home and School Forms. For the Home Form subscale scores, test-retest reliability coefficients ranged from .90 to .98 (median = .92), while for the Main Classroom Form subscale scores, test-retest reliability coefficients spanned from .90 to .96 (median = .97) (Miller Kuhaneck et al., 2010).

Types of validity often reported for tests include face validity, content validity, criterion-related validity, and construct validity (AERA, APA, & NCME, 1999). Two subtypes of criterion-related validity frequently included are concurrent validity and predictive validity. Two subtypes of criterion-related validity frequently

included are concurrent validity and predictive validity, while subtypes of construct validity often reported include factor analysis validity, discriminant validity, convergent validity, divergent validity, diagnostic validity, and rating scale validity (Fawcett, 2007; Wolfe & Smith, 2007a). Many scales are now using a combination of classical test theory methods (e.g., factor analysis) and item response theory approaches (e.g., Rasch analysis) to examine the construct validity of a measure (Wolfe & Smith, 2007b). The SPM-P manual reported a range of validity evidence.

Content validity for the SPM-P forms was ensured since the SPM-P items were derived directly from the SPM. In turn, the SPM was developed based on items from two previously published scales: those being the evaluation of sensory processing (Johnson-Ecker & Parham, 2000; Parham & Ecker, 2002) and the School Assessment of Sensory Integration (Miller Kuhaneck, Henry, Glennon, & Mu, 2007). The SPM-P items were also reviewed by a panel of experts and revised based on their feedback. Finally, content validity was demonstrated since the SPM-P items (like those of the SPM) are based largely on the constructs of Ayres SI theory.

A research version of the SPM-P was subjected to confirmatory and exploratory factor analyses (a type of classical test theory approach to validity) to examine its construct validity. Findings of the factor analyses provided support for the basic scale structure of the SPM-P Home and Classroom Forms. Item-scale correlations are reported for the Home and Classroom Forms and provide evidence that supports the separate scoring and interpretation of the SPM-P scales.

The SPM-P authors used Rasch analysis (Bond & Fox, 2001) to investigate its rating scale validity structure. With Rasch analysis, two sets of scores are generated, one for participants (person ability scores) and the other for the SPM items (item difficulty scores), expressed by means of a common numerical metric called a logit score (Bond & Fox, 2001). The use of a common logit table allows instrument developers to examine the functioning of items with respect to the different ability levels of participants. In other words, the Rasch method provided insights into how the Likert-type scoring categories of the SPM-P item rating scale work together to measure differing amounts of sensory processing difficulties. The rating scale validity results indicated that each of the SPM-P's four rating scale categories (never, occasionally, frequently, always) "is the most probable response for a distinct segment of the underlying variable of sensory processing dysfunction. . .none of the categories are redundant. . .the category sequence of increasing behavioral frequency is properly aligned with the continuum of increasing sensory pathology" (Miller Kuhaneck et al., 2010, p. 55).

Convergent validity was examined by correlating the SPM-P Home Form with the Short Sensory Profile (Dunn, 1999) using a sample of 105 children (74 boys and 31 girls) and the Infant/Toddler Sensory Profile (Dunn & Daniels, 2002) using a sample of 62 children (42 boys and 20 girls). The SPM-P Home Form total score and the Short Sensory Profile total scores were moderately correlated with each other at $r = .62$. Subscale score correlations ranged from .06 to .59 with the majority of the inter-scale correlations being significant at $r > .20$ (Miller Kuhaneck et al., 2010). The correlations between the SPM-P Home Form and the Infant/Toddler Sensory Profile were generally strong with correlations ranging from .04 to .53 with the majority of inter-scale correlations being $r > .25$ (Miller Kuhaneck et al., 2010).

The convergent validity of the SPM-P School Form was examined by correlating it with the Sensory Profile School Companion (Dunn, 2006) using a sample of 20 children (16 boys and 4 girls). Correlation results were generally supportive of the convergent validity between the two sensory processing scales. Inter-scale correlation coefficients ranged from .07 to .64 with the majority of them being $> .44$ (Miller Kuhaneck et al., 2010).

Discriminant validity was demonstrated for the SPM-P based on the data from a separate group (other than the standardization sample) of 242 children receiving occupational therapy

intervention. The SPM-P subscales and items were able to differentiate between typically healthy from those with a known clinical diagnosis including autism spectrum disorder (ASD) (Miller Kuhaneck et al., 2010). "Even at the item level, the SPM-P shows robust capacity to differentiate between clinical and nonclinical groups" (Miller Kuhaneck et al., 2010, p. 63).

In the SPM-P manual, results about the sensitivity and specificity of the Home and School Forms were reported. At the cutoff score of T = 60, the SPM-P Home TOT scale had a sensitivity of .64 and specificity of .84 (Miller Kuhaneck et al., 2010). At the same cutoff score, the SPM-P School TOT scale had a sensitivity of .52 and specificity of .82 (Miller Kuhaneck et al., 2010).

Clinical Uses

The SPM-P provides invaluable information for practitioners related to the identification of and intervention with young children presenting with sensory processing difficulties. It can be used in a range of settings including clinical, community-based, child care, early intervention, early childhood education, hospital, rehabilitation, and research. The SPM-P manual notes that it can be "used as either a quick screening instrument or as one component of a comprehensive diagnostic evaluation" (Miller Kuhaneck et al., 2010, p. 13).

The SPM-P forms can be used by a variety of health and education professionals (including occupational therapists, psychologists, early childhood education teachers, social workers, counselors, physiotherapists, speech-language pathologists, nurses, pediatricians, physicians, and early intervention specialists among others) to evaluate the sensory processing issues of preschool-age children (Miller Kuhaneck et al., 2010). For example, the SPM-P's dual environment approach lets practitioners investigate why a child who functions well in a structured preschool classroom with a predictable daily routine may have problems in certain home environments. "The SPM-P can be administered by itself as a screening instrument, but the examiner should not use the results to make diagnostic or treatment decisions without first assembling the widest possible spectrum of information about the child" (Miller Kuhaneck et al., 2010, p. 4). It is recommended that other sources of information (e.g., medical records, clinical observations, interviews with parents and teachers) be accessed as well.

It has been documented that many children and adults with ASD exhibit sensory processing dysfunction (SPD) (Baker, Lane, Angley, & Young, 2008; Baranek, Parham, & Bodfish, 2005; Baranek, David, Poe, Stone, & Watson, 2006; Dunn, 2010; Kientz & Dunn, 1997; Leekam, Nieto, Libby, Wing, & Gould, 2007; Rogers, Hepburn, & Wehner, 2003; Tomchek & Dunn, 2007; Watling, Deitz, & White, 2001). The SPM-P manual states that "with moderate to severe autism, it is not uncommon to see all SPM-P scales elevated in the Definite Dysfunction range" (Miller Kuhaneck et al., 2010, p. 25). It is typically expected that children diagnosed with ASD will have elevated scores on the SOC and PLA subscales. Difficulties in social functioning are one of the hallmark diagnostic criteria for ASD, so it is anticipated that children would have poor scores on the SOC subscale while the "deficits in participation and praxis may be caused or exacerbated by processing deficits in specific sensory systems" (Miller Kuhaneck et al., 2010, p. 25).

In summary, the SPM-P is a welcome addition to the range of tools that practitioners can utilize to assess children diagnosed with or suspected of having ASD. The SPM-P hones in issues indicative of SPD. It is a companion instrument to the SPM and allows monitoring of a child's sensory processing from 2 to 12 years of age. The SPM-P is based on the same subscale structure and SI theory as the SPM, thus allowing continuity of assessment, intervention, and monitoring from preschool settings to primary school contexts. The SPM-P provides information about two different environments (home and early childhood education settings) based on the input and views of two different respondents (parent/caregiver and preschool teacher). This feature of the SPM-P also fits with the principles of family-

centered practice since the opinions, input, and views of parents and care givers are solicited. The ease of scoring and interpreting the results is another attractive characteristic of the SPM-P. These features make it easier for practitioners to explain test results and engage parents in the intervention process.

Both the SPM and SPM-P can be used for evidence-based practice, scientifically based research, differentiated instruction, and monitoring of progress of a child receiving services (Miller Kuhaneck et al., 2010). The SPM-P also has extensive reliability and validity data reported about it in its manual. However, given that it is a relatively new measure, it is recommended that the SPM-P be investigated more closely by external reviewers and investigators so that a related body of psychometric knowledge can be developed about the scale. The SPM-P is highly recommended for use by practitioners who work with children diagnosed with ASD.

See Also

- Occupational Therapy (OT)
- Sensation Avoiding
- Sensation-Seeking
- Sensory Diet
- Sensory Experiences Questionnaire
- Sensory Impairment in Autism
- Sensory Integration (SI) Therapy
- Sensory Processing
- Sensory Processing Assessment
- Sensory Sensitivity Questionnaire: Revised
- Sensory Stimuli
- Standardized Tests

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Sensory Seeking

► Sensation-Seeking

Sensory Sensitivity Questionnaire: Revised

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Synonyms

SSQ-R

Description

The SSQ-R was developed as a preliminary tool with the specific aim of informing formal methods of assessing "the nature and extent of sensory hyper- and hypo-sensitivities across all modalities in children with autism" in comparison to neurotypical peers (Talay-Ongan & Wood, 2000, p. 203). This parent-completed questionnaire includes a total of 54 close-ended items, 9 in each of 6 sensory domains: auditory, visual, tactile, gustatory, vestibular, and olfactory. Items from each modality are randomly distributed within the questionnaire. Respondents rate each item *yes* or *no* based on behaviors typically displayed by the child. Descriptive comments can be recorded for each item at the discretion of the respondent. Example items include:

- My child seems oblivious to (often bad) odors.
- Certain sounds appear to be painful to my child.

Only one paper using the SSQ-R was published in the literature though May 2011.

Historical Background

The Sensory Sensitivity Questionnaire-Revised (SSQ-R) was developed through a process involving a review of caregiver-report questionnaires of sensory-based performance and

behavior by Bettison (1992, 1994), Edelson (1992), and Ayres (1979). Thirty-seven items were selected, revised, and grouped into auditory, visual, tactile, gustatory, olfactory, and vestibular domains. The resulting 37-item measure was pilot tested on a small sample of nine children with autism and age- and gender-matched controls in Australia. Twenty-two items on the initial version were found to discriminate between the children with and without autism in the sample. These 22 items were retained. The remaining items were revised based on qualitative comments provided by the pilot study participants. Additional items were developed through further analysis of the sources originally consulted during test development in order to have an equal number of test items in each sensory domain. The resulting 54-item questionnaire is titled the Sensory Sensitivity Questionnaire-Revised (SSQ-R).

Psychometric Data

Psychometric investigation of the SSQ-R is limited. Authors state that content validity is assumed because items describe behaviors believed to reflect sensory hyper- or hyposensitivities. Concurrent validity is also assumed due to the substantial similarities to other tools examining the same processes. The one published study that examined the SSQ-R reported that 45 of the 54 items were found to discriminate between children with autism and those with neurotypical development using a Cronbach's coefficient alpha criteria of 0.95 (Talay-Ongan & Wood, 2000).

Clinical Uses

The close-ended, yes/no response for each item makes this tool likely easy and quick to use. However, it is currently available through the author only; therefore, it is unlikely to be encountered in clinical documentation, though it may be more heavily used in the region where the tool was developed.

See Also

▶ Tactile Defensiveness
▶ Touch Sensitivity

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Sensory Stimuli

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Definition

A sensory stimulus is any event or object that is received by the senses and elicits a response from a person. The stimulus can come in many forms such as light, heat, sound, touch, as well as from internal factors. Sensory stimuli can be perceived by the auditory, tactile, visual, gustatory, proprioceptive, and vestibular systems. One characteristic of people with ASD is difficulty with perceiving stimuli as the information is often interpreted differently by the person's brain. Unusual responses to sensory stimuli are typically referred to as hypo- or hypersensitive reactions. "Dunn (1997) described the unusual sensory reactions of children by defining

hyper-reactivity as having a lowered threshold to sensory input (sensory avoiding), or low tolerance to sensory input (sensory sensitivity), and hypo-reactivity as a higher threshold to sensory input (poor registration) or seeking out sensory input (sensory seeking)" (Jasmin et al., 2008).

See Also

- ▶ Sensory Impairment in Autism
- ▶ Sensory Processing
- ▶ Stimulus

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Sensory System for Sense of Hearing

- ▶ Auditory System

Sentence Structure

- ▶ Syntax

Separate Classroom

- ▶ Self-contained Classroom

Separation Anxiety Disorder

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Synonyms

SAD

Short Description or Definition

Separation anxiety disorder (SAD) is characterized by excessive fear of separation from a person to whom a child is attached (American Psychiatric Association [APA], 2000). Children with SAD usually worry that if separated from a significant person (usually a parent) something bad will happen to them, such as being kidnapped. Additionally, they may worry that something bad will happen to the attachment figure, such as injury or death. Physical symptoms when separation is anticipated coincide with such worries (e.g., stomachaches). The disturbance stemming from SAD symptoms causes significant interference in the child's home, social, or school life. For a diagnosis of SAD (APA, 2000), individuals must experience these symptoms for at least 4 weeks and have an onset before 18 years of age. This area of anxiety is commonly experienced, at a clinical level, by children and youth with ASD.

Categorization

SAD is categorized as a childhood anxiety disorder in the DSM-IV-TR. It is one among a variety of child onset disorders.

Epidemiology

Rates of anxiety disorders in the ASD population have varied between 11% and 84% (Muris, Steerneman, Merkelbach, Holdrinet, & Meesters, 1998; Simonoff et al., 2008). Incidence rates of SAD in the ASD population vary from 0.5% to 19% (Leyfer et al., 2006; Mattila et al., 2010; Simonoff et al., 2008; Sukhodolsky et al., 2008). A review of prevalence rates in typically developing children indicates rates of SAD to be between 0.5% and 20.2% (Cartwright-Hatton, McNicol, & Doubleday, 2006). In a comparison study of school-age children with and without a pervasive developmental disorder (PDD), Gadow and colleagues (2005) found similar SAD symptom prevalence rates based on parent report in the PDD clinical sample and the non-PDD clinical sample.

Research indicates that SAD may occur more frequently in children with ASD who have higher cognitive functioning (IQ $>$ 70; Sukhodolsky et al., 2008). Of children with ASD and greater cognitive ability, 19% were found to have a co-occurring SAD. SAD commonly presents comorbidly with other anxiety disorders such as generalized anxiety disorder and social phobia.

Natural History, Prognostic Factors, and Outcomes

Little is known about the natural history of SAD in the ASD population. In the typically developing population, many factors such as genetics, anxious temperaments, certain parenting behaviors, and stressful life events are thought to influence the development of anxiety disorders, particularly SAD (Craske, 1999; Eeves et al., 1997; Rapee, 2001; Wood, 2006). One recent treatment demonstrated that improvements in a putative parenting mechanism linked with SAD (intrusiveness) over the course of the acute phase of intervention mediated a reduction of anxiety in school-age children at a 1-year follow-up assessment (Wood et al., 2009). It is hypothesized that when parents take over tasks that children could do for themselves (intrusiveness), it reduces children's self-efficacy for effective action when away from parents, heightening separation anxiety (Wood, 2006). Interestingly, intrusive behaviors are associated specifically with SAD symptoms and not other anxiety disorders. The initial clinical evidence from this treatment study highlights the possibility of a dynamic (reversible) effect of intrusive parenting on SAD, but it does not imply that such parenting initially caused the anxiety. Little is known about prognostic factors for SAD in individuals with ASD.

For children with ASD, preliminary studies of CBT for the treatment of anxiety, including SAD, in individuals with ASD have shown positive outcomes with similar rates of anxiety remission as observed among typically developing children with anxiety disorders (Chalfant, Rapee, & Carroll, 2007; Reaven et al., 2009; Sofronoff, Attwood, & Hinton, 2005; Wood et al., 2009a, 2009b). Although various studies have shown positive responses to CBT, the studies have not specifically examined SAD separately. These studies have treated multiple anxiety disorders, given the finding that most children with ASD referred for treatment have multiple anxiety disorders, not just SAD. Further research is needed to determine what factors are associated with treatment outcomes for SAD symptoms, specifically.

Clinical Expression and Pathophysiology

Children with SAD experience specific cognitive, behavioral, and physiological manifestations of anxiety related to separation (APA, 2000). While separation anxiety is normative in infants and toddlers, it typically declines once toddlers reach 30 months of age (Marks, 1987; Ehrenreich, Santucci, & Weiner, 2008). Separation anxiety past 30 months of age is atypical and can be SAD-related based on the severity of behaviors and worries. A core anxious belief in children with SAD is an excessive fear that something bad will happen to themselves or a significant person (e.g., parent) if separated, causing significant interference in family, school,

and social functioning (e.g., school failure). As a result, children may demonstrate worry when they anticipate a separation (e.g., a child may cry or beg parents not to leave upon learning of an impending separation such as a parent going to run errands while leaving the child at home). Further, there may be places children refuse to go, for example, school, because they are scared to be separated. Children often want the parent near them at bedtime until they have fallen asleep or insist on sleeping with their parents (co-sleeping). It is, of course, important to disentangle whether co-sleeping is a deviation from cultural or family expectations in determining whether this behavior may reflect SAD. Children may be afraid to be alone in their house or in parts of their house even when family members are at home (e.g., child is afraid to be in the bedroom when family is in the living room). They may follow family members around the home or request to be accompanied to different rooms in the home. Children also often have bad dreams about being separated from loved ones, such as being lost, or being caught in a natural disaster. These persistent fears and worries cause significant distress, and some children experience accompanying physical symptoms such as nausea, vomiting, and headaches.

Sze and Wood (2007) conducted a case study of an 11-year-old girl with concurrent ASD and SAD and described common fears that children with ASD and SAD experience. The youngster was reluctant to be separated from her parents due to worries that she would be kidnapped or that her parents would be killed while they were apart. She would repeatedly call her parents, up to 20 times a day, when they were away from her. Further, during the night, she would frequently join her parents to sleep in their bed. She would not stay over at her grandparents' house or engage in age-appropriate social activities such as sleepovers due to fear of separation from parents.

Evaluation and Differential Diagnosis

Evaluation of SAD in individuals with ASD is still largely conducted with instruments developed for use in the typically developing population. SAD is commonly assessed with semi-structured interviews based on DSM-IV criteria, which involve clinicians, parents, and children. In such semi-structured interviews, clinicians ask the parent and child questions concerning the child's anxiety and distress when separation is anticipated. Further questions focus on worries that the child might have prior to and during a separation, with particular focus on worries about harm befalling the child or parent during a separation. Additional questions focus on avoidance or refusal to go places without parents and avoidance or refusal to go to sleep without their parents. Interviews also include questions on physical symptoms that may occur in conjunction with these worries. After gathering information on specific symptoms, clinicians ask about the impact these anxiety symptoms have in home, social, or academic life. For example, parents may be unable to leave their child with a babysitter or to be in a separate room from their child while in their house, often resulting in considerable conflict among multiple family members. Additionally, SAD-related symptoms can significantly interfere with children's social life if they avoid play dates or cry in front of friends at separation situations like school drop-off. Further, SAD-related symptoms such as intermittent or chronic school refusal can significantly interfere with a child's academic life. To meet DSM-IV-TR diagnostic criteria for SAD, children must exhibit three of the core symptoms for at least 4 weeks and demonstrate significant interference in child's home, social, or academic life or experience significant distress related to the anxiety symptoms.

In addition to clinical interviews, parent, teacher, and self-reports of these behaviors are useful in evaluating a child for SAD. Although there are often discrepancies among reporters and inter-rater agreement can be modest, such measures are useful in gaining a full understanding of the child's behaviors in different settings. Few measures have been specifically developed to assess SAD in the ASD population, although the Child and Adolescent Symptom Inventory (CASI) developed by Gadow and Sprafkin

(1994, 1997) does contain a SAD subscale. Research is beginning to show, however, preliminary evidence for the validity of measures established in the typically developing population in the ASD population (Chalfant et al., 2007; Wood et al., 2009).

The Anxiety Diagnostic Interview Scale for DSM-IV – Child and Parent (ADIS C/P; Silverman & Albano, 1996) is a frequently used semi-structured interview conducted separately with the child and parent in order to assess the child's level of anxiety with regard to several different anxiety disorders, including SAD, and has been used in ASD samples (e.g., Chalfant et al., 2007; White et al., 2009; Wood et al., 2009a). The ADIS has very favorable psychometric properties in the typically developing population (e.g., Wood, Piacentini, Bergman, McCracken, & Barrios, 2002) with preliminary evidence of acceptable inter-rater reliability and treatment sensitivity in ASD (Chalfant et al., 2007; Wood et al., 2009a, b). From the interview, severity scores are generated for each anxiety diagnosis, ranging from 0 to 8 (with higher scores representing more anxiety and a 0 representing no diagnosis), for each anxiety disorder diagnosis. A score of 4 (moderate) or greater is deemed as clinically significant.

The Multidimensional Anxiety Scale for Children – Child and Parent (MASC C/P; March, 1998) is another measure commonly used in the ASD population to assess anxiety. The MASC is a 39-item paper and pencil measure where children and parents rate the child's level of anxiety on a 4-point Likert scale. The MASC is composed of four subscales, including physical symptoms, social anxiety symptoms, harm avoidance, and separation. The MASC has robust psychometric properties in typically developing samples (March, Parker, Sullivan, Stallings, & Conners, 1997); however, its validity in ASD samples is still being determined (Bellini, 2004; White, Ollendick, Scahill, Oswald, & Albano, 2009).

Evaluation of SAD in the ASD population is complicated by the wide variability in ASD symptomology (Bellini, 2004; Wood & Gadow, 2010). Similar to other psychiatric conditions, it can be difficult to tease apart SAD symptoms from ASD symptoms. Characteristics associated with ASD such as social difficulties, adherence to routines, and lower adaptive functioning skills may complicate recognition of SAD in these individuals. For example, not partaking in play dates may be symptomatic of SAD if avoidance is due to worries about being separated from a parent and not just symptomatic of ASD-related social deficits. Additionally, adherence to particular bedtime routines may be symptomatic of SAD, and not just ASD, if the bedtime routine requires that the parent staying close to the child throughout the night. Parent assistance in daily living skills due to SAD-related fears (not wanting to separate from parent) also can be distinguished from parent assistance due to lower adaptive functioning skills. For example, a child may need assistance bathing due to lower adaptive skills (ASD-related) or the parent may be providing assistance because the child insists that the parent be in the same room as him or her (SAD related). Diagnosticians must be skilled in distinguishing between ASD- and SAD-related symptoms to determine the possible impact of SAD on a child's functioning. In addition, there is still considerable controversy over whether "true" psychiatric syndromes occur in the ASD population or if they are an extension of the ASD diathesis (see, e.g., Wood & Gadow, 2010). More research is needed to describe the relation between ASD, SAD, and other psychiatric conditions.

Treatment

Various treatments have been suggested for SAD in the ASD population. There is preliminary evidence for the efficacy of modified cognitive behavioral therapy (CBT) in treating SAD in children with high-functioning autism (HFA; Chalfant et al., 2007; Reaven et al., 2009; Sofronoff et al., 2005; Wood et al., 2009). Traditional CBT for typically developing children often consists of psychoeducation and coping skills training. Once new coping skills have been taught, sessions consist of practicing these new skills in increasingly feared situations (Barrett, Dadds, & Rapee, 1996; Kendall et al., 1997).

Enhancements of CBT for individuals with ASD address common impairments associated with ASD in social communication, perspective taking, and understanding of emotions and social cues (Sze & Wood, 2007, 2008). There is often an additional emphasis on increasing self-help skills, using cartoons to convey emotions and thoughts, and creating a reward system to increase motivation. Special interests have also successfully been incorporated into treatment to teach coping skills and increase motivation (Sofronoff et al., 2005; Sze & Wood, 2007, 2008; Wood et al., 2009).

In the case study by Sze and Wood (2007), a modified CBT treatment plan was effective in treating SAD in an 11-year-old girl also diagnosed with ASD. Characteristic of CBT treatment began with psychoeducation and coping skills training. To address some of the client's ASD-related symptoms, which can interfere with traditional CBT practices, the therapist used more concrete spoken language and placed a greater emphasis on role playing and visual materials. Additionally, she illustrated abstract concepts using simpler terms and the client's special interests as examples. Further, the therapist employed an interactive rather than didactic style of communication during sessions. A modification of CBT that may be particularly important for the treatment of SAD in the ASD population was the incorporation of work on independent living skills (also see Drahota, Wood, Sze, & Van Dyke, 2011). The therapist encouraged the parent to gradually reduce the level of assistance in self-help skills and offer choices to increase child's confidence and self-efficacy. After the psychoeducation and skills training components, the therapist developed an anxiety hierarchy with the family to serve as a treatment plan for the rest of the sessions. This hierarchy not only included items pertaining to the child's anxiety and fears but also ASD symptoms. Examples of items included on the participant's hierarchy for SAD were "staying at grandparents' house for 1 h without calling parents, staying at grandparents' house overnight with only one telephone call to parents, and sleeping in my own bed throughout the night without entering parents' bedroom." Additionally, items pertaining to ASD that were included on the hierarchy were "playing and eating with a target peer at recess and lunch, initiating a telephone call to a target peer, and inviting a target peer over for a play date, acting like a good host." The therapist and child discussed coping thoughts for these feared situations. The child was assigned homework to sleep independently, reduce the number of times she called her parents when they were away, and spend time at her grandparents' house gradually without calling her parents. Within 3 weeks of doing these SAD-related exposures, she no longer reported any anxiety concerning separation from her parents. SAD-related worries stayed in remittance throughout the rest of treatment, and she no longer met criteria for SAD at the posttreatment assessment.

Clinical trials that have included SAD as one of the targeted anxiety disorders have demonstrated positive outcomes with modified CBT in this population. Although specific information about the remittance rates for SAD have not been included in the trials, which include children with several types of anxiety disorders, the interventions were effective in relieving anxiety symptoms overall. Wood and colleagues (2009) conducted a randomized controlled trial to examine the efficacy of CBT in 40 children aged 7–11 years old. The treatment program included psychoeducation, coping skills training, and in vivo exposures. Additionally, therapists consulted with schoolteachers and assigned weekly homework for the child to practice at home. At the intake assessments, participants had an average of 4.18 psychiatric disorders, and at posttreatment, over half of the participants in the immediate treatment condition had remission of all anxiety disorders. Chalfant et al. (2007) also conducted a randomized controlled trial for 47 individuals aged 8–13 with HFA and anxiety disorders examining group CBT. At post-assessments, they found that significantly more children in the immediate treatment condition no longer met criteria for an anxiety disorder than the waitlist condition. Reaven and colleagues (2009) examined group CBT for individuals aged 8–14 with HFA and found significant decreases of anxiety in the immediate treatment versus waitlist

group on parent reports of anxiety. Significant decreases in parent-reported SAD symptoms were observed in the immediate treatment group at posttreatment. These studies indicated that modified cognitive behavioral therapy can be an effective treatment modality for treating anxiety disorders in children and youth with HFA.

Medication, relaxation techniques, modeling, behavior modification, and a variety of other therapies have also been explored as treatments for SAD in the typically developing population. While it is likely these practices are used in community settings for children with ASD, there has been little empirical evidence for their efficacy in the ASD population. Selective serotonin reuptake inhibitor (SSRI) medications are frequently prescribed for anxiety in children with ASD, and while there is evidence for their use in the treatment of anxiety disorders in typically developing children, no clinical trials have examined their efficacy for anxiety reduction in the ASD population. Research on effective treatments for SAD as well as other anxiety disorders in the ASD population is indicated.

See Also

► Cognitive Behavioral Therapy (CBT)

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SEQ

▶ Sensory Experiences Questionnaire

Sequential Processing

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Synonyms

Analytic processing; Serial processing

Definition

Sequential processing is the ability to take in, store, and process information in an orderly way. It is the ability to arrange separate elements into successive series (in a serial or temporal order).

Sequential processing refers to the manipulation of stimuli one at a time or feature by feature (i.e., performing a series of movements according to instructions, repeating numbers in a specific order) as opposed to simultaneous processing that emphasizes integrated input formed in holistic units (i.e., face-processing tasks, analogies).

Sequential processing enables the individual to start and complete a single task in contrast to parallel processing or multitasking.

A disorder in sequential processing may impact various areas of functioning (i.e., tasks that require the concept of first, next, last).

Individuals who have a sequential processing deficit may exhibit difficulty with word decoding skills and phonetics, grammar, breaking down arithmetic problems into their component parts, following a sequence of steps or rules, and following oral instructions (Powell, Houghton, & Douglas, 1997).

See also The Kaufman Assessment Battery for Children (Kaufman & Kaufman, 1983). The sequential processing scale of the K-ABC is a measure of problem-solving skills that emphasize sequence and the processing of information in a serial order. The simultaneous processing scale measures problem-solving skills that involve the use of several processes at the same time.

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Serax

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Synonyms

Oxazepam

Definition

Oxazepam is a benzodiazepine. The mechanism of action is complicated, but it has been shown that the benzodiazepines bind to specific GABA receptors in the brain and enhance a GABA function. GABA is a primary inhibitory neurotransmitter in the brain. The effect of the benzodiazepines is to promote the influx of chloride ions in specific brain areas. This is the mechanism by which it enhances the inhibitory effects of GABA. Oxazepam is used primarily to treat anxiety disorders, but may also be used as a sleep medication.

See Also

► Benzodiazepines

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Serentil

► Mesoridazine

Serial Position Effect

► Primacy Effects

Serial Processing

► Sequential Processing

Seroplex

► Escitalopram

Seroquel

► Quetiapine

Seroquel XR

► Quetiapine

Serotonin

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Synonyms

5-HT; 5-Hydroxytryptamine

Definition

Serotonin is a central and peripheral neurotransmitter and neuromodulator that also acts as a growth factor in the central nervous system during development. Serotonin is produced from the essential amino acid tryptophan after hydroxylation and decarboxylation and is degraded to 5-hydroxyindoleacetic acid (5-HIAA).

Elevated levels of platelet serotonin have been consistently reported in autism; however, the cause of the elevation has remained elusive. It is also not clear whether brain serotonin production or function is altered in autism. However, alterations in type-2 serotonin receptors in brain and platelets have been reported.

See Also

► CSF 5-HIAA
► Neurotransmitter

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Serotonin Behavioral Syndrome

► Serotonin Syndrome

Serotonin Reuptake Inhibitors (SRIs)

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Definition

Serotonin reuptake inhibitors are a class of compounds, most of which are prescription drugs, although the others are an active ingredient in over-the-counter medications, drugs for which marketing has been discontinued, compounds

that have not been marketed, compounds in herbs, and cocaine, whose mechanism of action consists of or includes the inhibition of the reuptake of serotonin (5-HT), most of which are primarily used for the treatment of major depressive disorder (MDD) in the United States, although some are also marketed for the treatment of these other conditions: obsessive-compulsive disorder (OCD), fibromyalgia (FM), generalized anxiety disorder (GAD), social anxiety disorder, diabetic peripheral neuropathic pain (DPNP), and chronic musculoskeletal pain.

Historical Background

The first psychiatric drugs whose mechanisms of action included the reuptake of 5-HT are most of the tricyclic and tetracyclic antidepressants (TCAs). The TCAs are doxepin, first marketed by Pfizer in 1969 as Sinequan; trimipramine, first marketed by Odyssey Pharmaceuticals in 1979 as Surmontil; amoxapine, first marketed by Lederle in 1980 as Asendin; maprotiline, first marketed by Novartis in 1980 as Ludiomil; clomipramine, first marketed by Tyco Healthcare in 1989 as Anafranil; imipramine, first marketed by Novartis in 1959 as Tofranil; amitriptyline, first marketed by AstraZeneca in 1961 as Elavil; nortriptyline, first marketed by Eli Lilly in 1964 as Aventyl Hydrochloride; protriptyline, first marketed by Odyssey Pharmaceuticals in 1967 as Vivactil; and desipramine, first marketed by Sanofi-Aventis U.S. in 1964 as Norpramin.

The development of this group of prescription drugs in the family of classical antidepressants began around the time tricyclic compounds were being developed for the treatment of schizophrenia. Consequently, these drugs were first tested for efficacy in the treatment of schizophrenia, although they were instead found to act as antidepressants in the patients in whom they were studied. The study of the pharmacology of the TCAs led to the development of the selective serotonin reuptake inhibitors (SSRIs), a family of antidepressants that are generally clinically favorable to the TCAs due to having significantly fewer side effects.

The first SSRI developed was zimelidine; however, its production was discontinued due to its toxicity. The subsequent SSRIs to be developed have fewer side effects than the TCAs while showing similarities in the percent of patients who respond to SSRIs as compared to the TCAs. The six SSRIs that were developed after zimelidine are fluoxetine, sertraline, paroxetine, fluvoxamine, citalopram, and escitalopram. Fluoxetine was first marketed by Lilly in 1987 as brand-name drugs Prozac and Sarafem. Sertraline was first marketed by Pfizer in 1991 as Zoloft. Paroxetine was first marketed by GlaxoSmithKline in 1992 as Paxil. Fluvoxamine was first marketed by Solvay in 1994 as Luvox. Citalopram was first marketed by Forest Labs in 1998 as Celexa. Escitalopram was first marketed by Forest Labs in 2002 as Lexapro. Most of these drugs are marketed for the treatment of MDD among other conditions, although fluvoxamine is only marketed for the treatment of OCD in the United States and Europe.

Another family of SRIs developed beginning in the 1990s is the selective serotonin-norepinephrine reuptake inhibitors (SNRIs). The four SNRIs marketed in the United States are venlafaxine, first marketed by Wyeth Pharmaceuticals, Inc., in 1993 as Effexor; duloxetine, first marketed by Eli Lilly in 2004 as Cymbalta; desvenlafaxine, first marketed by Wyeth Pharmaceuticals, Inc., in 2008 as Pristiq; and milnacipran was first marketed by Cypress Bioscience in 2009 as Savella. Duloxetine and milnacipran are not yet available as generic drugs. Milnacipran is marketed in Japan as a treatment for MDD, although it is only FDA-approved for use in the treatment of FM in the United States.

Research on the pathophysiology of depression has led to the development of SRIs outside of these three families such as the serotonin-, norepinephrine-, dopamine-reuptake inhibitors (SNDRIs) which inhibit the reuptake of 5-HT, norepinephrine (NE), and dopamine (DA). Although the SNDRIs are not currently marketed in the United States, other SRIs that are not of the families of TCAs, SSRIs, or SNRIs such as ziprasidone, trazodone, and dextromethorphan are. One SRI that was used for obesity

management and weight loss, sibutramine with the brand name Meridia, was marketed by Abbott but has been discontinued.

Current Knowledge

Three families of drugs that act as SRIs are the SSRIs, the SNRIs, and the TCAs. Most of these SRIs are generally used to treat MDD, although some of these drugs have other indications such as OCD and other anxiety disorders. Trazodone, with the brand name Oleptro, and nefazodone, formerly with the brand name Serzone, are SRIs with 5-HT_{2A} antagonist activity marketed in the United States for the treatment of depression. Other compounds that act as SRIs with 5-HT_{2A} antagonist activity have been developed but have not been marketed in the United States. Cyclobenzaprine, with the brand name Flexeril, is an SRI marketed in the United States as a short-term, adjunctive treatment to physical therapy and rest for muscle spasms associated with acute, painful musculoskeletal conditions. In addition, the opioids pethidine, tramadol, methadone, dextromethorphan, and propoxyphene may have a small amount of SRI activity. The active ingredient in over-the-counter medications dextromethorphan exhibits SRI activity as well as the compounds hyperforin and adhyperforin in St. John's wort and either mesembrine or its metabolite Δ^7 mesembrenone in *Sceletium tortuosum*. A relatively new group of compounds called SNDRIs are reuptake inhibitors of 5-HT, NE, and DA; however, these compounds are still in relatively early stages of drug development. Additionally, compounds that act as SRIs and 5-HT_{2C} antagonists have been developed but are not currently marketed in the United States. Other variations of compounds with SRI activity have been reported in the patent literature but require further testing to determine their viability as medications.

The SSRIs are the only SRIs which affect 5-HT receptors without also affecting NE. The six SSRIs that are currently marketed in the United States are fluoxetine, sertraline, paroxetine, fluvoxamine, citalopram, and escitalopram. Fluoxetine, with the brand names Prozac and Sarafem, is marketed for the treatment of MDD and OCD. Sertraline, with the brand name Zoloft, is marketed for the treatment of MDD, OCD, panic disorder, posttraumatic stress disorder (PTSD), premenstrual dysphoric disorder (PMDD), and social anxiety disorder. Paroxetine, with the brand names Paxil, Paxil CR, and Pexeva, is marketed for the treatment of MDD, OCD, panic disorder, social anxiety disorder, GAD, and PTSD. Fluvoxamine, with the brand names Luvox and Luvox CR, is marketed for the treatment of OCD in the United States and is marketed for the treatment of MDD in other countries. Citalopram, with the brand name Celexa, is marketed for the treatment of MDD. Escitalopram, with the brand name Lexapro, is marketed for the treatment of MDD and GAD. SoRI-6238 is another compound known to be an SSRI.

The SNRIs selectively inhibit the reuptake of both 5-HT and NE. These drugs are similar in clinical use to the SSRIs but have the additional effects of treating pain and physical symptoms, such as those of FM. Milnacipran, with the brand name Savella, is marketed just for the treatment of FM in the United States, although it is marketed for the treatment of MDD in Japan. Duloxetine, with the brand name Cymbalta, is marketed for the treatment of MDD, GAD, DPNP, FM, and chronic musculoskeletal pain. Venlafaxine, with the brand names Effexor and Effexor XR, is marketed for the treatment of MDD, GAD, social anxiety disorder, and panic disorder. Desvenlafaxine, with the brand name Pristiq, is marketed for the treatment of MDD. Other SNRI compounds have been developed but have not been marketed in the United States.

The TCAs are a family of SRIs which affect both 5-HT and NE as well as acting as anticholinergic or antimuscarinic agents, alpha-adrenergic antagonists, and antihistamines. Although these drugs seem to have similar efficacy to the SSRIs and SNRIs and may be more effective than those drugs, the TCAs are not as well tolerated and have more side effects than the SSRIs and the SNRIs. Clinically, the TCAs are rarely used due to their side effects. Although these compounds are named for their chemical

rings, their side chains are believed to be more important to their functions. The ten TCAs currently marketed in the United States are clomipramine, doxepin, trimipramine, amoxapine, maprotiline, imipramine, amitriptyline, nortriptyline, protriptyline, and desipramine. Different compounds have different degrees of 5-HT reuptake inhibition; for example, clomipramine exhibits a relatively high amount of SRI activity compared to other TCAs.

Clomipramine, with the brand name Anafranil, is marketed for the treatment of OCD. Doxepin, marketed under the brand name Sinequan, is labeled for use as a treatment for psychoneurotic individuals, alcoholic individuals, individuals with an organic disease with comorbid depression, anxiety, or both; and for individuals with psychotic depressive disorders with anxiety. A formulation of doxepin is also marketed with the brand name Silenor to treat insomnia, and a cream with doxepin hydrochloride as its active ingredient marketed with the brand name Zonalon is marketed for the short-term treatment of pruritus in adults with atopic dermatitis or lichen simplex chronicus. Trimipramine, with the brand name Surmontil; amoxapine, formerly with the brand name Asendin; maprotiline, with the brand name Ludiomil; imipramine, with the brand name Tofranil; a formulation combining amitriptyline hydrochloride with perphenazine, with the brand names Triavil 2-10, Triavil 2-25, Triavil 4-10, Triavil 4-25, and Triavil 4-50; nortriptyline, with the brand name Pamelor; protriptyline, with the brand name Vivactil; and desipramine, with the brand name Norpramin, are marketed for the treatment of depression. Additionally, a formulation combining amitriptyline hydrochloride with chlordiazepoxide, with the brand name Limbitrol, is marketed as a treatment for depression associated with anxiety.

Two important safety issues must be noted with the use of SRIs. The concomitant use of SRIs and monoamine oxidase inhibitors (MAOIs) is a known cause of serotonin syndrome which is potentially lethal. Also, the use of antidepressants in children, adolescents, and young adults may increase depressive symptoms or cause the onset of suicidal ideation; therefore, the appropriate discretion must be used when prescribing SRIs in children or adolescents with depression.

Future Directions

In recent years, the development of new, more efficacious antidepressants has been attempted by combining the effects of SRIs with other pharmacological effects. The SNRIs are an example of a group of drugs whose development has begun relatively recently which combine SRI effects with NE reuptake inhibition in order to enhance antidepressant effects compared to SSRIs. Since dopamine is thought to be implicated in depression as well, research and development has begun for SNDRIs, compounds with SRI effects, NE reuptake inhibition, and DA reuptake inhibition. At least five SNDRI compounds have been developed. Other compounds being developed and investigated are SRIs and 5-HT_{2A} antagonists; at least 27 of these compounds have been developed to date. The treatment of depression with a combination of SRIs with atypical antipsychotics is another approach being investigated. Other compounds with SRI activity have reportedly been developed, but these compounds require further testing to determine their viability as medications.

See Also

- ▶ Selective Serotonin Reuptake Inhibitors (SSRIs)
- ▶ Tricyclic Antidepressants (TCAs)

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Serotonin Syndrome

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Synonyms

Hyperactivity syndrome; Serotonin behavioral syndrome

Short Description or Definition

Serotonin syndrome is a rare but life-threatening side effect of serotonin (5-HT)-enhancing substances in which overactivation of 5-HT receptors causes various physiological symptoms including diarrhea, agitation, autonomic instability, and cardiovascular collapse.

Categorization

It is a syndrome consisting of mental, autonomic, and neurological disorders.

Epidemiology

Serotonin syndrome is rare, and some reported cases of neuroleptic malignant syndrome (NMS) may actually have been serotonin syndrome since these two syndromes present with similar symptoms and physicians are less familiar with serotonin syndrome than NMS. Although little is known about the prevalence of serotonin syndrome, one retrospective study showed that 4 of the 17 patients using lithium and paroxetine concomitantly developed the syndrome.

This syndrome is more common in individuals taking selective serotonin reuptake inhibitors (SSRIs) than in the general population. Risk factors include dehydration, agitation, and organic cerebral disorders. Onset occurs within 24 h of the administration of the causal agent or agents for all ages and both sexes.

Natural History, Prognostic Factors, and Outcomes

Serotonin syndrome is thought to be caused by the overstimulation of 5-HT_{1A} receptors and potentially involves 5-HT_2 agonists, catecholamines, dopamine (DA), and/or tryptamine as well. Serotonin syndrome is caused by overdose of 5-HT precursors or agonists or the concomitant use of at least two compounds from these groups: serotonin precursors or agonists, serotonin-release

stimulators, serotonin reuptake inhibitors (SRIs), and compounds that inhibit 5-HT metabolism in a nonspecific manner including monoamine oxidase inhibitors (MAOIs) and cocaine. Although the current theory regarding the pathophysiology of serotonin syndrome suggests that MAOI-B agents would not precipitate or contribute to serotonin syndrome, evidence suggests that any of the clinically available MAOIs can cause serotonin syndrome. Venlafaxine, trazodone, nefazodone, MAOIs, lithium, tryptophan, meperidine, sumatriptan, buspirone, amphetamines, and SSRIs have been reported to have caused serotonin syndrome. Serotonin syndrome may also result from the concomitant use of an SRI and methylene blue. Onset of symptoms is abrupt and occurs less than 24 h after the causal agent enters the body. When in mild to moderately severe form, serotonin syndrome usually resolves within 24–72 h although symptoms may last weeks without progression and end when the serotonergic agents are removed. This syndrome may result in death.

Clinical Expression and Pathophysiology

The pathophysiology of serotonin syndrome is not well understood, but excessive activation of serotonin receptors, mainly the 5-HT_{1A} receptors, is thought by many to occur in serotonin syndrome. Other agents which may be involved in the pathophysiology of serotonin syndrome include 5-HT_2 agonists, catecholamines, dopamine (DA), and tryptamine. In serotonin syndrome, the following symptoms are experienced in the order listed: diarrhea; restlessness; agitation, hyperreflexia, autonomic instability; myoclonus, seizures, hyperthermia, shivering, rigidity; delirium, coma, status epilepticus; cardiovascular collapse; and death.

The main symptoms of serotonin syndrome are altered consciousness, autonomic instability, and neuromuscular abnormalities. Observed symptoms include agitation, tremor, myoclonus, hyperreflexia, tremulousness, dysarthria, incoordination, headache, abdominal cramping, bloating, diarrhea, sweating, flushing, delirium, hypomanic symptoms, racing thoughts, pressure of speech, elevated/dysphoric mood, confusion, disorientation, lethargy, diaphoresis, fever, hyperthermia, elevated blood pressure, tachycardia, hypotension, hypertension, and cardiovascular collapse resulting in death.

Evaluation and Differential Diagnosis

Since no single diagnostic test exists for serotonin syndrome, multiple approaches to the differential diagnosis of this syndrome exist. The three components of a differential diagnosis of serotonin syndrome are a history of the use of a serotonergic agent, the presence of signs or symptoms associated with serotonin syndrome, and the absence of other similar conditions such as NMS. Physicians may consult the Radomski criteria for diagnostic criteria of serotonin syndrome (Radomski, Dursun, Reveley, & Kutcher, 2000).

Both certain diseases and poisonings should be ruled out for a differential diagnosis of serotonin syndrome. The conditions that should be ruled out are catatonia, severe dystonic reaction, encephalitis, hyperthyroidism, malignant hyperthermia, meningitis, NMS, septicemia, stiff man syndrome, herpetic encephalopathy, myocardial necrosis, delirium tremens, and tetanus. The poisonings that should be ruled out are poisonings with adrenergics, anticholinergics, amphetamines, cocaine, 2,4-dichlorophenoxyacetic acid, dinitrophenol, lithium, lysergic acid diethylamide (LSD), MAOIs, pentachlorophenol, phencyclidine (PCP), salicylates, strychnine, and water hemlock. Ruling out NMS is important since it presents in a manner similar to serotonin syndrome. Laboratory tests are indistinguishable between these two syndromes. A drug history including prolonged exposure to neuroleptic agents or discontinuation of dopamine (DA) agonists, lead pipe rigidity, and absence of mydriasis would indicate a diagnosis of NMS as opposed to that of serotonin syndrome.

Treatment

Prevention of serotonin syndrome is attempted by avoiding the concomitant use of SRIs and MAOIs and allowing time between discontinuation of one of these types of drugs and the initiation of treatment with a drug of the other type. At least 2 weeks must be allowed before beginning an MAOI after discontinuing most SSRIs, although at least 5 weeks must be allowed before beginning an MAOI after discontinuing fluoxetine. At least a few days must be allowed before beginning and MAOI after discontinuing a tricyclic antidepressant (TCA).

Treatment consists of the discontinuation of offending agent and the use of intensive care measures as needed while waiting for the syndrome to resolve. Benzodiazepines, cyproheptadine, chlorpromazine, methysergide, propranolol, nitroglycerine, dantrolene, anticonvulsants, mechanical ventilation, paralyzing agents, and cooling blankets may be utilized to aid in treatment. Supportive care is sufficient in all but severe cases. In severe cases, therapeutic agents can be used, although none of them have shown clear and consistent efficacy for the treatment of serotonin syndrome.

See Also

- ▶ Antidepressant Medications
- ▶ Serotonin Reuptake Inhibitors (SRIs)

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Sertraline

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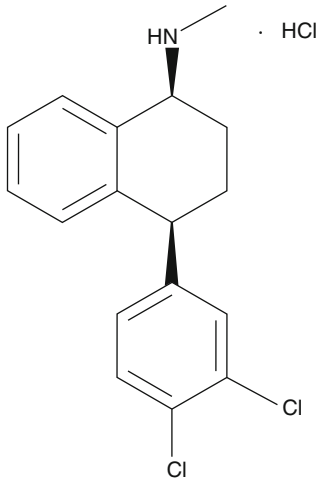
Synonyms

Sertraline hydrochloride; Zoloft

Definition



Sertraline is a prescription drug in the group of selective serotonin reuptake inhibitors (SSRIs) in the family of antidepressant medications whose active ingredient sertraline hydrochloride has the chemical formula $C_{17}H_{17}NCl_2$•HCl. This drug was initially FDA-approved for medical use in the year 1991. This drug is FDA-approved for the treatment of major depressive disorder, obsessive-compulsive disorder (OCD), panic disorder with or without agoraphobia, posttraumatic stress disorder (PTSD), premenstrual dysphoric disorder (PMDD), and social anxiety disorder. Risks include onset of suicidal ideation and increased depression in major depressive disorder. Observed side effects include nausea, diarrhea/loose stools, insomnia, somnolence, headache, dry mouth, ejaculation failure, and decreased libido.

See Also

► Antidepressant Medications

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Sertraline Hydrochloride

► Sertraline

Service

► Employment

Service Delivery Model

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Definition

Service delivery model refers to a set of practices, organized around a conceptual framework, that promote the development, learning, or welfare of individuals with autism spectrum disorders (ASD) and their families (i.e., this entry will not address health services). "Model" implies that a clearly articulated organization of practices exist; "service" indicates that the treatment, intervention, or therapy practices that individuals with autism receive are specified, and "delivery" specifies that there is a method for implementing the service(s) and documenting the quantity

and/or quality of the implementation. This definition may be construed broadly or in more discrete terms.

When construed broadly, service delivery model may refer to provisions of service specified by a governmental agency, insurance company, or other human service agency. For example, the Individuals with Disabilities Improvement Education Act (IDEIA) funds services to students with disabilities, including ASD, enrolled in public school programs and infants and toddler with disabilities enrolled in early intervention programs (http://idea.ed.gov/). Medicaid agencies within states create waivers that provide funds for service for Individuals with ASD (http://www.cga.ct.gov/2007/rpt/2007-R-0319.htm). Similarly, in some states, insurance companies fund services for individuals with ASD, such as speech and language therapy or early intensive behavioral intervention (Young, Ruble, & McGrew, 2009).

Format for Service Delivery

Intervention and treatment services for children and youth with ASD may be delivered in different formats. *Clinic-based services* occur, as the name suggests, in a clinical setting, and often, a trained therapist delivers the service to the child or youth with ASD. For example, a speech pathologist may provide speech. At times, the therapists will also work with parents to show or teach them ways of working with their child at home. An example of a clinic-based service is when a child with ASD receives discrete trial training at a treatment center, as happens for part of the Lovaas Institute model (http://www.lovaas.com/about.php), or a child and family attend clinic-based sessions for developmental therapy as occurs with the DIR model (http://www.icdl.com/dirFloortime/overview/GuidelinesforComprehensiveApproach.shtm).

Services may also be delivered in the *home or community* setting. In such service delivery models, a therapist or home visitor may travel to the child's home and work directly with the child, work with the parent to teach her or him to deliver the intervention, or a combination of the two. The content and purpose of these programs vary considerably. For example, Devlin and Harber (2004) had described home-based programs in which the parent delivers discrete trial training intervention for their children with ASD. In contrast, other home-based service models consist of home visitors who support families in promoting communication during natural routines and play (Wetherby & Woods, 2006).

A third type of service delivery model is through the *school-based* programs. In this model, children with ASD attend and participate in classes that may be specially designed for students with ASD or that exist in inclusive general education settings. In these service delivery models, the class is led by a teacher and other professionals provide related service at the school. These are the types of services prescribed by the public schools and supported by IDEIA, mentioned previously. A variation on this public school service model occurs in high school, when adolescents with ASD are involved in community independence and vocational training (Bambara, Wilson, & McKenzie, 2007).

A fourth type of service delivery model occurs for adults with ASD during the post-school years. The needs of adults with ASD vary and so do the services. In some communities, agencies provide support and options for residence outside of the family's home, and options may range from group homes to independent community residence with support (Stancliffe, Emerson, & Lakin, 2004). In addition, a goal for many adults with ASD is supported or independent employment, and agencies may provide vocational skills training and supported employment in the community (Mank, 2007).

In addition, often there are combinations of the service delivery model just noted. For example, Project DATA (Schwartz, Sandall, McBride, & Boulware, 2004) is an early intervention program for children with ASD that operates in a classroom setting, but in which children with ASD also received individual discrete trial training and a home-based component in which staff visit the home to work with the parents on a regular, frequent basis.

Comprehensive Treatment Programs as Service Delivery Models

The more discrete definition of service delivery models refers to intervention or treatment programs that include specifically articulated practices, procedures for assessing implementation, evidence of replication (or use in more than one site), and often evidence of efficacy (Odom, Boyd, Hall, & Hume, 2010). These programs have been also called "comprehensive treatment models" (Odom, Rogers, McDougle, Hume, & McGee, 2007) or "brand-name" programs (National Research Council, 2001).

Historical Background

The initial mode of treatment services for children with ASD were institutional (Kanner, 1971), often having a psychodynamic orientation (Ruttenberg, 1971). A controversial program established by Bruno Bettelheim (1967) in the 1950s–1960s was based on removing children from the purportedly damaging influence of their "refrigerator" mothers, with these services again delivered in a residential setting. Partly in reaction to the psychodynamic approach and also changing theoretical perspectives in the field, other models emerged in the 1960s. The two emerging treatment models of the time were the "Lovaas" model (Lovaas, 1971) and the TEACCH (Treatment and Education of Autistic and Related Communication Handicapped Children) model (Mesibov, Shea, & Schopler, 2004). The Lovaas model, which first was known as the UCLA Young Autism Program (Lovaas, 1996) and then the Lovaas Institute model, is based on the application of the principles of applied behavior analysis. Its most prominent feature is the use of discrete trial training, although the current Lovaas Institute model includes a wider range of practices. The TEACCH model follows a psychoeducational and social learning theory theoretical framework, incorporates a "structured teaching" approach (Schopler, Brehm, Kinsbourne, & Reichler, 1971), and proposed, early on, to incorporate parents as the "therapists" for their own children with ASD (Schopler & Reichler, 1971).

From the 1980s to early 2000s, comprehensive treatment models continued to develop and followed a broader array of theoretical and conceptual frameworks. For example, the Pivotal Response Treatment model (Koegel & Koegel, 2006) and the Walden model (McGee, Morrier, & Daly, 1999) followed a more "naturalistic" application of applied behavior analysis. The LEAP (Learning Experiences: An Alternative Program for Preschoolers and their Parents) model (Hoyson, Jamieson, & Strain, 1984) incorporated early childhood education orientation, typically developing children, and the application of applied behavior analysis. The DIR model developed by Greenspan and going by the popular name of Floortime followed a clinical, "relationship-based" process (Greenspan & Weider, 2006). The Early Start Denver model, also known just as the Denver model, incorporate both developmental and behavioral principles in a clinical (Dawson et al., 2010) and also school-based format (Rogers, Hall, Osaki, Reavens, & Herbison, 2001).

In the early 2000, the National Academy of Sciences convened a committee to review educational programs for students with ASD, and they identified models that they called "brand-name" programs because individuals often referred to them by the developer's name or an acronym established for the program (e.g., "the Lovaas model," "Walden," TEACCH, LEAP, etc.). The committee concluded that although these service delivery models/comprehensive treatment programs were identifiable and clearly existed, with the exception of the UCLA Young Autism Project, studies addressing the efficacy of these programs were limited.

Current Knowledge

In the ensuing years, comprehensive treatment models continued to be developed and appeared in the literature. In a set of books edited by Handleman and Harris (2006, 2008), developers

of comprehensive treatment models described approaches for preschool and school-age children with ASD and their families. To examine the cohesiveness of comprehensive treatment models for young children with ASD, Odom et al. (2010) searched the literature and identified 30 programs. They classified these programs as applied behavior analysis (ABA)-Clinic or Home (e.g., Lovaas Institute, Pivotal Response Treatment), ABA-Classroom Based (e.g., May Institute, Princeton Child Development Institute), ABA-Inclusive (e.g., LEAP, Walden model), Developmental and Relationship-Based (e.g., Early Start Denver model, SCERTS [Social Communication, Emotional Regulation, and Transaction Support]), and Idiosyncratic (e.g., TEACCH, Miller Method). Odom et al. concluded that as a group, programs were strongest in their specification of practices and content inherent in their models and replications by other sites. They were relatively weak on measurement of implementation and evidence of efficacy.

In a review of the literature that examined the evidence of efficacy of comprehensive treatment models, Rogers and Vismara (2008) found that the Lovaas Institute model has the strongest evidence of efficacy, and the Pivotal Response Treatment has emerging evidence. Conducting one of the most comprehensive reviews of the research literature, the National Standards Project (2009) found evidence for "established" comprehensive treatment models and focused intervention practices. They identified Comprehensive Behavioral Treatment for Young Children and Pivotal Response Treatment as two comprehensive approaches that met their criteria for "established treatments." Also, they identified developmental relationship-based treatment as an emerging treatment (i.e., some positive evidence, but not enough to meet the criteria for established treatment). A review issued by the What Works Clearinghouse (http://ies.ed.gov/ncee/wwc/reports/ece_cd/lovaas_model/index.asp), however, found that the Lovaas model had potentially positive effects on cognitive development, but no discernible effects on communication/language, social-emotional, or functional behavior.

Future Directions

The field of treatment service delivery has been pushed by the search for the most effective practices for children and youth with ASD and their families. In the past, efficacy research on comprehensive treatment models and services has been limited by funding opportunities. Efficacy studies are expensive, especially if they are school-based and require random assignment of classrooms or buildings rather than individual children and families. Currently more avenues for funding exist for efficacy and effectiveness studies (i.e., through NIH, HRSA, and the Institute for Education Science), and in the future, there will be more scientific evidence documenting the effects of comprehensive treatment models as well as comparison of the relative effects of different models.

With greater confidence in the efficacy of specific treatment and service models will come the desire to "scale up" the implementation of these models. Implementation science (Fixsen, Naoom, Blase, Friedman, & Wallace, 2005) has made great inroads into examining factors affecting the use of model features and quality of service in a variety of fields of human service areas (Durlak & DuPre, 2008). In the future, not only will the specific practices within models be critical for determining the impact of the services provided, other implementation factors such as professional development and training, coaching, and administrative support will separate the effective from the ineffective delivery of services to individuals with ASD and their families.

In the past, the majority of the research and development related to service delivery models has occurred at the early childhood and elementary levels. With the increasing awareness of ASD across the age span has come the recognition of the need for treatment and service delivery models for middle school, high school, and adulthood (Interagency Autism Coordinating Committee, 2011). In their strategic plan, the Interagency Autism Coordinating Committee (2011) has identified high school programs for students with ASD as one critical area of need. Effective comprehensive treatment and service models will undoubtedly emerge in the future.

As in every area of life in the twenty-first century, technology will impact the future of treatment and service delivery for individuals with ASD. At the individual level, treatment models and services will design personal technology (e.g., iTouch, Pads, personal organizers) that fosters independence. For example, iPods have been used to prompt individuals through schedules for their school day (Cihak, Gahrenkog, Ayres, & Smith, 2010). For students, this may foster a shift from the interpersonal to the "technopersonal" (i.e., increased communication through electronic media). In professional development, there are already websites that display online courses and modules of evidence-based practices, which will be used in training and can be the basis for treatment and service delivery (National Professional Development Center on ASD, 2011; www.npdc.fpg.edu). Following the principles of telemedicine, the easy use of videotelemetry allows supervision and coaching of professionals and parent located at remote sites (Vismara, Young, Stahmer, McMahon, & Rogers, 2009). Currently, technology is advancing faster than the treatment and service delivery science, and it will lead to great changes in the future.

See Also

- ▶ Applied Behavior Analysis
- ▶ Early Start Denver Model
- ▶ Pivotal Response Training
- ▶ Supported Employment

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Set Shifting

► Cognitive Flexibility

Setting Events

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Definition

Setting events are prior events or conditions, internal or external to the individual, that influence the probability and form of behavior presented by the individual. Setting events are related to the concepts of discriminative stimulus and establishing operation. A discriminative

stimulus is an antecedent stimulus in the presence of which a response is likely to occur because in the past, the response has been more successful in the presence of that stimulus that in the absence of that stimulus. An establishing operation (sometimes referred to as motivating operation) is an environmental event that affects the individual by momentarily altering the reinforcing effectiveness of a consequence and altering the rate or intensity of behavior that has resulted in that consequence (Michael, 1993). Typical stimulus control analyses focus on brief temporal associations between stimuli and response, focusing on stimuli contiguous with the behavior of interest. The distinction between setting events and the concepts of discriminative stimulus and establishing operation is that setting events do not refer to the simple presence or absence of discrete immediate objects or events. Setting events are more complex events that may overlap the behavior of interest or precede the behavior of interest by immediate or large temporal gaps, and setting events may include the individual's response to events. The key distinction is that the setting events might be temporally distant from the behavior of interest and that they could include stimuli within the individual. Thus setting events could occur in a wholly separate time and place, long before the behavior of interest, or they could occur while the behavior of interest is happening. The section "Current Knowledge" presents examples of setting events that may influence the behavior of individuals with autism. The events could have occurred hours or days before, or they include the behavior of the individual, yet the setting events still have an impact on the behavior of the individual (Wahler & Fox, 1981).

Historical Background

Early research in applied behavior analysis focused on the immediate antecedents and consequences of behavior. Setting events emerged from efforts to understand the potential influence of environment interactions that were not immediate (Kantor, 1959).

Current Knowledge

There are many setting events known to influence the behavior of individuals with autism. It is critical for those working and living with individuals diagnosed with autism to identify known setting events, the behavioral circumstances people recently or historically passed through. Knowledge of the individual is equally important as knowledge of autism because a specific setting event will likely be functional for some people and not for others. Parents and teachings who have a lot of experience with a specific person are the best sources for determining which setting events are influential. Knowing how a specific setting event might influence a specific behavior in the individual has the advantage of allowing time to prepare positive behavior supports (Lucyshyn, Kayser, Irvin, & Blumberg, 2002).

Examples of antecedent interventions are presented below. The emphasis on understanding how setting events influence the actions of individual people cannot be overstated. The adage, "once you have seen one person with autism, you have seen one person with autism," is quite applicable. The details of the influences of setting events are highly individualized across people with autism.

Types of Setting Events

Environmental. Characteristics of setting events in the environment may include if the setting is loud and chaotic versus quiet and orderly, a crowd of people versus a few people, daily routines versus high-rate novelty and unpredicted schedule changes, difficult demands versus previously mastered demands, demands that require a long time to complete or concurrent demands presented at a high rate versus demands that can be completed quickly (Carr, Reeve, & Magito-McLaughlin, 1996).

Physiological. Physiological setting events of greatest interest within the individual are those that make the person with autism less amenable to reinforcement, less tolerant of frustration, and more likely to engage in intense behavior reinforced by attention or escape from stress. Such events may include pain (e.g., earaches,

toothaches, sunburns, and constipation), illness (e.g., seasonal allergies), discomfort (disorienting medication), lack of sleep or fatigue, recent seizure activity (Carr & Smith, 1995), and menstruation (Carr, Smith, Giacin, Whelan, & Pancari, 2003). In some cases, setting events are related to sensory dysfunction that includes auditory, tactile, or visual defensiveness. Therefore, individual behavior may be influenced by loud, high-pitched, or sudden noise (e.g., vacuum cleaners or electronic pencil sharpeners), clothes that are too tight or too loose, seat belts that are too tight, sensations that are too gentle such as a soft touch, or light that is too bright, fluorescent, or blinking.

Social. Social setting events may have occurred earlier in the day, on the bus to school, just before or during the time of interest. These events could include interpersonal conflict, novel people, or the absences of selected people typically present (the substitute teacher syndrome).

Immediate antecedents. Discrete, immediate events that may influence the subsequent behavior of individuals with autism include failure to pass contracts or earn rewards that include preferred activities or tangible reinforcers, the delay or loss of scheduled rewards or preferred activities due to unforeseen events (e.g., cannot go on the scheduled trip to the park because of inclement weather, cannot visit a friend because they are ill), or simple instructions, demands, or requests to engage in required activity versus opportunities to choose (Carr & Newsom, 1985).

Psychological states. Finally, internal behavioral characteristics of the individual can serve as setting events that alter the reinforcing properties of consequences. Psychological states may include sad mood, stress, perseverative thinking or overfocused thoughts, specific fears, or the absence of specific stimuli. For example, a comfort item such as a blanket or a specific toy might set the occasion for desirable behavior. Conversely, the absence of the comfort item might set the occasion for intense anxious fear responses.

Functional Assessment

Knowledge of potential setting events highlights the importance of functional assessment. However, functional assessment needs to evaluate more than the current setting and the events immediately preceding the behavior. The functional assessment may need to assess events long preceding the immediate behavior of interest and behavior within the individual. In some cases, an indirect functional assessment that utilizes subjective data provided by caregivers may be more practical than an experimental functional analysis. If behavior is disrupted by global occurrences such as weather patterns (e.g., snow days that disrupt school routines), it might be systematically difficult to alter those events. However, an event that is not manipulable in an experimental sense may still affect the behavior.

Setting events are not unique to individuals with autism. What is unique is the wide range of idiosyncratic events that may serve to influence the behaviors of a person with autism and the wide range of maladaptive responses that might be evoked. The setting events described above can lead to behavior ranging from resistance to teaching to tantrums, aggression, self-injurious behavior or stereotypical repetitive behavior. It is important to avoid the temptation to seek rationale explanation for the impact of a setting event. If pencil sharpeners disturb a child, we may never know why, but that does not reduce the impact of the pencil sharpener.

Intervention

As suggested above, a functional analysis of setting events can lead directly to intervention strategies. Staff and parents may (1) prevent a stressful event from occurring or remove the person from that event before the person is exposed to the stressor, (2) ensure that specific stimuli that occasion success are present, (3) make alternate preparations to increase the likelihood of success (e.g., foreshadow an event with a student and then rehearse potential adaptive responses), or (4) program incremental exposure to setting events to increase opportunities to adapt and respond successfully.

There are advantages to interventions that focus on antecedent programming. Sometimes reinforcement procedures do not work because they are difficult to consistently apply or because

of difficulties identifying effective reinforcers. There are numerous concerns about the role of punishing consequences. In contrast, caretakers may be more willing to apply antecedent intervention. "Antecedent intervention has the purpose of preventing the occurrence of challenging behavior . . . an antecedent approach manipulates conditions to eliminate the probability of undesirable behavior" (Luiselli, 2008, p. 394). With the help of parent and teacher input, indirect or descriptive functional assessments can lead to hypothesis statements about the strength of setting events or events that correlate with behavior. The outcomes may be hypotheses that are useful in a practical sense on a daily basis.

The Setting and the Schedule

For example, teachers could assess the presence of psychological or medical states. Upon arriving at school, personnel may ask questions such as "Is he overfocused on anything today? Did he talk about seeing insects on the bus ride to school?" or "How did he sleep last night? Is his nose still stuffy?" Knowledge of a person's physiological or medical state or social interactions earlier that day may result in temporary curriculum changes (e.g., more choices, Cannella, O'Reilly, & Lancioni, 2005; preferred tasks, shorter tasks, slower pacing, Luiselli, 2008).

Knowledge of sensory dysfunction can lead to simple solutions. For example, the noise occasioned when a classroom chair slides across the floor might evoke high-rate hand flapping and an emotional tantrum. An inexpensive solution observed in many classrooms is tennis balls attached to legs of chairs, so noise is suppressed. The importance of environmental structure leads to careful consideration of predictable scheduling.

Skill building. Functional communication (O'Reilly, Cannella, Sigafoos, & Lancioni, 2006) can help teach adaptive skills when stressful settings are identified. A teacher could help a student prepare for a challenging lesson by teaching the student an adaptive response such as "I need help." In turn, the teacher could provide assistance and praise contingent on the student's request for help. If noisy settings elicit emotional reaction, in separate discrete trials, staff could gradually expose the student to incremental increases in the noise, allowing for sensory adaptation (habituation). These hypothetical strategies can emerge directly from understanding how an environmental event influences the behavior of the individual child.

Future Directions

Setting events are important, but compared with discriminative stimuli, setting events are less likely to be a focus of experimental research or a functional analysis. One reason is that setting events can occur in remote time long before the behavior of interest, and functional analysis tends to focus on the current setting or stimuli that immediately precede the behavior of interest. Another reason setting events are less considered is that functional analysis most often focuses on reinforcing consequences, whereas some setting events affect behavior regardless of the consequences. Finally, since our original understanding of the law of effect, the majority of behavior modification research has focused on manipulating consequences of behavior. Nonetheless, the advantages and successes of antecedent interventions bode well for proportionately more research.

See Also

- ▶ Applied Behavior Analysis
- ▶ Behavioral Assessment
- ▶ Functional Analysis

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Sex Chromosomes

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Synonyms

X and Y chromosomes

Definition

The sex chromosomes (X and Y) determine male (XY) and female (XX) genetic sex. The X chromosome is large and contains considerably more genetic material than the Y chromosome (155 megabases (Mb) of DNA vs. 60 Mb) (Jorde, Carey, & Bamshad, 2010). Sex-linked disorders are caused by mutations on either the X or Y chromosome and demonstrate characteristic modes of inheritance that distinguish them from disorders caused by mutations on the autosomes, or the nonsex chromosomes. For example, X-linked mutations cannot be transmitted from father to son, unlike autosomal mutations, and are more likely to affect males, because males have only one X chromosome (Jorde et al., 2010).

Because autism is four times more likely to occur in males than females and is highly heritable, studies have examined the extent to which genes found on the X chromosome might contribute to the etiology of autism (Skuse, 2000, 2007). That is, early studies questioned whether autism is an X-linked disorder, based on the male predominance. However, there is no evidence from genome-wide linkage scans to suggest a simple pattern of sex-linked inheritance (Skuse, 2000, 2007). This is consistent with findings from recent large-scale genome-wide studies that are revealing considerable heterogeneity in the genetic architecture of autism such that multiple genes on different chromosomes likely interact to confer risk (State, 2010).

Although idiopathic autism is highly heterogeneous and characterized by a complex pattern of inheritance, studies of rare monogenic syndromes that are associated with autism have been instrumental in identifying genes that are likely to confer risk (State, 2010). While these susceptibility genes are found throughout the genome, a number of them are located on the X chromosome. These include *fragile X mental retardation protein*, the gene that causes fragile X syndrome, which is highly associated with autism (Moss & Howlin, 2009). In addition, Rett syndrome, which occurs almost exclusively in females, is caused by mutations in the X-linked *MECP2* gene (Moss & Howlin). Another

important X-linked susceptibility gene is *neuroligin 4X* (*NLGN4X*), which was identified in studies of two families with autism, one of which included individuals with autism and intellectual disability, carrying truncating mutations disrupting this gene (State, 2010).

Given the considerable genetic heterogeneity and lack of evidence for a simple pattern of X-linked inheritance, the cause of the higher frequency of autism in males is not known. One hypothesis is that imprinting of genes on the X chromosome may lead to the expression of protective genes on the paternally inherited X chromosome in females (Skuse, 2000). Another question is whether X-linked syndromes of intellectual disability, which are more common in males, account in part for the male predominance, yet severe intellectual disability occurs more often in females with autism (Skuse, 2007). One recent model addresses the overlap of autism and intellectual disability in the context of emerging observations regarding pleiotropy, suggesting that susceptibility genes may confer risk for both autism and intellectual disability, and that the expression of one or the other is influenced by the combined effects of genetic, epigenetic, and environmental factors during development (State, 2010).

See Also

- ▶ Chromosomal Abnormalities
- ▶ Pleiotropy
- ▶ Sex Hormones

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Sex Education

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Definition

Sexual awareness comes early for most children. By age 3 years, most children recognize that girls and boys are different. An understanding of where babies come from and later on of the changes in one's body at puberty develops through interactions with many people: siblings, parents, other family members, peers, and teachers. These interactions may be difficult for people with ASDs.

People used to think that the social problems associated with autism prevented sexual interest or relationships. We now know that is not true. Early intervention as well as an emphasis on programs in the community has helped more people with ASDs to have very meaningful relationships, including sexual relationships. Parents of adolescents with ASDs, like many parents, may find it difficult to view adolescents as sexual beings, and they may worry about the adolescent being taken advantage of.

Children learn early that there are different rules for private and public behavior and for who can touch what, where, and when. Adolescents need to cope with distinctions between love and sex and learn about the importance of contraception and prevention of sexually transmitted infections as well as issues of separating from their families and developing long-term relationships. These issues may be more difficult for children on the autism spectrum because of language and communication difficulties, social

issues, and varying cognitive levels. Learning about sexuality may not occur at the same age or in the same ways for children with ASDs. Peer relationships may be lacking, and other avenues for socializing may be lacking. It may be harder for children with ASDs to learn the difference between what is okay to think and what is acceptable to say or do. The distinction between private and public behavior may be poorly understood, and the tendency to be very literal may cause misunderstandings.

It is important to make the learning process about sexuality as positive as possible and to help the child learn what not to do as well as what to do. The ultimate goal is to help the adolescent form a more positive view of himself or herself.

In general, parents of adolescents and young adults with ASDs should help dealing with emerging sexuality by having open discussions, with information at a level that is appropriate for the individual. Socially acceptable behaviors should be made clear. Sex is only one part of what needs to be discussed. The role that relationships play in sexuality and the differences between friendship and a sexual relationship need to be taught.

Adolescents with Asperger's disorder or autism can at times be quite preoccupied with sex or with wanting a girlfriend or boyfriend. These can be age-appropriate concerns but sometimes cause awkward situations when approaches are made in an unconventional manner.

Privacy and modesty are important concepts that may be difficult for children and adolescents with ASDs to understand. Difficulties in generalization can make these hard to teach and understand. Bathroom use early on can be a place to begin this teaching.

Masturbation can be an issue with any child. This can be a source of discomfort for parents and teachers. The distinction between private and public behavior may be hard to learn at times. This at times can be a problem in school. Allowing the student opportunities for frequent movement or objects to manipulate with the hands as an alternative activity may be helpful. Exercise can also be helpful. The occupational therapist or specialized teacher may be helpful in coming up with strategies for teaching the adolescent or young adult with an ASD that masturbation is not appropriate at school.

Teaching about boundaries is another important issue. Parents are frequently worried about the possibility of sexual or physical abuse. Abuse or inappropriate sexual behavior can be issues. Most children with ASDs are closely supervised and that will hopefully prevent either of these problems. For verbal children, teaching the "no, go, tell" strategy may be useful. This method is described by Schwier and Hinsburger (2000).

Occasionally individuals on the autism spectrum experience difficulties in relation to gender identity. Also occasionally inappropriate sexual comments or requests can lead to legal entanglements.

See Also

▶ Daily Living Skills

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Sex Hormones

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Synonyms

Androgens (male sex hormones); Estrogens (female sex hormones)

Definition

Sex hormones, including testosterone and estrogen, are produced by the gonads, or sex organs. In addition to their role in the development of the reproductive system, these hormones serve important functions in brain development, such as controlling the growth and survival of nerve cells, or neurons (Keller, Panteri, & Biamonte, 2008). Both testosterone and estrogen exert their effects on neurons by binding to protein receptors within the cell, which, in turn, directly control the expression of specific genes in these cells (Keller et al., 2008).

The higher frequency of autism in males (4:1) has raised questions about the effect of sex hormones on the risk of developing autism (Keller et al., 2008). One possible explanation for the male predominance, given the genetic risk of autism, is that sex hormones have a modifying effect on an underlying genetic predisposition (Keller et al.). According to this theory, sex hormones may influence the penetrance of a risk gene such that males carrying a particular mutation may be more likely to develop symptoms of autism than females with the same mutation due to their exposure to different sex hormones during brain development (Keller et al.). It has been proposed that sex hormones may exert this modifying effect via an epigenetic mechanism, that is, by modulating the levels and timing of gene expression by altering chromatin structure (Kaminsky, Wang, & Petronis, 2006).

One group of researchers led by Simon Baron-Cohen has proposed an "extreme male brain" theory of autism, which posits that traits associated with autism represent a more marked version of a male pattern of cognitive processing (Auyeung & Baron-Cohen, 2008; Baron-Cohen, Knickmeyer, & Belmonte, 2005). According to this theory, females have a greater tendency toward "empathizing," or understanding another person's emotions, while the tendency of males is toward "systematizing," or analyzing a system based on rules. Baron-Cohen suggests that individuals with autism function in a more extreme manner than the average male in their propensity to "systematize" rather than "empathize" (Auyeung & Baron-Cohen, 2008; Baron-Cohen et al., 2005). Moreover, he proposes that such sexual differences in cognitive processing, and by extension, traits associated with autism, may be related to levels of fetal testosterone, and that the ratio of the lengths of the second and fourth digits, which is lower in males, may serve as an approach to assess exposure to androgens during fetal development (Auyeung & Baron-Cohen, 2008). However, experimental validation of this hypothesis, via studies analyzing the association of fetal testosterone levels and the occurrence of autism, is required (Auyeung & Baron-Cohen).

There are a limited number of studies of differences in sex hormone levels in individuals with autism, and no studies of therapeutic interventions involving the use of sex hormones (Anderson & Hoshino, 2005). At this time, further research is required to elucidate how sex hormones establish sexual dimorphisms both in the developing brain, producing structural differences, and at the molecular level, resulting in sex-specific differences in gene expression.

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Sexuality in Autism

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Definition

Sexuality refers to the physiological processes, behaviors, impulses, and desires associated with reproduction, the genital organs, and mating.

Historical Background

Research has studied sexuality in autism over the last 30 years. Early thinking assumed that individuals with autism were generally asexual or that they expressed their sexuality in inappropriate ways. More recently, there have been a small number of studies examining the sexual behaviors of various samples of individuals with autism or Asperger's disorder, with more attention being paid to males. However, the challenges of studying a highly private aspect of human experience in a group with limited communication skills leave us with only a beginning understanding of how individuals with autism experience their sexuality.

Current Knowledge

There is a wide variation in the sexual functioning of individuals with autism, and so generalizations must be made with care. There are people who experience full sexuality with partners, entering into marriage and having children. There are others who never have any interest in sexual activities.

That being said, research has generally found few differences in the physiology and development of sexual functions between people with autism and others. A majority of individuals with autism, both men and women, demonstrate an interest in sexuality and masturbate or seek sexual stimulation in other ways. For some, particularly individuals with greater developmental challenges, the interest in sexuality may be delayed or may never emerge, but this is the minority. While there have not been extensive clinical studies of sexual functioning, it is thought that most individuals with autism enter puberty at the expected time, evidence the physical changes associated with this development, experience arousal and climax, and are capable of reproduction. Many exhibit behavior challenges and regression during puberty as they adjust to the changes in their bodies.

However, moving beyond the physiological aspects of sexuality, differences are found in the ways individuals with autism experience attraction and arousal. Social challenges reduce the

focus on romantic bonding with others and the power of sexual taboos or regulations. Consequently, for many, sexual fantasies are less likely to focus on an erotic situation with partners, and there is a greater frequency of attractions to nonhuman contents such as objects, animals, cartoon characters, undergarments, body parts, or particular sensory experiences.

There is also some suggestion in the literature that individuals with autism are more likely to experience homosexuality, bisexuality, or issues related to gender identity. While there is no strong empirical evidence to support this trend, it is consistent with the idea that the social challenges of autism lead to a sexual orientation and gender identity less bound by societal dictates or rules from the family and peer group. Furthermore, with autism, sexuality can develop more independently of relationships to others. For some high functioning individuals, struggles with their sense of gender are closely tied to more general questions about their identity as a young adult – what roles they can fill, how they should act, and what types of relationships they should form.

Challenges to sexual relationships: When trying to engage in sexual activities with partners, individuals with autism encounter several sets of obstacles. Their challenges with social skills, reduced social motivation, and problems following the "hidden curriculum" of social conventions often leave them isolated or withdrawn, the target of teasing or bullying, and without friendships or a peer network. They may not have regular access to and interactions with potential partners. Furthermore, competent courtship or sexual play requires subtle (verbal and nonverbal) communication, knowledge of complex social rules, and well-developed sensory processing, all areas of challenge for most people with autism. Many males experience extreme frustration that they cannot find partners for romantic or sexual relationships. For some of the highest functioning individuals, they are able to maintain friendships with women and to regularly socialize with other adults, yet do not have the skills to effectively engage in the behaviors needed to start a sexual relationship. In our culture, women often have less difficulty finding partners who are seeking sexual interactions but may encounter a succession of liaisons that only include sexual activities without the establishment of a romantic or committed relationship. With their limited social judgment, some women with autism are vulnerable to engaging with serial partners in a dangerous and promiscuous manner.

Even when individuals with autism are able to find a partner, their experience of sexuality can be out of synch with the relationship. They may not enjoy the sensory aspects of lovemaking, may have difficulty focusing on the pleasure of their partner, or may engage in behaviors not affirming to their partner. The literature written by individuals with autism highlights the challenges of marriage or long-term sexual relationships.

Problems with sexual behaviors: While some individuals with autism experience pleasurable and satisfying sexual activities (autoerotic and with partners) that conform to the rules and expectations of the culture, there are a number of difficulties cited in the literature. One of the greatest concerns of families and caretakers is repetitive, compulsive masturbation for extended periods of time. In some cases, this may entail finding erotic materials on the Internet or calling sexual phone services. With their limited judgment and poor understanding of the implications of their actions, individuals may run up large bills or fall prey to computer viruses. An excessive interest in self-pleasuring sexual activities is most common when the individual is understimulated without the availability of other recreational activities or entertainment (such as for individuals in an institutional setting). Usually, providing alternative leisure activities and teaching them the skills to take advantage of such activities leads to a reduction in sexual self-stimulation.

Difficulties with not being able to effectively stimulate oneself to climax can cause problems. Poor technique can lead to hypermasturbation, or repetitive, nonorgasmic self-stimulation, as the individual does not experience the release and resolution of orgasm. In rare cases, individuals engage in atypical masturbatory activities with objects or materials that lead to self-mutilation or injury. There are also many cases where psychotropic medication impacts sexual arousal or

the ability to reach climax, and this can interfere with satisfying sexual practices.

Another key area of challenge relates to a lack of modesty. People with autism may not experience discomfort in front of other people when undressed, engaging in self-stimulation, looking at sexual materials, or talking about sexual topics. For some, self-stimulating sexual behaviors may occur compulsively in certain situations or in response to particular sensory experiences, even when they are in a public setting. Additionally, touching the genital area or other sexual gestures may be exhibited as part of a stereotypy without sexual stimulation being experienced. Whatever the motivation, these sexual behaviors in public lead to alienation of peers and others, trouble with school and community authorities, and embarrassment for family members.

Sexual impulses can also lead to inappropriate contact with strangers or people in the community. Some individuals become attracted to and stimulated by women's hair, legs, or other body parts. They may stare at people with the desired attribute or even attempt to touch them. Males with autism, accustomed to getting hugs from teachers and other caretakers when younger, may seek out hugs from women as an adolescent or adult and become noticeably aroused by such contact. Some of these behaviors may be more driven by sensory seeking than by sexual arousal, but they appear to be sexual violations and are responded to as such, leaving the individual vulnerable to extreme sanctions.

Sexual behaviors performed by individuals with autism in public are often misunderstood to be paraphilias or sexual disorders. They can be viewed as exhibitionistic when they disrobe, even though they are undressing because of sensory issues and a lack of understanding of social rules around nudity, rather than because it is sexually arousing. Their focus on objects or body parts can be described as fetishistic. An interest in looking at images of children can be seen to be pedophilic. While there are high functioning individuals with autism who present true paraphilias, careful assessment of these behaviors indicates that they are more frequently the product of sensory processing issues, a lack of understanding of social rules, and deficits in perspective taking. As with any inappropriate sexual conduct, they require a strong response that will prevent their occurrence. Yet, unlike true paraphilias, when these behaviors are based in autistic functioning, they are responsive to education and behavioral intervention.

In severe cases, sexual interests and practices can lead to criminal behaviors such stealing objects for sexual stimulation (e.g., women's undergarments), illegally using credit cards to access pornography, or making inappropriate sexual advances. Staring at or touching strangers in public can be understood to be stalking or sexual assault. There is a particularly troubling trend of male individuals, searching for erotic materials on the Internet, visiting child pornography sites. These individuals may have no capacity or desire to prey on children yet get caught and arrested when detected by law authorities. When sexual behaviors are viewed to be criminal, individuals have to deal with a justice system that often does not understand autism and can deal harshly and destructively with individuals.

In all these cases, thorough assessment of the pattern of behavior is needed. For example, in one case, a young man was making detailed, sexually threatening comments to women using seemingly precise jargon and terminology to describe what he intended to do. A comprehensive evaluation of his pattern of arousal and sexual knowledge revealed that he knew very little about sexuality and experienced no sexual arousal. He was just mimicking phrases he had heard and was reinforced by the reaction he received.

A final challenge related to sexuality is the vulnerability of people with autism to predatory individuals. With their difficulties with perspective taking, understanding social rules, judging intent, and anticipating outcomes, individuals are easy targets for people who are sexually abusive, assaultive, or predatory. This is particularly true for females. It is important to provide education and necessary levels of supervision to prevent victimization.

Facilitating sexual development: Building a positive sexual adjustment in people with autism requires careful monitoring, individualized sex

education, and behavioral intervention when problems occur. Caregivers need to consider all the situations confronting the individual and ensure that they will not be vulnerable to predators, exposed to sexual materials, or likely to act inappropriately. Access to the Internet or phone lines should be controlled. The amount of hugs and physical contact permitted with teachers and caregivers should be adjusted and eliminated when the child is in preadolescence. As the child develops and is more able to be independent, it is essential to teach him the skills he will need to handle potential sexual impulses or threats and remain safe and appropriate.

Effective sex education is the best way to prevent sexual problems. It should be provided as soon as the child exhibits sexual interest or behaviors and reviewed and revisited on a regular schedule. The information should be geared to the individual's needs and his ability to understand. For the people with the greatest level of challenge, this instruction might just focus on rules about acceptable sexual behaviors in public and in private, and on appropriate and inappropriate touching. It may be necessary as well to teach the individual effective ways to stimulate himself/herself and define where and when this can occur. With higher functioning people who are seeking sexual partners, education should cover more detailed information about sexual functioning, sexually transmitted diseases, pregnancy, and sexual abuse/assault. Depending on the level of understanding, there should also be instruction about dating relationships and the process of courtship. Teaching should be delivered in a way that is effective for people on the autism spectrum. This includes emphasizing rote instruction, using visual context cues and materials, providing rehearsal with scaffolded supports, fading prompts as they are no longer needed, and including generalization training. Teaching techniques known to be effective with individuals with autism, such as social stories, rule cards, priming, and social autopsies, should be utilized to ensure effective instruction.

When sexual problems occur, careful assessment is warranted. For many difficult situations, additional education may be all that is needed. When problems persist, the incidents should be tracked and studied through a functional behavior analysis in order to identify triggers and situations that must be avoided, to teach needed skills and alternative responses to the inappropriate conduct, and to ensure that the target behaviors are not being inadvertently reinforced. As noted above, designing the most effective response may require careful assessment of the individual's sexual knowledge and pattern of arousal, sensory processing factors, and other secondary factors.

Future Directions

Research into sexuality and autism is just beginning to systematically assess the sexual functioning, development, interests, and behaviors of people on the autism spectrum. This work should be expanded to larger, more representative samples and should examine differences across gender, age, cognitive ability, level of autism, and other key variables. Particular attention should be paid to problematic sexual conduct/victimization and ways to prevent and effectively treat it. There is a developing literature on sexual education for people with autism, and this needs to expand to provide families and schools access to effective teaching materials that apply to a wide range of individuals. At the level of social and behavioral research, we need to better understand how high functioning individuals with autism can remain more integrated with peer groups and develop the skills needed for dating, courtship, and maintenance of sexual relationships.

See Also

▶ Daily Living Skills

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SFA

► School Function Assessment

SHANK 3

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Synonyms

DEL22q13.3 (Entrez Gene, OMIM, Uniprot); KIAA1650; Proline-rich synapse-associated protein 2; PROSAP2; PSAP2; SCZD15; SPANK-2

Definition

SHANK3, the gene encoding the protein *SH3 and multiple ankyrin repeat domains 3*, belongs to the SHANK family of genes; the other members are SHANK1 and SHANK2. The members of the SHANK family of genes are scaffolding proteins, comprising multiple domains, that are found in the postsynaptic density and connect membrane proteins, such as neurotransmitter receptors (e.g., NMDA-type and metabotropic glutamate) and ion channels, to the actin cytoskeleton and to intracellular signaling pathways. They are actively involved in synapse formation and dendritic spine development (EntrezGene, Uniprot, Durand et al., 2012). SHANK3 is located on chromosome 22.q13.3 and the canonical verified isoform consists of 1741 amino acids, with at least one other isoform (Uniprot).

SHANK3 is the site of a recurrent chromosomal breakpoint within 22q13.3 (Bonaglia et al., 2006), leading to a 22q13.3 deletion syndrome. Deletions and other disruptions in 22q13.3 were subsequently linked strongly to autism (Durand et al., 2007). Recent clinical reviews have stated that 22q13 abnormalities are estimated to be involved in roughly 1% of all autism diagnoses (Abrahams & Geschwind, 2008; Buxbaum, 2009). Functional studies also demonstrate the severe effects of SHANK3 disruption; mutations in SHANK3 were recently shown to affect dendritic spine development (Durand et al., 2012). A mouse SHANK3 knockout (in which both copies of a gene have been removed) also demonstrated compulsive and repetitive behavior and social impairments, reminiscent of an autism phenotype (Peça et al., 2011). SHANK3 is one of a handful of genes thought to be conclusively associated with ASD. It has also recently been linked to schizophrenia (Gauthier et al., 2010).

See Also

► Synaptic Proteins

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Shaping of Behavior

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Definition

Shaping of behavior is a behavior modification technique that rewards successive approximations to a desired target behavior. For individuals with autism, shaping can be used to teach new behaviors. The procedure involves defining what the target behavior should be and then choosing which initial response to reinforce. The initial response to reward should be something that the individual exhibits that is related to the target behavior. Approximations to the desired behavior are differentially reinforced as the shaping procedure is implemented. Each successive approximation that is closer to the target behavior is reinforced, while reinforcement is withheld for earlier approximations in order to continue moving toward the target behavior. For example, shaping was initially used to teach children with autism expressive words. Rather than only providing a reward when a desired word was produced, differential speech attempts that become closer and closer to the target word were rewarded in order to shape the target word and increase the individual's motivation to speak. Newer approaches found that shaping usually is not necessary for producing speech in nonverbal children, and reinforcing verbal attempts may be more effective (Koegel, & Koegel, 2012).

See Also

▶ Behavior Modification
▶ Differential Reinforcement
▶ Reinforcement

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Shared Storybook Reading

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Definition

Shared storybook reading is a naturalistic and interactive routine in which an adult and a child

engage in dialogue and share joint attention on a storybook. During shared storybook reading, children are exposed to both oral and written language at the same time (Ezell & Justice, 2005) because children both see and hear the words during the interaction. This routine promotes the development of language and social engagement (Kaderavek & Justice, 2002), which are two of the core deficit areas for children with ASDs. Children are exposed to shared storybook reading early in life; many parents report reading to children by six months of age (Catts & Khami, 1999). Many parents naturally scaffold their child's development by gradually increasing the cognitive and language expectations during shared storybook reading to match children's growing abilities (Catts & Khami, 1999). For example, toddlers can learn to turn the pages in a book or identify new vocabulary words, whereas older children might learn to make inferences (e.g., "How do you think this boy feels?") or predictions (e.g., "Where do you think he will look next?"). When parents scaffold children's language during shared storybook reading, it becomes a context that can facilitate language development across all ages. Shared storybook reading interventions focus on teaching adults (i.e., parents, teachers, or other caregivers) scaffolding strategies to support language, emergent literacy, and social engagement during the shared storybook reading context. Scaffolding strategies support increased responsiveness to children's communication attempts and engagement during shared storybook reading. The adult's role shifts over time as the child gains skills and is able to take on a more equal role during the shared storybook reading (Kaderavek & Sulzby, 1998).

Historical Background

Historically, children with disabilities have had reduced access to emergent literacy activities like shared storybook reading when they were not perceived to demonstrate signs of literacy readiness (e.g., the ability to comment about pictures in a book, the ability to answer questions during a story, the ability to sit still for an entire storybook). Children with disabilities begin their school careers with less than one-half the exposures to print as their typical peers (van Kleeck, Gillam, Hamilton, & McGrath, 1997; van Kleeck & Vander Woude, 2003).

Children with autism spectrum disorders may have unique risks for reduced exposure to emergent literacy activities, such as shared storybook reading. Firstly, children with ASDs are at risk for difficulty with literacy because literacy is a language-based skill (Catts & Khami, 1999) and children with ASDs have difficulty acquiring language. Secondly, caregiver perceptions and practices (Koppenhaver, Coleman, Kalman, & Yoder, 1991) may contribute to reduced opportunity for literacy exposure. Caregivers may underestimate the abilities of children with disabilities because the children have been labeled as having delays and difficulties (Koppenhaver et al., 1991). In particular, parents of children with ASDs may feel overwhelmed by their child's behavioral needs or resistance to social interactions. Furthermore, parents of children with developmental disabilities often devote large portions of the day meeting educational, therapeutic, and medical needs, leaving little time for "extra" activities related to emergent literacy. It is important to recognize that parents of children with ASDs will likely require support to engage in early literacy experiences with their children.

Rationale or Underlying Theory

Children with disabilities have historically had reduced opportunity to participate in emergent literacy activities, which are the building blocks to later literacy achievement. The *interactive to independent* model of literacy development (Kaderavek & Rabidoux, 2004) proposes the access to literacy for individuals with atypical communication. The model includes five levels of achievement drawn from the social interaction, participation, and situated pragmatics theories of language and literacy development. Vygotsky's social interaction theory (Vygotsky, 1978)

suggests that literacy development is a product of children's supportive social interactions surrounding literacy. Beukelman and Mirenda's participation theory (Beukelman & Mirenda, 1998) stresses the importance of removing barriers to literacy for individuals with disabilities. Finally, the situated pragmatics theory (Duchan, Sonnenmeier, & Hewitt, 1994) expands the definition of literacy contexts by stressing the importance of developing goals that allow children to participate in naturally occurring contexts. In the context of the *interactive to independent* model, literacy is not a static skill requiring achievement of specific predetermined criteria before moving onto more advanced steps. Instead, literacy is a dynamic skill made up of several smaller sets of subskills that can be achieved in a nonlinear fashion. The model focuses on five levels of development as children move from emergent to conventional literacy. The first level focuses on joint attention and responsiveness during early literacy interactions by helping the child maintain focus on storybooks, teaching the parent strategies to increase engagement, and increasing the duration of shared literacy experiences. The second level focuses on balance and turn taking by helping the parent build on the child's communicative attempts to increase the child's communicative repertoire surrounding literacy materials. The first two levels of this model have a pragmatic focus in that they prioritize the social aspects of shared literacy experiences, such as turn taking, joint attention, and acceptance of a range of communicative behaviors. The third level of the model begins to move toward conventional literacy by helping the child to increase emergent literacy skills, such as print awareness, phonological awareness, and metalinguistic awareness. The fourth and fifth levels represent movement toward conventional independent literacy, which is defined as a complex language-based skill that involves the ability to read and write. Specifically, the fourth level focuses on achievement of conventional literacy with social support, whereas the fifth level targets the achievement of full conventional literacy without social support (i.e., independent literacy achievement).

Goals and Objectives

The long-term goal of shared storybook reading interventions is to increase literacy opportunity for children with autism spectrum disorders, thus, increasing their opportunity to participate in a literate society. The objectives of shared storybook reading interventions focus on increasing active participation during in shared storybook reading exchanges. Objectives should be child-centered, individualized, and measurable. Justice and Pence (2005) have suggested three features that are essential to effective shared storybook reading interactions: parent sensitivity and responsiveness, child engagement, and repeated reading. The first feature, parent sensitivity and responsiveness, refers to parents who allow children time to respond and show they value child contributions to the interaction. Behaviors of sensitive and responsive adults include observing, waiting, listening, and being face to face with the child. The second feature, child engagement, is facilitated by allowing the child to participate during the storybook reading. Child participation might include labeling pictures, commenting, and asking questions. Children are more likely to be engaged when they are allowed to set the pace of the interaction. The third feature, repeated reading, allows for increased familiarity and facilitates vocabulary learning. These three features are ways for adults to intentionally scaffold language and engagement during shared storybook reading, thus, moving children to higher levels of performance within the interaction. Another tool, the Kaderavek-Sulzby Bookreading Observational Protocol (KSBOP) (Kaderavek & Sulzby, 1998), can be utilized to assess areas of strength and need during parent–child shared storybook reading exchanges, including parent scaffolding behaviors, child language attempts, and other variables that are contributing to the success of the interaction.

Treatment Participants

Shared storybook reading is an intervention context appropriate for any child, including children with autism spectrum disorders.

Treatment Procedures

Interventions using shared storybook reading focus on teaching adults scaffolding strategies to support language, emergent literacy, and social engagement. These strategies include teaching adults ways to increase responsiveness to children's communication attempts and support engagement during shared storybook reading. The adult's role shifts over time as the child gains skills and is able to take on a more equal role during the shared storybook reading (Kaderavek & Sulzby, 1998). Specific strategies include ask WH questions, repeat or recast what the child says, praise and encourage, follow the child's interests or lead, ask open-ended questions, expand what the child says, use attention getters.

Often, the focus of shared storybook reading interventions is to change adult behaviors. That said, it is important to note that some parents of children with disabilities are already responsive to their children's needs and already adjust their behavior and language accordingly. For example, Justice and Kaderavek (2003) analyzed the shared storybook interactions between 11 preschoolers with language impairment and their mothers. They found that some children with language impairment and their mothers often shared topic control and balance of contributions (although some had a more unequal experience), suggesting that interventions targeting strategies during book reading interactions should be well designed such that they do not decrease positive back-and-forth interactions that are already present in parent–child interactions. In other words, shared storybook interventions should enhance and encourage strategies that parents may already be doing as well as teach them new skills to facilitate language and social engagement.

Efficacy Information

Shared storybook reading contributes to early language and literacy development (Ezell & Justice, 2005). Shared storybook reading interventions have been effective at increasing vocabulary development, social engagement, and emergent literacy awareness in at-risk groups, including children living in poverty (Whitehurst et al., 1994a, b) and preschoolers with language impairment (Crain-Thoreson & Dale, 1999; Crowe, Norris, & Hoffman, 2000). Clinicians, teachers, and parents were successful at learning to increase strategies to support children's language, social engagement, and emergent literacy skills during shared storybook reading.

To date, only one case study has examined the use of shared storybook reading as an intervention context for children with ASDs. Bellon, Ogletree, and Harn (2000) examined the use of scaffolding strategies during a clinician-implemented shared storybook reading intervention for a preschooler with high-functioning autism. A seven-week intervention resulted in an increase in the preschooler's spontaneous speech. This preliminary study indicated that shared storybook reading may be an effective intervention context for young children with ASDs. Shared storybook reading has not yet been explored using a parent-implemented intervention paradigm for preschoolers with ASDs, although a number of other parent-implemented interventions have successfully been examined in children with ASDs.

Outcome Measurement

Outcome measures for shared storybook reading interventions include measures of parent behavior, child behavior, and parent–child variables. Parent focused measures include measuring changes in rate and frequency of scaffolding strategy use. Child focused measures include measuring changes in children's language (e.g., vocabulary measures, mean length of utterance) or emergent literacy skills (e.g., formal measure of phonological awareness and emergent literacy). Parent–child variables attempt to measure

changes in social interaction, such as turn-taking ratios or duration of interaction.

Qualifications of Treatment Providers

Interventionists with specific expertise in shared storybook reading interventions include speech-language pathologists and educators.

See Also

► Emergent Literacy

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Shell Shock

► Posttraumatic Stress Disorder

Sheltered Employment

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Definition

Sheltered employment refers to segregated programs designed to help individuals with disabilities who are not able to work in a competitive employment setting. Sheltered workshops, day treatment, and work activity centers are examples of sheltered employment programs. Usually, sheltered employment programs are run by private, not-for-profit organizations that receive funding through state and federal sources (Kregel & Dean, 2002).

Historical Background

Sheltered employment programs can typically be categorized into two types: extended employment and transitional employment. Extended employment placements are designed to allow the individual the opportunity to utilize his/her abilities to work and earn money in a segregated workshop setting. In transitional employment settings, the individual is provided with training in a segregated setting in order to develop skills that would be necessary to be successful in an integrated employment setting (Kregel & Dean, 2002). However, as Taylor notes in 2002, only about 3.5% of individuals in sheltered employment move on to work in competitive employment settings. Taylor also notes that individuals working in a sheltered setting earn significantly less per week than their counterparts working in competitive employment.

The success rate of sheltered employment settings has often been questioned by critics who state that individuals in these settings are not provided with significant employment outcomes and are isolated which contributes to lowered expectations in the workplace and can spur negative attitudes from the rest of the community (Kregel & Dean, 2002).

In response to the criticisms of sheltered employment, the U.S. Department of Education's Rehabilitation Services Administration changed the regulations that govern State Vocational Rehabilitation Programs in January of 2001. This change redefines the term "employment outcome" to mean an individual working in an integrated setting (Wehman, Revell, & Brooke, 2003). No longer would a sheltered, segregated setting be an acceptable, final employment outcome for an individual with a disability.

Current Knowledge

Since sheltered employment is no longer an acceptable final employment outcome for an individual with a disability, many individuals are placed into supported employment programs as an alternative (Kregel & Dean, 2002). Individuals may still be placed into a sheltered employment settings as long as the goal is for the individual to build skills and gain experience in order to move into competitive, integrated employment.

See Also

- ▶ Competitive Employment
- ▶ Sheltered Workshops
- ▶ Supported Employment

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Sheltered Workshops

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Synonyms

Supported employment

Definition

A sheltered workshop is a self-contained workplace that offers a supportive and protected work environment for people with disabilities. Sheltered workshops are funded by a combination of public vocational and rehabilitation programs and contracts from businesses. Workshops are private not-for-profit corporations. Each workshop must have a special certificate from the Department of Labor. The goal of a sheltered workshop is to provide meaningful vocational experience and job skills for people with disabilities who cannot find work elsewhere. Employees receive payment; however, their hourly pay is usually below the market rate for similar work in private industry. The workshop may also provide such related vocational rehabilitation services as job interview training.

See Also

► Supported Employment

References and Readings

Disability.gov. https://www.disability.gov/home/about_us

Short-Term Memory

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Definition

Short-term memory refers to the immediate or temporary storage of information.

Historical Background

The limited data that can be stored in short-term memory will be lost if not repeated or rehearsed. An individual's ability to temporarily store information is considered to be a function of a variety of factors, including how the information was encoded, whether it could be rehearsed, and even the psychological state of the individual, such as his or her anxiety level (e.g., Darke, 1988). Early work on memory suggested that short-term memory was a unified temporary storage system (Atkinson & Shiffrin, 1968). According to Baddeley and Hitch (1974), short-term memory was later proposed to have several components, collectively referred to as working memory, responsible for simultaneously storing and operating on information for relatively short periods of time when an individual performs cognitive tasks. These three components of working memory were referred to as the central executive, the visuospatial sketchpad, and the phonological loop. The central executive component is conceptualized as a control system with a key role in identifying issues on which to focus attention, decision-making, and response selection (Boller, 1996). The visuospatial sketchpad is considered responsible for storing visual and spatial information, while the phonological loop is responsible for storing sounds, and is thought to be important for language development (Baddeley, 1992). More recently, Baddeley (2000)

proposed a revision to the Baddeley and Hitch (1974) model by conceptualizing the central executive as a domain general component that integrates or coordinates information from visuospatial and verbal information. Moreover, the new system proposed by Baddeley (2000) includes the notion of an "episodic buffer" which is thought to be a short-term storage system that is controlled by the central executive, integrates information, and plays a role in the exchange of information to and from episodic long-term memory.

Several theories exist concerning potential short-term memory deficits in autism (see Poirier & Martin, 2008 for a review). Some have suggested that because short-term memory tasks require individuals to recall stimuli in their order of presentation, individuals with autism should show a deficit due to deficits in temporal processing (Boucher, 2001). Others argue that difficulties with retrieval on short-term memory tasks, in particular, should be apparent in autism due to impairments in remembering contextual and personally experienced aspects of events (Bowler, Gardiner, & Berthollier, 2004). Finally, there is some evidence of a group-by-difficulty interaction such that short-term memory impairments for higher-functioning individuals with autism may appear as task difficulty increases (Craik & Anderson, 1999).

Current Knowledge

Although previous empirical findings suggested an intact short-term memory system in individuals with autism (e.g., Hermelin & O'Connor, 1967), these studies may have had some methodological limitations, including a reliance on span-type tasks and use of a smaller than ideal number of trials (Poirier & Martin, 2008). With respect to working memory, which is commonly considered a dimension of executive function, individuals with autism appear to show performance consistent with the types of deficits one might see in patients with frontal lobe damage (Hill, 2004), leading many in the field to argue that autism is inherently a disorder of executive function. However, empirical findings indicating a working memory deficit specific to autism are somewhat mixed (see Poirier & Martin, 2008 for a review of current findings concerning working memory in autism). For example, in a study of verbal working memory, Bennetto, Pennington, and Rogers (1996) found individuals with autism (11–25 years of age) to be impaired in working memory in comparison to a comparison group of individuals with learning disorders. However, Russell, Jarrold, and Henry's (1996) study of working memory found no significant difference between children with autism and a moderate-learning-difficulties comparison group, although both of these groups performed significantly worse than a normally developing comparison group. Some studies have even found no working memory deficits in their samples of individuals with autism (Guerts, Verte, Oosterlaan, Roeyers, & Sergeant, 2004; Ozonoff & Strayer, 2001). Differences in these studies may be a function of the difficulty of the task or the level of support provided to retrieve information (Poirier & Martin, 2008). Interestingly, when studies have differentiated between tasks that allow the use of inner speech to regulate behavior (e.g., tasks like the Luria hand game) and those that require a verbal response and therefore do not allow for inner speech (e.g., the day/night task), group differences were not found in the latter tasks, supporting the contention by Russell and colleagues that individuals with autism have a particular impairment in their ability to use inner speech to rehearse the rules of working memory tasks (Russell, 1997).

Finally, an alternative account of working memory deficits in autism has been put forth by Minshew and Goldstein (1998), who suggest that such deficits are a function of information processing difficulties that overwhelm working memory resources. Studies supporting this approach reveal that differences in working memory performance appear as the working memory load increases (Joseph, McGrath, & Tager-Flusberg, 2005).

Future Directions

Given the mixed findings to date on short-term memory and working memory deficits in autism, there is a clear need for future work in this area. According to Poirier and Martin (2008), future research should address whether verbal working memory and spatial working memory are both equally affected in ASDs. There is also a need for more research on whether observed deficits are due to complex information processing issues and whether these vary according to task complexity and difficulty, or task support for retrieval. Future work should also explore the implications of deficits in short-term memory, for example, the extent to which verbal short-term memory difficulties may impact language development (Alloway, Rajendran, & Archibald, 2009).

See Also

- ▶ Executive Function (EF)
- ▶ Memory
- ▶ Memory Assessment
- ▶ Memory Development

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Sibling Support

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Definition

Sibling supports are any services, interventions, or programs focused on typically developing siblings of individuals with intellectual or developmental disabilities, including autism spectrum disorders (ASD), with the goal of improving sibling well-being or increasing siblings' participation in the lives of their brothers or sisters with a disability. Sibling supports most often take the form of peer support but can also be informational sessions aimed at increasing knowledge about their brother or sister.

Historical Background

Sibling supports were initially developed in reaction to extant research and anecdotal reports suggesting that having a brother or sister with an intellectual or developmental disability, including ASD, can be difficult for some siblings (Lobato, 1983; Meyer & Vadasy, 1994). Although supports and services are often available to the individual with the disability himself or herself, supports are far less common for family members, including siblings.

The number of sibling support programs and interventions has increased somewhat over the past 20 years; Sibshops (Meyer & Vadasy, 1994) is perhaps the first and best-known example of a sibling support. Many of the sibling support programs that have followed either incorporate aspects of the Sibshop model or build on it. It is important to note that support interventions and programs for siblings have typically been geared toward siblings of individuals (mostly children) with any intellectual or developmental disability, including siblings of those with ASD. With the exception of one program, none of these supports specifically targets siblings of individuals with ASD.

Rationale or Underlying Theory

Sibling support programs and interventions share two main rationales. The rationale for programs that mainly focus on fostering sibling peer support – such as Sibshops (event-based program for siblings of children with disabilities: Meyer & Vadasy, 1994), Sibkids (an internet listserv for siblings of children with disabilities developed as part of the Sibling Support Project, the umbrella organization that also includes Sibshops), and support group for siblings of children with ASD based at the Thistletown Regional Centre in Toronto, Ontario (Smith & Perry, 2004) – is that being a sibling of an individual with intellectual and developmental disabilities can be a primarily positive experience, primarily negative experience, or a combination of the two. Furthermore, these siblings face unique challenges and experiences not shared by children who do not have a brother or sister with disabilities. Thus, developing peer supports with others who have a brother or sister with intellectual or developmental disabilities will allow siblings to discuss their experiences with others who understand, leading to wellness and well-being.

The rationale for sibling supports that are more informational in nature – such as the Sunsibs program based at Sunfield residential school in the United Kingdom (described in Conway & Meyer, 2008), the Siblink program (Lobato & Kao, 2002), the "Intervention for Siblings: Experience Enhancement" program (ISEE; Williams et al., 2003), and an unnamed program focused on siblings from socioeconomically disadvantaged families living in the inner city (Phillips, 1999) – is that increasing siblings' knowledge about their brother or sister's disability, behaviors, and needs will be beneficial to the nondisabled siblings. Specifically, increasing knowledge might lower the stress experienced by these siblings,

help them to develop a closer relationship with their brother or sister with disabilities, and prepare them for the possibility of providing care for their brother or sister in adulthood.

Goals and Objectives

Existing sibling support programs have three general goals/objectives: increasing peer support, sharing of information, and increasing involvement of the sibling with the brother or sister with the disability. The Sibling Support Project, which includes both Sibshops and the Sibkids/Sibnet listservs, has the primary objective of *fostering peer support*. The Sibshop guidebook (Meyer & Vadasy, 1994) lays out five specific goals related to this objective: (1) "Provide brothers and sisters of children with special needs an opportunity to meet other siblings in a relaxed, recreational setting"; (2) "Provide brothers and sisters with opportunities to discuss common joys and concerns with other siblings of children with special needs"; (3) "Provide siblings with an opportunity to learn how others handle situations commonly experienced by siblings of children with special needs"; (4) "Provide siblings with an opportunity to learn more about the implications of their sibling's special needs"; and (5) "Provide parents and other professionals with opportunities to learn more about the concerns and opportunities frequently experienced by brothers and sisters of people with special needs." As can be seen from these specific goals, sharing of information from one sibling to another (and not necessarily from teacher to sibling) is also an important aspect of Sibshops. Although not as well defined, the internet listserv arm of the Sibling Support Project (Sibkids for children and Sibnet for adults) has the objective of providing peer support and discussion in a secure environment.

Two of the existing sibling support programs have the primary objective of *increasing knowledge about the brother's or sister's disability*. The Thistletown program (Smith & Perry, 2004) has perhaps the most delineated specific goals from this group of programs, including the following: (1) increasing knowledge and understanding of ASD and related developmental disorders, (2) providing the opportunity for siblings to discuss their feeling in an accepting environment, (3) helping siblings to share ways of coping with difficult situations unique to having a sibling with autism, (4) enhancing siblings' self-concepts, and (5) encouraging siblings to have fun in a supportive environment. As can be seen from these goals, sibling peer support is also an objective of the Thistletown program. The ISEE program (Williams et al., 2003) has the specific objectives of improving sibling knowledge, as well as improving siblings' perceptions of and affective reactions to their brother's or sister's illness or disability (this program also included siblings of children with chronic illness).

The support program geared toward socioeconomically disadvantaged children (Phillips, 1999) and the SibLink program (Lobato & Kao, 2002) both promote *providing information and enhancing peer social support* as equal objectives. Specifically, the program for disadvantaged families has the goal of alleviating the stress of having a sibling with an intellectual disability by providing information about developmental disabilities to facilitate understanding and by creating a context that provides social support from peers and adults. The SibLink program has the goals of improving sibling knowledge, sibling adjustment to living with a brother or sister with a chronic illness or developmental disability, and sibling connectedness to others who have a brother or sister with a chronic illness or developmental disability.

Finally, the Sunsibs program (as described in Conway & Meyer, 2008) has the primary objective of *increasing involvement of the sibling in the lives of his/her brother or sister with ASD or other disabilities*. In order to increase sibling involvement, Sunsibs has the specific goals of providing opportunities for siblings of children in the Sunfield program to meet other siblings and build relationships with them, of keeping siblings in touch with the Sunfield facility, and of helping siblings feel an integral part of their brother's or sister's lives while that brother or sister is participating in the Sunfield programs.

As can be seen from the above descriptions, sibling support programs differ in the emphasis placed on facilitating increased peer support,

sharing of information, and increased involvement of the sibling with the brother or sister with the disability. Furthermore, many of the programs incorporate two or three of these themes into their overall goals or objectives.

Treatment Participants

The majority of sibling supports focus on school-aged children. Sibshops were originally developed for siblings aged 8–13 years but had been adapted to older or younger school-aged children (Conway & Meyer, 2008; Meyer & Vadasy, 1994). The Sibkid listserv is geared toward siblings under 18 years of age. The Thistletown program included siblings aged 6–16 years (Smith & Perry, 2004), ISEE included siblings aged 7–15 years (Williams et al., 2003), and the program for disadvantaged children included siblings aged 9–12 years (Phillips, 1999). Further, the SibLink program included siblings aged 8–13 years (Lobato & Kao, 2002). Two of the programs are open to adult siblings. The Sunsibs program allows adult siblings to participate, as long as their brother or sister with the disability is between 6 and 19 years of age (Conway & Meyer, 2008). The Sibnet listserv is open to siblings who are 18 years of age or older.

Nearly all of the existing sibling supports focus on siblings of individual with intellectual or developmental disabilities more generally, including those with ASD. The sole program that included only siblings of individuals with ASD is the Thistletown program. Two of the sibling supports – the ISEE and SibLink programs – included siblings of children with chronic illness in addition to siblings of children with developmental disabilities.

Treatment Procedures

Sibling supports take the form of workshops/events, one-on-one supports, and secure internet listservs. Specific information about the procedures and content for each program can be found in the References and Readings. Workshops and events are the most prevalent type of procedure. Sibshops (Meyer & Vadasy, 1994) consist of events that contain a mix of information, discussion, games, activities, and guests. The Thistletown program is an 8-week, age-specific support group that includes exercises, games, and activities promoting group cohesion, informational session on autism and related disorders, and discussions of feelings and attitudes associated with living with a person with a developmental disability (Smith & Perry, 2004). Similarly, the SibLink program consists of six 90-min sessions conducted over 6–8 weeks, focused on improving sibling knowledge and family communication, managing feelings about having a brother or sister with a disability, and discussing how to balance siblings' own needs (Lobato & Kao, 2002). The SibLink program also includes recreational activities at each session. The ISEE program contains structured teaching about the brother's or sister's disability or illness and psychosocial sessions over the course of a 5-day summer camp and two follow-up booster sessions (Williams et al., 2003). The program for socioeconomically disadvantaged children consists of an after-school program that lasts for 15 weeks and involves discussion about developmental disabilities, recreational activities, and homework assistance (Phillips, 1999). The commonalities among most of these programs are the following: (1) having a specific starting and ending point with a limited number of sessions (except for Sibshops, which is ongoing) and (2) inclusion of social, informational, and recreational components.

The other procedures are less common. The Sunsibs program involves more direct support and training to the sibling, whereas the Sibkid and Sibnet listservs involve siblings in posting and responding to messages on a secure website.

Efficacy Information

All of the sibling supports except for Sunsibs and the Sibkids/Sibnet listservs have some information about efficacy. However, it is difficult to draw

conclusions about efficacy as the authors were only able to find one study that tests efficacy for most of the programs. Specific information about efficacy for each program is available in the References and Readings. Four of the five studies included standardized, validated measures as indicators of efficacy. Two programs – the ISEE program and the program for socioeconomically disadvantaged children – included before and after treatment measures and a control group that did not receive the treatment. For the ISEE program, researchers found improvements in knowledge and attitudes, social support, and self-esteem, and to some extent, behavior problems for siblings in the full-treatment condition (structured teaching and psychosocial sessions at summer camp) and improvements in attitude, self-esteem, and social support in the partial-treatment condition (summer camp only). Researchers concluded that there were dosage effects, with the full-treatment siblings showing the most improvement and partial-treatment siblings showing more improvement than controls (Williams et al., 2003). Researchers testing the program for socioeconomically disadvantaged children collected data on sibling depression, anxiety, perceived social support, and sibling relationship. They found improvement in each of these measures from before to after intervention, with no improvement in the control group (Phillips, 1999).

Efficacy evaluation of two of the interventions – the Thistletown and SibLink programs – included standardized measures taken before and after intervention but no control group. Siblings who participated in the Thistletown program reported increased self-concept and greater knowledge about their brother's or sister's disability (ASD) at the conclusion of the program, but there were no significant differences in coping (Smith & Perry, 2004). After treatment, participants in the SibLink program reported more accurate knowledge of their brother's or sister's disability, greater connectedness with that sibling, and fewer behavior problems relative to pretreatment (Lobato & Kao, 2002).

Finally, efficacy of Sibshops was not evaluated by standardized measures, but instead by asking 30 sibling participants about their feelings regarding the program (Johnson & Sandall, 2005). Evaluators found that over 90% of surveyed siblings reported positive effects of Sibshops on their feelings toward their brother or sister, over 60% stated that Sibshops taught them coping skills, and 94% said that they would recommend Sibshops to others. In a study of 16 Sibshops participants, D'Arcy, Flynn, McCarthy, O'Connor, and Tierney (2005) found that 14 children reported that they liked the program, with 11 rating Sibshops as "excellent" or "very good," though the participants showed no significant improvements in self-esteem after attending Sibshops.

In sum, there is some evidence to suggest that sibling supports are effective in improving sibling knowledge about their brother or sister with disabilities and sibling psychosocial and behavioral outcomes. Further study is needed to determine whether benefits of each of these sibling supports are also found in other samples.

Outcome Measurement

A number of standardized measures used to determine efficacy were included in the studies. There were no common efficacy measures across studies. In other words, each instrument was used as an indicator of efficacy in only one of the interventions/support programs. Self-esteem and self-concept were measured using the Piers-Harris Children's Self-Concept Scale (Piers & Harris, 1969), the Self-Perception Profile for Children (Harter, 1985), and the Self-Esteem Questionnaire (DuBois, Felner, Brand, & Phillips, 1996). Sibling psychological well-being was measured using the Child Depression Inventory (Kovacs, 1992) and the Children's Manifest Anxiety Scale-Revised (Reynolds & Richmond, 1985). Sibling behavior problems were measured using the Eyberg Child Behavior Inventory (Eyberg & Robinson, 1983) and the Child Behavior Checklist (Achenbach & Edelbrock, 1983). Sibling social support was measured with the Social Support Scale for Children (Harter, 1985) and the Perceived Social Support Scale-Revised (Procidino & Heller, 1983). A number of different measures of sibling

knowledge of, attitudes about, and relationship toward their brother or sister with the disability were used to determine efficacy, many of which appear to be developed for that specific research project. Exceptions include the Autism Knowledge Measure for Young Children (Perry, 1989), the Sibling Relationships Questionnaire (Furman & Buhrmester, 1985), and the Sibling Perception Questionnaire (Hodapp, Wijma, & Masino, 1997; Sahler & Carpenter, 1989).

Qualifications of Treatment Providers

Just over one-half of the sibling supports have no specified qualifications for treatment providers except for training in that specific support program. The exceptions are the ISEE program, which uses pediatric nurse clinicians to deliver treatment, and the program for socioeconomically disadvantaged children, which require team leaders to have a minimum of 3 years of experience working with families of children with developmental disabilities and at least a high school education. The SibLink program was delivered by two doctoral-level trainees in psychology or psychiatry for each sibling group.

See Also

- ▶ Family Burden
- ▶ Family Therapy

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Siemerling-Creutzfeldt Disease

▶ Adrenoleukodystrophy

Sign Language

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Synonyms

American sign language (ASL); Conceptually accurate signed English (CASE); Linguistics of verbal English (LOVE); Manual sign; Manually coded English (MCE); Seeing essential English (SEE I); Signed English; Signing exact English (SEE II)

Definition

Sign language is a system of communicating visually and spatially through signs created with the hands. The term "sign language" does not specify a particular sign system such as American Sign Language (ASL) or manual codes of English such as Seeing Essential English (SEE I), Signing Exact English (SEE II), Linguistics of Verbal English (LOVE), and Conceptually Accurate Signed English (CASE). However, the word "language" denotes a rule-governed system of communication and not a code for a language. ASL is the natural language of the deaf community in the United States and much of Canada (Neidel et al., 2000). ASL is a distinct language from spoken English, while manual codes of English are based on spoken English and are an attempt to represent English on the hands. Typically, when signing is employed in the language intervention for children with autism, the type of signing systems that are used are manual codes of English rather than ASL. The main reason for this may be the hope that using sign language will lead to verbal communication, an outcome which has been supported by research (Schlosser & Wendt, 2008).

See Also

▶ American Sign Language (ASL)
▶ Manual Sign

References and Readings

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Signed English

▶ Manual Sign
▶ Sign Language

Signing Exact English (SEE II)

▶ Manual Sign
▶ Sign Language

Siladryl Allergy [OTC]

▶ Diphenhydramine

Silphen Cough [OTC]

▶ Diphenhydramine

Simple Phobia

► Phobia

Simply Sleep™ [OTC]

► Diphenhydramine

Simpson-Angus Scale for Extrapyramidal Symptoms

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Definition

The Simpson-Angus Rating Scale is a 10-item scale used to rate adverse neurological effects of antipsychotic medications more broadly. It involves direct observation and a brief neurological examination.

For example, the rating requires the clinician to observe the patient's gait and check for tremor, excessive salivation, as well as rigidity in the arms, shoulder, and neck.

Each item is rated from 0 to 4 and a total score can be obtained.

See Also

► Antipsychotics: Drugs

References and Readings

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Sinequan

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Synonyms

Doxepin

Definition

Sinequan (doxepin) is a tricyclic antidepressant medication that has largely fallen out of use as an antidepressant. It is approved for the treatment of adults with insomnia – especially midsleep awakening. It is associated with multiple adverse effects including poor coordination, confusion, and increased heart rate and also has a potential for cardiac arrhythmia. Other adverse effects include dry mouth, urinary retention, and constipation. There are no studies of the use of doxepin in children or adults with autism spectrum disorders.

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Single Case

► Qualitative Versus Quantitative Approaches

Single-Nucleotide Polymorphism

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Synonyms

Single-nucleotide variation; SNP

Definition

A single-nucleotide polymorphism (SNP, pronounced "snip") is the variation in a single base of DNA that is present in at least 1% of the population. SNPs are a subset of single-nucleotide variants (SNVs) that include both rare (<1%) and common (≥1%) variants of a single base pair. The term SNP usually refers to a substitution (when a different base pair is present, e.g., ATCCA instead of ATGCA) rather than a single base insertion (e.g., ATCACA) or a single base deletion (e.g., ATCA). Confusingly, the abbreviation "SNP" is sometimes used to describe insertions or deletions of a few bases of DNA or rare single-nucleotide polymorphisms (which are technically SNVs).

SNPs may be found in coding or noncoding regions of the genome and particular variants may increase or decrease risk of a particular disease. Alternatively, a SNP may also act as a marker for a nearby variant that contributes risk or resilience. Therefore, SNPs are commonly used in genetic studies looking for common variants associated with disease such as genome-wide association studies (GWAS).

Every human has about three million SNPs (and an additional 150,000 rare SNVs). Since there are so many SNPs, every individual has a unique combination of SNPs (except for identical twins). This diversity means SNPs can be used to identify a person from a forensic sample (DNA fingerprinting), to identify family relationships, and to examine the ancestral origins of an individual (e.g., African, European, Asian).

Human SNPs are recorded in the NCBI database "dbSNP" (http://www.ncbi.nlm.nih.gov/projects/SNP/). Each SNP has a unique identifier beginning with the letters "rs," (e.g., rs3572840). For many SNPs, ancestry information is given and a small number include clinical information about known disease risk associations.

See Also

- ▶ Common Disease-Common Variant Hypothesis
- ▶ Copy Number Variation
- ▶ DNA
- ▶ Genetics
- ▶ Genome-Wide Association

Single-Nucleotide Variation

- ▶ Single-Nucleotide Polymorphism

Single-Subject Design

- ▶ Qualitative Versus Quantitative Approaches

Single-Subject Study

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Definition

Single-subject research (sometimes referred to as single-case research) refers to a collection of experimental research designs (e.g., multiple baseline, withdrawal, alternating treatment; see references

for list of guides) that can be used to measure the effects of an intervention in individual participants. By manipulating the experimental conditions, each individual serves as their own control, enabling scientists to infer causal relations.

Historical Background

Early examples of single-subject research can be found in research in psychology and physiology conducted in the nineteenth and early twentieth centuries. Scientists such as Fechner, Ebbinghaus, and Pavlov all used individual research subjects and repeated measure over time in their experiments (Barlow, Nock, & Hersen, 2009). With this focus on the individual and frequent measurement, the researchers could identify variables related to changes in subject performance. These characteristics of frequent measurement, repeated over time at the individual level, are the hallmark of single-subject design because they allow each subject (or *participant* in studies with humans) to serve as their own control. The generality of findings relevant for individuals is then examined with additional subjects to identify fundamental variables responsible for the phenomena under study.

Burrhus Frederick Skinner's research was largely focused on single-subject methodology and resulted in an extensive body of findings related to learning and behavior. Skinner conducted thousands of experiments showing how certain variables resulted in consistent effects on learning and performance (see Ferster & Skinner, 1957; Skinner, 1938) and, more than any other person, is responsible for the development of the laws of behavior central to fields of the experimental analysis of behavior and applied behavior analysis (ABA; see Baer, Wolf, & Risley, 1968). Since Skinner and other early scientists pioneered single-subject research, others have continued to use and advocate for the use of single-subject research methodology as the primary way to identify specific variables related to individual's success and lack of progress.

The logic of single-subject design is focused on establishing a predictable trend in behavior, such that if any changes in behavior are noted, they can be attributed to changes made in interventions at the time of the change in behavior. By establishing this predictable trend, or baseline, an individual can serve as his/her own control, eliminating the need for a comparison group or other control procedures. To establish this baseline, single-subject design uses frequent data collection to track performance on target behaviors for a single individual, such as initiating conversation, on-task behavior, or occurrence of inappropriate behaviors. As data are collected, the data can then be summarized in graphical form, which provides a clear illustration of trends in the target behavior over time; trends can be improving, deteriorating, or stabile (i.e., no change). Once these trends are established, then changes can be made, if necessary, to improve performance. Following changes, comparisons can be made between pre- and post-change levels in performance.

Current Knowledge

Research studies including individuals with autism spectrum disorders (ASDs and other populations) are often separated into two research paradigms, group-design and single-subject research. Notably, each design is appropriate for some research questions and not others. At times, it has been incorrectly noted that one research methodology is superior to another. This perspective fails to account for the nature of the questions being asked. Broadly speaking, group research is designed to answer what is the average effect of a procedure on a group of individuals. Single-subject research, on the other hand, is designed to ask to what extent will a given procedure results in clear effects observed with each individual. In other words, group-design research asks about the average effect of a treatment, and single-subject research asks about effects at the individual level. In relation to individuals with ASDs, single-subject research has been invaluable because it is sensitive to the wide variety of individual strengths and challenges experienced by individuals with ASDs and is the only way to identify the key variables and interventions that result in increased

success for each individual. In fact, intervention research on children with ASDs and single-subject designs is more frequently used than all other research paradigms (Reichow, Barton, Volkmar, & Cicchetti, 2007) and has laid the foundations for the identification of many evidence-based treatments for individuals with ASDs.

Relative to autism research, single-subject design has been invaluable in demonstrating important outcomes for individuals with ASDs and the careful assessment and planning that is necessary to appropriately individualize interventions for each person. In addition to basic and applied research, single-subject design has been central to educational and therapeutic interventions for individuals with ASDs. Single-subject design methodology is also the foundation of effective data-based decision making for individuals in educational and therapeutic settings, where ongoing data collection, progress monitoring, and using those data to identify the need for program revision is essential. The translation of this research paradigm into practice where it can be used to isolate intervention effects at the level of the individual is critical for ensuring that individuals receiving services have effective programs that are helping move them toward optimal outcomes.

Finally, it is important to note that single-subject design is not the same as case study research. Case study research is limited to an account of an individual's performance or experiences over the course of some intervention(s) or a retelling of an account of case(s) from a clinician (e.g., Kanner's original 1943 report of 11 children with early infantile autism could be considered a case study). When used to describe interventions, case study research is not experimental in that it does not allow for clear identification of functional relations between variables (i.e., causal relations), whereas single-subject designs, on the other hand, manipulate experimental conditions such that a functional relation (causal relation), if existing, can be identified.

See Also

► Applied Behavior Analysis
► Behavior Analysis

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Singsong

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Definition

Odd patterns of vocal intonation can be referred to as "singsong," a term which generally describes a speech style with a wide pitch range with large rises and falls. It should be noted that this term is somewhat imprecise as it is also occasionally used to describe a very different style of speech with a particularly narrow pitch range, as in a poetry reading, or speech produced to the tune of a preferred song. In all cases, this term is used to indicate that speech has a quality that is different from the typical melodic patterns of conversation. Some individuals with ASD have been noted to

have a "singsong" style of speaking, with exaggerated or theatrical-sounding prosodic patterns.

See Also

- ▶ Intonation
- ▶ Monotone
- ▶ Pedantic Speech
- ▶ Prosody

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SIPT

- ▶ Sensory Integration and Praxis Test

Situations-Options-Choices-Consequences-Strategies-Simulation (SOCCSS) Program

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Definition

Situations-Options-Choices-Consequences-Strategies-Simulation (SOCCSS) Program is a strategy developed by Jan Roosa according to Myles and Aderon (2001). It is a social decision-making process designed to help students on the autism spectrum and with other disabilities understand social situations. Individuals on the autism spectrum have difficulty in instances where they must understand and act upon the "unwritten rules" of a social situation. It is a step-by-step process by which individuals with ASDs learn to analyze and apply discrete skills in a given situation (Texas Statewide Leadership for Autism, 2009). This is a particularly helpful technique because individuals with ASDs have difficulty generalizing skills across environments and situations. SOCCSS can be used analytically as an interpretive tool or it can be used as an instructional tool to aid in learning how to handle future social situations. Gray's (1994) *Comic Strip Conversations* have been described as a visual or graphic SOCCSS (Minnesota Para-Professional Consortium).

The SOCCSS social skills strategy consists of the six steps that comprise the acronym. Step 1 *S*ituation: the teacher or therapist helps the individual analyze the problem by answering the five "W's" (i.e., who, what, when, and why) of the situation. Step 2 *O*ptions: involves brainstorming ways to respond. Step 3 *C*onsequences: includes a review of the possible consequences of each option generated in the previous step. Step 4: *C*hoices: consists of reviewing each options-consequences sequence and then prioritizing possible responses. The individual then selects his or her most likely response. Step 5 *S*trategy: turns the previous four steps into a plan of action which may include a written script. Step 6 *S*imulations: are practice sessions to deal with situation via guided imagery, reading written scripts, role plays, and other forms of behavioral rehearsal (Minnesota Para-Professional Consortium).

Before the SOCCSS strategy is implemented with an individual with an ASD, he or she should be assessed for his or her abilities across a variety dimensions. These dimensions include behavioral abilities and characteristics of the person with the ASD. SOCCSS requires some ability to:

- Answer who, what, when, where, and why questions

- Understand a simple cause-and-effect relationship
- Make choices
- Follow multistep directions
- Participate in social interactions
- Problem solve
- Identify or accept a socially appropriate outcome
- Generalize learning (Interactive Collaborative Autism Network)

Characteristics that need to be considered when assessing the appropriateness of SOCCSS or the need to modify the strategy include:

- Literal interpretation of information
- Poor perspective taking
- Inflexibility or a tendency to adhere strictly to a routine
- Difficulty predicting outcomes
- Lack of knowledge about social conventions such as turn-taking
- Lack of understanding of the cause-and-effect relationship of one's behavior on others
- Difficulty generalizing learning
- Difficulty multi-channeling (Lawson, 2001), i.e., the ability to respond to more than one stimulus at a time (Interactive Collaborative Network)

See Also

► Comic Strip Conversations

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Skill

► Behavior
► Target Behavior

Skinnerian Categories of Verbal Behavior

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Synonyms

Skinner's verbal behavior; Verbal behavior

Definition

The defining feature of Skinner's view of language is that verbal behavior is a behavior under the control of consequences mediated by other people. For Skinner, the proper object of study is behavior itself. He was less interested in the mental structures like knowledge or language competence but rather the functional relationships of the behavior in the environment in which it occurs. In Skinner's view, verbal

behavior is a function of controlling consequences and stimuli, not the product of a special inherent capacity. The child's response is conditioned by its consequence in a specified situation or what Skinner called the antecedent-behavior-consequence (ABC) structure. The upshot of this theory is the concept that children learn language not because they have any inherent language-learning capacity but because their speech behaviors are consequated by others in the environment. For example, a toddler says "bah" and his mother responds, "Sure! Here's the ball." If the child is rewarded for "emitting" a specific behavior (i.e., making a sound), the child will learn to make the sound again under the same circumstances to gain the same reward. While many scholars contest this view of language learning, it suggests a method of teaching verbal behaviors to children, by careful structuring of antecedents to help children acquire words for a range of functions.

Skinner's categories of verbal behavior include echoic, mand, tact, and intraverbal. According to Skinner's theory, each has a different function and will be produced under circumstances that elicit that function. An echoic is the repetition of a heard word or phrase for verbal learning and practice, or an imitation. It is elicited by a request for imitation and a reward of the imitation. A mand behavior functions as a request (e.g., "Can I have juice") to immediately benefit the speaker. A tact is a label (e.g., "ball," "duck"). Intraverbals are responses to others' verbal behavior (conversational responses).

See Also

► Operant Conditioning

References and Readings

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Skinner's Verbal Behavior

► Skinnerian Categories of Verbal Behavior

SLDT-A

► Social Language Development Test

SLDT-E

► Social Language Development Test

Sleep Bruxism

► Bruxism

Sleep Disorders

► Medical Conditions Associated with Autism

Sleep-ettes D [OTC]

► Diphenhydramine

Sleepinal® [OTC]

► Diphenhydramine

Sleep-tabs [OTC]

► Diphenhydramine

SLO Syndrome

▶ Smith-Lemli-Opitz Syndrome

SLOS

▶ Smith-Lemli-Opitz Syndrome

SLP

▶ Speech-Language Pathologist (SLP)

Smith V. Robinson (1984)

▶ Smith v. Robinson (1984) Rights to Attorney Fees for Parents

Smith v. Robinson (1984) Rights to Attorney Fees for Parents

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Synonyms

Smith v. Robinson (1984)

Definition

This case addressed a parent's entitlement to reimbursement of attorney's fees incurred as a result of legal action against a public school board for discrimination against the special needs of a mentally impaired student. In *Smith v. Robinson*, the Cumberland, Rhode Island, superintendent of schools denied continued funding, by the school committee, of the necessary special programs required by the petitioner, a child who suffers from cerebral palsy and other mental handicaps. The petitioner's parents filed an action in federal district court against the school committee and against various state school officials. The parents brought forth claims for declaratory and injunctive relief based on state law, specifically the Education of the Handicapped Act (hereinafter "EHA" or the "Act"), on §504 of the Rehabilitation Act of 1973 and, with respect to certain federal constitutional claims, on 42 U.S.C. §1983. Although the district court originally found for the petitioner and awarded attorney's fees, on appeal, the Court of Appeals reversed the lower court's decision on the grounds that the petitioner's action, and subsequent relief granted, fell within the scope of the Act which does not provide for attorney's fees. The Court of Appeals went on to state that notwithstanding the petitioner's federal constitutional claims – which generally allow for the reimbursement of attorney's fees – the relevant decision was within the scope of the EHA and that the Act's omission of attorney's fees does not imply the court's use of federal law in awarding fees. The US Supreme Court thereafter upheld the Court of Appeals' decision.

Conclusion

In *Smith v. Robinson*, although the child's parents prevailed in their claims of discrimination and violation of due process against the school committee in federal court, the US Supreme Court held against reimbursement of attorney's fees for the entire proceedings.

The Supreme Court held that a petitioner availing himself of the EHA and being successful thereunder cannot collect attorney's fees for unsuccessful federal claims simultaneously filed. In addition, the court found that the specific

simultaneous claims – §504 of the Rehabilitation Act of 1973 and on 42 U.S.C. §1983 – raised by the petitioners did not, in and of themselves, allow for attorney's fees.

See Also

► Liability

Smith-Lemli-Opitz Syndrome

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Synonyms

7-Dehydrocholesterol reductase deficiency; RSH syndrome; SLO syndrome; SLOS

Short Description or Definition

Smith-Lemli-Opitz syndrome (SLOS) was described by the original authors as "RSH syndrome" based on the first initials of three individuals with SLOS (Smith, Lemli, & Opitz, 1964). New cases were later described and additional characteristics were delineated. SLOS is an autosomal recessive disorder due to inborn error of cholesterol metabolism caused by mutations of the 7-dehydrocholesterol reductase gene (*DHCR7*) (Tint et al., 1994), and the gene was later identified at 11q12-q13 (Fitzky et al., 1998; Wassif et al., 1998; Waterham et al., 1998). In individuals with SLOS enzyme, activity of the protein coded by *DHCR7* is reduced or absent, resulting in insufficient cholesterol synthesis and the accumulation of precursor sterols, 7-dehydrocholesterol (7DHC) and its isomer 8-dehydrocholesterol (8DHC). This deficiency causes extremely variable clinical, physical, and behavioral manifestations: from presenting as a lethal disorder with multiple major congenital anomalies to presenting with minor physical stigmata, as well as behavioral and learning disabilities, autism spectrum disorders, aggression, self-injury, sleep problems, irritability, and attention deficit hyperactivity disorder.

Categorization

Smith-Lemli-Opitz-Syndrome (SLOS) is categorized as an autosomal recessive multiple malformation Mendelian disorder (Kelley, 2000; Opitz, 1969).

Epidemiology

SLOS has an estimated incidence among individuals of European ancestry in Canada and the USA of 1 in 15,000 to 1 in 60,000 births (Bzdúch, Behulova, & Skodova, 2000; Lowry & Yong, 1980; Opitz, 1999a; Porter, 2000; Ryan et al., 1998; Tint et al., 1994) and a carrier frequency of 1 in 30 to 1 in 50 for the most common SLOS mutant allele in North American populations (Battaile et al., 2001; Nowaczyk & Waye, 2001). In the Asian and African races, SLOS is less common and historically females were diagnosed less frequently due to a lower degree of visible genital anomalies (Porter, 2000). In those affected with more severe mutations, there is increased incidence of intrauterine fetal deaths and neonatal deaths. Also, individuals with SLOS who have mild features are often not diagnosed and may come to the attention of clinicians due to the diagnosis of SLOS in a family member.

Individuals with SLOS have a deficiency of 3-beta-hydroxysterol delta-7-reductase activity due to mutation of the 3-beta-hydroxysterol delta-7-reductase gene (*DHCR7*). This enzymatic deficiency impairs the conversion of 7-dehydrocholesterol (7DHC) to cholesterol in

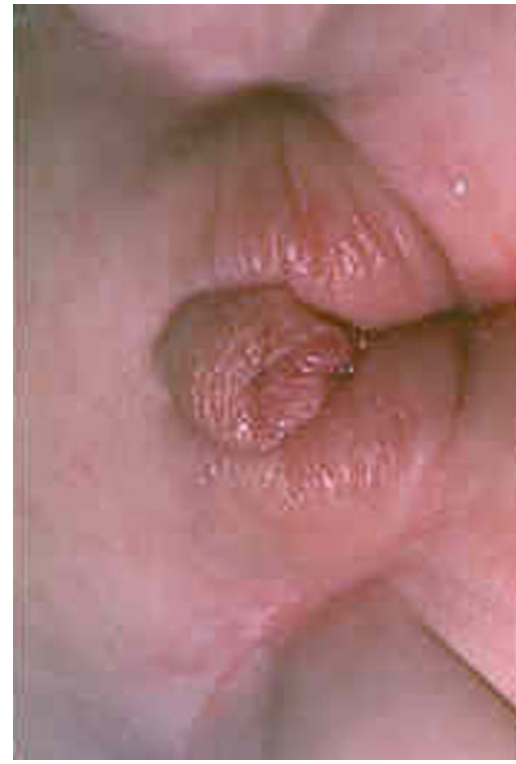
the last step of cholesterol biosynthesis via the Kandutsch-Russel biosynthetic pathway. Therefore, total sterol and cholesterol levels are decreased and 7DHC and 8DHC levels are elevated (Porter, 2000). In SLOS, the clinical (nonbehavioral) severity of abnormalities correlates with the ratio of the blood level of 7DHC (or the sum 7DHC plus 8DHC) expressed as a fraction of total sterols (total sterols = cholesterol plus 7DHC plus 8DHC) (Kelley & Hennekam, 2000). The best biochemical predictor of clinical severity is the plasma cholesterol level, which decreased with increasing clinical severity (Cunniff, Kratz, Moser, Natowicz, & Kelley, 1997). Independent of sterol synthesis, absolute blood sterols levels are subject to wide physiological variables, giving a spectrum of variability (Kelley & Hennekam, 2000). In one study, approximately 10% of subjects with SLOS had normal cholesterol levels at the time of diagnosis, and the SLOS diagnosis would have been missed without specific quantification of 7DHC (Cunniff et al., 1997).

Natural History, Prognostic Factors, Outcomes

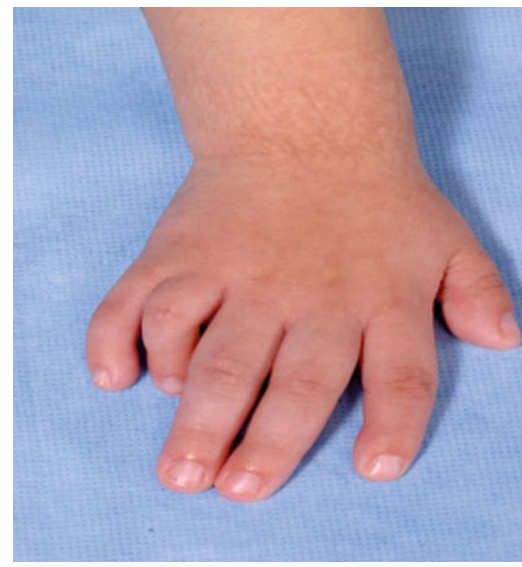
Smith-Lemli-Opitz Syndrome is characterized by major abnormalities of development at birth (Kelley, 2000). At 6 weeks of gestation when the heart chambers and cerebral ventricles are forming, there are disturbances in morphogenesis. Furthermore, at 12 weeks of gestation, more effects are noted during the development of terminal digits (K).

Clinical Expression and Pathophysiology

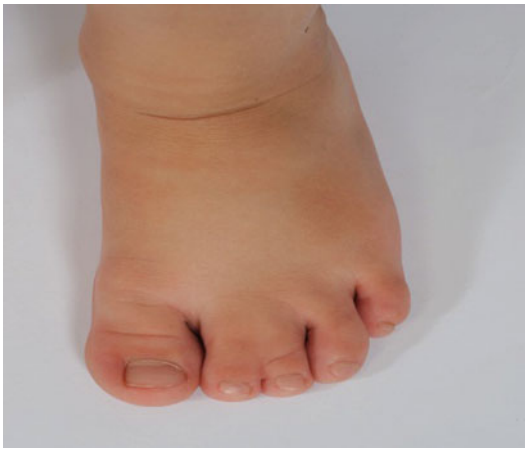
The clinical manifestations of SLOS are extremely variable and the phenotypic spectrum is broad. At the severe end of the spectrum, SLOS is a lethal disorder with multiple major congenital anomalies, and in mild cases SLOS combines minor physical stigmata with behavioral and learning disabilities. Phenotypic features include developmental delay, abnormal genitalia,



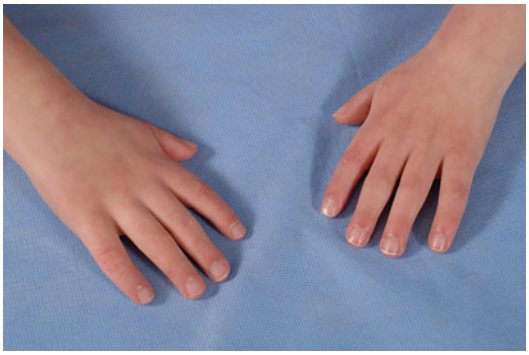
as well as hand and toe abnormalities that may include:
Polydactyly



and toe syndactyly.



Short Thumbs



In mild cases, toe syndactyly may be the only evident physical anomaly (Bukelis, Porter, Zimmerman, & Tierney, 2007). Hirschsprung disease, sexual ambiguity, or partial sex reversal in 46, XY males and structural defects of the heart, lungs, liver, and kidneys may occur (Kelley, 2000). Facial and cranial abnormalities that may occur include hypertelorism, narrow forehead, short nose with upturned nares, prominent nasal bridge, soft cleft palate or bifid uvula, posteriorly rotated and low-set ears, micrognathia, high-arched hard palate, and microcephaly (Kelley & Hennekam, 2000). Potential ocular abnormalities include cataracts, underdevelopment of the optic nerve, ptosis epicanthus, unequal palpebral fissures, and convergent strabismus. Other central nervous system (CNS) anomalies include agenesis or hypoplasia of the corpus callosum or cerebellum, increased ventricular size, and decreased size of frontal lobes (Nowaczyk & Tierney, 2004). In the more severely affected individuals, there may be lethal brain defects such holoprosencephaly (seen in about 5%) and incomplete myelination (Jira et al., 2003). Structural abnormalities include callosal abnormalities, a Dandy-Walker variant, an arachnoid cyst, and holoprosencephaly (Caruso et al., 2004). The individuals may have severe language impairment (Kelley, 1996; Nwokoro & Mulvihill, 1997; Tierney, Nwokoro, & Kelley, 2000, 2001, Tierney et al., 2001; Tint et al., 1994), with greater receptive than expressive language abilities (Kelley, 1996; Tierney et al., 2001). Nwokoro and Mulvihill (1997) described a sleep disturbance and Ryan et al. (1998) studied 23 biochemically confirmed subjects aged 6 months and older and found that 70% had a sleep cycle disturbance that usually did not respond to sedatives. Individuals with SLOS have also been described as "hyperactive" (Elias & Irons, 1995; Opitz, 1999b), and attention deficit hyperactivity disorder was diagnosed in one child, who was reported to have a positive clinical response to treatment with methylphenidate (Nowaczyk, Whelan, & Hill, 1998). Abnormal aggression occurred in 35 of 56 subjects (63%) in a repeated manner sometime in the past or present, and 89% of individuals with SLOS had repeated self-injury, 54% had self-biting, 48% had head banging, and 54% had opisthokinesis (a highly characteristic arched backward diving motion of the upper body often resulting in the child's hitting an object). An additional 7 subjects (13%) did not demonstrate the characteristic opisthokinesis but did arch their neck backward frequently, while 17 (30%) did neither (Tierney et al., 2001). Over half of 17 subjects with SLOS meet Autism Diagnostic Interview (ADI-R) and DSM-IV diagnostic criteria for autism (Tierney et al., 2001), and in another study of 14 SLOS subjects, approximately three-fourths (71–86% depending upon the evaluation method) met the criteria for some variant of ASD, with 50% having met the criteria for autism (Sikora, Pettit-Kekel, Penfield, Merkens, & Steiner, 2006).

The characteristic irritability of SLOS continues throughout life, with aggression reported

in both children and adults (Pauli, Williams, Josephson, & Tint, 1997; Ryan et al., 1998). Tierney et al. (2001) found that a group of 30 individuals with SLOS, ages 3.2–32.4 years, had auditory, oral, visual, and tactile processing difficulties (sensory hyperreactivity/hypersensitivity) that was greater than 2 standard deviations from the mean observed with a group of typical subjects (Dunn & Westman, 1997), and had statistically greater difficulties with these behaviors than typical subjects (Dunn & Westman, 1997), subjects with attention deficit hyperactivity disorder (Bennett & Dunn, 1996), Asperger disorder (W. Dunn, personal communication, 1999), autistic disorder (Kientz & Dunn, 1997), and other developmental disorders (Ermer & Dunn, 1998). Such injuries frequently present and was found upon interview that 89% of subjects had a history of self-injury at some time and that 68% had self-injury within the prior month including less injurious behaviors such as skin picking, and the Nisonger-CBRF scale demonstrated a self-injury rate of 83% that occurred within the 2 months prior to assessment (Tierney et al., 2001).

Evaluation and Differential Diagnosis

Professional organizations such as the American Academy of Neurology and the Child Neurology Society are recommending screening for biochemical and genetic disorders that are associated with ASDs (Filipek et al., 2000). A clinical diagnosis of SLOS or suspected mild SLOS can be confirmed by biochemical testing. An elevated plasma 7DHC level relative to the cholesterol level establishes the diagnosis, although 7DHC levels can also be measured in other tissues. Furthermore, although the majority of individuals with SLOS have lower than normal cholesterol levels, approximately 10% of affected individuals diagnosed clinically and biochemically with SLOS have normal total cholesterol levels and only mildly elevated levels of 7DHC (Irons, 2007), particularly those who have a milder phenotype or are older (Kelley, 1995). Thus, a normal value for plasma cholesterol does not exclude the diagnosis of SLOS. Also, different laboratories may report the 7DHC results in either milligrams per deciliter, micrograms per milliliter, or millimoles per liter (Irons, 2007).

Some neuroleptic medications for the treatment of behavioral and psychiatric disorders interfere with the activity of enzyme DHCR7 and mildly lower the production of cholesterol. This may lead to false-positive test results. Molecular genetic testing and/or fibroblasts testing is needed to clarify the diagnosis in those individuals. More than 120 mutations in SLOS have been described (Correa-Cerro & Porter, 2005; Yu & Patel, 2005).

Genetic Counseling

Due to the autosomal recessive nature of the disorder, each sibling of an affected individual should be tested as there is a 25% chance that an offspring will be affected, a 50% chance of being an asymptomatic carrier, and a 25% chance of being unaffected and not a carrier (Irons, 2007). Carriers are heterozygotes for SLOS and are not at risk of developing the disorder and do not have abnormal cholesterol levels. Biochemical testing of fibroblasts has been used for carrier detection (Shefer et al., 1997), as has molecular carrier testing if the *DHCR7* mutations in the family are known. For evaluation of the affected individual, in addition to biochemical testing, molecular genetic testing is used. Most affected individuals are compound heterozygotes for two different abnormal alleles, with an overall mutation detection rate of 96% (Witsch-Baumgartner, Löffler, & Utermann, 2001). It has been hypothesized that the other mutations that are not detected on molecular testing are due to mutations that regulate the transcription or function of the gene product (Correa-Cerro & Porter, 2005). Biochemical testing or molecular genetic testing can be used for prenatal pregnancies (Irons, 2007). Knowing the specific mutation mutations that the parents carry can help to assess for risks in the affected offspring. For pregnancies of carriers in families that may result in SLOS, diagnostic elevation of 7DHC levels may be assessed for in amniotic fluid obtained by amniocentesis (Abuelo et al., 1995; Dallaire et al., 1995;

Rossiter, Hofman, & Kelley, 1995) or in tissue obtained from chorionic villus samples (CVS) (Mills et al., 1996; Sharp, Haan, Fletcher, Khong, & Carey, 1997). In fetuses who have a family history of a mild variant form of SLOS, the 7DHC enzyme deficiency will need to be demonstrated in cultured amniocytes (Irons, 2007).

Treatment

Cholesterol is needed not only for myelination, neuroactive steroid synthesis, and cell wall structure in the body but is also needed for modulation of the oxytocin receptor, serotonin receptors, and the G-proteins that are necessary for other neurotransmitter function (Bukelis et al., 2007; Lee & Tierney, 2011). The current standard treatment for SLOS is to begin dietary cholesterol supplementation as soon as this condition is diagnosed. Cholesterol is supplied in natural form (egg yolk, cream, liver) or as a purified cholesterol suspension; the dosing for the cholesterol suspension typically is started in the range of 40–50 mg/kg/day up to 150 mg/kg/day for maintenance treatment (Linck, Lin, Flavell, Connor, & Steiner, 2000). Cholesterol supplementation improves the ratio of cholesterol to total sterols (Elias, Irons, Hurley, Tint, & Salen, 1997; Irons et al., 1997; Nwokoro & Mulvihill, 1997) and can decrease 7DHC levels (Linck et al., 2000).

Tube feeding is often required in infants and younger children because of feeding difficulties. Medical and surgical management of gastroesophageal reflux may be needed. During severe acute illness (e.g., infections) or following major surgical procedures, patients with SLOS may develop overt adrenal insufficiency requiring fresh frozen plasma as a source of cholesterol.

Treatment of individuals with SLOS with dietary cholesterol supplementation has resulted in limited clinical effects and benefits. Yet, clinical anecdotal reports and open-label studies with cholesterol treatment in children with SLOS have demonstrated reductions in the number of infections, decreased rashes (Elias et al., 1997), reduced photosensitivity (Azurdia, Anstey, & Rhodes, 2001, Elias et al., 1997; Starck, Lovgren-Sandblom, & Bjorkhem, 2002), and improved speech articulation (Irons et al., 1997). In a study of six children with SLOS (from birth to 11 years) receiving cholesterol supplementation, Elias et al. (1997) reported that all of the six children had decreased problem behaviors, better tolerance of infection, improvement of gastrointestinal symptoms, as well as the improvement in photosensitivity, rashes, and infections noted above. After cholesterol supplement is begun, individuals had decreased irritability (Elias & Irons, 1995; Nwokoro & Mulvihill, 1997), a happier affect (Irons et al., 1995; Nwokoro & Mulvihill, 1997; Pauli et al., 1997; Opitz, 1999b), decreased hyperactivity with improved attention (Elias & Irons, 1995), and decreased self-injury. Other behaviors reported to improve with cholesterol supplementation include aggressive behaviors (Nwokoro & Mulvihill, 1997; Ryan et al., 1998), temper outbursts, trichotillomania, and tactile defensiveness (Nwokoro & Mulvihill, 1997). In order to retrospectively compare the behaviors that occurred before and after cholesterol supplementation began, a Parenting Global Rating Form was completed by the parents of 44 subjects who began cholesterol supplementation after early infancy. The parents of 6 subjects (12%) said that there was no change in behavior following treatment with cholesterol. For the remaining 38 subjects (75%) for whom the parents saw behavioral change after cholesterol treatment was initiated, the mean score was 7.9 $\pm$ 1.7 on a scale of 1 (terrible) to 10 (excellent), indicating that they believed that cholesterol supplementation had a very positive effect on average (Tierney et al., 2001). Kelley and Hennekam (2000) also reported that irritability and sleep disorders improved rapidly after initiation of therapy in contrast to other behavioral issues such as tactile sensitivity which improved over a longer period of time. Furthermore, consistent with what is described by many caretakers, they also reported that behavioral abnormalities return when dietary cholesterol therapy is interrupted. Martin et al.

(2001), in a case report, described significant improvement in hyperactivity, aggression, and self-injurious behavior within 48 h of initiating dietary cholesterol therapy.

Elias et al. (1997) reported in six children that all demonstrated improved growth and more rapid progress in development after cholesterol supplementation was begun, with increased pubertal progression in the older subjects. In contrast, however, in a longitudinal study of cognitive, motor, and adaptive developmental progress in 14 youths with SLOS receiving cholesterol supplementation, Sikora et al. revealed that despite dietary cholesterol supplementation, developmental quotients did not improve over time (Sikora et al., 2004). Similarly, in a double-blinded placebo-controlled, crossover trial in ten individuals with SLOS, Tierney, Conley, Goodwin, and Porter (2010) found no short-term behavioral effects of dietary cholesterol supplementation. The disparities in clinical improvements demonstrated by these studies may be related to the absence of a direct cholesterol transport mechanism across the blood-brain barrier (Lee & Tierney, 2011). It is possible that supplementation with cholesterol beginning in infancy or early childhood may improve cognitive outcomes in SLOS patients. But, to date, no positive effect of cholesterol supplementation on cognitive development has been found in a controlled prospective study. Although Sikora et al. (2004) found that the developmental status of SLOS did not improve over time with cholesterol supplementation, it is possible that supplementation with cholesterol beginning in infancy or early childhood may improve cognitive outcomes in individuals with SLOS.

Dietary cholesterol therapy may impact the development of or presentation of autistic features. Individuals with SLOS treated with cholesterol have been reported to be more sociable, including initiating hugs and being more interactive (Irons et al., 1995; Ryan et al., 1998). Of subjects with SLOS who began cholesterol supplementation before the age of 5.0 years (9/17), 22% met the criteria for autism at ages 4.0–5.0 years while on supplementation, whereas, of the 8 subjects not supplemented with cholesterol before age 5.0 years, 88% met the criteria for autism at ages 4.0–5.0 years while not on supplementation (Tierney et al., 2001). Although these findings are retrospective and in a small population, they suggest that cholesterol supplementation might have decreased the severity ASD symptoms that would have occurred. Furthermore, no side effects have been reported with cholesterol treatment, which has been in use for about 15 years, serum cholesterol levels are rarely normalized, and elevated 7DHC levels persist. There is data that suggests 7DHC has some toxic effects in that 7DHC increases the degradation of HMG CoA reductase (resulting in lower sterol levels) (Fitzky et al., 2001) and that 7DHC impairs intracellular cholesterol transport (Wassif et al., 2002). O'Brien et al. (2002) suggested in a rat model that correction of the SLOS CNS biochemical defect is associated with return of a normal eye-blink response.

Multiple lines of evidence suggest that statins, a class of medications used to lower cholesterol in those with abnormally high levels, may improve DHCR7 activity, resulting in increased cholesterol levels in individuals with mild DHCR7 deficiency (Jira et al., 2000), in human fibroblasts from mildly affected individuals (Wassif et al., 2005), and in an SLOS mouse model (Correa-Cerro et al., 2006). The mechanism by which statins may increase plasma cholesterol is hypothesized to result from increased expression of a *DHCR7* allele that encodes a mutant enzyme with residual enzymatic function and is supported by in vitro experiments using SLOS fibroblasts (Wassif et al., 2005).

Mildly to moderately raised levels of 7DHC have been found in three psychiatric patients without SLOS who were treated with haloperidol (Nowaczyk & Tierney, 2004), with 7DHC levels directly proportional to the dose of haloperidol. 7DHC levels decreased to normal upon haloperidol discontinuation, although it is unknown if an increase in the 7DHC level would have a beneficial or a deleterious effect. However, the benefits of these medications for behavioral treatment may outweigh the potential risks of lowering cholesterol synthesis. If the behavioral and learning deficits reported in SLOS are related to

alterations in sterol composition, rather than fixed developmental defects, then therapeutic interventions designed to alter brain sterol composition may be effective in improving behavioral symptoms (Aneja & Tierney, 2008).

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SNAP

▶ Strong Narrative Assessment Procedure (SNAP)

SNP

▶ Single-Nucleotide Polymorphism

Social

▶ Play

Social Anxiety Disorder

▶ Social Phobia

Social Behaviors and Social Impairment

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Definition

Social behaviors encompass all behaviors used to interact and communicate with other people. These comprise behaviors as simple as looking at another and smiling at them to more complex behaviors such as entering into a crowded room with a group of strangers and beginning to interact with them. Many of these behaviors, from the most simple to complex, are challenging for people with an autism spectrum disorder (ASD).

Impairments in the development of social behavior, or social impairments, lie at the heart of autism.

Historical Background

Impairments in social behaviors have been noted from Leo Kanner's (1943) original observations, on which he based his first detailed account of 11 cases of autism. He observed the failure of these children to interact with other people in the usual way, with many preferring to be alone. He wrote about their failure to look at other people, and to even notice their presence/absence, such that "Comings and goings, even of the mother, did not seem to register" and "The father or mother or both may have been away for an hour or a month; at their homecoming, there is no indication that the child has been even aware of their absence." Impairments in social behavior have continued to be considered at the heart of autism, with the various iterations of the DSM (from 1980 onward) including qualitative impairment in reciprocal social interaction as one of the three core diagnostic features.

Current Knowledge

The lack of social reciprocity, considered a core underlying feature of ASDs, is evident from the period of infancy (Barbaro & Dissanayake, 2009) and persists throughout development and into adulthood (Schopler & Mesibov, 1983; Howlin, Goode, Hutton, & Rutter, 2004). Early forms of social impairment are evident in the failure to engage in reciprocal en face interactions with the caregiver(s) comprising behaviors such as eye gaze, affect sharing, and bouts of mutual facial and gestural imitation. These early dyadic behaviors culminate in social routines like peek-a-boo-type games in typical development, which are mutually rewarding for both social partners.

The early deficits in dyadic interactions in autism during infancy lead to concomitant difficulties in triadic interactions, such as engaging in joint attention (shared gaze/affect with a social partner and an object/event of mutual interest) and social referencing. The use of social gestures, such as pointing and waving, typical in prelinguistic children, is also infrequent. Impairments in empathic responding and the early developing positive social behaviors like helping and sharing (collaborative prosocial behaviors) ensue. However, despite these early developing difficulties in social engagement and responding, it is important to note that children with autism develop attachments to their caregivers, which are functionally and qualitatively similar to those of their non-autistic peers (Dissanayake & Sigman, 2001).

In early childhood, there is little initiation of social interactions with other people, which becomes clearly evident during the preschool years, in interacting with peers. Children with an ASD are usually found on the periphery of social activity with little social play evident (Macintosh & Dissanayake, 2006). Solitary play is the norm unless the child is directly engaged in an interaction with a mature play partner. As a result, peer relationships are limited and, when evident, center around the more narrow interests of the children with an ASD. Thus, friendships are infrequent among these children, leading to missed opportunities to use and practice their social behaviors and skills. The capacity to form and maintain relationships with peers is a crucial developmental task for children, and impairment in this ability is recognized as a core feature of ASDs.

The development of perspective-taking skills, critical to the development of social relationships, is compromised in autism. Turn taking in interactions is difficult. Taking another's affective and/or cognitive perspective is crucial to understanding other people as well as understanding the self in relation to others. Indeed, the development of selfhood in autism is atypical which lies at the core of their social-cognitive difficulties (Hobson, 1990). The development of social understanding and social responsiveness is deeply intertwined, and each is compromised in autism. It is important to note that it is not just a lack of social behaviors but also knowledge of how and when to use what social behavior and

skills have been acquired that leads to the marked social impairment in autism.

The direct consequence of the social interaction difficulties, particularly found among more able children and adolescents with an ASD, is social isolation and peer rejection, leading to poor social support and reported loneliness (Bauminger, Shulman, & Agam, 2003). Often, these higher functioning individuals report a desire for friendships but lack the necessary social skills to go about establishing them. The commonly reported mood (depression and anxiety) problems in these individuals, especially common during adolescence and adulthood, are likely to be exacerbated by their social difficulties.

Future Directions

Given the centrality of social impairment in ASDs, the teaching of social behaviors and skills comprises an important component in any intervention program, regardless of age and ability level (White, Koenig, & Scahill, 2007). In addition to teaching social behaviors and skills, a key component of any intervention program is to motivate affected individuals to interact socially with others. The development of social competence relies on this.

More research is sorely needed on the efficacy/effectiveness of intervention programs designed to enhance the social behaviors and skills of infants, children, adolescents, and adults with an ASD. These lifelong developmental disorders are likely to demand developmentally appropriate social intervention treatments that change to accommodate the particular life stage. As with all interventions, treatment efficacy will be enhanced if these begin at the earliest possible time in development.

See Also

- ▶ Attachment
- ▶ Friendships
- ▶ Imitation
- ▶ Social Cognition

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Social Cognition

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Definition

The mental processes in which individuals are involved with when making sense of the social world, including the understanding of self, others, and the interplay between self and others, are what is called social cognition (Lewis, 1999; Beer & Ochsner, 2006). Social cognition broadly includes the cognitive processes that

enables spontaneous decoding and encoding (provide correct interpretation) of verbal and nonverbal social and emotional cues, the ability to recognize central and peripheral social and emotional information, the knowledge of different social behaviors and their consequences in diverse social tasks (e.g., social knowledge and understanding), and the ability to make an adequate attribution about another person's mental state (i.e., "theory of mind" abilities, Perner & Wimmer, 1985), as well as about the self (Crick & Dodge, 1994, Lewis, 1999). Social cognition, thus, is including information processing about all people, including the self, and about the norms and procedures of the social world. The knowledge about social norms and procedures is both declarative and procedural. By large, declarative knowledge is what the individual knows about social concepts, scripts, relations, and phenomena, and procedural knowledge is the knowledge of rules, skills, and strategies that enables the use of declarative knowledge in order to react or respond efficiently in diverse social situations.

See Also

- ▶ Attention
- ▶ Frontal Lobe Findings in Autism
- ▶ Pragmatics
- ▶ Theory of Mind

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Social Cognitive Learning Theory

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Definition

Social cognitive learning theory is a broad-ranging theoretical model of human behavior and is a major contribution to the social and behavioral sciences developed by Albert Bandura. Social cognitive learning theory posits that individuals are active agents in their development, not simply passive observers. In this model, there is a dynamic, continuous interrelationship between an individual's behaviors, the environment, and intrapersonal factors (i.e., cognitive, affective, and biological events) during development (Bandura, 1986, 1999). The model seeks to explain the determinants of behavior as well as the dynamic conditions that can change behavior over time.

Historical Background

Social cognitive learning theory grew from Miller and Dollard's initial work in the area of social learning theory in 1941. Social learning theory provides a foundation for the development of social cognitive learning theory, embodying the idea that if an individual were motivated to learn a particular behavior, it would be learned through observation and imitation of actions.

Social cognitive learning theory expanded on this premise and is the product of decades of research and analysis of human functioning through the lens of learning frameworks. In 1963, Bandura and Walters wrote the seminal work *Social Learning and Personality Development*, which set forth the most comprehensive and complex account of social learning theory with its emphasis on observational learning and vicarious reinforcement. Social learning theory was a departure from prevalent models of development of the time, such as psychoanalysis and behaviorism (Grusec, 1992). Psychoanalysts described behavior as driven by internal impulses, whereas behaviorists described behavior as completely shaped by the environment (Davis & Luthans, 1980; Waller, 2004). Social learning theory, while drawing on behaviorism in some ways, depicted behavior as a product of both internal factors and environmental factors and was the first major neo-behavior analytic theory to ascribe a role to cognition.

Bandura considered observational learning and imitation to be core components of social learning theory (Bandura, 1969). Social learning theory posited that observational learning was a more effective method for behavioral change than direct learning or successive approximations (Grusec, 1992). Social learning theory also conceptualized imitation differently than previous frameworks (Bandura & Walters, 1963; Grusec, 1992). In social learning theory, imitative responses did not need to be reinforced for observational learning to occur (Grusec, 1992).

In 1986, Bandura renamed this framework from "social learning theory" to "social cognitive theory" with the publication of *Social Foundations of Thought and Actions: A Social Cognitive Theory*. The renaming of the theory demonstrated the new emphasis on cognitive processes. The new terminology helped to better represent the components and processes he had been advocating since the early 1960s (Grusec, 1992). From 1986 on, Bandura consistently referred to the theory as social cognitive theory although the underlying framework remained the same.

This entry refers to the framework as "social cognitive learning theory" (SCLT) which combines the two names given by Bandura for the framework and is used by some scholars (e.g., Money, 1996). This term will be used throughout the remainder of this entry.

Current Knowledge

Core Concepts of SCLT

According to SCLT, there is a dynamic relationship between behavior, cognition, and other personal and environmental influences where each factor continually influences and impacts the others (i.e., triadic reciprocal determinism) (Bandura, 1989). Individuals are both producers and products of their environment (Bandura, 1989). That is, the way people interpret their behavior impacts and alters their beliefs and the environment they operate in, which then affects their future behaviors (Bandura, 1986).

SCLT proposes that individuals are not simply passive observers but active agents in their development; therefore, it takes an agentic perspective to human functioning (Bandura, 2005). That is, humans have control over their thoughts and behavior. They are active planners, forethinkers, self-regulators, and self-examiners by integrating their experiences to actively interact within their environment (Bandura, 2005). The centrality of human agency is embodied by six core concepts that are fundamental to SCLT: the ability to symbolize and engage in forethought, vicarious learning, self-regulatory mechanisms, self-reflection, and self-efficacy (Bandura, 1986). They place the individual as an active participant in the dynamic relationship between the environment, the individual's cognitions, personal factors, and behaviors rather than a passive bystander of environmental variables or unconscious internal conflicts. These key concepts are described in more detail below.

Bandura noted that symbolization of thoughts allows people to store information that can be utilized for guiding future behavior (Bandura, 1989). Symbols are mental representations of thoughts or images, which allow people to have structure, meaning, and continuity in their lives (e.g., language and gestures) to navigate their

world, understand their environment, and problem solve (Malone, 2002). For example, a child develops a mental image of a smile and simultaneously assigns emotional and verbal meaning to this representation such as "a smile indicates that someone is friendly and approachable." He later recalls and builds onto this "symbol" based on his experiences. The child's internal representation of a smile influences him to respond positively to a smiling peer (e.g., by greeting or asking the peer to play). It is proposed that the use of symbols allows for individuals to model observed behavior (Bandura, 1971).

The concept of forethought is that individuals can assess the likely consequences of their actions before they actually engage in an activity. Forethought utilizes symbolic representations in order to create future-directed plans (Bandura, 2005). For example, when approaching a group of people engaged in a conversation, a person may mentally assess a range of strategies to enter the conversation. The choices can vary from appropriate such as making an on-topic comment (e.g., "Hi, that's a funny story you just shared!") to inappropriate (e.g., spontaneously dancing in front of the group to get their attention). The person assesses these choices and associated outcomes and then selects the strategy that would achieve the desired result (e.g., entering the conversation by commenting on the topic in order to be welcomed by the group). It is the mechanism individuals use to create a course of action, set goals, and predict the likely consequences of behavior, which motivate and influence future behavior (Bandura, 2005).

Vicarious learning, also known as observational learning, is a departure from previous behavioral models of learning. Rather than depending solely on one's own actions and experiences as a source of learning, Bandura suggested that individuals learn by observing and modeling others' behavior. As such, individuals learn novel behaviors without the process of trial and error associated with direct learning (Bandura, 1986); learning by example reduces error in behavior. Observational learning involves modeling behavior, particularly when the observed behavior is rewarded. It is guided by attention to the model's actions, forming symbolic representations of these new behaviors in memory, performing the observed behavior, and experiencing motivation to produce the actions. For example, a child may observe a friend successfully join a game by seeing how the friend first stands next to and watches other children play, waits for an appropriate pause, and finally expresses an interest in joining the game (e.g., "I want to play ball, too!"). The child observes that these behaviors were successful in entering a play situation. She later recalls and engages in similar behaviors when presented with a related social scenario. The developmental level of the learner may also influence learning and behavior, which has potential consequences for individuals on the autism spectrum (discussed in more detail in the next section). Vicarious learning facilitates the acquisition of information that guides behavior (Grusec, 1992).

Self-reflection is the ability for people to evaluate their experiences. It is a mechanism that allows people to ultimately adapt behaviors and cognitions according to what they have seen, heard, felt, realized, and so forth. For example, after experiencing a difficult conversation with a friend, a teenager may recall the conversation. He evaluates whether the situation was handled appropriately by mentally reviewing his interactions as well as that of his friend. He assesses his feelings about the overall interaction and what actions he could have done differently to make the conversation more successful. Bandura identified self-reflection as the most "distinctly human" capability (1986, p. 21).

Self-regulation refers to the ability to make adaptations to behavioral responses (Bandura 2003, 2005). Motivation and performance are not solely based on material incentives but social influences and personal standards as well (Bandura, 2005). Personal standards are used as a yardstick for monitoring and comparing behaviors. If one's behavior does not measure up to these standards, the individual will self-evaluate and adjust behaviors accordingly. For example, a girl sees her friend in a quiet library and enthusiastically greets her peer. The librarian at the library responds by exclaiming "shh!" The girl

takes into account this information from her environment (i.e., the feedback from others that she needs to speak quietly) and adapts her behaviors by speaking at a lower volume and standing closer to her peer to continue the interaction. The ability to engage in the self-regulation is shaped by the ability to accurately and reliably engage in self-observation and self-monitoring (Bandura, 2003).

Self-efficacy, the belief that one is able to produce desired outcomes, is fundamental to SCLT. It is viewed as a foundation for motivation, confidence, emotional and psychological well-being, and understanding and explaining people's actions (Bandura, 1977; Bandura, Adams, & Beyer, 1977). Bandura (1986) defines self-efficacy as "people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances" (p. 391); so, it is a belief about one's capabilities, rather than necessarily knowing what to do. For example, a person with high self-efficacy about his social skills will feel confident in his ability to successfully enter social conversations at a party. Consequently, he will be more likely to try entering new social situations and interact with unfamiliar people because he is sure that his strategies will lead to positive responses from others. Self-efficacy is essential for behavior change (Bandura & Walters, 1963; Bandura, 1977) because a person's belief in the capability of producing a desired outcome influences the incentive to act or change. Poor perceptions of self-efficacy will weaken motivation to persevere in the face of challenges. Self-efficacy beliefs are developed through successful experiences in particular situations (defined in SCLT as mastery of experiences), seeing a person similar to oneself succeed (vicarious experiences), being told that one is capable of succeeding (social persuasion), and positive interpretation of an event (reduction of stress reactions and negative affect) (Bandura, 1994).

In summary, SCLT posits that specific cognitive processes mediate behaviors. In both direct and indirect learning experiences, the environment and thoughts affect one another in an intertwined fashion. These theoretical underpinnings provide an overarching understanding of human development. The theory has been highly influential in psychology, providing foundations for mid-level theories as well as intervention programs. It has provided a conceptual framework for some mid-level cognitive behavioral theories because it embraces the combined importance of external factors (i.e., experience and social contexts) and internal factors (i.e., cognition) in understanding and predicting human behavior.

SCLT in Understanding Autism Spectrum Disorder

As outlined above, SCLT suggests that an individual's development and functioning relies on one's ability to symbolize, to engage in forethought, learn vicariously, self-regulate, self-reflect, and experience self-efficacy (Bandura, 1986). Individuals with ASD may have limitations in a number of these areas, and these impairments likely have important consequences on their development, behavior, and capacity to benefit from intervention strategies.

Impairment in the ability to symbolize, for example, is consistently reported in ASD (e.g., Bernabei, Palli, Levi, Mazzoncini, & Cannoni, 1999). These challenges are evidenced by lack of imagination or pretend play (Jarrold, 2003; Varga, 2010), deficits in theory of mind (Peterson, Garnett, Kelly, & Attwood, 2009), and limited use of gestures and other nonverbal means of communication (Shumway & Wetherby, 2009). Such deficits impede one's ability to make sense of perceived information from people and their environment, create mental representations, and apply this to their behavioral repertoire. This can have detrimental consequences in terms of social cognitive development and understanding one's social milieu.

Evidence suggests that individuals with ASD exhibit atypical visual scanning and attention (Brenner, Turner, & Muller, 2007), which impacts the ability to benefit from observational learning. For example, individuals with ASD may have difficulty processing visual information using a top-down strategy (Loth, Gomez, & Happe, 2011). Whereas typically developing

individuals are able to use prior knowledge and context to perceive fragmented or degraded images as recognizable stimuli (e.g., faces), individuals with ASD often attend to local features of a stimulus when processing visual information (e.g., Nakahachi et al., 2008; Rondan & Deruelle, 2007). In other words, individuals with ASD may attend to details rather than relying on prior knowledge and experience and context to interpret ambiguous stimuli. In addition, evidence suggests that rather than attending to pertinent features of a face (e.g., eyes), individuals with ASD tend to devote attention to the mouth when viewing faces (e.g., Klin, Jones, Schultz, Volkmar, & Cohen, 2002). It has been hypothesized that these patterns of attention contribute to face processing and recognition deficits associated with ASD (Golarai, Grill-Spector, & Reiss, 2006), demonstrating how atypical visual attention impacts interpretation of social stimuli. Atypical processing of social stimuli undoubtedly impacts the ability to garner important information from one's environment, impeding successful observational learning. It has also been demonstrated that individuals with ASD fail to orient to social stimuli (e.g., their name being called; Dawson, Meltzoff, Osterling, Rinaldi, & Brown, 1998), indicating they may not be motivated to attend to social stimuli and likely miss critical cues in their environment. Failure to attend to social cues suggests that individuals with ASD perceive, assimilate, and are shaped by a set of informational cues that differs from typically developing individuals. Studies of young children have also demonstrated that ASD is characterized by challenges with disengagement of attention, or difficulty disengaging from one stimulus and shifting eye gaze to a new stimulus (Landry & Byson, 2004; Zwaigenbaum et al., 2005). This impedes successful visual scanning of one's environment and ability to process salient stimuli, which are critical features of observational learning. Finally, it has consistently been reported that individuals with ASD have impairments in joint attention, or the sharing of attention between two people to reference a stimulus, and this finding is considered a token feature of ASD (e.g., Mundy, Sullivan, & Mastergeorge, 2009). This skill is fundamental to learning about one's environment and developing symbolic thought. Within a SCLT framework, deficits in these areas may have serious implications in terms of one's ability to learn from their environment, develop appropriate social skills, and function in everyday life.

According to SCLT, individuals with ASD may experience further disadvantage given their impaired imitation (i.e., modeling) skills (Williams, Whiten, & Singh, 2004). Evidence suggests that mirror neuron dysfunction may partially account for these difficulties (e.g., Williams, 2008). Mirror neurons fire not only when an individual is actively imitating but also when observing others executing the same actions (e.g., Iacoboni & Depretto, 2006). Impairments in this neural system would suggest that in addition to the impact on the ability to imitate, individuals with ASD may not process another's actions when observing them. This can have detrimental consequences on the capacity to learn from one's environment and integrate social information into their schema.

Another aspect of autism is the failure to develop developmentally appropriate friendships (Bauminger & Kasari, 2000; Chamberlain, Kasari, & Rotheram-Fuller, 2006). This challenge may impact both motivation in observational learning and development of self-efficacy. Motivation, in observational learning, refers to the incentive to reproduce the observed behavior (Bandura, 1986; Malone, 2002). The incentive for observational learning behavior is often a form of social reinforcement or approval. Social reinforcement or approval may be less motivating for individuals with autism due to social deficits, such as social and emotional reciprocity and developmentally appropriate relationships with peers (Bauminger & Kasari, 2000; Chamberlain et al., 2006).

These challenges associated with ASD have consequences on one's capacity to perceive and assimilate salient information from their environment, thereby impeding appropriate social development according to SCLT. Intervention strategies targeted at these specific deficits (e.g., visual attention, imitation) may provide

individuals with ASD with the opportunity to more efficiently and successfully acquire information from their environment and from other people. For example, Faja and colleagues (Faja, Aylward, Bernier, & Dawson, 2008) developed a computerized face-training program to facilitate proper visual attention and improved face recognition in individuals with ASD. And, teaching joint attention to young children with autism has led to improvements in related skills, including imitation and spontaneous speech (Whalen, Schreiberman, & Ingersoll, 2006). These examples demonstrate how targeting skills related to SCLT can have broad effects on social functioning in ASD.

SCLT and Interventions for ASD

Video modeling is a form of behavioral intervention used to target numerous behaviors in individuals with autism. In video modeling, the model is shown on a video rather than live, in an attempt to change a behavior or help the individual with autism learn a new, appropriate behavior (Grant & Evans, 1994). Generally, the individual views the video, observing the model engaging in the appropriate behavior, and then imitates the target behavior (Charlop-Christy, Le & Freeman, 2000). Video modeling has been shown to be an effective, and rapid, behavioral intervention in numerous single-case design studies. It has been shown to be effective for low- and high-functioning individuals with autism (Charlop-Christy et al., 2000). Video modeling incorporates many tenets of SCLT in order to promote behavioral changes in individuals with autism.

Primarily, video modeling incorporates the four processes required for observational learning, attention, retention, symbolic representation, and motivation, in order to enhance the effectiveness of observational learning for individuals with autism. Charlop-Christy et al. (2000) found that video modeling was a more effective behavioral intervention than in vivo modeling for individuals with autism. Video modeling improved the attention of individuals with autism as compared to in vivo modeling. Many individuals with autism have difficulty with stimulus overselectivity, failing to perceive the entire stimulus and its relevant cues. Video modeling can counteract this problem by focusing in on the specific stimulus cues necessary to learn the target behavior (Charlop-Christy et al.). Video modeling minimizes attentional requirements, allows the individual to focus on the appropriate stimuli repeatedly, and thereby facilitates successful acquisition of the target behavior and its maintenance in memory (Corbett & Abdullah, 2005).

Video modeling reduces the amount of symbolic representation necessary for observational learning to occur by decreasing the amount of language present in the video. The individual with autism is only required to listen to and comprehend minimal, if any, language (Sherer et al., 2001), which reduces or eliminates the challenge of symbolically representing language.

Furthermore, motivation may enhance the effectiveness of video modeling as a behavioral intervention because video viewing is an easy, low-demand activity, which many individuals with autism engage in at home (Shipley-Benamou, Lutzker, & Taubman, 2002). This method of teaching new information is less structured than many behavioral interventions and creates a more casual learning environment, which may encourage successful acquisition of new information (Charlop-Christy & Daneshvar, 2003). Studies by Charlop-Christy, Schreibman, Pierce, and Kurtz (1998) and Schreibman (1988) found that individuals with autism often repeat phrases from videos, television, or commercials; watch the same video multiple times; or perseverate on a certain television show or video. These findings suggest that video viewing is intrinsically reinforcing for some individuals with autism (Charlop-Christy et al., 2000).

Video modeling has been used to target a wide range of skills in individuals with autism. A review of 19 studies on video modeling and autism by Delano (2007) found that video modeling proved effective in addressing social-communicative skills, functional skills, perspective-taking skills, and problem behavior. Haring, Kennedy, Adams, and Pitts-Conway (1987) used video modeling to promote the development of

purchasing skills to individuals with autism. Video modeling was used by Charlop and Milstein (1989) to promote conversational speech to children with autism. Grant and Evans (1994) showed that video modeling enhanced social initiation and appropriate toy play in children with autism. Studies by Charlop-Christy (1993, 1994) demonstrated that play behaviors, such as independent play, cooperative play, and pretend play, improved through a video modeling intervention. Video modeling also improved the level of verbal and motor play response in children with autism (D'Ateno, Mangiapanello, & Taylor, 2003) and reciprocal play skills (Nikopoulos & Keenan, 2004). Lastly, a few studies have used video modeling to reduce disruptive and challenging behaviors (Shipley-Benamou et al., 2002; Buggey, 2005).

SCLT is a core foundation of cognitive behavioral therapy (CBT). Interventions using CBT for individuals with autism (e.g., Chalfant, Rapee, & Carroll, 2006; Reaven et al., 2009; Sofronoff, Attwood, & Hinto, 2005; Wood et al., 2009) emphasize attention, motivation, self-reflection, self-regulation, and self-efficacy. In CBT, active participation by the child to develop and practice coping skills is key. Studies have shown CBT to be an effective intervention in reducing anxiety in children with high-functioning autism and Asperger's disorder (Chalfant et al., 2006; Reaven et al., 2009; Sofronoff et al., 2005; Wood et al., 2009).

A fundamental component of CBT with individuals with autism is developing awareness and identification of emotion feelings in order to promote greater self-regulation of behavior. Self-reflection and self-regulation are often challenging for individuals with autism; therefore, these are taught to participants in CBT by practicing the identification of cues of emotion (e.g., through body feelings), which is one method of self-reflection (Chalfant et al., 2006; Reaven et al., 2009; Wood et al., 2009). In addition, the interventions underscored teaching the connections between feelings and thoughts.

Another component of SCLT utilized in CBT with individuals with autism is the promotion of self-efficacy. The work by Wood et al. (2009) targeted improving self-efficacy as a fundamental component of the CBT intervention. Wood et al. (2009) and Drahota, Wood, Sze, and Van Dyke (2011) discussed the importance of improving self-care in individuals with autism in order to increase individuals' mastery experiences and ultimately improve self-efficacy. The focus on improving self-care is important because researchers have found adaptive skill deficits in individuals with autism (Rodrigue, Morgan, & Geffken, 1991). As mentioned earlier, according to SCLT, one way of improving self-efficacy is through mastery experiences. CBT interventions also promote mastery experiences in feared situations. For example, Wood et al. (2009) and Reaven et al. (2009) used a hierarchy of feared situations where participants are rewarded as they try increasingly challenging (feared) situations. The use of a hierarchy allows the participants to start with less fearful situations and work their way up to more challenging feared situations, gaining confidence with small steps as they go. The successful achievement of the feared situations in vivo in CBT allows the participant to systematically confront and succeed in anxiety-provoking situations, which systematically increases the participants' self-efficacy.

Future Directions

SCLT provides an informative framework for understanding human functioning and may have relevance to the impact of ASD symptoms on learning and adaptive behavior in individuals with autism. Video modeling and CBT are two interventions that are influenced by SCLT in treating ASD symptoms, and each has evidence of efficacy. Future research with individuals with autism may consider incorporating SCLT principles to inform interventions in order to improve skill learning and comprehension. By creating interventions that consider how deficits in autism impact symbolic representations, forethought, vicarious learning, self-reflection, self-regulation, and self-efficacy, the interventions may be able to better achieve their goals and meet the needs of affected individuals.

See Also

- ▶ Cognitive Behavioral Therapy (CBT)
- ▶ Joint Attention
- ▶ Video Modeling/Video Self-modeling

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Social Communication

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Synonyms

Reciprocal communication

Definition

Social communication is a broad term that describes the vast amount of verbal and nonverbal behaviors used to interact with other people. Examples of the verbal and nonverbal behaviors are (but are not limited to) speech, prosody, gestures, and facial expressions. These behaviors can be used to initiate or respond to joint attention, to share emotion with others, or to signal when an individual wants the attention of another person, along with many other uses.

A deficit in social communication is a diagnostic characteristic of children with ASD.

See Also

- Gestures
- Pragmatics
- Prosody
- Reciprocal Communication/Interaction
- Speech

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Social Communication Disorder

- Pragmatic Language Impairment
- Semantic Pragmatic Disorder

Social Communication Questionnaire

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Synonyms

Autism screening questionnaire (ASQ); SCQ

Description

The Social Communication Questionnaire (SCQ), formerly known as the Autism Screening Questionnaire (ASQ), is a screening measure that was developed to identify symptomology associated with autism spectrum disorder (ASD; Rutter, Bailey, & Lord, 2003). It is widely recognized in the field as a recommended screening measure for ASD (Coonrod & Stone, 2005; Hus & Lord, 2011).

The SCQ contains 40 *yes*/*no* items that are completed by the parent or primary caregiver. It is applicable to individuals whose chronological age is over 4 years, provided that their mental age is over 2 years. A body of research is accumulating that aims to determine the utility of the SCQ in young children, however (e.g., Corsello, Leventhal, & Cook, 2003).

There are two versions of the SCQ. The Lifetime version inquires about the individual's entire developmental history, and the items in the Current

version refer to the individual's behavior in the most recent 3-month period. The Lifetime form should be used for diagnostic screening purposes, and the Current form is appropriate to use when the goal is to understand an individual's current level of ASD symptomology, such as when evaluating treatment or educational plans.

Scoring of the SCQ results in a total score that is compared to a cutoff score developed from the Lifetime form. The total score is calculated by summing the item responses as indicated on the scoring form that is provided as part of the SCQ protocol. For each item, a score of 1 is given for abnormal behavior, and a score of 0 is given for its absence. All items are given equal weight in determining the total score. Different scoring procedures are used for verbal and nonverbal individuals. For verbal individuals, six items asking about language abnormalities are included in the total score, whereas these items are disregarded for individuals who are nonverbal. A cutoff score of 15 or greater identifies individuals who are likely to have an ASD, indicating that more thorough evaluations are warranted. Subscores that correspond to the three symptom domains of ASD (social abnormalities, communication abnormalities, and restricted, repetitive, and stereotyped behavior) can also be calculated. However, it must be noted that due to insufficient research on these subscores, they should be used for research purposes only (Rutter et al., 2003).

Historical Background

The SCQ was originally developed as a companion to the Autism Diagnostic Interview-Revised (ADI-R; Rutter, LeCouteur, & Lord, 2003). It was designed as a shorter version of the ADI-R, which is a 93-item structured interview. Items from the ADI-R with discriminative diagnostic validity were chosen for the SCQ. Selected items assess the three symptom domains of ASD: reciprocal social interaction, communication, and restricted, repetitive, and stereotyped patterns of behavior. Items were also selected based on the extent to which the behavior in question was readily observable by the caregiver. The wording of the items was also modified to increase the clarity of the item for parents.

Psychometric Data

Standardization data for the SCQ were collected from 200 individuals between the ages of 4–40 years (Berument, Rutter, Lord, Pickles, & Bailey, 1999). The sample included 160 individuals with ASD and 40 with nonspectrum disorders. Validity of the SCQ was assessed by analyzing its factor structure, the ability of SCQ items and total score to discriminate ASD and non-ASD groups, and correlating SCQ scores with those from the ADI-R. Factor analysis of the SCQ supported a four-factor structure consisting of the following factors: social interaction, communication, abnormal language, and stereotyped behavior. Item analyses indicated that 85 % of the items differentiated between ASD and non-ASD individuals at a statistically significant level. Similarly, total scores on the SCQ were significantly different between ASD and non-ASD groups. Examination of total scores indicated a cutoff score of 15 for discriminating ASD from non-ASD diagnoses. A cutoff of 22 was suggested to distinguish between autism and other ASDs. Comparisons to the ADI-R revealed significant correlations between all domains of the two instruments as well as the total scores. Two additional studies support the concurrent validity of the SCQ and ADI-R. Both found good agreement between the SCQ and the ADI-R diagnostic categories but found lower agreement between the SCQ and ADI-R at the item level (Rutter et al., 2003). In sum, the standardization data supported the validity of the SCQ and suggested strong psychometric properties.

A subsequent study of the diagnostic validity of the SCQ examined its performance in a sample of 157 children ($n = 71$ autism, $n = 49$ ASD, $n = 37$ non-ASD) (Corsello, Leventhal, & Cook, 2003). Total mean scores between diagnostic groups were in the expected direction, with the autism group earning the highest scores, followed by the ASD group, and the non-ASD group had

the lowest mean total scores. The authors stated that these results suggest that the total SCQ score corresponds with diagnosis and is a reasonable index of symptom severity. However, there is also evidence that the diagnostic validity of the SCQ appears to be enhanced when it is used in conjunction with observational measures such as the Autism Diagnostic Observation Schedule (ADOS; Lord, Rutter, DiLavore, & Risi, 1999) (Corsello et al., 2007, in Hus & Lord, 2011).

Whereas the literature agrees that the SCQ is a reliable and valid screening tool for individuals 4 years and older, adaptations may need to be made when using the SCQ in children under this age. Corsello and colleagues have suggested that when using the SCQ with children under the age of 5 years, the cutoff score should be lowered in order to improve the sensitivity of the measure (Corsello et al., 2007, in Bishop, Luyster, Richler, & Lord, 2008). Another option is to use the Current version of the SCQ, which can be used with children as young as 2 years (Hus & Lord, 2011).

Clinical Uses

The authors of the SCQ cite three main uses of the instrument (Rutter et al., 2003). First, it can be used as a screening instrument to detect individuals who are in need of a clinical assessment for ASD. Second, SCQ scores can be used as a measure of overall ASD symptomology between different groups, such as children with other developmental disorders. Third, scores can be used as an index of severity of ASD symptoms between groups or in one group over time, as in the case of treatment studies.

When using the SCQ as a screening instrument for ASD, it must be noted that the SCQ does not replace a diagnostic assessment. It should not be used on its own as a diagnostic tool (Rutter et al., 2003).

See Also

- ▶ Autism Diagnostic Interview-Revised
- ▶ Screening Measures

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Social Gaze

- ▶ Mutual Gaze

Social Initiation

- ▶ Initiation of Communication

Social Interaction Supports

- ▶ Interpersonal Supports

Social Interventions

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Definition

Social interventions are therapeutic efforts intended to improve the social competence of individuals with autism spectrum disorders (ASD). Deficits in social interaction are the primary source of impairment for most people on the autism spectrum, regardless of their cognitive or language ability (Carter, Davis, Klin, & Volkmar, 2005). Despite changes in form and appearance over time, ASD-related social deficits rarely remit with development alone (Sigman & Ruskin, 1999). Social interventions target improved social competence by directly teaching specific prosocial skills, by reducing competing or socially inappropriate behaviors, or by teaching related or pivotal skills that, if improved, are believed to contribute to improved social functioning. No single theoretical orientation, conceptualization of ASD-related social deficits, or clinical approach unifies all social interventions for people with ASD. However, it is generally accepted that social competence is related to attaining and maintaining satisfying social relationships, which are, in turn, related to quality of life (Segrin & Givertz, 2003).

Due to the diversity of ASD-related social deficits and the heterogeneity of ASD presentation, many different types of intervention have been developed to improve social competence. Interventions can be classified according to the target for change, the proposed mechanism of action, and the format. With respect to what is targeted for change with intervention, many interventions focus on building specified, discrete skills, whereas others address what are considered "pivotal" skills, and still others seek to enhance social competence more broadly. Most research in this area has been on psychosocial approaches; as such, this chapter reviews these exclusively. Interventions also vary by format; they can be delivered in a one-on-one format (e.g., traditional therapy), in a group, ubiquitously in the home environment, or even without a live teacher (e.g., computerized skills training, practice programs, and games). This chapter reviews published research on social interventions for individuals with ASD. Although the majority of research has been with school-aged children, this review also includes applicable studies on very young children, adolescents, and adults.

Historical Background

It is somewhat surprising, and also frustrating for many families and clinicians, that interventions to address the socialization deficits of ASD have been fairly slow to develop relative to interventions targeting other problems. Since Kanner's (1943) original description of autism, social difficulty has been known as a prominent and unifying characteristic of ASD. However, not until the 1970s did clinical scientists begin to investigate the possibility of social skills interventions to improve these problems (Bemporad, 1979; Stokes, 1977). The historical oversight of intervention development in the area of social deficits is perhaps most surprising in light of the fact that social skills training is a common component of treatment for many other childhood disorders and concerns, such as attention-deficit/hyperactivity disorder (ADHD), depression, and shyness (de Boo & Prins, 2007; Greco & Morris, 2001; Segrin, 2000).

Mesibov (1984) was the first to extract key elements from established social skills training programs and apply them to a group social skills treatment model for verbal adolescents and adults (age 14–35 years) with ASD. These key elements included modeling, coaching, and role-playing with feedback. Training objectives included how to stay on topic in conversation, pay attention, and meet other people. Although Mesibov (1984) only reported preliminary data, his qualitative reports from participants and family members indicated that the treatment goals were being accomplished, and he described noticeable

improvements in initiating and maintaining conversations during the role-play situations. Williams (1989) followed with a similar group format for an intervention using modeling, role-playing, and interactive games. Ten children and adolescents (age 9–16 years) with ASD completed 4 years of a weekly 45-min social skills training session. Teachers completed a social behavior questionnaire before and after the social skills group. Their reports indicated that a group intervention can improve social behavior and peer relationships in people with ASD.

These early studies of group interventions for improving social skills in young people with ASD highlight a common theme for much of the research in this area – methodological limitations have restricted the field's ability to draw firm conclusions about efficacy. Factors such as a lack of rigorous data collection, control condition, manualized curricula and independent evaluators (masked to treatment assignment) have made it difficult to compare various types of treatment directly, replicate findings in subsequent studies, and supply clinicians with empirically grounded treatment recommendations. Instead of formal statistical analyses, the aim of studies such as Mesibov's (1984) and Williams's (1989) was to demonstrate the feasibility and value of social skills training for individuals with ASD. Importantly, these studies helped people realize that it is not a lack of social interest, but rather a lack of social skills (both knowledge and fluency) that causes major problems for many people with ASD.

Although some early researchers focused on ASD group interventions for social skills, others studied individual treatment. Lovaas (1987) was the first to describe behavioral modification treatment for young children with ASD, which is based on operant theory and entails intensive therapy across settings. The intensive instruction requires the child to actively engage with his or her social environment, while providing the child with consistent reinforcement for adaptive behaviors and interactive play with peers. Although Lovaas's 15-year-long Young Autism Project did not include specific social skills measures to assess change, more global measures found that participants in the treatment group achieved less restrictive school placements than the control-group children. A few years later, McEachin, Smith and Lovaas (1993) conducted a more extensive follow-up to specifically assess social functioning. The treatment-group participants scored significantly better on the socialization subscale of the Vineland Adaptive Behavior Scales (Sparrow, Balla, & Cicchetti, 1984) relative to the control-group participants, providing further support for behavioral treatment as a social skills intervention for ASD.

Despite these early and informative research studies, a lack of readily available social intervention programs for ASD existed well into the 1990s (Klin & Volkmar, 2000). Toward the end of the twentieth century, a broader range of social skills interventions was being developed and scientifically investigated, including self-management techniques (Koegel, Koegel, Hurley, & Frea, 1992) and sociodramatic play-based approaches (Thorp, Stahmer, & Schreibman, 1995). Science was also maturing, as evidenced by more rigorous data collection efforts and recognition of the need for well-characterized samples along with manual-based programs to allow for replication. Ozonoff and Miller (1995) relied on quantitative outcome measures, formal statistical analyses, and independent evaluators to explore the effectiveness of a different type of group intervention for adolescents with ASD. Their social skills training program focused on teaching theory of mind (i.e., the ability to infer the mental states of others), a documented deficit of autism (Baron-Cohen, Leslie, & Frith, 1986). After four and a half months of training, the five adolescents in the treatment group improved their performance on theory of mind tests relative to the no-treatment control-group participants. The treatment group did not show improvement in social skills, based on parent and teacher reports, suggesting that the improvement in theory of mind performance did not automatically translate to improvement in social competence.

In the past, many professionals did not receive formal training in social intervention strategies for ASD (Klin & Volkmar, 2000). It is therefore probable that they did not feel comfortable

relying on such treatment in clinical practice. Increased awareness of and interest in social interventions for ASD in recent years have been driven largely by the rising prevalence of ASD and subsequent consumer demand for services. It is established that traditional, weekly (e.g., 1 hour per week) therapy to treat social skill deficits is insufficient, on its own, to produce meaningful and sustainable improvements in social behavior for people with ASD (Lord et al., 2005). Current research is addressing the most effective means to produce lasting and meaningful improvements in social functioning.

Current Knowledge

Research on social interventions for children with ASD has generally demonstrated promising, though equivocal, results. In a meta-analysis on the efficacy of school-based social interventions, Bellini, Peters, Benner, and Hopf (2007) reported that the evaluated social skills interventions were minimally effective for most students with ASD. A subsequent meta-analysis by Wang and Spillane (2009) concluded that video modeling was an evidence-based and effective intervention for children with ASD. Social Stories (Gray, 1998) and peer-mediated approaches also had support, but were generally less effective. Reichow and Volkmar (2010), in their review, determined that social skills groups could be considered an established, evidence-based intervention, while video modeling is promising. Firm conclusions about efficacy are difficult to make at this time primarily because of methodological limitations (e.g., small samples and lack of random assignment), inconsistencies across outcome measures (e.g., parent reports often indicate improvement, but observational indices do not), and lack of evidence to indicate longevity of treatment benefits (Bellini et al., 2007; Lopata, Volker, Toomey, Chow, & Thomeer, 2008; Rao, Beidel, & Murray, 2008; White, Koenig, & Scahill, 2007). Perhaps the most consistently reported finding across applied studies on social interventions for ASD is that there is considerable variability in terms of treatment response across participants.

Group-delivered interventions may be the most prevalent form of social intervention for people with ASD. Based on criteria set forth by the Task Force on Promotion and Dissemination (1995), there is no single group-based social skills curriculum that can be considered a well-established treatment. There is a lack of studies comparing manualized treatments to other active treatments or placebo conditions. Randomized controlled trials (RCTs) in this area have typically utilized a no-treatment, wait-list, comparison condition, not allowing for determination of treatment superiority. Moreover, there has not been replication by different investigative teams of the same intervention program, which is one of the APA Division 12 criteria. Nevertheless, there have been two recent RCTs of manualized, group-delivered social skills interventions for children with ASD published (Koenig et al., 2010; Lopata et al., 2010), both of which indicate promising outcomes.

Lopata and colleagues (2010) conducted an RCT of a manualized summer social intervention with 36 children with confirmed high-functioning autism spectrum disorder (HFASD) diagnoses. Children were assigned to either the treatment group or wait-list control group. The treatment was a group-delivered program, based on the skillstreaming teaching protocol (Goldstein, McGinnis, Sprafkin, Gershaw, & Klein, 1997). Results indicated that the Lopata et al. program was effective, with five of the seven primary outcome measures yielding significant group differences favoring the experimental treatment. Parent-reported indices of social functioning resulted in medium to large effects, and child measures indicated a large effect of treatment on social skills knowledge. The program was a 6-week, full-day intervention that targeted discrete social skills, accurate interpretation of nonliteral language, expansion of the children's repertoire of interests, and reduction of socially inappropriate behaviors. A parent training component was also included.

In another recent RCT with children with ASD, Koenig and colleagues (2010) randomized 44 children (age 8–11 years) to group-delivered social skills training or wait-list. The

manualized intervention was based on social learning theory and behavior therapy principles and included neurotypical peer tutors for skill modeling and generalization. The treatment was delivered weekly, in structured 75-min sessions that taught targeted social skills to groups of four to five children. The majority (70%) of the children who received the intervention were treatment responders, based on independent clinical evaluations of the child's social behavior at home and in the community, whereas none of the wait-list condition participants were treatment responders (Koenig et al., 2010).

There are several specific types of social interventions, other than group interventions, which show considerable promise as being effective for some individuals with ASD. Social Stories (Gray, 1998) are a straightforward approach used to explain social situations and behaviors to people with ASD. Social Stories are often used to promote appropriate social skills and decrease problem behaviors. Results from several single subject and small-sample studies have been quite positive (e.g., Dodd, Hupp, Jewell, & Krohn, 2008; Sansosti & Powell-Smith, 2008). Sansosti and Powell-Smith (2008) integrated computer-presented Social Stories with video modeling (e.g., Charlop-Christy, Le, & Freeman, 2000) and found positive effects on social communication skills in three boys (age 6–10 years) with ASD using a multiple baseline design. Dodd and colleagues (2008) demonstrated that parents and siblings could effectively teach Social Stories to improve social skills in two boys with ASD.

Pivotal response treatment (PRT) is another type of intervention, derived from the principles of applied behavioral analysis (ABA), for people with ASD (Koegel, Openden, Fredeen, & Koegel, 2006). Instead of targeting distinct individual behaviors, PRT focuses on pivotal areas of a child's development. The goal of PRT is to provide learning opportunities within the context of the child's natural environments. Pivotal behaviors are those that, when developed or improved, can lead to positive changes in other areas of functioning. Pivotal behaviors include motivation, responsivity to multiple cues, self-management, self-initiations, and empathy. PRT techniques have been shown to improve social communication and social interactions with peers in children with ASD (Koegel, Koegel, Vernon, & Brookman-Frazee, 2010).

Recent studies have investigated the efficacy of manualized parent-assisted social skills interventions for children and adolescents with ASD. Frankel, Myatt, Sugar, Whitman, Gorospe, and Laugeson (2010) evaluated one such intervention, Children's Friendship Training (CFT), in an RCT with 68 children (second through fifth graders) with ASD. CFT focuses on conversational skills, peer-group entry skills, developing friendship networks, good sportsmanship, appropriate host behavior during playdates, and handling teasing. The CFT program included 12 weekly, 60-min group sessions, with one group for the children and one group for the parents. After 12 weeks of CFT, the treatment group outperformed the delayed treatment control group on parent measures of frequency of hosted playdates and appropriate playdate behavior (e.g., decreased disengaged behavior such as playing videogames or watching television) and also on child-reported measures of loneliness and popularity. At a 3-month follow-up assessment, the parents continued to report a significant improvement in their child's social skills from baseline. However, despite hosting more playdates, the children were not invited to significantly more playdates. Also, it is important to note that these participants were all high-functioning; the results may not be highly generalizable across the autism spectrum.

Efforts to promote interaction and integration with peers without ASD may be the most commonly used ecological intervention. Promoting proximity to peers and posting visual reminders of specific social skills around a classroom share a focus on modifying the individual's social environment as a means to influence social functioning and are often integrated into other approaches (e.g., Bauminger, 2007). McConnell (2002) concluded that such interventions are often helpful, but insufficient on their own, to produce lasting improvement in social competence. Peer-mediated interventions typically involve more socially skilled peers directly training socially

appropriate skills to the child with ASD or using prompts and other behavioral strategies to promote age-appropriate social behavior (e.g., Kamps et al., 2002). In general, outcomes show benefit, but it is not clear if improvement readily extends to social groups and untrained peers, beyond the peer trainers themselves (McConnell, 2002).

Most of the studies reviewed thus far have been conducted with school-aged children. By comparison, research on the feasibility and efficacy of social interventions for very young children or adolescents and adults is limited. Despite evidence for the reliability and utility of early identification and diagnosis (Chawarska, Klin, Paul, & Volkmar, 2007), interventions targeting social deficits in very young children with ASD have not been well-studied. Dawson et al. (2010) evaluated the efficacy of the Early Start Denver Model (ESDM), a comprehensive intervention that integrates ABA principles with developmental and relationship-based methods for infants to preschool-aged children with ASD. Forty-eight children (younger than 30 months at entry) with ASD were randomly assigned to either the ESDM treatment or the control condition (commonly available community interventions) for a 2-year period. Those children in the ESDM condition received an average of 15.2 h per week of direct treatment with clinicians plus 16.3 h (on average) of parent-led ESDM treatment. After 2 years, the ESDM-group toddlers showed significant improvements in IQ, diagnostic status, and adaptive behavior relative to the control-group toddlers. Landa, Holman, O'Neill, and Stuart (2010) reported positive results from an RCT comparing a therapeutic intervention that targeted socially synchronous engagement to a treatment of equivalent dosage that did not target interpersonal synchrony, with 50 toddlers diagnosed with ASD (age 21–33 months). Toddlers who received the supplementary social curriculum (i.e., explicit training of socially engaged imitation, joint attention, and affect sharing) outperformed those in the comparison condition at posttreatment. These studies highlight the importance and potential impact of early detection of ASD and social skills intervention at even a very young age.

Research on interventions targeting behaviors conceptually related to social competence has also yielded some promising results. Such 'collateral interventions' mechanism of action, theoretically, is that change in the targeted behavioral domain (e.g., imitation) will effect improved social functioning. Imitation skills are often impaired in children with ASD and are associated with impaired social-communication skills (Stone & Yoder, 2001). In an RCT with 21 young children (age 27–47 months) with autism, Ingersoll (2010) demonstrated that a naturalistic intervention to improve imitation skills, "reciprocal imitation training," resulted in significant improvements in spontaneous imitation skills. Typically, programs integrate at least two types of approaches (e.g., direct training and peer-mediated) to improve social competence.

Laugeson, Frankel, Mogil, and Dillon (2009) investigated a manualized parent-assisted social skills intervention, the Program for the Education and Enrichment of Relational Skills (PEERS), for adolescents with ASD. The targeted social skills were identical to those of CFT (Frankel et al., 2010), with the addition of exiting conversations, changing bad reputations, and handling bullying or arguments. Thirty-three adolescents with ASD participated in the RCT. Treatment included 12 weekly, 90-min group sessions, with separate sessions for the adolescents and parents. After 12 weeks of PEERS, the treatment group demonstrated improvement on four of 12 outcome measures, including increased knowledge of friendship-related social etiquette rules, increased frequency of hosted get-togethers, and improved quality of friendships. Parent reports indicated that the treatment-group teens were superior to the control-group teens on overall level of social skills. Similar to Frankel et al.'s (2010) findings, however, there was no significant increase in the number of invitations to get-togethers, despite the increase in hosted get-togethers. A recent open trial of a group-based intervention, adapted for adolescents, reported significant improvement in parent-reported social competence following treatment, but improvements did not persist at the three-month follow-up assessment (White, Koenig, & Scahill, 2010).

Future Directions

This is a very exciting point in the field of social interventions for people with ASD, with many opportunities for exciting advances in research. As the biologically based, though not fully determined, explanation of ASD-related social deficits becomes integrated with a richer empirical understanding of effective methods for teaching and promoting fluid social skill use, the number and quality of efficacious prevention and treatment options will expand. As is evident by the research reviewed in this chapter, there is still a great amount of work to be done in this endeavor.

Most clinical scientists agree that interventions for ASD are neither expected nor intended to cure the disorder; rather, the goal is to build appropriate social skills or decrease specific problematic behaviors that impede social competence. Interventions rarely, if ever, result in complete amelioration of ASD-related social difficulties (National Autism Center, 2009). Methodologically, most clinical trials that address child psychopathology aim to substantially reduce, if not completely abate, the target problem (e.g., social anxiety). A "treatment responder" is typically defined as someone who is disorder-free, or cured of the circumscribed problem, following treatment. This is not the case for social interventions for ASD. A new benchmark is needed to gauge change in a clinically meaningful way, but there is not yet an agreement on how to do this. Clinically, it can be difficult to know how best to assess progress in order to determine when the treatment goals have been achieved.

To proceed with identifying efficacious social interventions for people with ASD, innovation is needed with respect to methodology. It is clear that randomized clinical trials, most likely multisite to provide sufficiently large sample sizes of well-characterized participants, are necessary. Innovation in identifying sensitive change measures that are not overly cumbersome for assessors or families is also needed. Ideally, treatment response in such trials will be assessed multimodally and via multiple reporters, including more novel approaches such as neurocognitive markers (e.g., change in eye gaze patterns) and direct behavior observations when possible. Finally, attention must be given to the longer-term goal – dissemination. Interventions must be capable of being used reliably and effectively by other practitioners, ideally those practicing in school or community settings, since many children and adolescents receive services in these venues. Programs that are not feasible for others to use for whatever reason (e.g., too resource-rich, time-intensive, or only useful for a very narrow subset of the population) will not be adopted, regardless of how efficacious they may be.

See Also

- ▶ Social Communication
- ▶ Social Skills Improvement System
- ▶ Social Skill Interventions

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Social Language Development Test

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Synonyms

SLDT-A; SLDT-E; Social language development test-adolescent; Social language development test-elementary

Description

The tests of social language development-elementary and adolescent (Bowers, Huisingh, & LoGiudice, 2008, 2010) are diagnostic tests of social language skills. They are designed to determine the role language development plays in the acquisition of social understanding for students from the ages of 6.0–17.11 years from the following educational settings: regular education (no active IEP) and special education (active IEP). Students with a diagnosis of autism and delayed language development were included in the item pool and standardization studies.

The testing materials are as follows:

The social language development test-elementary (SLDT-E) includes an examiner's manual, the scoring standards and example responses book, a picture stimuli book, and test forms. Ages include 6.0–11.11 years.

The SLDT-E is comprised of four subtests designed to differentiate how students with language impairments and autism differ from their

typically developing peers in social cognitive processing, in identifying feelings of participants in a conflict, in identifying and evaluating strategies to overcome obstacles, and in knowing when a conflict is resolved. The subtests are the following: (a) making inferences, (b) interpersonal negotiation, (c) multiple interpretations, and (d) supporting peers. Each subtest has 12 items.

Many children with language impairments (LI) exhibit poor social interaction with others, and these social differences may appear as early as preschool and continue or intensify as these children mature (Brinton, Robinson, & Fujiki, 2004; Cohen et al., 1998; Craig, 1993; Fujiki, Brinton, Robinson, & Watson, 1997; Hadley & Rice, 1991). A tool that would pinpoint areas of strengths and weaknesses would guide speech-language pathologists (SLPs) in determining appropriate intervention goals and objectives. Tasks in this test focus on taking someone else's perspective, making correct inferences, negotiation conflicts with peers, being flexible in interpreting situations, and supporting friends diplomatically.

The social language development test-adolescent (SLDT-A) includes an examiner's manual, the scoring standards and example responses book, a picture stimuli book, test forms, and an audio CD used with subtest E: interpreting ironic statements. Ages include 12.0–17.11 years.

The SLDT-A is comprised of five subtests designed to differentiate typically developing elementary children from typically developing adolescents, typically developing adolescents from language-impaired adolescents, and language-impaired adolescents from adolescents identified with high-functioning autism. The subtests are the following: (a) making inferences, (b) interpreting social language, (c) problem solving (stating and justifying solutions), (d) social interaction, and (e) interpreting ironic statements. Each subtest has 12 items each. Three of the subtests have two questions per item.

Language is the skill that is central to engaging in all aspects of peer relationships. Students with limited language skills are susceptible to misinterpretations and have more difficulty participating in the highly verbal, rapidly delivered social processes used in peer group formation (Gallagher, 1993). They often have difficulty maintaining friendships, negotiating conflict, and getting along with others. Tasks in this test focus on taking someone else's perspective, making correct inferences, solving problems with peers, interpreting social language, and understanding idioms, irony, and sarcasm.

These tests do not address all aspects of social language or pragmatic skills. Rather, they focus on social interpretation and interaction with peers and/or friends. For both tests, the items are not arranged in order of difficulty because, as of yet, no hierarchy is established for these tasks. For this reason, there are no basals or ceilings; each subtest is administered in its entirety to every student.

The tests begin with the first item in subtest A. Explicit directions for how to administer the items are provided. Demonstration items are provided for each subtest. These items may be altered or explained to show the student how to respond.

Following the demonstration item, each subtest begins with item 1 regardless of the student's age. Each item is presented verbally. The only exception is subtest E: interpreting ironic statements on the SLDT-A. An audio CD is used to administer this subtest.

Allowable prompts, used only as worded, are listed on the test forms. These are used if the student's response is unclear. These prompts are not used to give the student "a second chance" after a clear, complete, but incorrect response.

More than one testing session is allowable if the break between sessions occurs upon completion of a subtest and all of its questions.

The test examiner must be a trained professional familiar with language disorders (e.g., speech-language pathologist, psychologist) as they require careful interpretation of responses by the examiner.

Subtests A in both tests tap the student's ability to infer what someone in a photo is thinking. The student also states the visual clues that facilitated making the inference. Skills assessed in these subtests include the ability to:

- Detect nonverbal and context clues in a picture of a person or people
- Assume the perspective of a specific person in a picture

- Infer what the person is thinking
- Express the person's thought as a relevant, direct quotation
- State the visual clue that suggests what the person is thinking

A score of 1 or 0 is assigned to each response based on the relevancy and quality of the response. For the SLDT-A, the student must provide an appropriate response for both questions to earn a score of 1.

SLDT-E Subtest B: Interpersonal Negotiation asks the student to imagine being involved in a given conflict with a friend. The student states the problem (task a), proposes an appropriate solution (task b), and explains why that would be a good solution (task c). No pictures or photos are used for this subtest. Skills assessed in this subtest include the ability to:

- Understand a short passage about a conflict with a friend
- Infer the perspective of each person in the conflict
- State the problem clearly
- Propose a solution
- Explain why that would be a good solution

A score of 3, 2, 1, or 0 is assigned to each response based on relevancy and quality.

SLDT-A Subtest B: Interpreting Social Language asks the student questions about how people communicate. The student is asked to give an example and an appropriate context in which the type of communication would be used. Skills assessed include the ability to:

- Demonstrate actions
- Tell an appropriate reason or use for an action
- Think/talk about language
- Interpret figurative language including idioms

A score of 1 or 0 is assigned to each response based on relevancy and quality.

SLDT-E Subtest C: Multiple Interpretations asks the student to provide two distinctively different, plausible interpretations of the same photo. Skills assessed in this subtest include the ability to:

- Logically interpret a situation in a photo in two different ways

A score of 1 or 0 is assigned to each response, based on relevancy and quality.

SLDT-A Subtest C: Problem Solving (Stating and Justifying Solutions) asks the student to solve a problem by stating and justifying a logical solution. The student must give both a solution and a justification. Skills assessed include the ability to:

- State an appropriate solution to a problem in a situation with a peer
- Justify the solution
- Negotiate conflicts with peers
- Take the perspective of the other person in the situation
- State the conflict from a mutual perspective

A score of 1 or 0 is assigned to each response based on relevancy and quality.

SLDT-E Subtest D: Supporting Peers asks the student to take the perspective of someone involved in a situation with a friend. The student tells what to say in reaction to the friend's situation. Responses receive credit based on the degree of support they offer to the friend, not on the truthfulness.

Being truthful is a basic maxim of interpersonal communication (Grice, 1980), yet speakers are also expected to help, not hurt, their communicative partners (Lakeoff, 1973; Sweetser, 1987). Telling white lies successfully requires reconciling these apparently contradictory communication rules and knowing when and how to adapt them to suit various social situations (Talwar, Murphy, & Lee, 2007).

A score of 4, 3, 2, 1, or 0 is assigned to each response based on relevancy and quality of support for a friend.

SLDT-A Subtest D: Social Interaction asks the student to listen to situations and answer questions about them. In some situations, an appropriate response may include a dishonest or rude remark. Skills assessed include the ability to:

- Listen to short passages
- Understand social interactions with peers
- Provide an appropriate, supportive response
- Ignore the situation (when doing nothing is the best option)

A score of 1 or 0 is assigned to each response based on the relevancy and quality of support for the situation.

SLDT-A Subtest E: Interpreting Ironic Statements asks the student to listen to some

situations on a CD. The narrator reads the situations and asks what someone means at the end of each one. Research on intonation features associated with irony is inconsistent, and ironic speech does not necessarily include "signature acoustic features" (Bryant & Fox Tree, 2005; Nakassis & Snedeker, 2002). For this reason, the assumed features of irony (e.g., exaggerated pitch) were "toned down" so that the student must rely on context discrepancies and other context clues to determine the ironic meaning of a statement. Our research proved that including exaggerated intonations made the task too easy for the age range of this test. Skills assessed included the ability to:

- Understand common idioms used in everyday language
- Reject the literal meaning of the statement
- Understand the speaker's belief
- Judge the speaker's attitude
- Recognize sarcasm and interpret irony

A score of 1 or 0 is assigned to each response based on the relevancy and quality.

Historical Background

In 1983, we published a test of pragmatics called the interpersonal language skills assessment (ILSA) by speech-language pathologists, Carolyn Blagden (now LoGiudice) and Nancy McConnell. This test of pragmatic behaviors looked at interaction of 8–13-year-olds while playing a board game. The authors wanted to determine if there was age progression and reverse age progression on such behaviors as advising, commanding, accusing, deprecating, justifying, and supporting. They found that in general, as students got older, their outright negative comments decreased while their sarcasm increased. They also found out that comments with grammar or semantic errors decreased with age. Although some speech pathologists were curious about the skills assessed in the ILSA, there was a general lack of interest from the field. By 1989, this test was out of print.

Between 1990 and 2008, we continued to scour the research on pragmatic/social language skills. Our hypothesis was that children develop social "governors" as they mature. Over time, research articles about peer support, negotiating, making inferences, and interpreting facial expression and body language appeared in the literature. We also read research about the development of these skills in children on the autism spectrum and on children who had language disorders but who were not classified as autistic.

Despite a growing body of research, as of yet, there is no well-recognized, research-based developmental model for children learning social interaction skills. That may be because the following:

- Adults seem to have mastered social interaction without any conscious effort or formal instruction.
- Much of social language is abstract and covert and cannot be observed directly. We can only assume what someone else is thinking based on nonverbal cues, background knowledge, and the person's words and actions.

We do know that children with language impairments exhibit poor social interaction with others. We decided that if speech pathologists had an effective, standardized tool to assess the social interaction skills of students that would also pinpoint areas of strengths and weaknesses, it would guide the SLP in qualifying students for therapy and help in determining appropriate intervention goals and objectives.

We began writing and rewriting items and testing and retesting children. Our item pool results showed us the need for a scoring system that was sensitive to subtle changes in verbal behavior. The standardization studies proved the scoring standards were correct but that further refining was necessary. These tests represent the important data we gathered and we believe are a good start toward identifying children with social language differences.

Psychometric Data

Item pool and standardization studies were conducted for both tests. The items and subtests for both tests were subjected to rigorous statistical analyses in these studies.

The item pool and standardization studies for each test included subjects from regular education, special education, all socioeconomic levels, and from various racial groups, including White, Black, Hispanic or Latino, and other mixed racial group. Subjects with IEPs for special services but who attended regular education classes were also included. Subjects who did not use English proficiently at school, were nonverbal, had any degree of hearing loss, or resided outside the United States were excluded from the standardization studies for each test. Subjects were from all geographic regions of the United States. The sample population reflected the national school population demographics from the 2004 national census for race, gender, age, and educational placement for the item pool and standardization studies.

For both tests, the item pool items were administered to random samples of subjects at yearly age intervals. Subjects included in the item pool studies were not included in the standardization studies.

A team of expert speech-language pathologists determined credit levels for item pool responses during a response analysis session. Items that did not show statistical age progression, showed bias, or were not deemed fair for an ethnic group were eliminated. Item difficulty indexes and item discrimination indexes were computed for each item at each of the yearly age levels. Items retained for the final versions of the test met two empirical criteria:

1. Demonstrate age progression in terms of increasing percents of subjects passing at successive age levels
2. Demonstrate significant discrimination between high and low scorers on the subtest at each age level

The test examiners were speech-language pathologists who held a master's degree or higher from an accredited university.

SLDT-E

Item Pool

1. Four subtests, 68 items.
2. $N = 390$ subjects ages 6 years, 0 months to 11 years, 11 months.
3. Data was gathered at yearly age intervals.

Standardization

1. Four subtests, 48 items.
2. $N = 1{,}104$ subjects ages 6 years, 0 months to 11 years, 11 months.
3. Data was gathered at half-year age intervals. The item pool analysis showed that significant changes in social language development could be shown by grouping subjects in this manner.
4. Test examiners were required to make value judgments regarding the appropriateness of responses and to score them as indicated on the scoring standards provided to them.
5. The final version of the test has four subtests, 12 items per subtest for a total of 48 items.

SLDT-A

Item Pool

1. Five subtests, 89 items.
2. $N = 500$ subjects ages 12 years, 0 months, to 17 years, 11 months.
3. Data was gathered at yearly age intervals.

Standardization

1. Five subtests, 69 items.
2. $N = 834$ subjects ages 12 years, 0 months, to 17 years, 11 months.
3. Data was gathered at half-year age intervals. The item pool analysis showed that significant changes in social language development could be shown by grouping subjects in this manner.
4. Test examiners were required to make value judgments regarding the appropriateness of responses and to score them as indicated on the scoring standards provided to them.
5. The final version of the test has five subsets, 12 items per subtest for a total of a 60 items.

Mean and median raw score values and standard deviations for each subtest and the total test score were computed for both tests. There were no significant gender differences which supported the use of combined male-female norms for the elementary and adolescent tests.

For reporting purposes, three types of scores are used: age equivalents, percentile ranks, and standard scores.

Reliability was established by both the use of test-retest and internal consistency methods. Table 1 represents the internal

Social Language Development Test, Table 1 Test-retest reliability coefficients and standard errors of measurement for each task, each subtest, and total test by age

		Making inferences						Interpersonal negotiation													
		Task a		Task b		Making inferences total		Task a		Task b		Task c		Interpersonal negotiation total		Multiple interpretations		Supporting peers		Total test	
Chronological age	N	r	SEM	r	SEM	r	SEM	r	SEM	r	SEM	r	SEM	r	SEM	r	SEM	r	SEM	r	SEM
6-0 … 6-5	9	.94	0.79	.46	2.35	.87	1.98	.64	6.12	.25	6.30	.40	6.82	.59	15.21	.70	1.73	.66	5.86	.59	23.11
6-6 … 6-11	3	.50	2.46	1.00	0.00	.99	0.66	−.40	12.24	1.00	0.26	.99	0.82	1.00	1.16	.98	0.43	.99	0.95	1.00	1.44
7-0 … 7-5	3	.97	0.52	.94	0.71	.98	0.81	−.20	7.76	.80	9.05	1.00	0.40	.94	4.74	.93	0.76	.97	1.87	.98	4.81
7-6 … 7-11	11	.75	1.63	.42	2.22	.67	3.02	.87	2.50	.70	2.95	.72	3.59	.81	7.19	.59	1.90	.81	4.02	.91	8.64
8-0 … 8-5	12	.91	1.09	.86	1.16	.91	1.70	.80	2.78	.91	1.74	.84	2.65	.87	5.89	.53	1.91	.86	3.19	.88	9.75
8-6 … 8-11	8	.14	3.08	.53	1.85	.58	3.44	.66	4.11	.82	2.93	.86	2.59	.92	5.06	.59	1.84	.65	5.40	.76	14.54
9-0 … 9-5	7	.83	1.22	.74	1.01	.87	1.58	.57	4.28	.72	2.89	.94	1.43	.80	6.55	.75	1.41	.92	2.41	.90	7.69
9-6 … 9-11	8	.67	1.67	.77	0.97	.83	1.75	.05	4.86	.63	2.98	.69	3.10	.56	8.48	.78	1.30	.86	2.95	.66	12.64
10-0 … 10-5	6	.44	2.08	.82	1.02	.72	2.53	.90	1.94	.28	4.87	.05	5.92	.12	14.89	.67	1.59	.53	5.06	.53	17.21
10-6 … 10-11	9	.36	2.47	.69	1.03	.48	3.03	.48	2.69	.80	2.07	.28	4.54	.57	6.88	.86	0.99	.58	4.30	.58	11.34
11-0 … 11-5	10	.72	1.82	−.30	2.99	.58	3.53	.39	5.56	.68	3.81	.53	4.98	.84	7.77	.88	1.04	.89	2.77	.78	15.27
11-6 … 11-11	10	.35	2.35	.88	0.70	.70	2.32	.69	2.53	.69	3.20	.90	1.94	.94	3.35	.57	1.67	.30	6.75	.87	8.71
Median		**.63**	**1.77**	**.65**	**1.33**	**.77**	**2.20**	**.45**	**4.78**	**.56**	**3.59**	**.68**	**3.23**	**.75**	**7.26**	**.74**	**1.38**	**.75**	**3.79**	**.79**	**11.26**

r reliability coefficient, *SEM* standard error of measurement

Social Language Development Test, Table 2 Reliability based on item homogeneity: Kuder-Richardson (KR20) coefficients for each task, each subtest, and total test by age

	Making inferences			Interpersonal negotiation subtest						
Chronological age	Task a	Task b	Making inferences total	Task a	Task b	Task c	Interpersonal negotiation total	Multiple interpretations	Supporting peers	Total test
6-0 … 6-5	.75	.73	.84	.84	.76	.83	.93	.74	.77	.95
6-6 … 6-11	.78	.76	.86	.86	.77	.83	.93	.71	.77	.96
7-0 … 7-5	.70	.74	.82	.75	.71	.78	.89	.68	.76	.94
7-6 … 7-11	.75	.73	.82	.81	.67	.75	.90	.70	.74	.93
8-0 … 8-5	.78	.77	.86	.80	.66	.75	.88	.65	.66	.93
8-6 … 8-11	.76	.74	.84	.83	.73	.78	.91	.68	.77	.95
9-0 … 9-5	.71	.62	.80	.83	.52	.75	.87	.68	.77	.93
9-6 … 9-11	.70	.63	.79	.76	.56	.68	.85	.67	.73	.92
10-0 … 10-5	.69	.74	.83	.78	.70	.76	.90	.67	.62	.93
10-6 … 10-11	.76	.60	.80	.38	.46	.69	.77	.65	.57	.87
11-0 … 11-5	.80	.78	.88	.89	.78	.82	.94	.74	.83	.97
11-6 … 11-11	.73	.67	.80	.45	.44	.72	.75	.65	.65	.89
Median KR20	**.74**	**.71**	**.83**	**.75**	**.65**	**.76**	**.88**	**.68**	**.72**	**.93**

consistency results for the SLDT-E, and Table 2 represents the internal consistency results for the SLDT-A.

Empirical validity for each test was established with contrasted groups. Validity was established by comparing the test performances of randomly selected subjects from the sample population with a matched sample of subjects with language disorders and autism spectrum disorders receiving special services. The SLDT-E and the SLDT-A significantly discriminate between these clinical groups at most age levels. The exception is on the SLDT-E for ages 6–0 through 6–5. In this age group, the normative sample and the language-disordered group did not show a significant difference for the total test score.

Construct validity was established with point biserial correlations. Inspection of these correlations revealed highly satisfactory levels of item consistency for both tests (88% for the SLDT-E and 97% for the SLDT-A). The subtest intercorrelations and the correlations of individual subtests with the total test suggest that the subtests do assess separate social language functions but also measure a common general dimension. Overall, internal consistency estimates were satisfactory.

Race/socioeconomic group differences were conducted at the subtest level for both tests. Random samples of White, Black, and Hispanic or Latino student performances at the item level were compared by analyzing the proportion of students passing each item and at the subtest level by:

- Chi-square analyses to determine if significant relations existed between race and test performance
- Two-factor analysis of variance (ANOVA) analyses

In the SLDT-E, there were race differences in only 11% of the total number of the possible statistical tests for race and socioeconomic status (SES) group differences in only 18% of the statistical tests for that factor. In the SLDT-A, there were race and SES group differences in only 5% of the total number of the possible statistical tests for race and SES differences in only 15% of the statistical tests for that factor.

For both tests, the differences were usually small with most of them in the magnitude of one or two raw scores. Collectively, the results indicate that neither race nor SES group has a major impact on possible race or SES group bias for either the elementary or adolescent test. Further study is warranted however.

Clinical Uses

The results obtained from diagnostic testing should help the examiner to:

1. Identify the student's strengths and weaknesses
2. Make recommendations for additional testing
3. Make well-founded, educationally significant recommendations for remediation
4. Help teachers, parents, guardians, and the student understand the nature of the student's social language functioning
5. Make well-founded recommendations for boosting social success in school and at home

A student's performance on either of these tests may relate to his academic performance and peer interaction. A student may perform poorly on these tests because he has below average vocabulary skills, difficulty recognizing and interpreting facial expressions and body language, does not know the steps involved in processing a photo of someone, etc.

Performance on the individual subtests and total test performance, along with additional diagnostic tests and parent/teacher report, will give the SLP a framework for developing a remediation program that addresses the student's social language weaknesses and builds on the student's strengths.

For each subtest on the SLDT-E and SLDT-A, the authors identified error patterns and, based on those, identified remediation strategies for the SLP. These are described in the examiner's manuals.

As previously stated, these tests do not address all aspects of social language or pragmatic skills. They focus on social interpretation and interaction with peers and/or friends and are the first tests to have normative data on which to base therapeutic decisions. The authors encourage further research into social language skill development.

See Also

- ▶ Asperger Syndrome
- ▶ High-Functioning Autism (HFA)
- ▶ Norm-Referenced Testing

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Social Language Development Test-Adolescent

► Social Language Development Test

Social Language Development Test-Elementary

► Social Language Development Test

Social Phobia

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Synonyms

Social anxiety disorder

Short Description or Definition

Marked and persistent fear of social situations or of the scrutiny of others. The anxiety leads to avoidance of social situations or to significant distress when they are endured.

Categorization

According to DSM IV TR (American Psychiatric Association, 2000), social phobia, also known as social anxiety disorder, is characterized by marked and persistent fear of one or more social situations in which the person will be subject to potential scrutiny by others. The individual may fear acting in an embarrassing or humiliating way or may fear showing overt symptoms of anxiety such as stammering, blushing, or trembling. The thoughts that are triggered by social situations may include the idea of being perceived as anxious, weak, stupid, or "crazy." Physical symptoms are almost always associated with the anxiety-provoking situations and can include palpitations, tremors, sweating, blushing, gastrointestinal discomfort, and muscle tension. As a consequence, certain social situations such as speaking or eating in public are usually avoided or, less frequently, endured with intense anxiety or distress. The avoidance of such situations or the distress they cause must interfere significantly with the normal routine of the individual, their occupational or academic functioning, or their social activities or relationships. When the fear relates to most social situations, the disorder is specified as *generalized*.

In adults, the diagnosis of social anxiety disorder requires a degree of insight such that the person recognizes that their fear is excessive or irrational. In children, however, this feature may be absent. In young people under the age of 18, for whom some socially oriented anxiety or avoidance are very common, the diagnosis is made only if the symptoms have persisted for at least 6 months.

The ICD-10 (World Health Organization [WHO], 1992) describes social phobia as a fear centered around the fear of scrutiny by others usually leading to avoidance of social situations and also emphasizes the physical symptoms that typically make up part of the clinical picture and the embarrassment they cause. These may present as blushing, hand tremor, nausea, or urgency of micturition. The ICD-10 diagnosis of social phobia in adults depends on the anxiety being predominantly related to particular social situations and causing avoidance whenever possible.

ICD-10 defines social anxiety disorder of childhood as arising before age 6 and being characterized by persistent or recurring fear and/or avoidance of strangers. The fear may be centered on adults, peers, or both and the diagnosis is made when associated with a normal degree of selective attachment to parents or other familiar persons.

Epidemiology

Social phobia is common, with lifetime prevalence rates estimated between 2% and 13% (American Psychiatric Association, 2000; Kessler, Chiu, Demler, & Walters, 2005) and a possible preponderance of females in younger samples.

Estimates of prevalence rates for social phobia among individuals with Autism Spectrum Disorders (ASD) vary widely, likely reflecting differences in both measurement methodology and sample characterization. Most of the reported rates have been based on child and adolescent samples and have included primarily samples of high-functioning autism. Two studies utilizing versions of the Kiddie-SADS (Kaufman et al., 1997) found almost identical prevalence of social phobia among such samples, reporting 7% and 7.5% rates of the disorder (Gjevik, Eldevik, Fjaeran-Granum, & Sponheim, 2011; Leyfer et al., 2006). Other studies have reported significantly higher occurrences. Simonoff et al. (2008) reported 30% prevalence while Kuusikko et al. (2008) found that 57.1% of adolescents with ASD in their sample manifested clinically significant symptoms of social phobia. Intermediate prevalence rates have been reported in additional studies (Bellini, 2004; Muris, Steerneman, Merckelbach, Holdrinet, & Meesters, 1998).

Although research supports a role for genetic factors predisposing individuals to social phobia (Kendler, Neale, Kessler, Heath, & Eaves, 1992), the role of family and genetic factors associating ASD and social phobia is unclear. A study of the first-degree relatives of individuals with autism found 39% meeting criteria for social phobia, and the association was greater for high, compared to low-functioning autism (Smalley, McCracken, & Tanguay, 1995). In another study, parents of individuals with autism and parents of individuals with Down syndrome were assessed, and elevated rates of anxiety disorders were reported among parents of probands with ASD (Piven et al., 1991).

Natural History, Prognostic Factors, Outcomes

Social phobia is commonly diagnosed starting from early adolescence and has a mean age of onset in the mid-teens but the disorder, or precursors thereof, typically appear earlier (Grant et al., 2005). Among the early risk factors for social phobia is chronic behavioral inhibition (Essex, Klein, Slattery, Goldsmith, & Kalin, 2010; Schwartz, Snidman, & Kagan, 1999), which is a temperamental characteristic typified by elevated fear response to both social and nonsocial novelty.

The course of social phobia tends to be chronic and impairing, with only approximately one-third of adult patients remitting over an 8-year period

(Yonkers, Bruce, Dyck, & Keller, 2003) and without significant differences between the sexes. The presence of suicidality and relatively low baseline functioning predict the greatest chronicity of the anxiety in women.

Clinical Expression and Pathophysiology

The clinical expression of social phobia is centered on the fear of embarrassment in social or performance situations and on the consequent avoidance of those situations. Physiological arousal tends to accompany even the potential experience of social scrutiny and experimental research has supported increased cortisol stress-responsiveness in socially anxious individuals confronted with a social-stress-inducing situation (Roelofs et al., 2009). Various neurotransmitter and neuropeptide systems have been suggested to play a role in the formation, maintenance, or treatment of social phobia including serotonin, glutamate, dopamine, and oxytocin (Mathew, Coplan, & Gorman, 2001).

Evaluation and Differential Diagnosis

The most significant challenge to the evaluation of social anxiety disorder in individuals with ASD relates to the overlapping features of the disorders such as the impaired social functioning inherent to ASD. DSM IV TR cautions against diagnosing social phobia when the symptoms are better explained by ASD; however, no clear guidelines for determining when comorbidity can be diagnosed exist. Determining whether avoidance of certain social situations is being caused by anxiety, lack of interest, or other motivations can be difficult. Additionally, understanding which aspects of a certain situation are causing anxiety or avoidance can be challenging, particularly with nonverbal or otherwise less communicative individuals. Differentiating social phobia from mood disorders such as depression can also be difficult when the diagnosis must rest on parent report or behavioral observations without a description of the underlying cognitions prompting the behavior.

One approach to overcoming these challenges has been to adapt assessment instruments to the ASD population. Kuusikko et al. (2008) attempted to improve diagnosis by removing from self-report social anxiety scales those items that might actually relate directly to ASD. Few tools have been developed specifically for the diagnosis of comorbid conditions in ASD. These include the Autism Comorbidity Interview Present and Lifetime Version (Leyfer et al., 2006). This modified version of the Kiddie-SADS allows for the comorbid diagnosis of social phobia and ASD in children while attempting to distinguish between them by specifying that the fear or avoidance must be related to the social rather than nonsocial aspects of the situation and must not be due to lack of interest. Using this instrument, the authors reported a prevalence rate of only 7.4% in a sample of youth with ASD (Leyfer et al.). This rate was lower than for specific phobia or separation anxiety disorder in this sample.

One key to successful differential diagnosis between social phobia and ASD may be in the presence or absence of additional features of autism that do not constitute part of the clinical picture of social phobia (White, Bray, & Ollendick). For example, a socially avoidant individual who also displays restricted interest, over attention to detail, rigid routine, or an impaired theory of mind may be more likely to have an ASD.

Treatment

Treatment of social phobia in recent years has focused on Cognitive Behavioral Therapy (CBT) and pharmacological treatment (primarily with SSRI) (Segool & Carlson, 2008; Wagner et al., 2004). In a meta-analytic review of CBT for adult anxiety, treatment effects for social phobia were found to be smaller than for other disorders (Norton & Price, 2007). A number of variables have garnered at least tentative

empirical support for their impact on the outcome of treatment for social phobia including effectiveness in social interactions, feelings of loneliness, and depressed mood (Alfano et al., 2009).

Despite some misgivings about the applicability of CBT to the ASD population, based in part on the hypothesized deficits in theory of mind (Baron-Cohen, 2001), there are data to support the efficacy of the treatment in this population. In a trial of CBT for anxiety in children diagnosed with Asperger syndrome (AS) both individual CBT and CBT for child and parent resulted in reductions in social anxiety compared to a wait-list condition (Sofronoff, Attwood, Hinton, & Levin, 2007). Similar results have been reported in the few other trials that have been conducted of CBT for anxiety with ASD youth (Chalfant, Ron, & Louisa, 2007; White, Ollendick, Scahill, Oswald, & Albano, 2009), however these are still relatively scarce.

See Also

- ▶ Avoidant Personality Disorder
- ▶ Selective Mutism
- ▶ Social Anxiety Disorder

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Social Responsiveness Scale

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Synonyms

SRS

Abbreviations

AUC	Area under curve
ADHD	Attention deficit hyperactivity disorder
ADI-r	Autism diagnostic interview-revised
ADOS	Autism diagnostic observation scale
ASD	Autism spectrum disorder
BPVS	British picture vocabulary scale
CBCL	Child behavior checklist
CCC	Children's communication checklist
OCD	Obsessive compulsive disorder
PDD-NOS	Pervasive developmental disorders-not otherwise specified
ROC	Receiver operating characteristics
SCDC	Social and communication disorders checklist
SCQ	Social communication questionnaire
VABS	Vineland adaptive behavior scales

Description

The Social Responsiveness Scale (SRS) is a 65-item rating scale that measures the severity of autistic symptomatology as a quantitative trait, among children clinically affected by autism spectrum conditions as well as among children in the general population. It is particularly useful for characterizing milder autistic syndromes that lie at the boundary between the normal population distribution and clinical-level affectation. The SRS can be completed by a parent,

a teacher, a spouse (in the case of the adult version of the SRS), or another adult informant. The validity of self-report is still under study. The SRS involves ratings of children in their natural social contexts and reflects what has been consistently observed over weeks or months of time rather than in a single clinical or laboratory observation. In this way, it capitalizes on both direct observation and on the accumulated history of behaviors observed by the informant over time. The SRS generates quantitative scores for the severity of autistic traits and symptoms, and distinguishes Autism Spectrum Disorder (ASD) from other psychiatric conditions (Constantino, Przybeck, Friesen, & Todd, 2000). Norms have been published by gender and rater type (parent versus teacher) in order to standardize ratings, which otherwise differ as a function of these parameters. SRS scores are highly heritable (Constantino & Todd, 2003), stable over time (Constantino et al., 2009), exhibit high inter-rater reliability (Constantino et al., 2007a), are continuously distributed in the general population (Constantino & Todd, 2003), are nonsignificantly correlated with IQ among children representing the normal range of IQ in the general population (Constantino et al., 2007a), and exhibit a unitary factor structure (Constantino et al., 2004), which supports the use of a single index score as a quantitative measure of autistic severity. SRS scores greater than *75 T* (98.8th percentile) indicate a level of autistic social impairment that is generally highly clinically significant.

Historical Background

Over the course of some 25 studies involving over 10,000 individuals (including Constantino et al., 2006, 2007a,b, 2009; Constantino & Gruber, 2005; Constantino, Hudziak, & Todd, 2003b; Constantino & Todd, 2000; Lee et al., 2010; Levitt & Campbell, 2009; Pine, Luby, Abbacchi, & Constantino, 2006; Virkud, Todd, Abbacchi, Zhang, & Constantino, 2009), research involving the SRS has yielded information about the distribution of autistic traits and symptoms in children and families affected by autism, as well as children and families in the general population. Complementary research involving an array of other quantitative rating scales has converged with findings from studies involving the SRS in demonstrating that quantitative autistic traits *exhibit a continuous distribution in nature* (from very mild to very severe, see Fig. 1 panel A below) and are substantially heritable (estimates on the order of 0.60–0.80). The traits and symptoms captured by the SRS are extremely stable over time (5-year test-retest correlations on the order of 0.60–0.70 in clinical samples and 0.70–0.80 in nonclinical populations, as depicted in panel B below), yet capable of fluctuating within individuals over time and in response to intervention. The SRS is currently in use in a broad range of settings, including schools, clinical services, and research programs. It offers the capability of feasible and reliable quantitative characterization of core components of the autistic syndrome across informants and across environmental contexts, and has been translated into over 20 foreign languages at the time of this writing.

Psychometric Data

Each version of the SRS can be completed in 15 min and generates both scale scores for specific symptom domains relevant to the characterization and treatment of autistic syndromes, as well as a singular total score for autistic social impairment, empirically validated via factor, cluster, and latent class analysis (Constantino et al., 2004, 2007a). Higher total scores on the SRS indicate greater severity of social impairment; and inter-rater reliability is high (parent-teacher correlation 0.72, $n = 1{,}200$). The SRS exhibits nonsignificant correlations with IQ, and substantial agreement with the Autism Diagnostic Interview (ADI-r) and the Autism Diagnostic Observation Scale (ADOS) (Constantino et al., 2003, 2004, 2007a; Lee et al., 2010). Parent-report scores on the SRS distinguish children with ASDs (including Autistic Disorder, Asperger Disorder, and Pervasive Developmental Disorders [PDD-NOS]) from those with other

child psychiatric conditions (Constantino et al., 2004, 2000, 2007b; Constantino & Gruber, 2005). Autistic traits and symptoms measured by the SRS are continuously distributed not only in clinical populations but in the general population (Constantino & Todd, 2003). Furthermore, traits measured by the SRS aggregate in the male first-degree relatives of subjects with ASD in multiple-incidence families (Constantino et al., 2006; Virkud et al., 2009). In addition, there is evidence from molecular genetic studies that SRS scores map to specific autism susceptibility loci (Duvall et al., 2007; Levitt & Campbell, 2009; Coon et al., 2010).

Internal Consistency

Internal consistency is a form of reliability that can be estimated from a single administration. Studies using the SRS have reported very high estimates. The earliest study on the SRS (Constantino et al., 2000) assessed internal consistency in regular education children aged 4–7 years ($N = 197$). An alpha .97 was obtained. In a report on a clinical sample using the German translation, Bolte, Westerwald, Holtmann, Freitag, and Poustka (2011) obtained an alpha .94 in a mixed clinical group ($N = 255$) and alpha .96 in an ASD group ($N = 148$).

Retest Reliability/Temporal Stability Construct Validity

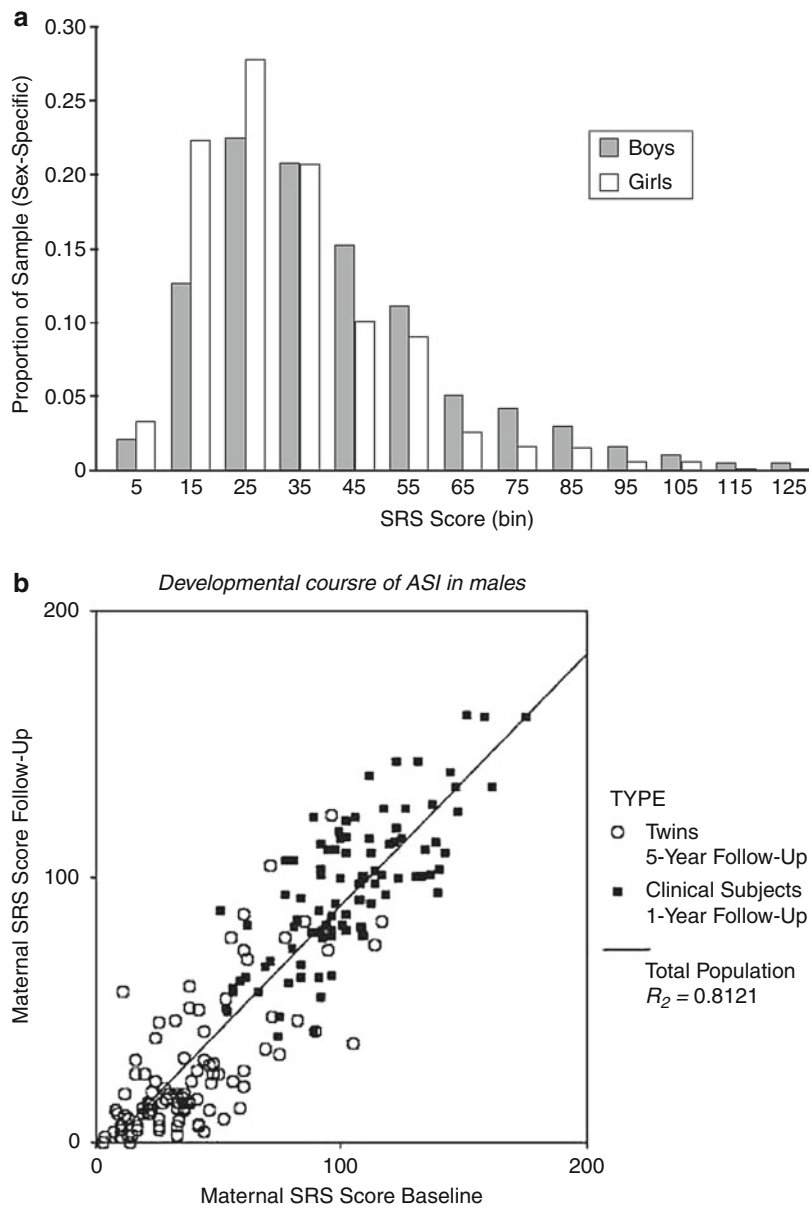
Retest reliability and temporal stability are closely related psychometric constructs. While the actual study principle is the same – an individual is asked to fill in an instrument twice so that results can be compared after time delay – the meaning of the result changes substantially when the two procedures are separated over increasingly long time periods. When the interval is short, say a few weeks to a few months, the study is said to address test-retest reliability and findings are attributed narrowly to the reliability of the instrument. When the interval is longer however, say on the order of 6 months to several years, then the study is said to address temporal stability and the results are attributed to the validity of the underlying construct (autism in the case of the SRS) and of the instrument.

Research interest has focused on longer intervals in clinical populations. It is a testimony to both the high validity of the autism construct and to the SRS in measuring that construct that correlations have been very high. Constantino et al. (2000) reported on a clinical group ($N = 30$) with a retest interval averaging 137 days and found a correlation $r = .88$. Bolte, Dziobek, and Poustka (2009) assessed a clinical group ($N = 49$), with a 3–6 month retest interval and found a retest correlation of $r = .95$ was obtained. Constantino et al. (2009) tested 95 male twin pairs ASD affected and 95 males typically developing (total $N = 285$) longitudinally over a 5-year period and found that retest correlations maintained around $r = .90$ in both groups, as shown in Fig. 1 Panel B.

In general, the reliability of an instrument is seen as a strong constraint on its validity. Thus, the evidence of longer interval construct stability above, with correlations on the order of 0.80–0.90, tends to obviate the need to put resources into documenting short interval retest reliability. Bolte, Poustka, and Constantino (2008) did evaluate retest reliability in conjunction with the development of the German edition, but only in the normative group. With a retest interval ranging from 3 weeks to 4 months, they found retest reliability was $r = .80$ for mothers and $r = .72$ for fathers.

Inter-rater Reliability/Convergent Validity

Inter-rater report comparisons serve two functions. In a narrow sense they are an aspect of reliability, since they involve applying the same items to the same child. Yet inter-rater comparisons also go beyond that to provide a broader aspect of validity, since they involve passing the items through different experience bases. Thus, mother and father, even while living in the same home and sharing many family experiences, do each have separate personal experiences with a child and, moreover, a unique prior personal history that can influence how each will interpret the meaning of the 65 test items. And this sense of difference in background, experience, and perspective expands even more when a parent report is compared to that of a teacher; for one a teacher and a parent have



Social Responsiveness Scale, Fig. 1 *School-age SRS studies*: (**a**) General population distribution (**b**) 5-year Stability (Constantino et al., 2009)

virtually no overlapping observations of a child's behavior and for another a teacher, while seeing the child in a more limited setting than the parent, can draw on professional training and direct experience with scores and even hundreds of other children when judging the child's behavior.

Despite these differences in perspective, studies reporting on different observers have found highly concordant reports. With regard to mother-father inter-rater agreement, Constantino et al. (2003a) collected mother and father reports in a sample of ASD-diagnosed individuals ($N = 61$). They found mother-father reports correlated $r = .91$. Bolte et al. (2008), using the German edition, reported on 527 mixed clinical cases (160 with ASDs) and also found mother-father reports correlated $r = .91$. In the normative sample, Bolte et al. (2009) obtained a mother-

father correlation $r = .61$. Prior comments regarding results in normative or other less-affected groups apply again here.

Parent reports have also been compared to teacher reports in clinical samples. Regarding parent-teacher comparisons, Constantino et al. (2003a) found mother-teacher reports correlating $r = .82$ and father-teacher reports correlating $r = .75$ (both $N = 61$). In a later study Constantino et al. (2007a) compared teacher- and parent-report SRS scores in a larger sample ($N = 577$) of clinically referred children and found parent-teacher reports correlated $r = .72$. As noted in the introductory comments, differences in experience bases are much larger between teachers and parents than between parents. These finding on parent-teacher comparisons are also highly indicative of strong reliability and validity.

Comparisons with Other Instruments: Concurrent Validation

Two broad issues can be addressed from reports where the SRS has been used with other instruments. Of these, *convergent validity* compares the instrument to others that have the same focal purpose. For the SRS, this involves comparisons with other instruments that are designed to evaluate symptoms and behaviors on the Autism Spectrum. In these comparisons, higher correlations are desirable. In contrast, *divergent/discriminant validity* addresses the instrument's performance in contexts where a broader variety of symptoms and behavior problems need to be addressed. For the SRS, this could involve comparison to instruments that assess other commonly identified psychological disorders and behavioral problems – for example, behavioral expressions of internalizing problems of anxiety, depression, and Obsessive Compulsive Disorder (OCD) or behavioral expressions of externalizing problems such as Attention Deficit Hyperactivity Disorder (ADHD), conduct disorders, and Bipolar disorder – or those that assess less specifically linked problems such as developmental delay. In these comparisons, moderate- to lower- or even zero-order correlations are desirable, demonstrating that the SRS explains variance that is unique to the social behavior associated with ASDs and not strongly overlapping with that due to behavioral difficulties associated with other disorders and identified by other instruments.

Convergent Validity

Parent and Teacher Report Behavior Assessments. Comparison with other ASD-directed measures have largely involved instruments using a similar approach to assessment: multiple item objective questionnaires with a multipoint Likert-scale or a true-false response format that is completed by informants familiar with the child's behavior in natural living contexts such as parents and teachers. Good agreement has been reported with the several instruments that have been investigated.

The most widely investigated comparison has been with the Social Communication Questionnaire (SCQ; Rutter et al., 2003), an instrument that uses a true-false response format with 40 items derived from the ADI-r. Findings with the SRS have been relatively consistent. In studies with mixed clinical samples as cited earlier, Charman et al. (2007) report a correlation $r = .68$ ($n = 119$); Bolte, Poustka, and Constantino (2008) report $r = .58$ ($n = 107$). In addition, also in a mixed clinical sample, (Pine, Guyer, Goldwin, Towbin, & Leibenluft, 2008) found $r = .65$ ($n = 352$) and in a small sample of children affected by epilepsy Granader et al. (2010) report $r = .61$ ($n = 21$). A slightly lower value was reported by Bolte et al. (2011), $r = .50$ ($n = 480$), in a sample that included typically developing as well as clinical subjects.

There have also been several studies correlating SRS scores with those from the Children's Communication Checklist (CCC; Bishop, 1998), a 70-item instrument with a Likert scale response format. Pine et al. (2008) reports correlations or $r = -.49$ and $-.72$ with the two ASD-focused (and positively valanced) subscales. Similarly, Charman et al. (2007) report a SRS to CCC correlation $r = -.75$.

The SRS has also been compared to the Social and Communication Disorders Checklist (SCDC, [Skuse, Mandy, & Scourfield, 2005]) a brief,

12-item scale using a 3-point Likert scale response format. Using German translations, Bolte et al. (2011) found the instruments moderately correlated $r = .49$.

The ADI-r and the ADOS. The SRS has also been compared to instruments that are less similar in design, in particular the Autism Diagnostic Interview, revised (▶ ADI-r; Lord, Rutter, & Le Couteur, 1994) and the Autism Diagnostic Observation Schedule (▶ ADOS; Lord et al., 2000).

The design characteristics of these instruments are quite different from that of the SRS and other behavioral parent and teacher reports cited in the previous section. The ADI-r is a long structured psychiatric interview from which a subset of questions are selected and coded; the ADOS is a structured observation of behavior conducted by a trained professional under standard conditions from which pre-identified behavior is identified and coded. Both instruments were designed to facilitate categorical, diagnostic decision making and, consequently, do not produce the same kind of dimensional results produced by the objective questionnaires. It has long been recognized that differences in method tend to produce evidence of validity at lower levels of correlation (e.g., Campbell & Fiske, 1959). Given the differences, results provided clear support for the validity of the SRS.

ADI-r results include "domain scores," sums of coded item subsets. Constantino et al. (2003a) reported an early investigation of SRS validity, comparing SRS to ADI-r lifetime scores in a sample ASD-diagnosed individuals ($N = 61$). We note that ADI-r domain scores characterize level of severity around the age of 4 years, at a relative peak in manifestations of autistic symptomatology from the standpoint of developmental history. Despite this fundamental difference between the SRS (which measures current dysfunction) and the ADI-r (which indexes historic symptomatology in early childhood), correlations between parent-report SRS scores and ADI-r domain scores ranged from .65 to .77 for mother reports, from .52 to .70 for teacher reports, and from .60 to .74 for father reports. In a subsequent report on a larger sample, somewhat lower, though highly statistically significant correlations were reported between SRS Parent reports and ADI-r domain scores (range of $r = .31 - .36$) and SRS Teacher reports (range of $r = .26 - .40$) (Constantino et al., 2007a). These correlations were on the order of what was observed for correlations between ADI-r and ADOS domain scores. In the study associated with the development of the German edition, Bolte et al. (2008) collected 133 clinical cases and report more specifically on parent reports for the separate domains: Social Interaction Domain score $r = .46$, Communication Domain Score $r = .40$, Stereotypic Behavior Domain score $r = .38$. Charman et al. (2007) used an ADI-r results that combined scores across domains and found a correlation $r = .59$. As noted in the introductory paragraph, the ADI-r was designed to facilitate categorical analyses and its brief domain scores do not provide a strong basis for correlational analyses, for example, Bolte et al. (2009) used standard adjustments to compensate for attenuated ranges in short scales. The relatively stronger finding in the Charman et al. (2007) study may in part reflect the combination of domains into a single, more dimensionalized score.

The same sets of investigators produced parallel findings on comparisons to the ADOS. Constantino et al. (2007a) found ADOS domain scores correlated with SRS Parent reports (range of $r = .37$ to .58) and SRS Teacher reports (range of $r = .15 - .43$). The Bolte et al. (2008) study reports Communications/Social Deficits score $r = .35$. In a subsequent study Bolte et al. (2011) found correlations in the $r = .32 - .35$ range with the ADOS Domain scores. Again, using a single combined domain score, Charman et al. (2007) found an SRS to ADOS correlation $r = .48$. The earlier comments regarding brief domain scores and Charman et al.'s use of a combined domain score also apply here.

Divergent/Discriminant Validity

The task of differentiating diagnostic groups is addressed by studies cited in a later section. This section provides a more general sense of overall validity from comparing correlations with different instruments and their scales. The comparison scales reported here are directed at a wider

variety of mental health problems and diagnoses, some of which may have overlapping symptoms with ASD and others thought or known to have no systematic relation to ASDs. Reported correlations will reflect a validation of the SRS by showing moderate- to low- or zero-order correlations.

As noted earlier, differences in methods can have an impact on correlational evidence (e.g., Campbell & Fiske, 1959). Most of the reports in the following discussion involve parent and teacher behavioral reports, similar in design to convergent measures like the SCQ, CCC, and SCDC. The appropriate comparison in this section is with those reported on the parent and teacher report behavioral measures in the previous section.

Studies using the Child Behavior Checklist (CBCL; [Achenbach & Ruffle, 2000]) support the view that the SRS is more sensitive to behaviors that can sometimes be associated with ASD-related problems, less sensitive to behavior seldom seen in ASDs, and – perhaps most critically – sufficiently independent of the CBCL to indicate sensitivity to behavioral problems not assessed by the CBCL. Two studies report correlations between the SRS and CBCL in clinical samples, with Constantino et al. (2000) reporting on 84 clinical cases and Bolte et al. (2008) reporting on 119 clinical cases from the German validation studies. Despite the differences in location and language, the findings were quite parallel. Both studies found moderate correlations for the SRS with CBCL subscales that have some overlap with the kinds of symptoms seen with ASDs: Social Problems, Thought Problems, and Attention Problems (correlations range $r = .48$ to .64). As expected, results were somewhat mixed but generally lower for correlation with CBCL subscales directed at less related behavior: Withdrawn, Delinquent Behavior, and Aggressive Behavior (correlations range $r = .34 - .54$). Both studies found zero-order correlations for the SRS with the CBCL Somatic Complaints subscale ($r = .11$ and .12 ns). In another study involving a general population twin sample, Constantino et al. (2003b) examined overlap in the constructs captured by the scales, suggesting about 16% total shared variance.

Using the Vineland Adaptive Behavior Scales (VABS; Sparrow, Balla, & Cicchetti, 1984) studies have reported on the relation of development to SRS scores. Charman et al. (2007) report a correlation of −44 for the positively valenced composite VABS scores with the SRS and Bolte et al. (2008) found a correlation $r = -.36$ for the composite correlations ranging from −.34 to −.43 for the subscales. This level of correlation appears reasonable for a developmental disorder like ASD. Regarding narrower cognitive ability, Charman et al. (2007) reported no significant correlation of the SRS to the British Picture Vocabulary Scale (BPVS; Dunn, Dunn, Whetton, & Burley, 1997).

Clinical Uses

The first question for a clinical assessment is whether affected individuals show scores elevated enough for the assessment to have clinical utility. Independent reports providing information on both typically developing children with those diagnosed as autistic have consistently shown a statistically significant and clinically meaningful separation. Children not affected by ASD or any other disorder are typically reported to have SRS Total Scores in the narrow range from 0 to 35. This is true in studies where children have been drawn to be representative of typically developing populations (Bolte et al. 2008, 2011; Coon et al., 2010) and in studies where matched controls have been drawn (Reiersen, Constantino, Volk, & Todd, 2007; Pine et al., 2008). In contrast, results for groups of children with PDD-NOS, ASD, or autistic disorder find SRS Total Score group means in the range 86–116 (Charman et al., 2007; Constantino et al., 2000; Coon et al., 2010; Kalb, Law, Landa, & Law, 2010). Even given the rather large standard deviations reported for autistic groups (ranging 27–33), the findings indicate a separation of two standard deviations or more. These differences are substantial and have a clear practical utility.

Clear and useful separation can also be seen when contrasting autism with other non-autistic diagnoses. Studies that have presented SRS

scores for mixed or specific non-ASD diagnosis clinical samples have reported group SRS Total Score means in the range 40–75, that is, consistently higher than those reported for typically developing groups and lower than those reported for autism-affected groups (Bolte et al., 2008, 2011; Charman et al., 2007; Constantino et al., 2000; Pine et al., 2008; Puleo & Kendall, 2011; Reiersen et al., 2007; Towbin, Pradella, Gorrindo, Pine, & Leibenluft, 2005). It must be noted that studies will produce different results depending on the specific symptoms associated with the contrast diagnosis and on the severity of clinically affected subjects who are ascertained or recruited.

Screening and Receiver Operating Characteristics (ROC) Reports

The SRS has had a number of clinical applications: qualifying subjects for research studies, providing support for clinical diagnoses, assessment of treatment effects, etc. Wide international concern about autism, however, has also led to an interest in developing and applying screening tools, and the SRS has been studied for this purpose. These studies evaluate an instrument's sensitivity (the proportion of actually affected individuals who are correctly identified) and specificity (the proportion of nonaffected individuals who are correctly identified). In general, there is a trade-off so that increasing specificity degrades sensitivity and vice versa.

The studies reported here reflect the complexity of the screening task (e.g., differing contrast diagnoses, population pools, comparison instruments, and cut points that may favor sensitivity in some cases and specificity in others). Even with the variation, however, the findings to be reported indicate that the SRS has a useful power to properly identify affected children and to accurately discriminate children with ASD conditions from typically developing children and also from those with varied non-ASD disorders. For a psychiatric sample of 133 children with ASD diagnoses and 126 mixed non-ASD diagnoses (sample described in Constantino et al. (2004)), a ROC analysis was reported. With the standard recommended research cutoff of 75, sensitivity was reported as .85 and specificity as .75. Charman et al. (2007) reported on a sample of children previously identified with developmental or special education risk factors, and contrasted 49 children with confirmed ASD diagnoses with 70 children with confirmed non-ASD diagnoses. Under these conditions, Area Under Curve (AUC) was .77, sensitivity was .78, and specificity was .67.

A larger and more diverse study by using the German translation involved a sample of 480 children, including 148 with ASD diagnoses, 255 with non-ASD clinical diagnoses, and 77 typically developing children (Bolte et al., 2011). Results were reported based on the recommended research cutoff for the SRS of 75 that was used in the prior two reports. Contrasting ASD cases with typically developing children they report AUC = .98 with sensitivity = .80, specificity = 1.0. Contrasting ASD cases with the non-ASD clinical group, they report AUC = .81 with sensitivity = .80, specificity = .69. Contrasting ASD with a clinical sub-sample of ADHD affected children, they report AUC = .86 with sensitivity = .80, specificity = .78. And finally, contrasting ASD with a clinical sub-sample of children with anxiety diagnoses, they report AUC = .82 with sensitivity = .81, specificity = .74.

The findings across the three studies and groups are fairly consistent with regard to sensitivity, ranging from .78 to .85 and clustering around .80. With regard to specificity, findings are more varied and depend on the nature of the contrast group, ranging from .69 to 1.0, with perhaps .75 as an adequate single estimate in clinical settings where there are mixed diagnoses in the contrast group. Co-equal high rates, as seen for the SRS, are generally desirable, but there can be applications where favoring one or the other many be preferred, for example, an instrument with higher sensitivity for use in early, broad population studies or one with higher specificity for use in aiding differential clinical diagnosis. The SRS is highly versatile in this sense; given the fact that it is fundamentally a quantitative trait measure, users can adjust the cutoff values used for screening to optimize sensitivity or positive predictive value.

The results above are reported on the conventional procedure, where a single administration of an instrument is used to identify children with potential problems. The SRS has two features that make it relatively easy to add to screening power. As a behavioral report, it does not require clinician time to conduct the assessment and as a report with several forms, it is relatively easy to collect more than one score on a child, for example, a parent and a teacher or a mother and a father. Taking advantage of these features, Constantino et al. (2007a) compared teacher- and parent-report SRS scores in a large sample ($N = 577$) of clinically referred children. A PDD-affected sample ($n = 271$) was compared to nonaffected siblings ($N = 119$). Parent and teacher forms were both administered and the screening power reported when both reports on a given child were elevated to the diagnostic cut point. Under these conditions the ROC analyses showed an AUC = .95 with sensitivity 0.75 and specificity 0.96.

Results in Other Clinical and Behavioral Research

While the SRS has the identification and characterization of ASDs as its central purpose, it has been used in studies of other behavior difficulties and clinical diagnoses. In all of the studies reported below, children with non-ASD clinical diagnoses are seen to have clinically relevant weakness in the kinds of social behavior assessed by the SRS. As noted by one of the teams (Pine et al., 2008), this can raise the question of whether ASDs are being under-assessed when there are comorbid conditions. More broadly, however, all of the findings show that the behavioral and social problems associated with ASD can have relevance in other areas. The SRS measures these problems in a way that is sensitive to their presence, differentiated in elevation from that seen in actual ASD diagnoses, and may be highly sensitive to treatment effects (Puleo & Kendall, 2011).

Heritability/Genetic Epidemiology

In an extensive line of research employing the SRS in large genetically informative samples of twins (Constantino & Todd, 2000, 2005; Ho, Todd, & Constantino, 2005), siblings (Constantino et al., 2006; Schwichtenberg, Young, Sigman, Hutman, & Ozonoff, 2010), and families (Virkud et al., 2009), representing both the general population Constantino and Todd (2003) and clinically affected families (Constantino, Zhang, Frazier, Abbacchi, & Law, 2010), including studies involving molecular genetic markers (Duvall et al., 2007; Campbell, Warren, Sutcliffe, Lee, & Levitt, 2010; Coon et al., 2010), it has been shown that the quantitative traits measured by the SRS are highly heritable across the entire range of severity in which they occur in nature (from mild to severe), and that subclinical autistic traits characterized by mild elevations SRS scores constitute candidate endophenotypes, that is, genetically related to the cause(s) of autism itself.

Brain Imaging

Several neuroimaging studies have elucidated brain imaging phenotypes that relate closely to variation in SRS scores, both in the general population and in clinically affected samples (Assaf et al., 2010; Di Martino et al., 2009; Kaiser et al., 2010; Paul, Corsello, Tranel, & Adolphs, 2010).

Longitudinal Course

Constantino et al. (2009) tested $N = 285$ (95 male twin pairs ASD affected and 95 male typical developing) longitudinally over a 5-year period, and found that test retest correlations maintained around $r = 90$ in both groups. Individual trajectories varied as a function of severity at baseline. Moderate improvement with age was noted, underscoring the instrument's potential utility for ascertaining incremental response to intervention. Ongoing research on the longer-term longitudinal course of autistic traits and symptoms among clinically affected children and their siblings is underway in NIH-funded research.

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See Also

- ▶ Attention Deficit/Hyperactivity Disorder
- ▶ Obsessive-Compulsive Disorder (OCD)
- ▶ Pervasive Developmental Disorders
- ▶ Vineland Adaptive Behavior Scales

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Social Scientist

► Psychologist

Social Scripts

► Scripts

Social Skill Interventions

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Definition

Social skill interventions attempt to remediate deficits in the set of social skills that are used to interact and communicate with others. For individuals with autism spectrum disorders (ASD), this means difficulties in initiating interactions, sharing enjoyment, sustaining reciprocity, taking the perspective of another, and making inferences about the interests of others. Social skill deficits are a central feature of ASD. There are many different programs established to treat these social skill deficits for individuals with ASD; however, many programs are not well researched and do not have an established evidence base.

Historical Background

The social skill deficits noted in autism spectrum disorder (ASD) were first described in papers published in 1943, one in English and one in German. Leo Kanner (1943) described 11 children with "early infantile autism" in his paper "Autistic disturbances of affective contact" and highlighted poor social relatedness as a key component of the disorder. Hans Asperger (1944) in Vienna, Austria, submitted a thesis on "Autistic psychopathy in childhood" and described four children with "autistic psychopathy." He identified these children with "deficient social behavior." Since this time, significant developments have been made to help us understand the neuropsychological underpinnings of social cognition. The notable work of researchers in the area of social cognition and theory of mind, including Dr. Baron-Cohen in England and Dr. Tony Attwood in Australia, has helped the profession and community gain a better understanding of the core social cognitive processes involved in the social interaction deficits characteristic of individuals with ASD. In addition, Dr. Temple Grandin, an individual with autism, has provided invaluable insight into the neurological strengths and challenges in autism, with her book "Thinking in Pictures" (1995), including difficulties understanding the social rules of interaction and developing relationships with other people. In recent years, there has been an increase in the awareness of the benefits of early intervention in ASD and the need for opportunities for social engagement. With this awareness has come a growing interest in developing early social communication skills including joint attention and symbolic play. Current researchers in this area include Dr. Peter Hobson, Dr. Connie Kasari, Dr. Peter Mundy, Dr. Barry Prizant, Dr. Sally Rogers, Dr. Laura Schreibman, and Dr. Amy Wetherby, among others. Practitioners, like Michelle Garcia Winner (2006), have described specific social cognition intervention strategies and developed social skills programming to assist professionals in intervention.

Rationale or Underlying Theory

Deficits in social interaction are one of the three core characteristics of autism spectrum disorder (ASD). Difficulties in engagement and socialization have far-reaching implications throughout childhood and into adulthood. Deficits in social cognition impact the development of relationships with others, academic and vocational success, as well as mental health and quality of life. Based on current research, early intervention that focuses on building joint attention, a pivotal skill leading to later development of language and social communication, is key to fostering and developing social engagement with others. Social skills intervention is an important part of any intervention program for children and adolescents/adults with ASD.

Goals and Objectives

Social skills intervention is intended to teach both pragmatics (the social use of language)

and social cognition (theory of mind, perspective taking), the latter being a critical component for children with ASD. Teaching pragmatic language skills can entail the (1) use of language (greeting, informing, demanding, promising, requesting), (2) changing language according to the needs of the listener or situation, and (3) following rules for conversation and storytelling (taking turns, introducing topics, staying on topic, rephrasing, using verbal/nonverbal signals, facial expressions/eye contact, proximity). Social cognitive aspects are addressed by teaching individuals to take the perspective and to perceive the thoughts and intentions of others. These skills are often best taught by making the abstract as "concrete" as possible, using visuals and pictures to represent abstract concepts.

Treatment Participants

Participants in social skills intervention can vary in age, skill development, and diagnosis. Children with social skill challenges span the range of developmental disabilities from those with specific learning disability and specific language impairment to those with ASD. For young children with ASD, the focus of intervention is establishing joint attention and sharing positive affect/engagement with others during play and people games/routines. During elementary and middle school, social skills intervention may be more focused on teaching specific pragmatic language skills as well as how to engage in group activities. For children that have Asperger syndrome or high-functioning autism, a focus on teaching social cognition skills begins early as these social cognitive differences are a hallmark of these disorders.

Treatment Procedures

Social skills intervention for young children with autism spectrum disorder (ASD) often occurs during parent-child interactions. Teaching parents to engage their young children with ASD has positive outcomes on skill development and can allow for parents to help their children engage with neurotypical peers. Small group settings are often utilized to teach children with autism how to play cooperatively with others. These groups are often facilitated by an educator or speech-language pathologist. For school-age children, social skills intervention occurs in groups of similarly aged peers and can include neurotypical peers as models of prosocial behavior. These groups are often facilitated by an educator, speech-language pathologist, and/or a psychologist and can occur within the school setting or privately. Social skills intervention for the older child or adolescent with ASD entails a focus on social cognition. Often a cognitive behavioral therapy (CBT) approach is utilized to address deficits in theory of mind and perspective taking. Typically, those social skills taught include turn-taking, sharing, initiating, playing with friends, having a conversation, suggesting play ideas, giving compliments, understanding jokes and idiomatic expressions, showing affection, and perspective taking. There are also a range of intervention strategies that support social skill development including peer mediation, social stories and comic strip conversations, video modeling, integrated playgroups, ILAUGH model, etc. Evidence-based programs utilize similar strategies for teaching social skills. Skillstreaming (McGinnis & Goldstein, 1997) utilizes modeling, role-playing, specific feedback, and skill transfer with homework activities to develop competence in interpersonal conflict resolution and to learn self-control of behavior. The Second Step program (Borch, 2002) contains in-school curricula, parent training, and skill development to teach socioemotional skills. Teaching strategies include modeling, coaching, group decision making, and direct skill practice. Cognitive behavioral techniques (CBTs) have been applied to the remediation of social deficits and involve the use of "self-talk" strategies to modify overt behaviors (Mahoney, 1974; Meichenbaum, 1977). Utilizing these techniques in social skills intervention, according to Kendall (1993),

involves cognitive, behavioral, developmental, and emotive strategies that include modeling, role-playing, reinforcement, and self-evaluation. CBTs have been utilized by specific practitioners to develop social skills intervention for individuals with autism spectrum disorder (ASD), including the social thinking curriculum (Winner, 2006).

Efficacy Information

Based on a review of four recent, critical reviews of social skills intervention research (Bellini, Peters, Benner, & Hope, 2007; Matson, Matson, & Rivet, 2007; Rao, Beidel, & Murray, 2008; White, Keonig, & Scahill, 2006), there is currently limited evidence for the effectiveness of group social skills intervention. Current research lacks control groups for comparison and lacks blind observers to evaluate results. All studies lack generalization techniques to demonstrate use of skills across settings. Further, there is limited longitudinal research to determine maintenance of skill acquisition, and, in many cases, there is a lack of consensus on a common definition of what comprises social skills. Of particular note is the study by Bellini et al. (2007) reviewing school-based social skills group intervention. Overall, there is a lack of evidence that children with ASD are receiving effective social skills intervention in the school setting. Recommendations based on these reviews include the need for a manualized social skills curriculum, the use of rigorous research designs to assess the effectiveness of intervention, the consistency in measurement, and the implementation of generalization measures.

Outcome Measurement

There are few assessment instruments that are able to adequately measure social skills across a variety of contexts. Standardized tests are typically not adequate in sensitivity measures to assess these skills. However, standardized measures exist that consist of parent, teacher, and individual rating scales and provide a view of social skills development that considers the impact on communication, academic performance, and behavior. Measures such as the *Social Skills Rating System* (SSRS; Gresham & Elliot, 1990) and the *Vineland Adaptive Behavior Scales*, Second Edition (Vineland II; Sparrow, Cicchetti, & Balla, 2005) are often utilized as standardized measures of social skill development. Other standardized measures specific to measuring skills in autism spectrum disorder (ASD) include the *Autism Social Skills Profile* (ASSP; Bellini, 2006), the *Social Responsiveness Scale* (SRS; Constantino & Gruber, 2005), and the *Social Communication Questionnaire* (SCQ; Rutter, Bailey, & Lord, 2003). These standardized measures should be paired with observations of social interactions in natural settings (home, school, group activities). A focus in the literature at this time is the limited generalization of social skills across environments and contexts. More rigorous research designs and targeted evaluation of social skills are needed to determine the efficacy of social skills intervention.

Qualifications of Treatment Providers

Individuals providing social skills intervention should have training and experience in working with individuals with autism spectrum disorders. These licensed professionals may include psychologists, speech-language pathologists, social workers, and educators. Individuals with some form of psychological training can be well versed in teaching skills to adolescents and can address some of the concomitant behavioral and psychological issues that can be present (depression, anxiety, etc.).

See Also

- ▶ Cognitive Behavioral Therapy (CBT)
- ▶ Social Cognition
- ▶ Social Communication
- ▶ Social Interventions

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Social Skills Improvement System

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Synonyms

Prosocial behaviors; Prosocial skills

Description

The Social Skills Improvement System (SSiS; Gresham & Elliott, 2008) Rating Scales assist professionals in screening and classifying students ages 3–18 years suspected of having significant social skills deficits. The SSiS Classwide Intervention Program and SSiS Intervention Guide are manualized treatment programs for eliminating or reducing social skill deficits identified on the SSiS Rating Scales. The SSiS uses a multirater (parents, teachers, and students with at least third-grade reading ability)

approach that provides a comprehensive examination of seven areas of prosocial skills (communication, cooperation, assertion, responsibility, empathy, engagement, and self-control) and five areas of problem behaviors (internalizing, externalizing, bullying, hyperactivity/inattention, and autism spectrum). The instrument yields norm-referenced scores based on a national sample representative of the 2006 US Census.

Given that autism is characterized by impaired social interactions, problems with verbal and nonverbal communication, and repetitive/stereotyped behaviors, the SSiS Rating Scales and related intervention manuals offer professionals a focused screener for autism spectrum disorders within a comprehensive content of social behavior. The SSiS Autism Spectrum Subscale is comprised of 15 items, 8 from the Social Skills Scale (e.g., interacts well with other children, makes eye contact when talking, uses gestures or body appropriately with others) and 7 items from the Problem Behaviors Scale (e.g., Is preoccupied with object parts, becomes upset when routines change, repeats the same thing over and over). The items on both the Social Skills Scale and Problem Behavior Scale are rated on a 4-point scale (0 = Never, 1 = Seldom, 2 = Often, 3 = Almost Always). Low-frequency ratings on the 8 social skills items, whereas high-frequency ratings on the problem behavior items are indicative of a possible autism spectrum disorder and thus should be followed up with a more comprehensive assessment.

Historical Background

The SSiS Rating Scales originally was published in 1990 as the *Social Skills Rating System* (SSRS; Gresham & Elliott, 1990). The SSRS was reportedly used by many professionals as part of their autism screening efforts; however, the SSRS was not designed with autism or autism spectrum disorders in mind. When the revision of the SSiS was being conceptualized, the authors consult with educators serving autistic children and the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., 1994) of the American Psychiatric Association and the National Research Council's report (2001) on *Educating Children with Autism* to ensure they were sensitive to critical identifying behaviors and conditions.

Psychometric Data

The SSiS-RS manual provides extensive validity evidence based on test content, internal structure, intercorrelations among scales and subscales, item-total correlations, and relations with other variables (Gresham & Elliott, 2008). Item development of the SSiS-RS was based on a broad review of the empirical literature on social skills deficits in special populations, reviews of published empirical studies using an earlier version of the scale (Social Skills Rating System, Gresham & Elliott, 1990), and research on the relationship between specific social behaviors and important social outcomes for children and youth. Intercorrelations among scales and subscales for each form are moderate to high for the social skills and problem behavior scales. Item-total correlations across forms by age tend to be moderate to high, many of which exceed .70–.80.

Correlations between the SSiS-RS and the Behavioral Assessment System for Children, Second Edition (BASC-2; Reynolds & Kamphaus, 2004) are moderate to high, depending on the scales and subscales. For example, the median correlations between the SSIS-RS total social skills score and the teacher form of the BASC-2 social skills score are .78 and .69 for the teacher and parent forms, respectively. Correlations between the SSIS-RS total social skills scores and the socialization scores of the Vineland Adaptive Behavior Scales, Second Edition (Vineland II; Sparrow, Cicchetti, & Balla, 2005) are .65 and .44 for the teacher and parent forms, respectively.

Using a sample of 50 students with an autism spectrum disorder as diagnosed by the DSM-IV-TR, a known group comparison analysis with a nonclinical sample was conducted. On the teacher and parent forms of the SSiS, all the mean score differences were statistically significant. The Social Skills Scale means of 74.6 and

75.8 were at least 1.5 standard deviations lower than the nonclinical reference sample of students. Conversely, the scale means for the problem behaviors on both forms were more than 1 standard deviation higher than for the nonclinical reference group. The greatest differences were on the Autism Spectrum Subscale, where the scores of 23.9 and 22.6 were nearly 2 standard deviations higher than the nonclinical reference group mean. These results are consistent with expectations that individuals with autism spectrum disorder have major deficiencies in social skills and tend to exhibit more problem behaviors, thus lending substantial support for the validity of the scores of this subscale as a measure of behaviors typically exhibited by individuals diagnosed with autism.

Clinical Uses

The SSiS Rating Scales – teacher, parent, and student forms – are intended to be used as a comprehensive measure of children's social skills and a useful screener of children's problem behaviors. In particular, these rating scales are designed to identify social skills acquisition and performance deficits in areas of communication, cooperation, assertion, responsibility, empathy, engagement, and self-control.

The Autism Spectrum Subscale is designed to facilitate a time-efficient and contextualized screening measure. By using the nationally representative norming sample for comparison, it is possible to get a clear comparison between a student suspected of an autism spectrum disorder to a same age and sex comparison group of nonclinical students.

See Also

- ▶ Social Behaviors and Social Impairment
- ▶ Social Communication Questionnaire
- ▶ Social Language Development Test
- ▶ Social Skill Interventions
- ▶ Stereotypic Behavior
- ▶ Structured Descriptive Assessment

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Social Stigma

▶ Stigmatization

Social Stories

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Definition

A social story is a brief story that describes a social situation including cues and appropriate responses.

Historical Background

Social Stories™ were first developed, introduced, and trademarked in 1991 by Carol Gray. They are generally regarded as a positive

intervention strategy with some components of priming. Social Stories™ were developed so that students with autism spectrum disorders (ASD) could learn social skills. They are written and tailored to the individual with ASD to help him or her understand and respond appropriately in various social situations.

Originally, social stories were written using three types of sentences: descriptive, directive, and perspective taking. Descriptive sentences provided an overview of a social situation in terms of relevant social cues. Directive sentences specified an appropriate response, and perspective sentences described the feelings and responses of both the individual with ASD and others represented in the target social situation. Ms. Gray specified a specific ratio of sentences to be contained within each Social Story™. Also, initially, Social Stories™ were presented as text, and the individual with ASD was encouraged to read them by himself or herself.

Over the years, in recognition that not all students with ASD were able to read and comprehend Social Stories™, the process for writing these stories has changed dramatically. Ms. Gray originally discouraged the inclusion of illustrations as she felt that a student may be distracted by them or misinterpret the situation based on an illustration. Today, it is commonplace to supplement social story text with pictures in the forms of photographs or Mayer Johnson™ Picture Communication Symbols or to use PowerPoint and computer-assisted presentation of Social Stories™. Social Stories™ also have been presented in the form of Comic Strip Conversations™, news articles, and research articles. Ms. Gray emphasizes presenting Social Stories™ in a format that is motivating to the individual with ASD. Other changes to the development and presentation of social stories are the revision of the types of sentences used within a social story; social stories now include the following: descriptive, directive, perspective, affirmative, control, cooperative, and partial sentences. As described by Ms. Gray, affirmative sentences may express a commonly shared value or feeling, and they serve to enhance the meaning of statements. Control sentences are written by the individual after he or she reviews the social story and are used to identify personal strategies that will help him or her recall and implement skills that are outlined in the social story. Cooperative sentences are sentences that point out ways that others will assist the individual. Finally, partial sentences promote prediction and encourage the person with ASD to guess the next step in the situation. It should be noted that, at this time, control and cooperative sentences are optional when writing Social Stories™. There is a recommended ratio of zero to one directive or control sentences and between two and five descriptive and/or perspective sentences in a Social Story™. Despite these expansions of the form of a social story, the intent remained to use it as an antecedent condition to teach students with ASD to recognize and respond to a wide array of social contexts.

Rationale or Underlying Theory

Some have described the rationale for using Social Stories™ as one that teaches persons with autism spectrum disorder to develop theory of mind (perspective-taking skills). Carol Gray does not present a theory but rather describes the goal of Social Stories™ is to

> Share accurate social information in a patient and reassuring manner that is easily understood by its audience. Half of all Social Stories™ developed should affirm something that an individual does well. Although the goal of a Story™ should never be to change the individual's behavior, that individual's improved understanding of events and expectations may lead to more effective responses.

An alternative explanation for the use of social stories is that it involves a shared schemata or background knowledge and allows one to "build a scaffold of understanding for a schema (mental representation) that an individual does not yet possess" (Reynhout & Carter, 2006). Myles and Simpson (2001) suggested that Social Stories™ provide access to the "hidden curriculum" (the dos and don'ts understood and adhered to by everyone except those with ASD) inherent in social situations (Reynhout & Carter, 2006).

Goals and Objectives

As previously mentioned, the goal of a social story is to share important information about a social context. Information is shared in a way that is age appropriate to the student with ASD and ideally allows him or her to read about and be more "comfortable" in social situations. Social Stories™ have been used to teach a variety of skills including following routines, academic skills such as math, social situations such as playing at recess, having a conversation, and respecting personal space. As noted by Gray and Garand (1993), "Generic Social Stories™ can be used to describe social situations frequently experienced by children with autism which can be individualized and adapted as the need arises."

Treatment Participants

Traditionally, persons with ASD have participated in the use of Social Stories™. Initially, Social Stories™ were recommended for use with students who have ASD and who have the ability to read and who are considered individuals with "high-functioning" autism.

Treatment Procedures

Social Stories™ are written according to the guidelines published by Carol Gray. Several considerations are necessary when writing Social Stories™. These considerations include the need to maintain the perspective of the student for whom the story is written, keep the story within the student's comprehension level, and include appropriate vocabulary and size of font for their reading ability. Behavioral responses should be stated in positive terms; that is, label what you want the student to do, rather than what they should not do, and Gray and Garand (1993) recommend that students demonstrate intellectual ability in the range of 35–55 on a standardized IQ test (Reynhout & Carter, 2006). Additionally, it is important to determine whether text will be supplemented with pictures and if pictures will be photographs, Picture Communication Symbols™ (Mayer Johnson), or embedded in a PowerPoint presentation.

Once social stories are developed, they are to be read to the child who is unable to read them independently. Reading of the Social Story™ should happen in advance of entering into the social situation, and there should be a time to check for comprehension. In summary, social stories are written according to the guidelines set forth by Carol Gray, and then read to or with the individual with ASD, after which, a comprehension check is made. Comprehension can be checked either orally or in writing by having the student answer a series of questions about the social story. There currently are no hard-and-fast guidelines about the frequency of using Social Stories™; however, it is noted that they can be faded over time.

Efficacy Information

To date, there is limited data on the efficacy of social stories. Studies that have been conducted have yielded mixed results. For example, Social Stories™ have rarely been evaluated exclusively; usually, they incorporate some other form of treatment such as role play, modeling, rehearsal, written checklists, and token rewards. The implementation of Social Stories™ also has varied from study to study. For example, those that have used social stories have varied the frequency of presentation as well as the setting for presentation (home, in class, outside of a classroom). They also have used Social Stories™ to follow up with a situation if there is a misperception by the student. In this situation, social stories are used as an antecedent and consequence, and, during the consequence portion, the reader highlights the information that was misinterpreted.

Variations in presentation, use, and style of Social Stories™ make it difficult to interpret the data. Of studies that have been conducted using single-subject research methodology, results have been mixed. Some researchers have

noted initial gains using Social Stories™, yet the gains are short lived, and there is lack of maintenance and generalization. Efficacy of Social Stories™ may also have been compromised. There is literature to suggest that there has been inconsistency in conforming to the guidelines for writing social stories. At best, current research data for Social Stories™ does not support them as an evidence-based practice; however, they continue to be used due to clinical popularity and the belief that they represent best practice strategies for students with ASD (Smith, 2001 in Reynhout & Carter, 2006).

Outcome Measurement

Currently, outcome measurement for Social Stories™ is unavailable. There are a few studies that have been conducted, and many of these studies have some methodological flaw(s). There are no current data regarding the efficacy or mastery of skills when using social stories.

Qualifications of Treatment Providers

There are no hard-and-fast qualifications for treatment providers; rather, one simply needs to be able to follow the guidelines set forth by Carol Gray. Treatment providers can be teachers, speech-language pathologists, parents, counselors, and other significant adults who work with or are familiar with the person with ASD.

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Social Thinking

► Pragmatics

Social-Emotional Learning Disability

► Nonverbal Learning Disabilities (NLD)

Social-Emotional Processing Disorder

► Right-Hemisphere Syndrome

Soiling

▶ Encopresis

Somatosensory Cortex

▶ Primary Sensory Areas

Sominex® [OTC]

▶ Diphenhydramine

Sominex® Maximum Strength [OTC]

▶ Diphenhydramine

Son-Rise Program

Robert LaRue
Douglass Developmental Disabilities Center, Rutgers, The State University of New Jersey, New Brunswick, NJ, USA

Synonyms

Options method

Definition

The Son-Rise Program was first described by Kaufman in the 1970s as a treatment for children with autism whereby the parent or therapist increases child motivation for social interaction by "joining in" or imitating child-led behavior. Kaufman based his therapy on the approach he developed to treat his young son with autism – an approach that Kaufman described as successful. The intensive one-to-one therapy is conducted in a distraction-free playroom, and the parent or therapist follows the child's lead by imitating the child's repetitive behavior and routines, or "isms." This showing of acceptance of the child's behavior is thought to increase the child's motivation to interact with others so that the therapist can build on the shared activity by encouraging social interaction and communication. The Son-Rise Program is implemented by parents and volunteer therapists in the home environment; parents coordinate and supervise the program following training through the Options Institute. No formal research has been conducted to assess the effectiveness of the Son-Rise Program. In addition to treating individuals with autism, the Son-Rise Program has been used to treat children and adults with other developmental disabilities such as Down syndrome.

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SPA

▶ Sensory Processing Assessment

SPANK-2

▶ SHANK 3

Sparrow, Sara

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[1]Yale Child Study Center, Psychology, and Epidemiology and Public Health, Yale University, New Haven, CT, USA
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Name and Degrees

Sparrow, Sara S. M.A. Ph.D. (May 9, 1933–June 10, 2010)

Major Appointments (Institution, Location, Dates)

2003 Professor Emerita, Yale University, Child Study Center and Department of Psychology; Senior Research Scientist, Yale Child Study Center
1989–2003 Professor of Psychology, Chief Psychologist, The Child Study Center, School of Medicine; Professor, Department of Psychology, Yale University
1986–1989 Professor of Psychology, Chief Psychologist, The Child Study Center, School of Medicine; Lecturer, Department of Psychology, Yale University
1977–1986 Associate Professor of Psychology, Chief Psychologist, The Child Study Center, School of Medicine; Lecturer, Department of Psychology, Yale University
1977–2002 Director, Psychology Internship Program, The Child Study Center, Yale University
1974–1977 Assistant Professor, The Child Study Center and the Department of Psychology; Chief Psychologist, The Child Study Center, Yale University
1974–1975 Visiting Professor, Child Development Department, Connecticut College, New London, Connecticut
1972–1974 Research Associate and Lecturer, Department of Psychology and The Child Study Center, Yale University
1972–1973 Acting Chief Psychologist, The Yale Child Study Center, Yale University
1970–1972 Research Associate, Department of Psychology, Yale University
1969–1970 Research Staff, Department of Psychology, Yale University
1968–1969 Postdoctoral Fellow, Department of Psychology, Yale University
1965 Director, Summer Speech Clinic, Speech Department, University of Florida
1962–1964 Coordinator, Speech and Hearing Program, Orange County Schools, Orlando, Florida
1958–1961 Speech Therapist, Orange County Schools, Orlando, Florida

Major Honors and Awards

2010 Lifetime Child Study Center Service Award
2009 Edgar Doll Award for "her outstanding research and sustained contributions to the understanding of intellectual and developmental disabilities," APA Toronto
2009 Distinguished Career Award, International Neuropsychology Society, Atlanta, GA
2008 Outstanding Alumnus of the Year, University of Florida, College of Public Health and Health Professions, Gainesville, FL
2006 Distinguished Alumnus Award, University of Florida, College of Public Health and Health Professions, Gainesville, FL
2004–2005 President, Division 33, Mental Retardation and Developmental Disabilities, American Psychological Association
2003–2004 President-Elect, Division 33, Mental Retardation and Developmental Disabilities, American Psychological Association
2002–2003 President-Elect Designate, Division 33, Mental Retardation and Developmental Disabilities, American Psychological Association
2002 Career Scientist Award, The American Academy on Mental Retardation
2000–2002 National Research Council, Committee on Disability Determination for Mental Retardation, Washington, DC
1998 Invited Participant, NICHD Workshop on Measurements of Clinical Outcome,

Surrogate Endpoints, and Diagnostic Markers in Pediatric Drug Trials. September 24–25, 1998 Rockville, MD
1998 Professional Achievement Award, 2nd Annual Learning Disorders Symposium, H.E.L.P. Group. September 18–19, 1998. Sherman Oaks, CA
1994–1997 Elected to the Board of Governors, International Neuropsychological Society
1993–1999 Coeditor, Journal of Child Neuropsychology
1993 Cochairperson, Human Resources Development Task Force, Center for Health and Human Services
1992 National Advisory Board: "Development and Implementation of a Plan to Assess the Neurodevelopment of Infants and Children Exposed to Drugs in Utero." NIMH
1990 Facilitator: National Conference on Implementing Public Academic Linkages for Clinical Training in Psychology. NIMH and APA, Dec. 10–12, 1990
1990 Project Review Committee, National Institute of Mental Health Training Grants
1989 "National Conference on Clinical Training for Multidisciplinary Services for Seriously Emotionally Disturbed Children and Adolescents." Georgetown University Leavey Conference Center, Washington, DC
1989 Member Consensus Development Panel, National Institutes of Health, Treatment of Destructive Behaviors in Persons with Developmental Disabilities
1988 Fellow, American Psychological Association (Div. 33)
1987 Review Panel Member, Research Project "The Higher Cerebral Function Disorders in Children," NICHD, Washington, DC, 1987, 1988, Chairman 1989–1994
1985–1986 Chairman, Quality Review Committee, Connecticut State Planning Council on Developmental Disabilities
1984 Fellow, American Psychological Association (Div. 12)
1984 First Recipient, Connecticut Psychological Association "Award for Distinguished Effort by a Connecticut Psychologist, Utilizing Psychological Knowledge and Skills, Which Has Made Contribution to the Welfare of the Public," for development and publication of revised Vineland Adaptive Behavior Scales (1984,1985), at Fairfield University, December 7, 1984
1984 Project Review Committee, National Institute of Mental Health Training Grants
1982 Elected to American Academy of Mental Retardation
1980–1986 Member, Connecticut State Planning Council on Developmental Disabilities (appointed by Governor).
1971–1972 Committee on Book Reading, International Reading Association
1970 Who's Who in American Women
1968 American Men of Science

Landmark Clinical, Scientific, and Professional Contributions

Vineland Adaptive Behavior Scales, Second Edition (Vineland-II)

Short Biography

Dr. Sara S. Sparrow was a North American psychologist, whose work focused on children and their developmental trajectories, ranging from intellectual giftedness to severe mental retardation. Dr. Sparrow made contributions to the fields of child neuropsychology and developmental disabilities across a wide range of diagnostic groups of children and also across cultures. She was particularly engaged with children with autism spectrum disorders, intellectual disabilities, and learning disabilities. Dr. Sparrow trained many mental health professionals at the doctoral and postdoctoral levels; she was the founder of the child psychology internship program at the Yale Child Study Center. She was also an influential and highly valued teacher and clinical supervisor within various Yale University programs. Several generations of her former trainees work all over the world, leading clinical science programs for children with special needs.

Dr. Sparrow's landmark contribution was the Vineland Adaptive Behavior Scales, Second

Edition (Vineland-II), which is one of the most broadly used psychological assessment instruments used throughout the world. She was the senior author and a devoted promoter of this instrument. The Vineland is used extensively in clinical, educational, and research settings as a means of evaluating individuals' personal and social skills in everyday living. It was the first life-span, norm-referenced instrument measuring adaptive behavior in multiple domains. The Vineland is a particularly critical diagnostic tool in the assessment of individuals with intellectual and developmental disabilities, including autism spectrum disorders.

A native of Minneapolis, Minnesota, Dr. Sparrow graduated summa cum laude from Montclair State College in New Jersey in 1958 and received her professional degrees from the University of Florida, M.A., in speech pathology in 1962 and Ph.D. in clinical psychology/clinical neuropsychology in 1968. She went to Yale in 1968 as a postdoctoral fellow in the Department of Psychology. She joined the department's research staff the following year, then served as acting chief psychologist at the Child Study Center in 1972–1973. She was appointed to the rank of assistant professor in 1974, associate professor in 1977, and full professor in 1986.

Dr. Sparrow's contributions to psychology included more than 120 articles and book chapters in the fields of child neuropsychology, learning disabilities, test development, and adaptive behavior in a broad range of child psychiatric conditions. Additionally, Dr. Sparrow maintained active clinical practice within the Yale Child Study Center, where she was Chief Psychologist from 1997 to 2002, and then continued working with patients and conducting research as Professor Emerita of Psychology and Advisor to the Yale Academic Skills Clinic until her untimely death. Beyond Yale, Dr. Sparrow assumed leadership roles in psychology at the national level. She served as President of Division 33 of the American Psychological Association (Intellectual and Developmental Disabilities), was a member of the National Research Council (National Academy of Sciences) Committee on Disability Determination for Mental Retardation, and was cofounder of the Journal of Child Neuropsychology.

Dr. Sparrow's scientific contributions have been recognized through numerous awards including Alumnus of the Year by the College of Public Health and Health Professions at the University of Florida; she and her husband, Dr. Domenic Cicchetti, shared the first Scientific Achievement Award given by the Connecticut Psychological Association; she was a recipient of the Edgar Doll Award from Division 33 of the APA which is the division's highest recognition of outstanding scientific contributions to the field of intellectual and developmental disabilities; and in 2002 Dr. Sparrow received the Career Scientist Award from the American Association of Mental Retardation for her lifetime contributions to the field.

See Also

▶ Vineland Adaptive Behavior Scales

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Spastic Diplegia

▶ Cerebral Palsy

Spastic Paralysis

▶ Cerebral Palsy

Special Education

Pamela Brucker
Special Education and Reading, Southern Connecticut State University, New Haven, CT, USA

Definition

Special education is a broad term that refers to a variety of direct instructional and related services that are available for students ages birth–21 who meet specified criteria for eligibility under the Individuals With Disabilities Education Act (IDEA). These services are designed to give the eligible student a "free and appropriate public education."

See Also

▶ Individuals with Disabilities Education Act (IDEA)

References and Readings

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Special Education Classroom

▶ Self-contained Classroom

Special Education Needs

▶ Special Needs

Special Needs

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Synonyms

Accommodations; Modifications; Special education needs

Definition

Special needs is a term often used to describe the needs of individuals with disabilities or who are at risk of developing disabilities and their unique needs as a result of deficits related to a disability or disorder, who require or may require in the future special services or treatment. Needs typically refer to special care, services, or accommodations necessary to support the individual or those supporting the individual with a disability or disorder. Special needs most often refer to intervention, curricula, behavior management, and transition planning; however, individual accommodations and modifications related to deficit of the disability are addressed under this term.

See Also

▶ Accommodations
▶ Modifications
▶ Transition Planning

References and Readings

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Special Olympics

Timothy Shriver
Special Olympics, Inc, Washington, DC, USA

Major Areas or Mission Statement

With sports at the core, Special Olympics stands as a leader in advancing rights, opportunities, and social change for people with intellectual disabilities around the world. In 2011, Special Olympics served nearly 4 million athletes worldwide. While the majority of the athletes (64.8%) are school-aged (8–21 years old), 33.4% are adults (22+), and 1.8% are young children (2–7), with more males (62%) than females (38%) participating. Special Olympics has been growing rapidly; since 2000, the Special Olympics athlete count has grown from just under 1 million to the current total of just under million.

Most staff in Special Olympics programs globally are volunteers with a wide variety of expertise, including credentialed sports coaches, health professionals, program administrators, and researchers. In 2011, more than 306,000 coaches supported Special Olympics athletes. In addition, 546,000 partners, or participants without disabilities, are now engaged in Unified Sports, a Special Olympics initiative that includes individuals with and without intellectual disabilities together. Nearly 29,000 of our athletes serve in leadership positions offered through another initiative, the Athlete Leadership Programs (ALPs).

Because of its inclusive nature, Special Olympics does not collect disability-specific information on its athletes, and, as such, there is no nationwide data on the number of participants in Special Olympics who have autism spectrum disorder (ASD). However, studies suggest that between 6% (Weiss, Diamond, Demark, & Lovald, 2003) and 19% (Glidden, Bamberger, Draheim, & Kersh, 2011) of Special Olympics athletes have ASD.

Mission Statement

"The mission of Special Olympics is to provide year-round sports training and athletic competition in a variety of Olympic-type sports for children and adults with intellectual disabilities, giving them continuing opportunities to develop physical fitness, demonstrate courage, experience joy and participate in a sharing of gifts, skills and friendship with their families, other Special Olympics athletes and the community."

Landmark Contributions

Brief History

In 1962, Eunice Kennedy Shriver started a summer day camp for children and adults with intellectual disabilities in her backyard in Maryland. She hoped to not only provide this underserved population with access to recreational opportunities but also to explore their capabilities in a variety of sports and physical activities. Just 6 years later, this small summer camp grew into the First International Special Olympics Summer Games, held at Soldier Field in Chicago, Illinois, USA. Over 1,000 individuals with intellectual disabilities came from 26 U.S. states and Canada to compete in track and field and swimming.

As the movement grew, so too did its national and international recognition as a serious sports movement. In 1971, the U.S. Olympic Committee gave Special Olympics official approval to

use the name "Olympics" in the United States, making Special Olympics one of only two organizations authorized to do so. Fifteen years later, the United Nations proclaimed the International Year of Special Olympics (1986) under the banner "Special Olympics – Uniting the World," and just 2 years later, the International Olympic Committee (IOC) officially endorsed and recognized Special Olympics (1988). The backyard camp had grown into an internationally recognized organization.

The subsequent decades were dedicated to expanding existing Special Olympics activities, as well as implementing new initiatives, such as Unified Sports, which creates an inclusive sports experience for participants with and without disabilities; Healthy Athletes, which provides free health screenings for athletes; and the Global Messenger Program, which offers public speaking and presentation skills training to athletes who are interested in representing the movement internationally. The organization also expanded to include cutting-edge research and evaluation, including the "Multinational Study of Attitudes toward Individuals with Intellectual Disabilities" (Siperstein, Norins, Corbin, & Shriver, 2003), the most comprehensive study ever conducted on the subject. When Special Olympics celebrated its 40th anniversary in 2008, it had grown to serve three million athletes in 173 countries around the world. Today, the organization stands as an international leader in research and advocacy for persons with intellectual disabilities. In fact, in 2010, the first Special Olympics Global Congress was held in Marrakech, Morocco, bringing together hundreds of movement leaders from countries around the world to chart the next 5 years of work.

Special Olympics is currently led by:

Timothy P. Shriver, Ph.D., Chairman and Chief Executive Officer

J. Brady Lum, President and Chief Operating Officer

Major contributions:

1. Special Olympics has shown that people with disabilities can participate in and benefit from sports and recreation. The movement has demonstrated that the same motivation, desire, and ability to play and compete are present in people, irrespective of the presence of a disability.
2. Special Olympics has documented the developmental significance of sports and recreation across the lifespan for people with disabilities, from motor skill development in young children ages 2–7 to community engagement for adults.
3. Special Olympics has led a movement of community inclusion by engaging millions of volunteers in meaningful experiences with people with intellectual disabilities, while also creating inclusive sports activities.
4. Special Olympics has acted as a public education and attitude change vehicle, presenting people with intellectual and developmental disabilities in valued and respected social and community roles all around the world.
5. Special Olympics has globalized the notion of sports and recreation for people with ID, particularly in developing countries.
6. Special Olympics has demonstrated its ability to change attitudes – challenging and eliminating the stigma associated with intellectual or developmental disabilities – and instead highlighting the value of and skills possessed by people with ID, inspiring people to become advocates for inclusive education, employment, health care, and public policy.
7. Special Olympics has pushed the boundaries of scholarly inquiry into the methods and models of personal and social change for people with intellectual disabilities.
8. Special Olympics has launched a worldwide movement to combat health disparities and discrimination in health-care systems and the largest public health system has established Healthy Athletes, for people with ID in the world.

Major Activities

Overview of Special Olympics programs:

Sports Training and Competition: Special Olympics offers a variety of sports training and competitions for people with intellectual

disabilities. In 2011, over 53,000 competitions were organized around the world, resulting in an average of 146 competitions every day.

Unified Sports: Unified Sports brings together equal numbers of Special Olympics athletes (with intellectual disabilities) and unified partners (peers without disabilities) on sports teams for organized, structured training and competition against other unified teams.

Healthy Athletes: Health Athletes offers free health screenings and health information to athletes and families at local, regional, and world games.

Young Athletes: Young Athletes is a curriculum designed to promote motor and social development for children ages 2 ½ to 7 through motor play activities and games.

Motor Activity Training Program: The Motor Activity Training Program is designed to provide individualized training programs for athletes with severe or profound intellectual disability who are unable to participate in official Special Olympics sports competitions because of their skill and/or functional capabilities.

Get Into It: The Get Into It educational resources explore the subjects of inclusion, acceptance, and social justice through the lens of core curriculum requirements and a service-learning framework.

Project UNIFY: Project UNIFY is a school-based initiative that uses sports and education programs to activate young people to develop school communities where all youth are agents of change – fostering respect, dignity, and advocacy for people with intellectual disabilities.

Athlete Leadership Programs (ALPs): The Athlete Leadership Program allows athletes to explore opportunities for greater participation in Special Olympics beyond sports training and competition as coaches, officials, team captains, spokespeople, and Board and committee members.

Research and Policy: Special Olympics conducts cutting-edge research and evaluation to better understand the many challenges faced by people with intellectual disabilities and the impact of Special Olympics on their lives. This research is also a driving force for realizing improved policies, laws, and rights for people with intellectual disabilities around the world.

Special Olympics Family Support Network: Family members of a person with intellectual disability often feel confused and alone. Special Olympics Family Support Network provides them acceptance, resources, hope, and a chance to become advocates – making them a valued voice in our movement.

Special Olympics Camp Shriver: A camp experience for people with intellectual disabilities to learn new sports skills, participate in individual and team sports, and build friendships. The camp creates an atmosphere of understanding, learning, and sharing so that new friendships between athletes and participants without intellectual disabilities (partners) are created and continue to thrive once camp is over.

The Value of Special Olympics

There is growing empirical evidence demonstrating the value of Special Olympics for its participants, both with and without disabilities. Studies have shown that Special Olympics athletes gain not only improved sports skills but also improved physical fitness (Balic, Mateos, Blasco, & Fernhall, 2000), increased self-esteem (Castagno, 2001), increased self-perceptions of physical competence and social acceptance (Weiss et al., 2003), and improved social competence (Dykens & Cohen, 1996). Indeed, athletes and families typically choose to participate in Special Olympics not only because of its sports opportunities but also because it is fun and offers prospects for social interaction (Harada & Siperstein, 2008; Harada, Siperstein, Parker, & Lenox, 2011). There is also evidence that participation in Special Olympics decreases problem behaviors (Rosegard, Pegg, & Compton, 2001) and increases adaptive behaviors (Favazza & Siperstein, in press; Favazza, Siperstein, Zeisel, Odom, & Moskowitz, under review). Further, typically developing individuals who participate in Unified Sports alongside teammates with intellectual disabilities have also demonstrated higher self-esteem, as well as greater willingness to interact with and more positive perceptions of

individuals with disabilities (Castagno, 2001). In addition, parents of Special Olympics athletes frequently find that participation in Special Olympics raises their expectations of their son or daughter's abilities (Glidden et al., 2011; Kersh & Siperstein, under review).

Although the benefits of participation in sports and recreation – and particularly in Special Olympics – have been well established for individuals with intellectual disabilities, only recently has the field begun to recognize the potential impact of sports and recreation on the social and motor development of individuals with autism spectrum disorder (ASD). Children with ASD frequently demonstrate motor impairments (Getchell & Lynch, 2007), may be less physically active than their typically developing counterparts (Pan, 2008), and are less involved in social and recreational activities with peers than those without disabilities (Solish, Perry, & Minnes, 2010). However, in their recent review of research on exercise and persons with ASD, Lang and colleagues (2010) found that persons with ASD participating in regular exercise experienced reductions in stereotypic, aggressive, and off-task behaviors. In addition, studies have suggested that participation in physical activity and recreational programs may have positive social benefits for individuals with autism, such as improved social behavior (Pan, 2010) and increased social interaction (Garcia-Villamisar & Dattilo, 2010), in addition to personal benefits, such as decreased stress and improved quality of life (Garcia-Villamisar & Dattilo). Of course, given the variability in specific deficits associated with ASD, some individuals may struggle with certain elements of team sports, including verbal and nonverbal communication with peers, loud noises, or personal contact (Crollick, Mancil, & Stopka, 2006). Therefore, to maximize the benefits of sports and recreations, some adaptations – such as visual supports to present clear and predictable expectations (Fittipaldi-Wert & Mowling, 2009), smooth transitions between activities (Crollick et al., 2006), and reinforcement of appropriate social and physical behaviors (Reid, O'Connor & Lloyd, 2003) – are often necessary.

The inclusive nature of Special Olympics requires that athletes not be singled out on the basis of their specific disabilities, and as a result, Special Olympics does not have distribution numbers by specific intellectual/developmental disability subcategories. However, there is burgeoning preliminary evidence that individuals with ASD have participated in and enjoyed Unified Sports, inclusive summer camps (Special Olympics Camp Shriver), and traditional Special Olympics competitions. Additionally, families have spoken of a number of benefits of Special Olympics for their child with ASD, particularly in improved social skills and increased opportunities for social interaction (Kersh & Siperstein, under review). Moving forward, Special Olympics will focus on how to best adapt its array of activities in order to accommodate its growing number of participants with ASD.

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Specific Language Impairment

▶ Childhood Aphasia
▶ Expressive Dysphasia
▶ Expressive Language Disorder

Specific Learning Disability

▶ Developmental Disabilities
▶ Learning Disability

Specific Reading Disability

▶ Dyslexia

Spectrum/Continuum of Autism

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Definition

Autism is one of a spectrum of disorders that includes Asperger syndrome, pervasive

developmental disorder-not otherwise specified (PDD-NOS), childhood disintegrative disorder (CDD), and Rett's disorder. These disorders are currently classified under the umbrella term of "pervasive developmental disorder (PDD)" in both the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV; American Psychiatric Association [APA], 1994) and the International Classification of Diseases (ICD-10; World Health Organization [WHO], 1992), but the term "autism spectrum disorder (ASD)" (also sometimes called autism spectrum condition (ASC)) is now more commonly used. Given the current state of knowledge, ASD appears to be a more useful description than PDD. It identifies autism as the reference point and suggests that at least some of the other disorders classified as PDD (i.e., atypical autism, PDD-NOS, Asperger syndrome) are differentiated from autism primarily by the age of onset, severity of symptoms, and presence of language delay and/or intellectual disability, whereas they are differentiated from non-spectrum disorders on the basis of several qualitative (and presumably biological) variables. Although CDD and Rett's disorder are also currently included in the PDD/ASD category, both of these disorders are exceedingly rare and differ significantly from other ASDs in the pattern of onset. In addition, given that there is now an identified genetic cause for the majority of cases of Rett's syndrome (Amir et al., 1999), it is unlikely that this disorder will be included in the ASD category in DSM-V. Thus, the following discussion focuses on autism, PDD-NOS, and Asperger syndrome, referred to collectively as ASD.

Historical Background

Individuals with ASD present with diverse sets of symptoms and behaviors that vary as a function of many different factors, including age, language, IQ, and severity of social/communication symptoms and restricted and repetitive behaviors. The concept of a spectrum is therefore useful because it suggests that two individuals "on the spectrum" may look very different from one another even though they are classified under the same diagnostic umbrella. A child who avoids eye contact, flaps his hands, says only one or two words, and shows little interest in social interactions might share a diagnosis of ASD with a child who uses complex sentences and is socially motivated under certain circumstances but lacks the social awareness or skills to know how to behave in social situations or maintain successful peer relationships. Aided in part by advances in standardized diagnostic instruments and by opportunities to study larger and more diverse samples of individuals with ASD, there is increasing awareness that the spectrum of autism encompasses a wide range of difficulties and strengths and that no two individuals with ASD can be expected to look exactly the same.

Within the broader spectrum of autism, current diagnostic classification systems provide guidelines for assigning specific diagnoses (i.e., for determining whether a diagnosis of autism or Asperger syndrome or PDD-NOS is most appropriate). Unfortunately, these diagnoses tend to be highly unreliable across different sites and clinicians (Mahoney et al., 1998; Lord et al., 2012). Particularly with respect to Asperger syndrome, diagnostic conceptualizations vary widely within the field, making it difficult for professionals to agree on or be consistent in their use of terminology (Ozonoff, South, & Miller, 2000). For example, whereas some research groups adhere to the strict DSM-IV definition when diagnosing Asperger syndrome, which requires that autism be ruled out first, other groups diagnose Asperger syndrome even if the criteria for autism is also met (Szatmari, Bryson, Boyle, Streiner, & Duku, 2003). Similarly, although PDD-NOS is technically intended as a category to describe atypical autism (ICD-10) or "not quite autism," it often ends up meaning "mild autism" or is used to classify young children to whom professionals do not yet feel comfortable giving an autism diagnosis (Walker et al., 2004). Disagreement about diagnostic criteria for differentiating within ASDs may help explain why, unlike earlier comparative studies, more recent investigations have not found clear differences between individuals

identified as "high functioning autism (HFA)" and those diagnosed with Asperger syndrome. In one study, Bennett et al. (2008) found that adolescent outcomes in autism symptoms and adaptive behavior were better predicted by structural language impairment (defined by the presence of deficits in grammar or syntax) in childhood than by a clinical diagnosis of HFA vs. Asperger syndrome. Repetitive behaviors have also not been found to differ significantly between these diagnostic groups (Cuccaro et al., 2007).

Current Knowledge

From a clinical standpoint, the specific ASD diagnosis a child receives is arguably much less important than the fact that he/she falls somewhere on the autism spectrum. However, inconsistent use of labels often leaves parents confused about what to make of their child's diagnosis. For example, Asperger syndrome has come to be portrayed in the media as a diagnosis characterized by special skills, high intelligence, and "quirky" personality traits, whereas autism is more commonly described as being associated with low IQ, limited language abilities, aloofness, and a poor prognosis. For parents of a child with ASD, their conceptualization of the disorder, including decisions about what interventions or resources to seek out and expectations about the future, is likely to differ depending on whether the child receives a diagnosis of autism or another spectrum diagnosis that is perceived as being less severe. Moreover, if a child is initially given a diagnosis of PDD-NOS by one professional but then given a diagnosis of autism by another professional, the parent may erroneously assume that something about the child changed when in fact each professional simply had his/her own idiosyncratic way of deciding on one diagnosis over the other.

Disagreement about how diagnoses are assigned within the spectrum also has a number of important implications for ASD research. For example, if all "mild" cases of autism are referred to as Asperger syndrome or PDD-NOS, then a diagnosis of autism will be more likely to be related to intellectual disability. If Asperger syndrome is defined as any case of mild autism without intellectual disability, samples of children with PDD-NOS will be lower in IQ than if Asperger syndrome has a narrower definition (Klin, Pauls, Schultz, & Volkmar, 2005).

From a neurobiological research perspective, clinical diagnostic designations are most useful if they are associated with different etiologies. But accumulating evidence suggests that these disorders are indeed on the same continuum and are therefore unlikely to be useful as a primary variable by which to stratify samples for etiological investigations. Analyses of datasets that include children with autism, PDD-NOS, and Asperger syndrome, as well as typically developing children and those with non-spectrum disorders, indicate that symptoms in the areas of communication, reciprocal social interaction, and restricted and repetitive behaviors constitute an "autism factor" that differentiates children with ASD *as a group* from children not on the spectrum (Constantino et al., 2004). Therefore, although the severity of symptoms in these domains differs among individual children with ASD, particular impairments in communication and reciprocal social interaction and the presence of restricted and repetitive behaviors set apart individuals across the whole autism spectrum from those with other disorders (see also Lord & Bishop, 2010).

Evidence that diagnostic distinctions within the spectrum may simply represent different degrees of the same disorder has also come from longitudinal follow-ups of children with ASD. Whereas movement "off" the spectrum is rare, it is not uncommon for children to change diagnoses within the spectrum depending on their symptom presentation at different points in development. A sizable proportion of children who initially receive a diagnosis of PDD-NOS in early preschool may go on to be diagnosed with autism in school age when their symptoms become more apparent and/or when the clinician becomes more certain about the diagnosis. Alternatively, some children diagnosed with autism may later receive a diagnosis of PDD-NOS

when their symptoms improve (Lord et al., 2006; Stone et al., 1999). Such findings about changes in diagnostic status would be surprising if autism and PDD-NOS were indeed qualitatively distinct, but the concept of a spectrum allows for the idea that a child may move within the spectrum depending on their particular symptom profile while still continuing to meet the criteria for an ASD at each time point.

There is no question that the behavioral phenotypes of individuals with ASD are tremendously heterogeneous in general, or that an individual with a specific ASD designation of Asperger syndrome, for example, may look quite different than someone with a diagnosis of autism. However, research continues to indicate that whereas professionals (and diagnostic instruments) are reliable in indicating whether a child is somewhere on the spectrum or not on the spectrum, there are substantial inconsistencies in how specific ASD diagnoses are assigned by different practitioners (Lord et al., 2012). Therefore, it is likely that all specific ASD designations will be collapsed into a single ASD diagnosis in the forthcoming fifth revision of the DSM (see www.dsm5.org).

This proposed revision for DSM-V has caused significant controversy. Many professionals, parents, and individuals with ASD feel that it is important to retain specific designations within the spectrum. Despite the issue of generally low levels of inter-rater reliability, it is argued that in some cases, diagnostic distinctions of autism vs. Asperger syndrome vs. PDD-NOS are useful or necessary in helping professionals communicate about different sorts of children or adults with ASD, or in helping families find resources that are appropriate. For example, parenting handbooks or social groups might be designed for individuals with "high functioning autism or Asperger syndrome" because the activities or suggestions are only relevant for those with fluent language. Similarly, a support group for parents of children with autism might be specifically intended to cater to families with children whose ASD symptoms are quite severe. Furthermore, some adults with ASD are more comfortable self-identifying as having Asperger syndrome (as opposed to autism or ASD) because they feel that this diagnosis more accurately reflects their profile of strengths and difficulties than the more classic definition of autism. Nevertheless, as they are currently defined, specific diagnoses within the spectrum have proven ineffective in reliably describing different groups of individuals with ASD.

On the other hand, the variability in language, cognitive functioning, and ASD symptoms and behaviors that exists among those diagnosed with ASD begs for *some* way of differentiating individuals with such discrepant behavioral profiles. Many authors have written about the need for measures of ASD severity. This information is necessary to facilitate communication about, and access to, appropriate services, as well as to measure the effectiveness of interventions and assess long-term outcomes. But the concept of ASD severity is still not well defined. Attempts have been made, through measures like the Social Responsiveness Scale (SRS; Constantino, 2002), to develop more continuous measures of autism symptoms that can be used to approximate severity, but more research is needed to determine the extent to which scores on these measures truly offer information about severity above and beyond what is provided by age and/or IQ. Often when people talk about a child at the "high end of the spectrum," they are referring to the child's high IQ or well-developed language abilities. Thus, putting the issues of IQ and language aside, it is not entirely clear what "severe" vs. "average" vs. "mild" ASD would be expected to look like. The ADOS calibrated severity score (Gotham, Pickles, & Lord, 2009) is a new metric that converts ADOS raw scores into standard scores based on comparisons of other children within the same age range and with similar language abilities. More research is needed to determine the validity of this score as a measure of ASD severity.

Future Directions

To begin to deal with the issue of severity in DSM-V, the proposed revisions stipulate that

a diagnosis of ASD will be described in terms of severity in two domains: social-communication symptoms and fixated interests/repetitive behaviors. Any associations with other known genetic or medical conditions, language disorders, intellectual disability, or psychiatric disorders will also be specified (see www.dsm5.org). It will be important to evaluate whether this dimensional approach to "within-ASD" designations results in enhanced inter-rater reliability among professionals compared to the current categorical approach. In addition, it will be important to examine the utility of the new severity dimensions for both clinical (e.g., using different severity designations to track children into various services) and research (e.g., as predictors of outcome to stratify genetics samples) purposes. Undertaking other measure development efforts in the area of ASD severity may also be helpful in providing a means of operationalizing various anchor points along the spectrum (e.g., mild vs. severe ASD) or along multiple spectra (i.e., defined by more narrow behavioral dimensions) relevant to a diagnosis of ASD.

See Also

- ▶ Asperger Syndrome
- ▶ DSM-IV

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Speech

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Synonyms

Talking; Verbalization

Definition

Speech is the physical production of language. Speech is a complex act that requires the coordination of multiple systems including respiration, voicing, articulation, and prosody. Speech begins with respiration. Respiration provides the air supply necessary to create speech sounds, also known as phonemes. As the air moves through the vocal tract into the larynx, the vocal folds are vibrated to produce voiced sounds (e.g., /g/) or remain still to produce voiceless sounds (e.g., /h/). Once the air moves out of the larynx, it continues through the vocal tract and into the mouth where the air is shaped into sounds by the articulators (e.g., lips, teeth, and tongue). Accurate speech sound production requires appropriate timing, direction, force, speed, and placement of the articulators (American Speech-Language-Hearing Association, n.d.; Freed, 2000; Zemlin, 1998). Producing speech enables individuals to communicate (e.g., expressing wants and needs, asking for information or help).

See Also

- ▶ Expressive Language
- ▶ Phonemes
- ▶ Phonetics
- ▶ Phonology
- ▶ Prosody

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Speech and Language Services

- ▶ Speech-Language Intervention

Speech Clinician

- ▶ Speech-Language Pathologist (SLP)

Speech Delay

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Definition

Speech delay is the diagnosis given to children who exhibit normal language development, but their speech production skills fall below those expected based on their chronological age and level of cognitive or intellectual functioning (Vinson, 2007). Speech-language pathologists use standardized language tests to diagnose speech delay. While the etiology underlying the delay may be unknown, speech delay has been associated with a variety of developmental disorders including autism spectrum disorders. Predictors of long-term speech delay in late-talking toddlers at 30–35 months include limited

phonetic inventory, simple syllable structures, more sound errors, greater inconsistency in substitution errors, atypical errors, and slow rate of resolution (Williams & Elbert, 2003). Speech therapy may be provided to children with a diagnosis of speech delay with the goal of helping them attain communication skills that are commensurate with their chronological/developmental age (Roth & Worthington, 2010).

See Also

- ▶ Articulation Disorders
- ▶ Speech Impairments
- ▶ Speech/Communication Disabilities

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Speech Disorder

- ▶ Speech Impairments
- ▶ Articulation Disorders

Speech Impairment

- ▶ Paraphasia

Speech Impairment/Disorder

- ▶ Speech/Communication Disabilities

Speech Impairments

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Synonyms

Speech disorder

Definition

Speech impairment is the diagnosis given to an individual when one or more of the components of speech (e.g., articulation, voice, fluency) are impaired. Speech-language pathologists use standardized tests to diagnose speech impairments. The different categories of speech impairments reflect the underlying etiology of the disorder and/or the impaired components. Childhood speech impairments include apraxia, dysarthria, speech sound disorders, stuttering, and voice. Adult speech impairments include apraxia, dysarthria, stuttering, and voice. An individual's speech impairment may emerge over the course of development, be acquired due to a brain injury, or be associated with a disorder such as cerebral palsy (American-Speech-Language-Hearing-Association, n.d.). Speech-language pathologists work with individuals with speech impairments to either help them attain communication skills that are commensurate with their chronological/developmental age or premorbid status or to help them attain functional communication skills that enable them to operate in the daily environment without handicap (Roth & Worthington, 2010).

See Also

- ▶ Apraxia
- ▶ Dysarthria
- ▶ Speech

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Speech Morphology

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Synonyms

Affixes; Bound morphemes; Grammatical morphemes

Definition

Speech morphology deals with the organization of morphemes, or the smallest units of meaning, in spoken language. Morpheme arrangement is governed by morphological rules and, in spoken language, by morphophonological rules. In speech, these rules dictate when pronunciation changes result from the combination of morphemes (e.g., *divine* + *ity* to form *divinity*).

Morphemes are categorized according to structure and function. Free morphemes can stand alone (e.g., *cat*), while bound morphemes must be attached to a free morpheme (e.g., plural *-s*). Bound morphemes can be classified as derivational or inflectional. Derivational morphemes change the class of a word (e.g., the verb *work* is changed to a noun by adding the morpheme *-er*, as in *work* → *worker*), while inflectional morphemes are associated with grammatical changes (e.g., plural, possessive, verb tense). While some individuals with autism spectrum disorders may exhibit normal morphological aspects of speech and language, others may exhibit deficits in grammatical morphology similar to those observed in children with specific language impairment (SLI). There is evidence to indicate that children with SLI have particular difficulty with finite verb morphology.

See Also

- ▶ Language
- ▶ Speech

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Speech Pathologist

- ▶ Speech-Language Pathologist (SLP)

Speech Sound Disorder

- ▶ Articulation Disorders

Speech Sound Production

- ▶ Articulation

Speech Teacher

▶ Speech-Language Pathologist (SLP)

Speech Therapist

▶ Speech-Language Pathologist (SLP)

Speech Therapy

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Definition

Speech therapy is a treatment aimed at modifying, minimizing, or resolving a communication disorder (Tomblin, 2002).

Historical Background

The first speech defects and treatments were reported in the third and fourth century B.C. (Klingebeil, 1939). The roots of modern day logopedics, known as speech therapy in the United States, began on the European continent (Rieber and Froeschels, 1966). The first center that took a special interest in speech functioning and rehabilitation was established in 1895 and located in Vienna. The work at this center was carried out by physicians who went on to form the profession of phoniatrics (the medical, research, and treatment of structures involved in speech production). In 1921, a phoniatrist and educationalist came together to initiate a training program for teachers that focused on teaching speech, and by 1928, thirty-nine schools in Vienna were offering remedial speech courses. In the 1900s, Americans began to travel to Germany and other European countries to study speech. As the number of speech practitioners in Europe grew, a decision was made to host an international congress in 1924, which focused on various aspects of communicative disorders. The International Association of Logopedics and Phoniatrics was founded during this congress (DeMontFort, 1990).

During this same time, graduate programs were beginning to develop in the United States. One of the first graduate programs was established in 1914 at the University of Wisconsin by Smiley Blaton. In the United States, the first practitioners of speech pathology were professionals and educators who took an interest in helping individuals with speech problems. These practitioners, referred to as "speech correctionists," were made up of physicians, scholars, and public school administrators all of whom fell under the National Association of Teachers of Speech. In 1925, Carl Seashore, a professor of psychology at the University of Iowa, initiated a meeting aimed at forming an academy for speech correction that was independent of the National Association of Teachers of Speech. The outcome of this meeting was the formation of the American Academy of Speech Correction, which would eventually go on to become the American Speech-Language-Hearing Association (Duchan, 2002; van Riper, 1981). The number of members of the American Speech and Hearing Association has grown from 25 members in 1925 to 14,000 members in 2011.

Although the roots of modern speech therapy began in Europe and the United States, today, clinicians provide speech therapy to individuals with communicative disorders throughout the world. However, there are significant differences in the length and content of the training programs. Many countries with limited resources do not have training programs even though these countries have citizens with hearing, speech, and language problems. Thus, a primary goal of the International Association of Logopedics and Phoniatrics is to establish an international set of essential principles and

common ground for those who serve individuals with communication disorders throughout the world (Butler, 1990).

Rationale or Underlying Theory

Communication is an essential social tool. Communication is considered disordered when an individual is no longer able to accomplish necessary social functions or the manner in which an individual communicates is viewed negatively (Tomblin, 2002). The overall goal of speech therapy is to modify, minimize, or resolve an individual's communication disorder and subsequently improve his or her quality of life. To accomplish this, the speech-language pathologist must identify factors causing and/or exacerbating the problem and then provide appropriate treatment. Treatment may be aimed at targeting areas of weakness, providing support or alternative methods of communication, and/or addressing behaviors and environments that affect communication (Tomblin, 2002).

Goals and Objectives

The objective of speech therapy varies depending on the individual. Goals most often fall into one of two categories: (1) the attainment of communication skills that are commensurate with the individual's chronological/developmental age or premorbid status or (2) the attainment of functional communication skills that enable the individual to function in his or her daily environment (Roth & Worthington, 2001).

Treatment Participants

Individuals with a diagnosed communicative disorder are eligible for speech therapy. Communicative disorders do not include speech and language differences that arise from dialect usage or nonnative language (Roth & Worthington, 2001; Vinson, 2002).

Treatment Procedures

The treatment of a communicative disorder begins with an assessment of the individual's communication behaviors. Treatment involves the following steps: (1) determination of treatment goal(s), (2) measurement of the behavior prior to the start of intervention for the purpose of establishing a pretreatment baseline, (3) implementation of intervention, and (4) generalization or carryover of the newly mastered communicative behavior from the clinical setting to the natural environment (Hedge, 1988; Roth & Worthington, 2001).

Treatment goals may be determined using either a normative or client-specific strategy. The normative strategy for treatment goal selection is based upon typical communication development. Therapy targets are selected and taught in the same order that they emerge developmentally. Normative goal selection is most often used with children who are receiving therapy to address articulation and/or language impairments. Client-specific goal selection involves selection of therapy targets based on an individual's specific needs rather than developmental norms. This includes "consideration of (1) the frequency with which a specific communicative behavior occurs in a client's daily activities, (2) the relative importance of a specific communicative behavior to the client, regardless of how often it occurs, (3) the client's potential for mastery of a given communication skills" (Roth & Worthington, 2001, p. 7).

There are often a variety of treatment methods available to target the selected treatment goal. Speech-language pathologists use evidence-based practice, which is the integration of clinical expertise with the best available evidence from systematic research, to determine what intervention method and/or therapy techniques to use (Dollaghan, 2007; Reilly, Douglas, & Oates, 2004).

A baseline measurement of the behavior that will be targeted during speech therapy should be taken prior to the start of intervention. Baseline measures provide a picture of the individual's communicative behaviors prior to treatment and

a base against which the effects of various treatments may be measured. More specifically, baseline measurements enable a clinician to document whether or not the targeted behavior has improved. Without pretreatment baseline measures, clinicians are unable to document whether an intervention was or was not effective (Hedge, 1998).

Finally, clinicians must determine whether or not the targeted behavior has been mastered. Mastery of a behavior includes generalization of a targeted behavior to outside of the clinical setting. To facilitate generalization, a variety of stimuli should be used when teaching the targeted behavior and the audience with whom the therapy targets are practiced should be varied (Roth & Worthington, 2001).

Efficacy Information

The National Outcomes Measurement System (NOMS), organized by the American Speech-Language-Hearing Association, is a national database comprised of outcome data from speech-language pathologists (SLPs) and audiologists working with adults and children in school and health-care settings. The results from this database indicate that speech therapy is effective at modifying, minimizing, and/or resolving communication disorders. In the area of adult treatment, intervention is considered effective if there is measurable change from admission to discharge. Measurable changes for patients were found in the areas of memory, swallowing, motor speech, language comprehension, and expression (American Speech-Language-Hearing Association, n.d.b). In the area of child treatment, children must make demonstrable progress in targeted areas. Results from prekindergarten data found that more than half of the children made demonstrable progress following SLP intervention in the areas of articulation/intelligibility, cognitive orientation, pragmatics, spoken language comprehension, spoken language production, and swallowing. This included children with lower functional communication and/or swallowing abilities. Thus, the data suggests that speech therapy is effective, as demonstrated by measuring change, in treating both adult and child communicative disorders (American Speech-Language-Hearing Association, n.d.a; American Speech-Language-Hearing Association, n.d.b; Mullen and Schooling, 2010).

Outcome Measurement

To determine outcome measurements, clinicians should compare pretreatment baseline measures to posttreatment measures and/or compare scores from admission and discharge. The differences in pretreatment and posttreatment measures may be used to determine the amount of change that has occurred as a result of treatment (Hedge, 1998). The National Outcomes Measurement System, organized by the American Speech-Language-Hearing Association, uses functional communication measures to describe the change in an individual's functional communication and/or swallowing ability over time. These measures are based on disorder-specific scales (Mullen and Schooling, 2010).

Qualifications of Treatment Providers

Qualifications needed to provide speech therapy services in the United States include Certification of Clinical Competence (CCC). This certificate, granted by the American Speech-Language-Hearing Association, requires a master's degree from an accredited graduate program, a passing score on the national PRAXIS exam (a certification examination written and administered by the Educational Testing Service), and completion of a nine-month clinical fellowship under the supervision of a certified speech-language pathologist. Most states license speech-language pathologists. State licensing requirements are most often comparable, although they may not be identical, to the qualifications for the Certificate of Clinical Competence. Speech-language pathologists licensed in other states must apply for licensure in the state in which

they are practicing (American Speech-Language-Hearing Association, n.d.c).

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Speech Therapy (Not Preferred)

▶ Speech-Language Intervention

Speech/Communication Disabilities

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Synonyms

Communication disorder; Language impairment/disorder; Speech impairment/disorder

Short Description or Definition

Speech/communication impairments are among the core features of autism spectrum disorders (ASD). Although enormous variability in the development of speech and language is observed in individuals with ASD, even those who are high functioning exhibit some type of communication disability. Deficits can occur at the nonverbal level (e.g., gestures, facial expressions, eye gaze), paralinguistic level (e.g., prosody, intonation), and linguistic level (e.g., language, speech). Communication deficits in the social use of speech and language are particularly salient. Research suggests that a subset of children with ASD also have grammatical deficits similar to children with specific language impairment. In addition, speech sound disorders are evident in a subset of children with ASD. Approximately 20–40% of individuals with autism never develop spoken language, and about 20% exhibit a loss of language skills as toddlers, also known as language regression.

Aspects of communication that are relatively preserved in individuals with ASD include segmental phonology (i.e., the system of speech sounds), syntax, and morphology (i.e., the form

or structure of language). Areas of relative difficulty include nonsegmental speech production (e.g., prosody, intonation, stress patterns, vocal quality), semantics (i.e., meaning), and pragmatics (i.e., social use of language).

Categorization

The Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR; American Psychiatric Association, 2000) includes five categories of communication disorders: expressive language disorder, mixed receptive-expressive language disorder, phonological disorder, stuttering, and communication disorder not otherwise specified (e.g., voice disorders). Speech/communication disabilities can be associated with developmental disabilities and syndromes, such as autism spectrum disorders.

Epidemiology

Speech/communication disabilities are core features of ASD. According to Frombonne's (2007) review, the prevalence for all pervasive developmental disorders (PDDs) is at least 36.4 per 10,000. Although the definition of Asperger's disorder includes no clinically significant delay in language, several researchers question whether language is unaffected in this syndrome (cf. American Speech-Language-Hearing Association, 2006).

Natural History, Prognostic Factors, Outcomes

Communication delays and deficits are often the first indicators of ASD. For example, children later diagnosed with ASD show a lack of interest in faces, voices, and social interactions as infants. Later in development, children with ASD may fail to understand or produce communicative gestures (e.g., pointing) and may be delayed in babbling, vocalizing, and speech development. Lack of communication skills is one of the most significant stress factors for families of children with ASD.

The speech/communicative outcomes of individuals with ASD are extremely variable. About 20% of children with ASD exhibit a regression in speech and language skills during their second year of life. About 40–50% never develops functional speech except for perhaps a few single words (although this percentage may be decreasing due to the positive effects of early identification and intervention). Little is known about the communication skills of nonverbal individuals with ASD because research has focused on verbal individuals.

Those individuals with ASD who do develop speech are often significantly delayed and do not speak until well into their preschool years. High-functioning individuals with ASD may have IQs in the normal range and appear precocious in their vocabulary size and ability to speak in detail on certain topics. Despite these strengths, this population continues to struggle with the comprehension and production of social and nonliteral communication.

Several characteristics have been linked to better communicative outcomes. For example, children with ASD who produce and imitate words, exhibit pretend play with objects, communicate with gestures, and show evidence of joint attention have greater rates of vocabulary growth and overall language skills. Negative prognostic indicators include a regression in language skills after a period of development and severe receptive language impairment. Children with lower IQs also tend to have poorer communicative functioning. Even for high-functioning individuals who attend college and are able to live independently, ASD is a lifelong disability that affects social communication and functioning.

Clinical Expression and Pathophysiology

Early Communication Development. Communication is a broad term that encompasses numerous modes of sending and receiving messages,

including gestures, body language, facial expressions, language, and speech. Typically developing children exhibit social communicative behaviors beginning in infancy. For example, they turn toward human voices, are fascinated by faces, smile to hold an adult's attention, vocalize, and demonstrate joint attention (e.g., paying attention to the same object as another person). In the first year of life, typically developing infants express a range of communicative intents, such as requesting, greeting, and protesting. For individuals with ASD, communication deficits are apparent almost from birth. One of the first signs of ASD is a lack of responsiveness to social interactions. For example, infants later diagnosed with ASD were described by their parents as uninterested in human voices or faces. They rarely smiled at others, vocalized in a communicative manner, or engaged in social games such as "peekaboo." In addition, 1-year-olds who were later diagnosed with ASD exhibited a lack of joint attentional behavior and paid less attention to people in their environment. The communicative intents of children with ASD are primarily to regulate their environment (e.g., getting others to do things for them) rather than for social purposes. They may exhibit unusual gestures, such as pulling an adult's hand toward a desired object (rather than pointing at the object or verbally requesting it). Other symptoms of communicative deficits include delayed development of pointing gestures, a lack of typical imitation skills, and deficits in pretend and imaginative play. In the second year of life, the receptive language abilities of children with ASD are depressed relative to their expressive abilities. The gap tends to narrow over time, with receptive and expressive language abilities becoming more similar by ages 3–4. Parents of children with ASD report becoming seriously concerned about their children's development during the toddler years, particularly due to their children's receptive and expressive language delays.

Children with ASD are generally late to begin talking and develop speech and language at a slower rate than typical children (except for children with Asperger's syndrome who do not exhibit speech and language delays). When they do speak, children with ASD are less spontaneous in their communication, and verbal expression is sparse. They also exhibit deficits in social communication, including following politeness rules, turn taking, and engaging in conversation.

Later Language, Speech, and Communicative Development. Language consists of three primary domains: form, content, and use. *Form* involves the structure of language (i.e., phonology, syntax, morphology), *content* involves the meaning of language (i.e., semantics, vocabulary), and *use* refers to the social use of language (e.g., pragmatics). Effective communication involves the interaction of these three domains. For example, language produced by typical individuals is most often syntactically correct, meaningful, and socially appropriate. In addition, effective communicators can decode other's communication in terms of its form, content, and use. In individuals with ASD, the domains of language can be dissociated, negatively impacting communication. Specially, the form of language may be preserved (e.g., syntax, morphology, phonology), but the meaning, and especially social use of language, is impaired. More details on the language, speech, and communication characteristics of individuals are included below.

Language Form (Phonology, Morphology, Syntax). The language form of individuals with ASD is relatively unimpaired compared to the language domains of content and use. In general, development of language form in children with ASD follows the same sequence as for typically developing children. Syntactic errors that are observed seem to be related to semantic or pragmatic difficulties. In general, the development of language form is commensurate with nonverbal mental age, although a more restricted range of syntactic constructions may be produced. A subgroup of children with ASD may exhibit grammatical deficits similar to children with specific language impairment. This subgroup of children is likely to omit certain grammatical morphemes such as articles, auxiliary and copula verbs, and verb tense markers (e.g., past tense, third person singular).

Language Content (Vocabulary, Semantics). Language content involves the rules for relating words to meaning. Individuals with ASD exhibit both strengths and impairments in this language domain. For example, research suggests that overall vocabulary knowledge may be a relative strength in individuals with autism spectrum disorders (ASD). In addition, children with ASD use semantic groupings (i.e., word relationships) in typical ways for categorizing and retrieving words. In spite of these strengths, notable deficits and unusual characteristics are apparent. For example, the acquisition of words that refer to mental state or emotional concepts may be especially impaired. Individuals with ASD may have difficulty generalizing the meanings of words to new contexts (e.g., understanding that the word "dog" can refer to many animals, not just the family pet). In addition, they often have difficulty comprehending vocabulary in nonliteral language (e.g., slang, figures of speech, proverbs, metaphors).

Individuals with ASD may produce speech that appears to be irrelevant to the current communicative context. These utterances are referred to as idiosyncratic or metaphorical language. For example, Kanner (1946) described a child with ASD who would yell, "Don't throw the dog off the balcony!" whenever he was about to throw something. His parents reported that several years earlier, they had been staying in a hotel with a balcony and warned the child not to throw his stuffed toy dog over the railing. Kanner emphasized that this type of utterance was not irrelevant or meaningless. Rather, individuals with ASD attach unique meanings to these "figures of speech" based on specific past experiences.

Language Use (Pragmatics, Social Use of Language). The social use of language is particularly impaired in individuals with ASD, including for high-functioning individuals with IQs in the normal range. Deficits in social communication are evident almost from birth, as children with ASD are less responsive to voices and faces. Social skills are learned and applied in transactional contexts, that is, during interactions between communication partners. The deficits in social communication in individuals with ASD result in less social experience, contributing to impaired development and learning. For children who develop verbal language, the speech acts they do exhibit are primarily for regulating their environment and the behaviors of others, rather than for social purposes. Later in development, engaging in conversation appears to be especially difficult. Deficits in eye gaze, intonation, topic maintenance, understanding the communicative intent of others, and providing the appropriate amount of information are apparent. In general, individuals with ASD exhibit impairments participating in communicative interactions that involve joint reference or shared topics and perspectives.

Speech. Among individuals with ASD who speak, articulation skills are a relative strength and are generally commensurate with mental age, although there may be a higher incidence of residual speech distortion errors on sounds such as /r/, /l/, and /s/ in adults. Despite strengths in speech sound development, paralinguistic aspects of speech (e.g., intonation, prosody) and vocal quality may be atypical, causing communication difficulties. For example, prosody and intonation may be monotonous, inappropriate, or overly dramatic. In addition to expressive deficits, individuals with ASD may have difficulty interpreting the prosody and intonation of others leading to misinterpretation of sarcasm, etc.

Echolalia. Echolalia is the repetition, with similar intonation, of words or phrases spoken by another person. Echolalia can be immediate (e.g., a child repeats, "Are you hungry?" when an adult asks him that question) or delayed (e.g., a child says, "You look sleepy," to indicate that it is bedtime). Echolalia was once considered to be aberrant, undesirable behavior. Now it is recognized as serving various communicative functions. Echolalia is more common in children with less language ability and tends to decline as language develops. Other populations of children, including typical children, also produce echolalic utterances, although not to the extent observed in children with ASD.

Pronoun Reversal. It has frequently been noted that children with ASD appear to reverse

the pronouns in their utterances. For example, they may say, "Pick you up!" instead of, "Pick me up!" These errors are thought to be a result of echolalia.

Evaluation and Differential Diagnosis

As stated earlier, impairments in communication, particularly for social purposes, are core features of ASD. Therefore, all individuals with ASD will have communication needs, although they will vary depending on the age, level of functioning, and individual characteristics of each person. For very young children, assessment will include evaluation of preverbal communication abilities, including gestures, eye gaze, joint attention, vocalizations, responsiveness to communication, and communicative functions. Observations during play or activities of daily living are important for gaining information about children's communicative behavior and their caregivers' interactional style. The use of checklists while observing the child in naturalistic interactions is common and may be the only feasible method of assessment for many children with ASD who have difficulty participating in structured test formats (see Paul, 2005, for examples of checklists).

A variety of parent report/interview assessment tools are available, including the *Receptive-Expressive Emergent Language Test-Third Edition* (REEL-3; Bzoch, League, & Brown, 2003) and the *Vineland Adaptive Behavior Scales, Second Edition* (VABS-II; Sparrow, Cicchetti, & Balla, 2005). Other assessment tools include direct observation of the child and may include more structured interactions or elicitation of particular behaviors. Examples include the *Communication and Symbolic Behavior and Play Scales-DP* (CSBS; Wetherby & Prizant, 2003), the *Peabody Picture Vocabulary Test-4th Edition (PPVT-4;* Dunn & Dunn, 2007), and the *Preschool Language Scale-5* (PLS-5; Zimmerman, Steiner, & Pond, 2011).

In verbal children, language samples may be collected for assessing the expression and use of language in naturalistic settings. Specific areas to assess include responsiveness to speech, mean length of utterance (a measure of syntactic development), word use, echolalia, pronoun use, and pragmatics. Pragmatic analysis may include the range of communicative functions (e.g., directing others, reasoning, empathizing), discourse management, register variation (e.g., politeness), presupposition (e.g., providing enough background information), and manner of communication.

For higher functioning individuals with ASD who can participate in formal testing situations, a variety of standardized language assessments are available (see Paul, 2007 for a comprehensive overview). Assessments that focus on pragmatic language or verbal reasoning may be the most useful in identifying core deficits. It is important to supplement standardized testing with informal observations within a variety of naturalistic contexts in order to capture deficits in social communication.

For individuals with ASD who are nonverbal, it is important to assess the various ways that they do communicate. In addition, their ability to use augmentative and alternative communication (AAC) may also be evaluated.

Speech can be assessed through procedures common to the evaluation of any client with a suspected speech sound disorder, depending on the ability of the individual with ASD to participate in a standardized assessment. Common tests include the *Arizona Articulation Proficiency Scale, Third Edition* (Arizona-3; Fudala, 2000) and the *Goldman-Fristoe Test of Articulation 2* (Goldman-Fristoe 2; Goldman & Fristoe, 2000). Also, speech can be evaluated through more naturalistic sampling procedures (e.g., recording an inventory of a client's phonetic repertoire during spontaneous speech).

Treatment

For individuals with ASD, research has demonstrated that a range of approaches are effective for promoting communication abilities (cf. ASHA, 2006). Common approaches range from naturalistic (e.g., Floor Time, Greenspan, Wieder, &

Simons, 1998) to highly structured, behavioral interventions (e.g., Lovaas, Calouri, & Jada, 1989). The incorporation of peers as models and/or trainers is also common. According to the National Research Council (2001), educational interventions for individuals with ASD should begin as early as possible, programming should be intensive with repeated and planned teaching opportunities, teacher-student ratios should be low, mechanisms for ongoing assessment and program evaluation should be in place, and family involvement and training is important. In addition, intervention for individuals with ASD should include spontaneous and functional communication, social skills, play skills, peer interactions, generalization of skills to natural contexts, mechanisms for addressing challenging behaviors, and promoting functional academic skills when appropriate.

For young children in the beginning stages of language development, the goals of intervention include rewarding efforts for communication and speech, expanding vocabulary and communicative functions, encouraging multiword utterances, expanding sentence types, developing emergent literacy, teaching functional use of imitation, and capitalizing on memorized forms. Various evidence-based approaches to facilitating language may be implemented, including prelinguistic milieu teaching, focused stimulation, and conversational recasting. In addition, approaches that focus on parent training, such as *It Takes Two To Talk* or *More Than Words* (both developed by the Hanen Center), have been shown to be effective.

For nonverbal individuals with ASD, the use of augmentative and alternative communication (AAC) strategies is common for facilitating communication. AAC approaches include sign language, Picture Exchange Communication System (PECS), communication boards, and voice output devices. For individuals who are literate, written language can be an effective means of communication and can be used for compensatory purposes (e.g., using a script or communication checklist for functioning within various situations). For example, Social Stories (Gray, 1993) employ a story format using visual materials to improve an individual with ASD's social understanding of various situations. Technology (e.g., texting, social networking) may assist individuals with ASD in social communication without the stress of face-to-face interactions. Comprehension monitoring strategies for older, higher functioning individuals with ASD (e.g., checklists) may also be effective.

In general, intervention for individuals with ASD needs to address core deficits in communication and social skills.

See Also

- ▶ Alternative Communication
- ▶ Communication Interventions

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Speech-for-the-Self

► Private Speech

Speech-Language Clinician

► Speech-Language Pathologist (SLP)

Speech-Language Intervention

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Synonyms

Communication services; Speech and language services; Speech therapy (not preferred); Speech-language pathology practice; Speech-language pathology services

Definition

The overall objective of speech-language therapy or speech-language pathology services is to optimize individuals' ability to communicate and swallow, thereby improving quality of life. Speech-language pathologists are the professionals who provide speech, language, and swallowing evaluations and treatment. Speech-language therapy may be conducted individually, in small groups, in a classroom, or in the community.

The following speech, language, and swallowing disorders are described, followed by a description of the treatment focus.

Speech Disorders

- Speech sound production – how we say sounds and put sounds together in words Fluency (stuttering) – how well speech flows
- Voice – how the voice sounds
- Speech-language therapy – focuses on improving articulation or pronunciation of sounds, improving fluency in increasingly longer utterances, and helping people who sound hoarse, lose their voice easily, talk too loudly or too softly, or talk through their nose

Language Disorders

- Spoken language – how well we understand what we hear and how well we use words to tell others what we are thinking. Loss of language following a stroke or brain injury is known as *aphasia*.
- Written language – how well we understand what we read, how well we read, and how well we write to communicate.
- Speech-language therapy – helps individuals who have problems understanding, speaking, reading, writing, and spelling.

Social Communication or Pragmatic Language Disorders

Social communication, or *pragmatics,* refers to the way in which individuals use language in context. This is one of the defining features of autism. It includes following rules for conversation, such as taking turns, staying on topic, describing an event in sequence, and talking differently depending on the listener and the setting.

Speech-language therapy focuses on helping people adapt their language use depending on the listener and the setting, learn the rules of conversation and storytelling, and use nonverbal language correctly (e.g., using gestures, knowing how close to stand when someone is talking).

Cognitive-Communication Disorders

People may have problems with memory, attention, problem solving, organization, and other thinking skills that interfere with effective communication.

Speech-language therapy helps individuals with organizing thoughts, recalling information, paying attention, planning, and solving problems.

Severe Communication Disorders

Speech-language therapy is used to assist people with severe communication disorders by providing direct service, by collaborating with teachers and families, and by evaluating, selecting, and developing augmentative and alternative communication (AAC) systems. Such systems may include low-tech communication boards with words or pictures, sign language, and speech-generating devices that produce a synthesized voice through use of a computer.

Feeding and Swallowing Disorders (Dysphagia)

People may have problems sucking, chewing, and swallowing food and liquid; this is known as *dysphagia*. Intervention helps to prevent poor nutrition, weight loss, and other health problems in individuals with dysphagia.

See Also

- ▶ Communication Services
- ▶ Speech and Language Services
- ▶ Speech Therapy
- ▶ Speech-Language Pathologist (SLP)
- ▶ Speech-Language Pathology Practice

References and Readings

American Speech-Language-Hearing Association (ASHA). www.asha.org

Speech-Language Pathologist (SLP)

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Synonyms

SLP (acronym for speech-language pathologist); Speech clinician (not preferred title); Speech pathologist (not preferred title); Speech teacher (not preferred title); Speech therapist (not

preferred title); Speech-language clinician (not preferred title); Speech-language therapist (not preferred title)

Definition

The American Speech-Language-Hearing Association (ASHA) is the professional, scientific, and credentialing association for 140,000 members and affiliates who are audiologists, speech-language pathologists, and speech, language, and hearing scientists. According to ASHA, *speech-language pathologists* are the professionals responsible for the diagnosis, prognosis, prescription, and treatment of speech, language, cognitive communication, and swallowing disorders. Working within the full range of human communication and its disorders, speech-language pathologists evaluate and treat individuals of all ages who have difficulty speaking, understanding, reading, writing, or swallowing. Individuals with autism typically present with communication disorders, including delayed speech and language as well as social communication disorders. Speech-language pathologists are often the first professionals to identify that a child has autism. Speech-language pathologists screen, assess, diagnose, and provide intervention services for children and adults with autism. Speech-language pathologists may work independently or as members of a team. In addition, speech-language pathologists may

- Train future professionals at colleges and universities
- Manage agencies, clinics, or private practices
- Engage in research to enhance knowledge about human communication processes
- Develop new methods and equipment to evaluate problems
- Establish more effective treatments
- Investigate behavioral patterns

Speech-language pathologists, as defined by ASHA, hold the ASHA Certificate of Clinical Competence in Speech-Language Pathology (CCC-SLP). Minimal criteria to become a speech-language pathologist include:

- Master's, doctoral, or other recognized postbaccalaureate degree from a program accredited by the Council on Academic Accreditation in Audiology and Speech-Language Pathology (CAA)
- At least 25 h of supervised clinical observation and 350 h of supervised clinical practice involving evaluation and treatment of children and adults with communication disorders
- Successful passing of a national examination in speech-language pathology
- Completion of a clinical fellowship after completion of the graduate degree – the fellowship consists of at least 36 weeks of full-time professional experience or its part-time equivalent

Demonstration of continued professional development is mandated for maintenance of the CCC-SLP. Where applicable, speech-language pathologists hold other required credentials (e.g., state licensure, teaching certification).

See Also

- ▶ Speech Clinician
- ▶ Speech Pathologist
- ▶ Speech Therapist
- ▶ Speech-Language Clinician
- ▶ Speech-Language Therapist

References and Readings

American Speech-Language-Hearing Association (ASHA). www.asha.org

Speech-Language Pathology Practice

- ▶ Speech-Language Intervention

Speech-Language Pathology Services

- ▶ Speech-Language Intervention

Speech-Language Therapist

▶ Speech-Language Pathologist (SLP)

Spinal Curvature

▶ Scoliosis

Spinal Fluid

▶ Cerebrospinal Fluid

SPM

▶ Sensory Processing Measure
▶ Sensory Processing Measure: Preschool (SPM-P)

SPM-P

▶ Sensory Processing Measure
▶ Sensory Processing Measure: Preschool (SPM-P)

Spoken Language

▶ Expressive Language
▶ Verbal Communication

Spoken Language Comprehension

▶ Listening Comprehension

Sports

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Definition

Sports are physical activities that usually require exertion, effort, and skill. They can be individual or team oriented and require athletic ability. Many sports are competitive in nature where one individual or team attempts to beat another in a game or in the achievement of a goal. Sports can be played both indoors and outdoors.

Historical Background

The inclusion of individuals with autism spectrum disorders in the USA in sports can be traced directly to the creation of the Special Olympics. Eunice Kennedy Shriver was the founder of the Special Olympics which started as a summer day camp program for children with intellectual disabilities in her own backyard in 1962. In 1968, the first international Special Olympics were held at Soldier Field in Chicago, IL, with athletes from 26 states and Canada competing in track and field and swimming events. Over the past 40 years, the organization has grown to a global movement. It now includes both summer and winter Olympic Games and involves over 3 million athletes in 180 countries (Special Olympics, 2011).

A second origin of the inclusion of individuals with autism in sports can be traced back to educational law. In 1975, the Education for All Handicapped Children Act, more commonly referred as P.L. 94-142, made education a right for all children with disabilities. Children with disabilities could no longer be denied an education. It was incumbent upon the local education agency or school district to provide a free and appropriate public education (FAPE) to all children with disabilities. Along with the legal concept of FAPE was the concept of mainstreaming.

It was not sufficient for school districts to simply educate students with disabilities separately from nondisabled students. School districts were required to "mainstream" students for an optimal time period that was individualized to the particular student. Physical education classes along with art, lunch, recess, and some academic subjects were written into Individualized Education Plans (IEPs) of students as areas in the curriculum where students with disabilities were mainstreamed or educated side by side with their nondisabled peers.

This landmark legislation also included the concept of ancillary services, i.e., services provided to the student that were not directly educational in nature but helped to support the student in reaching his or her educational goals as a part of his or her IEP. Physical therapy, occupational therapy, and adaptive physical education were some of those ancillary services that helped individuals with autism participate in sports not only in the public school systems but eventually in the greater community as well. P.L. 94-142 was subsequently reauthorized as the Individuals with Disabilities Act (IDEA) and reaffirmed the importance of educating students with disabilities side by side with their nondisabled peers, and the concept of mainstreaming evolved into the concept of inclusion. Physical education classes were one of the primary parts of the curriculum where inclusion was written into a student's IEP. Under IDEA, physical therapy and adaptive physical education were solidified as ancillary services to support students with autism in reaching their IEP goal and helped pave the way to including individuals with autism in sports.

A tertiary influence on the inclusion of individuals with autism in sports needs to be credited to individuals with physical disabilities. In fact, the Paralympics movement predates Special Olympics and the passage of legislation in the USA promoting access for people with disabilities. "In 1948, Sir Ludwig Guttmann organized a sports competition involving World War II veterans with a spinal cord injury in Stoke Mandeville, England. Four years later, competitors from the Netherlands joined the games and an international movement was born. Olympic style games for athletes with a disability were organized for the first time in Rome in 1960, now called Paralympics. In Toronto in 1976, other disability groups were added and the idea of merging together different disability groups for international sport competitions was born. In the same year, the first Paralympic Winter Games took place in Sweden" (International Paralympic Committee, 2011).

Disabled veterans and other groups of individuals with physical disabilities fought for access to services and the basic right to not be denied physical access. These groups fought for the passage of the Vocational Rehabilitation Act of 1975 including Section 504 which forbade public entities which received federal funding from denying the benefits of the services of the institution solely based upon a person's disability. In 1990, the act was reauthorized and renamed as the Americans with Disabilities Act (ADA). These movements contributed to the rise of Adapted Physical Activities where the sports or the equipment were modified so that individuals with physical disabilities could participate in sports. Modifying the social rules of some team sports for individuals on the autism spectrum, therefore, was made easier by these previous modifications. The importance of these movements changing the culture from exclusion to inclusion of people with different abilities cannot be underestimated when considering the inclusion of people with autism in sports.

Current Knowledge

It is imperative that individuals with ASDs develop lifelong habits that incorporate fitness into their daily routine. Sports can be a part of that fitness regime. The USA is faced with an obesity epidemic with over two-thirds of Americans being labeled as overweight or obese (Center for Disease Control [CDC], 2010). Sedentary lifestyles and diet are major contributors to obesity. The sequelae of obesity are serious including heart disease, diabetes, and certain forms of cancer (CDC, 2010; Rundle et al. 2010). Additionally, obese individuals suffer a lowered quality of

life and are actively discriminated against (CDC, 2010). For children, being overweight puts them at greater risk for being the victim of bullying and increased risk of suicidality (CDC, 2011a). Individuals who are obese also suffer from a shortened lifespan. The average American will live 77.9 years (CDC, 2011b). Those who are labeled obese are expected to decrease not only their own life expectancy but that of the US population as a whole (Steward, Culter, & Rosen, 2009). However, a positive relationship exists between exercise and longevity. Individuals who exercise regularly have reduced mortality from all causes (Blair & Brodney, 1999; Paffenbarger, Hyde, Wing, & Hsieh, 1986). For individuals on the autism spectrum, regular moderate to vigorous exercise is associated with increased attention span, a decrease in stereotypies (Elliott, Dobbin, Rose, & Soper, 1994), and a decrease in the use of psychotropic medications. Participation in sports is one way for individuals with ASDs to exercise regularly.

Individuals on the autism spectrum are at increased risk for developing obesity. One national health study of children found that children with an ASD were 42% more likely to be labeled obese than children without an ASD (Curtin, Anderson, Must, & Bandini, 2010). In fact, obesity is a well-recognized issue among people with developmental disabilities. A number of factors contribute to individuals with ASDs being more vulnerable to obesity. First, many individuals on the spectrum take medications to treat comorbid psychiatric and behavioral issues, which have either increased appetite or weight gain as a side effect. Second, some individuals on the spectrum have very restrictive self-imposed diets that are high in fat and have little nutritional value. In fact, anecdotal stories of individuals with ASDs eating only "white foods" such as breads and plain pasta suggest that they have a diet replete with carbohydrates that are associated with weight gain (VanBergeijk, 2009). Third, some people with ASDs have both coordination problems and problems with proprioception (Weimer, Schatz, Lincoln, Ballantyne, & Trauner, 2001), or the ability to know where one's own body is in space. Many sports require good eye-hand coordination, the ability to engage in multichanneling (Lawson, 2001), a good sense of where one's body is in space, and the ability to track a high-speed object and then perform another task in response (e.g., following a baseball with one's eye after it leaves the pitcher's hand and then responding by swinging a baseball bat to hit the approaching ball). The motor coordination nature of many sports conflicts directly with the individual on the spectrum's disability, thereby discouraging them from participating. Fourth, the social nature of many team sports also discourages participation. Team sports require team members to use both verbal and nonverbal communication where the intent is not always explicit. For example, a person with an ASD would have to be able to discern the intent of a team member in order to catch a behind-the-back pass or an "alley-oop" in a game of basketball. The person would also have to be flexible and not be too literal in their interpretation of rules of a game in order to be successful and would have to understand concepts like "stealing a base" as being a part of the game and not view it as cheating. The social stressors of team sports may discourage adults with ASDs from engaging in sports and benefiting from exercise. Again, a lack of regular exercise is associated with obesity, diabetes, orthopedic problems, loss of bone density, and heart disease (Pangrazi, Beighle, & Sidman, 2007).

Individual sports may be the best possible solution to the dilemma of the need to exercise through sports. Persons on the autism spectrum could even participate in individual events as a part of a team (e.g., running track and cross country, long jump, or swimming). It would be important to avoid more complex social interactions during these events such as relay races where the stress of attempting to figure out when one is suppose to start one's leg of a relay can be highly contextualized and require the reading nonverbal communication.

Swimming has a plethora of benefits as a sport. It is a sport that has low impact upon the joints, and the probability of injury is minimal. Consequently, it is a sport that one can participate in throughout the lifespan. However, for individuals

on the autism spectrum, there are additional benefits. For children on the autism spectrum, the number one cause of deaths is accidents. The most frequent accident is drowning followed closely by automobile accidents (Gillberg, Billstedt, Sundh, Gillberg, 2010; Shavelle, Strauss, & Pickett, 2001). By engaging in swimming lessons individuals on the autism spectrum not only do they engage in exercise, but they also will learn important survival skills including "drown proofing." The American Red Cross and YMCAs offer swimming lessons including those adapted for individuals on the spectrum.

As noted previously, many individuals on the spectrum have issues with coordination. Bilateral coordination is particularly poor often with individuals having extreme difficulty doing motions or actions across their bodies. They frequently have a history of not crawling as infants. Crawling is a complex motor action that involves using alternative halves of the body simultaneously. As infants, this promotes bilateral integration of the brain. In swimming, the crawl (freestyle) or backstroke is one of the few motions that older individuals on the spectrum use alternating halves of the body. While swimming these strokes the right hand works simultaneously with the left leg, then the left hand conducts a stroke in coordination with the right leg. This may promote bilateral integration of the brain and improve coordination. The cardiovascular benefits of swimming are well documented.

Walking is an activity that is available to most individuals on the autism spectrum. It requires very little in terms of equipment or training. A sedentary person walks between 1,000 and 3,000 steps a day (www.walkingsite.com). The CDC recommends walking 10,000 steps a day or roughly a little less than 5 miles a day (Besser & Dannenberg, 2005). Walking 10,000 steps a day is associated with better cardiac health, reduced stress, better moods, reduced risk of diabetes, lower blood pressure, and improvements in sleep quality (VanBergeijk, 2009).

Before starting a pedometer program with individuals on the autism spectrum, an assessment of their skills should be conducted. This includes their knowledge of and ability to implement pedestrian and personal safety. Not only should crossing the street safely be taught, assessed, and reviewed but also the importance of walking with a buddy, and not using portable MP3 players set so loudly, that they cannot hear oncoming traffic and other dangers. Part of the discussion should also include wearing bright reflective clothing and not wearing hoods that might block peripheral vision. Special care and instruction should be taken around daylight saving time. In the weeks following the change to daylight saving time in the fall, dusk is the most dangerous time for pedestrians. More pedestrians are struck and killed by automobiles at this time than any other time of the year.

When selecting a pedometer, simplicity is the best guide. The more features a pedometer has, the higher the cost will be. More importantly, the more buttons a pedometer has, the more likely an individual on the spectrum will accidently reset the device causing possible frustration which can lead to him or her giving up the exercise activity. A simple pedometer with a single reset button and a protective cover is the best option. The device should also have a clip to attach the device to one's belt or waistband and an alligator clip with a tether to avoid losing the device. Some newer generation MP3 players have pedometers built in as an additional feature to the primary function as a music player.

The pedometers can also be used in combination with persons on the autism spectrums' interest in video games and other pieces of exercise equipment. Wii™ games and Wii Fit™ as well as Dance, Dance, Revolution™ can be used in combination with the pedometers to make exercise fun and engaging. Pedometers can also be used in conjunction with treadmills. They are less effective with elliptical machines and exercise bikes because of the nature of the motion and the manner in which pedometer record movement.

Setting up an incentive and monitoring program will be critical to helping instituting a pedometer program and incorporating walking into a healthy lifestyle. Using behavior modification, individuals should be rewarded for wearing their pedometers and for reaching distance milestones. Graphing the accomplishments and

publically displaying their achievements can instill a healthy sense of competition among participants. Translating the number of steps into mileage and reaching certain well-known geographic landmarks can spur the participants on. Frequent award ceremonies or check-ins are imperative in getting the individuals to incorporate the new behavior into their daily behavior. Incentives should be of interest to the participants, and they should be involved in their selection and the setting of the goals to earn the incentive. If possible, the incentives should also be reinforcing of the activity (e.g., "Million Step Club Member" t-shirts or baseball hats) can be used as incentives. Challenges and competitions can be issued between subgroups or teams or participants and staff members.

Hiking and backpacking are a natural outgrowth of walking as a form of exercise. Walking in nature can be a great stress reliever among the peace and quiet of the woods (Rudy, 2009) and is considered a perfect sport for children on the autism spectrum (Marinac, 2010). The planning of a hike should have a goal of the hiker being able to survive 72 h in the woods in the event he or she becomes lost. Seventy-two hours are the average length of time lost hikers are found by search and rescue teams. Three-quarters of lost hikers requiring search and rescue were simply conducting day hikes with no intention of spending an overnight in the wilderness. Having plenty of water as well as means of extracting and purifying water from natural sources is an essential part of prehike planning. Trail maps, a compass, fire making, and signaling gear are also essential. Orienteering skills should be taught to the individual on the autism spectrum in order for them to be able to navigate and feel a sense of control when in the woods. Hiking can be done as an individual activity or there are many hiking and conservation groups an individual with an ASD can join where organized trips are planned for the group. If an individual on the spectrum enjoys the outdoors, then kayaking, canoeing, and camping are other recreational activities worth investigating.

Traditional gym memberships are also an option for individuals on the autism spectrum who are interested in maintaining their physical fitness. Many offer running tracks, swimming pools, weight rooms, and organized fitness classes such as yoga, spinning, and cardio classes. For persons with ASDs, it will be important to review social etiquette rules in a gym such as comportment in the locker room, appropriate attire for the various areas of the workout facility, the importance of wiping down the equipment after use, turn taking with the exercise equipment, etc. For those individuals with ASDs who find routine important, gym facilities are excellent environments where they can establish and maintain an exercise routine. Newer generation gym equipment even combines the use of electronics and computers. Not only can the user watch TV, listen to music, and monitor their speed and heart rates, but they can also play video games as a part of their exercise routine. Some brands of exercise bikes (both upright and recumbent models) have a video screen where they chase a yellow jersey rider and experience riding in a peloton on a course that the rider selects. Depending on the type of course the rider selects, he or she might be rewarded by seeing a reclusive Yeti or Bigfoot character as a part of the game. With a wireless feature, riders can compete live with other exercise enthusiasts via the World Wide Web (International Fitness Holdings, 2011).

If balance and coordination are not issues, then bicycle riding on the street or on a mountain bike trail is another sport that individuals on the autism spectrum could engage in. However, the person's ability to judge traffic and danger should be assessed prior to beginning this activity. Bicycle riding can, not only be a great fitness activity, but can also alleviate the person's need to rely upon others for transportation. Again, as long as balance is not an issue, then skateboarding or surfing may be considered as a sport for the individual or a form of exercise. With these two activities, protective gear and strong swimming ability are critical.

Martial arts have also been recommended as sports that are excellent for children on the autism spectrum. Among the reported benefits are discipline, increased concentration and memory, better balance and coordination, physical fitness, and

increased self-esteem. The repeated practicing of the forms provides the individual with an ASD predictability. The added benefit of martial arts training is that the individual learns self-defense skills. Children with ASDs are often the victims of bullying and as adults are the victims of hate crimes (Sherry, 2010).

Horseback riding is a sport that has been proposed not only as a physical fitness activity but as a therapeutic intervention as well. The purported benefits of horseback riding are improved circulation, muscle control, and coordination (Baker, 2008). It is also an activity where the participants form bonds with the horses and see the direct benefits of their attempts to communicate with their mounts. A distinction is made between hippotherapy and equine-assisted activities or therapeutic riding. The main differences are who leads the activity and the cost. Hippotherapy is conducted by a licensed physical or occupational therapist. Consequently, it is considerably more expensive than therapeutic riding which is led by riding instructors. However, some medical insurance may cover hippotherapy (Baker, 2008) (see North American Riding for the Handicapped Association for a listing of accredited facilities and certified instructors).

The concept of adaptive physical education is one that is derived from the field of special education. Adaptive physical education can be written into a child's Individualized Education Plan (IEP) under the Individuals with Disabilities Education Act (IDEA). Adaptive physical education is usually taught by someone trained in physical therapy and is used for students who have difficulties with gross motor coordination problems and other types of disabilities who would have difficulty participating in standard physical education classes. Although many individuals on the spectrum have coordination issues, persons with ASDs may benefit from the social skills training aspects of APE. In these classes, the students can be explicitly taught the social rules of team sports and the methods of verbal and nonverbal communication inherent in many games.

A slightly different concept is adaptive physical activity. "Adapted physical activity (APA) is a professional branch of kinesiology/physical education/sport & human movement sciences, which is directed toward persons who require adaptation for participation in the context of physical activity" (International Federation of Adaptive Physical Activity [IFAPA], 2011). Rather than focus upon the therapeutic aspects of working with a population, this approach to sports focuses upon access and adaptation. "In contrast to physical therapies, APA is dedicated to the concepts of empowerment and ecological validity. This means that physical activity of participants is self-driven and targeted towards mastery and excellence" (IFAPA, 2011). Although originally this approach evolved from the area of physical disabilities, it is a highly individualized approach that not only involves designing and modifying equipment to maximize participation in a sport but also includes "task criteria (e.g., modifying skill quality criteria or using a different skill), instructions (e.g., using personal supports, peer tutors, non-verbal instructions, motivational strategies), physical and social environments (e.g., increasing or decreasing court dimensions; segregated vs. inclusive; type of training climate: mastery oriented, collaborative or competitive social environment; degree of peer and parental support), & rules (e.g., double bounce rule in wheelchair tennis)" (IFAPA, 2011). The philosophy of this approach is best summarized from its web site: "adapted physical activity is about individualizing instruction, matching personal strengths and interests with appropriate activities and adapting environments to promote full participation in physical activity, regardless of the population being engaged" (IFAPA, 2011).

For individuals on the autism spectrum who are truly interested in team sports, the task is to find adaptive physical activities in order to participate in sports as a physical fitness activity. Adaptive leagues are being organized in team sports such as baseball, soccer, bowling, and basketball. A keyword search using "adaptive sports leagues" in an internet browser can help identify leagues in a local area. If no adaptive leagues are available in the area, then speaking to the organizers and coaches of the local leagues may be

a strategy to determine if they have a supportive attitude and philosophy of sportsmanship to include individuals on the autism spectrum.

Adaptive physical activities have been organized for team sports but for high adventure sports as well. This can include skiing, snowboarding, and even scuba diving. With skiing and snowboarding, the individual should be assessed for balance issues and adaptations should be made accordingly. Prior to scuba diving, participants must be assessed for contraindications to scuba diving which include claustrophobia, asthma, seizure disorder, heart conditions, and potential ear problems. Scuba diving as a sport has, inherent to it, many of the same benefits as swimming but also has additional benefits. Diving teaches participants navigation skills, nonverbal communication, strong reliance on others through the buddy system, emergency management, concentration, and attention to detail (e.g., time, depth, and air consumption). Some individuals have keen interests in marine biology, and dive trips can be organized around fish and coral identification. Others have interests in history and naval architecture. Nondive time can be spent researching shipwreck sites to explore at a later date on a scuba trip. Many individuals on the autism spectrum are fascinated with computers. The computer can be used not only to research shipwreck sites but other dive sites as well. Dive computers are wrist or console-mounted devices that help a diver keep track of depth, time, and the buildup of nitrogen in the diver's body. Finally, adaptive scuba diving can be the basis for adventure travel for individuals on the autism spectrum (Strayne, 2011).

Future Directions

What sport an individual selects to maintain his or her physical fitness is immaterial. What is important is that individuals on the autism spectrum need to participate in 20–30 min of physical activity daily (just like neurotypical individuals) in order to maintain a healthy lifestyle. The risk of obesity and its negative sequelae are higher for individuals on the autism spectrum. Therefore, it is imperative that sports and other forms of exercise become a part of their daily routine. Future research should focus upon what services providers can do to help individuals on the autism spectrum develop a routine where they are engaged in physical activity including sports 20–30 min a day. From an advocacy perspective, the inclusion of individuals on the autism spectrum in sports is an ongoing effort.

See Also

- ▶ Free Appropriate Public Education
- ▶ Inclusion
- ▶ Individuals with Disabilities Education Act (IDEA)
- ▶ Special Olympics
- ▶ Travel training
- ▶ Vocational Rehabilitation Act of 1973

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SRS

▶ Social Responsiveness Scale

SSQ-R

▶ Sensory Sensitivity Questionnaire: Revised

Staff Training and Development

▶ Feedback on Provider Work Performance

Stammering

▶ Fluency and Fluency Disorders

Standard

▶ Criterion

Standard Deviation (SD)

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Definition

The standard deviation is a measurement of the amount of variance a data set has from its mean. The larger the standard deviation the greater the variance; the smaller the standard deviation the less variance exists. The standard deviation is represented by the Greek letter sigma σ.

The standard deviation is calculated by finding the square root of the variance or, in other words, finding the square root of the average of the squared deviations of each number from the mean of all the numbers.

See Also

▶ Standard Error of the Mean

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Standard Error of Measurement

▶ Measurement Error

Standard Error of the Mean

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Definition

Standard Error of the Mean refers to the error associated with estimating a mean or average score of a population, or a sample (*N*), where *N* refers to the Number of subjects.

It is defined mathematically as the standard deviation (S.D.) divided by the square root of *N*. The logic behind this simple formula is evidenced by the quick realization that the larger *N* becomes, the smaller the absolute error in estimating the true or population mean.

This same logic is used in polling undertaken in political races. When pollsters claim that the margin of error is, say, plus or minus three points and one candidate shows a lead of only 2% points, they say further that such a result must be interpreted with caution because it is "within the margin of error." The margin of error is, in turn, based upon the size of the standard error of the mean, such that the larger the standard error, the less accurate the polling results, and vice versa.

Let us now take an example of the usefulness of knowing the standard error of the mean in understanding a hypothetical level of clinician agreement in diagnosing a given child as one of the following: non-autistic; on the autism spectrum, but not meeting full criteria for autism; or meeting current DSM criteria for autism. Suppose that using the Weighted Kappa statistic (Cohen, 1968), with the corrected standard error due to Cicchetti and Fleiss (1977) and Fleiss, Cohen, and Everitt (1969), we discover the following:

The overall Percentage of Observed (PO) agreement for our two well-trained clinicians is 94%. Suppose further that the Percentage of Expected (PE) agreement turns out to be 60%. Weighted Kappa is defined as the difference between observed and expected agreement (PO − PE) divided by the maximum difference from expected agreement that is possible (100 − PE).

$$\begin{aligned}\text{This translates into: Weighted Kappa} &= (\text{PO} - \text{PE})/(100 - \text{PE}) \\ &= (94 - 60)/(100 - 60) \\ &= .85\end{aligned}$$

The level of statistical significance of a given Weighted Kappa value is determined by dividing the size of Weighted Kappa by its Standard error of the mean (S.E.). This produces a *z* score such that a value of 1.96 or higher is statistically significant at the .05 level of probability. Suppose our S.E. based upon 250 cases is .425. This produces a *z* of 2.00, which is indeed significant at the .05 level.

But how do we interpret the Weighted Kappa value of .85, for level of clinical or practical significance?

By the criteria of Cicchetti (1994), Cicchetti and Sparrow (1981), and Fleiss, Levin, and Paik (2003), the Weighted Kappa value can be considered Excellent, and by the earlier criteria of Landis and Koch (1977), a Weighted Kappa value of .85 can be considered to be almost perfect.

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Standard Normal Distribution

▶ Normal Curve

Standard Score

▶ Z Scores

Standard Scores (Z and T scores)

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Definition

Standard Scores are raw scores that, for ease of interpretation, are converted to a common scale of measurement, or z distribution, with a mean or average value of 0 and a standard deviation of 1. When sample sizes, or Ns, are small, say less than 200, standard scores are interpreted as t scores. The simple formula for calculating a z score is: Z = X – 0/S.D. in which: X= the aforementioned raw score 0= the converted average or mean score of the population under investigation S.D. = the standard deviation of

that population When the sample size is large, a z value of + or – 1.96 so-called standard deviation units is statistically significant at the conventional 5% level of statistical significance. Thus, if the difference in average adaptive behavior scores of a large group of Asperger individuals and a large group of high functioning autistic persons resulted in a z value of 2.06, we would conclude, correctly, that the high functioning group had significantly higher overall adaptive behavior scores. However, if we now inspected the average scores of the two groups and discovered that they were standard scores of 104 and 100, respectively, we would likely conclude that although the difference was statistically significant, it was of limited clinical or practical significance. One should note that in the interpretation of the meaning of IQ score levels, scores are not based upon a mean or average of 0 and a standard deviation of 1; but rather -again for ease of interpretation- upon a mean of 100 (average IQ) and a standard deviation of 15. This is true for most, but not all major IQ tests. As an application, suppose we find in another large-sample study that Asperger individuals have an average IQ of 125 as compared to the average IQ of 100 in a group of non-Asperger general population individuals; and that this was statistically significant, say, at the 1% level. The difference in the size of the two mean IQ levels would be seen to be of clinical or practical significance, as well. It has been noted that a sample size of 200 is considered large; in fact, this is often used by biostatisticians to define a large N. This is no doubt related to the simple fact that as N gets larger, the t distribution values closer and closer approximate the z distribution values. For example, e at an N of 120, a t value of 1.98 would be required for statistical significance at the 5% level,. Thus a sample size or N of 200 virtually guarantees the required z level of 1.96.

See Also

► T Scores
► Z Scores

Standardization

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Introduction and Definition

Standardization is the process by which a test is administered in a standard or uniform manner from one examinee to another, as well as from one testing milieu to another. This means the test uses a consistent set of rules or instructions to obtain performance scores that should be conceptually more reliable and valid (accurate) than would be the case if the test were administered in what might be referred to as changing or variable test administration formats – ones that could vary from one test administrator to another, and from one respondent, client, or examinee to another.

Standardization Sample

It is safe to say that the most useful standardization sample would be a large and representative one in the country or other geographic area in which the process takes place.

Standard Scores

Standard scores have exactly the same format, meaning, and interpretation as **z** scores. These scores are based upon a mean or average score of 0 and a standard deviation of 1. A score of 0 would indicate the mean or average score; while one of +1.96 would indicate a score that would be expected to be obtained by only 5% of respondents.

The same logic is used with standard test scores. Most standardized tests such as the Vineland Adaptive Behavior Scales and most cognitive or IQ tests are based upon an average or mean

score of 100, with a standard deviation of 15. By the same reasoning as was done for the aforementioned **z** score, this would mean that only 5% of those taking either one of these two tests would be expected to score as high as 115 (again, one standard deviation above the mean or average score of 100).

Interpreting the Meaning of Standard Scores, with Reference to Vineland II Adaptive Behavior Scores

The possible range of Vineland Composite or Domain scores is between more than five standard deviations *below* the mean (or a standard score of 20) to four standard scores *above* the mean (or a score of 160) (Sparrow, Cicchetti, & Balla 2005).

Classifying Levels of Adaptive Behavior on the Basis of a Knowledge of Standard Scores

As noted in Sparrow et al. (2005, p. 65), Vineland Adaptive Levels, like scores on most IQ tests, can be meaningfully classified on the basis of the size of the associated standard score. This can be illustrated, as follows:

Adaptive level:	Standard Score Range:
High	130 and above
Moderately high	115–129
Adequate	86–114
Moderately low	71–85
Low	70 and below

How Standardized Test Scores Can Be Used to Understand Autistic Behavior

It is expected that a typical pattern of functioning for a person with Asperger Syndrome would be a relatively high IQ score, with a correspondingly relatively low Vineland Socialization standard score. Thus, it would not be unusual for such an individual to have an IQ score of, say, 125 in the moderately high range; but a socialization standard score of 80, or in the moderately low range. In developing an educational plan, emphasis would be mainly on developing and applying techniques to improve interpersonal skills, since cognitive skills are at a very adequate level of functioning.

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Standardized Behavior Checklists

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Definition

Standardized behavior checklists are instruments that have consistent content, usually comprising several items. These items assess the presence or absence of behavioural or emotional acts and are usually rated on a metric to enable scoring to take place. The checklists can be self-rated, but in the ASD field they are most often completed by informants who know the person well, such as by parents, teachers, workshop supervisors, or case workers.

Standardized Scores

► T Scores

Standardized Tests

► Language Tests

Standing Balance Assessment

► Posturography

Stanford-Binet

► Stanford-Binet Intelligence Scales and Revised Versions

Stanford-Binet Intelligence Scales

► Stanford-Binet Intelligence Scales and Revised Versions

Stanford-Binet Intelligence Scales and Revised Versions

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Synonyms

Early Stanford-Binet, Fifth Edition (Early SB5); SB5; Stanford-Binet; Stanford-Binet Intelligence Scales; Stanford-Binet Intelligence Test

Description

The Stanford-Binet Intelligence Scales – Fifth Edition (SB5) – is a widely used individually administered measure of intelligence and cognitive abilities for children and adults ages 2 to 85+. Average testing time is 45–75 min to complete the full-scale IQ battery. An Abbreviated Battery IQ is available which takes 15–20 min to complete but provides a more restricted assessment of cognitive abilities. The nonverbal IQ domain which can be administered to individuals with limited language abilities, and the verbal IQ domain, which can be administered to individuals with motor and visual impairments, take approximately 30 min each to administer.

The SB5 provides a comprehensive assessment of five factors of cognitive ability: fluid reasoning (ability to solve nonverbal and verbal problems using reasoning skills), knowledge (fund of general information), quantitative processing (ability to work with numbers and solve numerical problems), visual-spatial processing (ability to see patterns, relationships, and spatial orientations), and working memory (ability to store, sort, and transform information in short-term memory), which provide a profile of differential abilities. The SB5 also contains two domain composites: nonverbal IQ (NVIQ) and verbal IQ (VIQ). The five factors are crossed with the two domains resulting in ten subtests. The five factor indexes or the two domains can combine to form the full-scale IQ (FSIQ).

The SB5 has two subtests known as "the routing subtests" which are administered at the beginning of the test to help determine an initial estimate of the examinee's abilities and to identify an appropriate developmental starting point for the remaining subtests. The nonverbal fluid reasoning subtest (object series and matrices) provides an overview of an examinee's nonverbal ability, while the verbal knowledge subtest (vocabulary) is an indicator of an examinee's verbal ability. Excluding "the routing subtests," items for all subtests are grouped into "testlets" which are arranged by five levels of difficulty for the verbal domain and six levels of difficulty for the nonverbal domain. Many of the SB5 subtests contain more than one item due to the wide range of ages and abilities that each subtest covers. During the administration of the SB5, individuals are administered a series of testlets at each level of functional ability. According to the author, the assessment of several domains in each functional level provides a broader assessment and a larger variety of tasks to maintain the examinee's interest. Some subtests are also

comprised of different types of "activities" which do not specifically conform to testlets. Activities may extend across several testlets with different levels of difficulty. The SB5 is organized into three item books, one for the routing subtests, one for the verbal subtests, and one for the nonverbal subtests.

The SB5 generates a standard score (M = 100) with a standard deviation of 15, which is different than previous versions which had a standard deviation of 16. Subtest scores have a mean of 10 and a standard deviation of 3. The full-scale IQ of the SB5 ranges from 40 to 160.

Historical Background

The SB5 is the newest version of this well-established intelligence assessment that has a long-standing and rich history. The Stanford-Binet is a descendant of the first intelligence test, the 1905 Binet scale. In 1916, Lewis Terman completed an American version of the Binet-Simon Intelligence Scale (SB1). The test was then revised in 1937 (SB2) and renormed in 1960 (Stanford-Binet Intelligence Scale, Form L-M). It was revised again in 1986, resulting in the Stanford-Binet Intelligence Scale – Fourth Edition (SB-IV). The earliest version of the test used item groupings to assess functional ability, which were arranged by levels based on order of difficulty. The 1986 version, SB-IV, changed to a subtest-based point system based on items of increasing difficulty, much like other intelligences tests such as the Wechsler scales. The SB-IV also addressed theories of *g* measuring crystallized and fluid abilities. The following is a summary of the new features of the fifth edition (Roid, 2003b; Strauss, Sherman, & Otfried, 2006):

(a) Expansion of the test to allow the assessment of very low and very high levels of cognitive ability (i.e., extensive high-end items for measuring the highest level of gifted performance and improved low-end items for better measurement of young children, low functioning older children, or adults with mental retardation)
(b) Restoration of the original toys and manipulatives for assessing preschoolers that had been removed from previous versions
(c) Increased clinical utility
(d) Updated materials
(e) Increased nonverbal items to assist with assessment of examinees with limited English, deafness, or communication disorders
(f) Increased range of domains measured by the test
(g) Enhanced memory tasks to provide a comprehensive assessment for adults and the elderly
(h) Ability to compare verbal and nonverbal performance to assist with evaluating learning disabilities

As a result of these goals and changes, several new subtests were added, but many of the classic subtests were maintained. While the SB-IV measured four factors (verbal, quantitative, abstract/visual reasoning, and short-term memory), the SB5 measures five factors (fluid reasoning, knowledge, quantitative reasoning, visual-spatial processing, and working memory). These factors are based on Cattell-Horn-Carroll theories of intelligence which posits that there are ten broad areas of cognitive ability with narrower abilities underlying these broad factors. Factors that are not measured by the SB5 are auditory processing, long-term retrieval, and processing speed. The SB5 maintained the "routing" subtest technique which was developed in the 1986 version and continues to present items according to function levels. For the SB5, both the routing subtests and functional levels were redesigned using current psychometric methods including item response theory.

Psychometric Data

Normative data for the SB5 were gathered from 4,800 individuals between the ages of 2 and 85+ and was closely matched to the 2000 US Census based on age, gender, race/ethnicity, geographic region, and socioeconomic level. The SB5 was also administered to 1,365

individuals with mental health and clinical diagnoses (e.g., ADHD, autism, developmental disability, motor impairment, mental retardation, speech/language impairment, deafness/hard of hearing, and emotional disturbance).

Internal reliability is strong for the full-scale IQ at all ages ($r = .97–.98$). Reliabilities for the nonverbal IQ and verbal IQ are also very high (mean $r = .95$ and .96). The Abbreviated Battery IQ is lower but still good (mean $r = .91$, range .85–.96). Average reliabilities for the five factor index scores are high ($r = .90–.92$). The average internal consistencies are also respectable ($r = .84$ to .89). Overall, test-retest reliability is also good. (Four groups were retested after a test interval of 5–8 days; see Technical Manual.) Full-scale IQ and verbal IQ stability was high for all ages ($r = .93–.95$). Nonverbal IQ was slightly lower ($r = .89–.93$). Abbreviated Battery IQ was also lower but still acceptable ($r = .84–.87$). Subtest and factor index test-retest reliability was generally good (>.80); however, the Working Memory Index only obtained adequate reliability in adults. Practice effects were also evaluated and considered to be minimal after a 5–8-day interval. The full-scale IQ increased two to four points, the verbal IQ increased two to three points, and the nonverbal IQ increased two to five points.

Content validity for the SB5 is based on 7 years of development which included literature review, expert advice, user surveys, factor analyses of previous versions, pilot studies, tryout edition, and item response theory modeling. Fairness of the SB5 was evaluated along gender, ethnic, racial, cultural, linguistic, exceptional group status, and religious group status. Fairness evaluation techniques included logical analyses, "offensiveness review" by expert bias reviewers from each of the groups, and various empirical techniques such as conventional item analysis, construct-related studies, and studies of fairness prediction. Based on these evaluations, the SB5 is considered a fair test across groups. Concurrent and criterion validity data were obtained using the following tests: Stanford-Binet Intelligence Scale, Fourth Edition; Stanford-Binet Form L-M; Woodcock-Johnson III; Universal Nonverbal Intelligence Test; WAIS-III; WIAT-II; WISC-III; and WPPSI-R.

Clinical Uses

The SB5 has a wide variety of uses but is generally considered to be a measure of intelligence and verbal and nonverbal cognitive abilities. SB5 scales are used in the diagnosis of conditions such as intellectual disability (all ages), learning disabilities (all ages), and developmental cognitive delays in young children. It can also be helpful in the assessment of students in programs for the intellectually gifted. Supplemental assessments are usually administered along with the SB5 to assist with assessment and diagnosis. The fifth edition of the SB is designed to provide information for interventions including individual family plans (IEPs) for young children, support from school-to-work transition planning, adolescent and adult career change, employee selection and classification, and adult workers compensation evaluations. The SB5 may also be useful in forensic contexts, as well as part of research assessment batteries investigating abilities and aptitudes. The SB5 does not measure processing speed, an important factor in the assessment of neuropsychological conditions, and therefore, the SB5 may need to be supplemented by other neuropsychological tests to assist with differential diagnoses. Clinical data on patients with traumatic brain injury and Alzheimer's is also lacking to date. The SB5 is typically administered by psychologists or trained psychometrists with supervision by a psychologist in clinical, counseling, school, or research settings. As with many psychological assessments, the overall usefulness of the SB5 is strengthened when combined with other appropriate assessments to give a well-rounded picture of the examinee.

See Also

▶ Cognitive Skills
▶ Differential Ability Scales (DAS and DAS-II)
▶ Educational Testing

- ▶ Mullen Scales of Early Learning
- ▶ Psychological Assessment
- ▶ Wechsler Intelligence Scale for Children
- ▶ Wechsler Preschool and Primary Scale of Intelligence
- ▶ Wechsler Scales of Intelligence
- ▶ Woodcock-Johnson Cognitive and Achievement Batteries

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Stanford-Binet Intelligence Test

- ▶ Stanford-Binet Intelligence Scales and Revised Versions

STAR Program

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Definition

The STAR (*S*trategies for *T*eaching based on *A*utism *R*esearch) Autism Program uses applied behavior analysis methods to teach skills in the areas of expressive and receptive language, spontaneous language production, functional routines, academic skills, play, and social interaction to children with ASD. It combines the highly structured teaching approach of discrete trial training with a more naturalistic based approach of pivotal response teaching. Its curriculum was designed to be implemented by a variety of professionals such as special educators and speech-language pathologists, as well as by paraprofessional support staff. The STAR program has three different curriculum modules chosen based on the child's current level of functioning. However, limited empirical evidence is available to support the efficacy of this program.

Historical Background

The STAR program is based on the work of Drs. Joel Arick and David Krug, who initially developed a program combining several behavioral strategies for teaching children with autism including discrete trial training, augmentative communication systems, and the teaching of independence skills. This program was utilized in local school systems. Subsequently, they published a book entitled, "Autistic and severely handicapped in the classroom: Assessment, behavior management and communication training," describing the curriculum (Krug,

Rosenblum, Almond, & Arick, 1981). In the late nineties, Drs. Arick and Krug began a collaboration with Dr. Ruth Falco and Lauren Loos. This collaboration functioned to help develop a program driven by empirically based teaching methods.

Rationale or Underlying Theory

The purpose of this program is to use research-supported strategies to teach children with autism basic skills including language, pre-academic, and social skills and functional routines. There is a highly structured discrete trial component to teach skills initially, and then a less structured, naturalistic approach is used in an attempt to generalize those stills.

Goals and Objectives

This manualized program includes three levels, each with learning goals in the areas of language, social development, academic skills, and functional routines. Each child begins the program at the level that is congruent with their current developmental skill set.

Treatment Procedures

Skills are initially taught in a discrete trial format in a 1:1 instructional setting and data are collected. Once the skill is mastered, the skill is then taught in a more naturalistic context using a pivotal response teaching method.

Efficacy Information

Limited empirical evidence is available to support the efficacy of this program. While there is evidence that supports the techniques used in this treatment approach, the program as a whole has few data to support its efficacy. The sole study examining the effectiveness of the STAR program was conducted by STAR program developers.

Outcome Measurement

Arick, Nave, and Hoffman (2004) developed the Functional Assessment and Curriculum for Teaching Everyday Routines as a measure of a student's ability to participate in classroom activities.

Qualifications of Treatment Providers

Unlike many treatment programs for children on the autism spectrum, this program is designed to be implemented by a variety of individuals including teachers, support staff, and caregivers.

See Also

- ▶ Applied Behavior Analysis
- ▶ Pivotal Response Training

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Startle Reflex

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Synonyms

Startle response

Definition

A species-specific automatic response to the sudden onset of an acoustic, visual, or tactile stimulus. This response, or reflex, is viewed as a defensive response that varies systematically with the individual's emotional state. The startle response is characterized by a fast series of muscle contractions around the head, neck, and shoulders; the sudden closure of the eyelid (i.e., eyeblink) is the first, fastest, and most reliable component of this reflexive response. The startle reflex is mediated in part by the amygdala. Strength and latency of startle reflex, or eyeblink, have been used to investigate amygdala function in various psychiatric populations with putative amygdala dysfunction (e.g., autism, anxiety).

See Also

- ▶ Eyeblink Reflexes
- ▶ Moro Reflex

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Startle Response

- ▶ Eyeblink Reflexes
- ▶ Startle Reflex

STAT

- ▶ Screening Tool for Autism in Two-Year-Olds (STAT)

State Educational Agency

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Definition

The state education agency (SEA) refers to the state board of education or other agency or officer with the primary responsibilities for oversight and supervision of public elementary and secondary schools. In cases where there is no state board or agency with the authority to conduct supervision over local education agencies (LEAs), the SEA defaults to the officer or agency designated by the governor or in state law.

See Also

- ▶ Individuals with Disabilities Education Act (IDEA)

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State of Alertness

► Optimal Arousal

Statewide Service Programs

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Definition

Definition: Integrated programs that are explicitly structured to provide, or to directly facilitate the provision of, services to a population of persons with ASD across an entire state. Statewide programs that provide services directly to clients with ASD using a relatively uniform standard of practice are very rare, and so for purposes of comparison we also describe below examples of programs that are formally mandated, designed, and/or contracted to provide *training* to service providers in a specific approach related to ASD treatment and/or education across an entire state (e.g., statewide networks for training in positive behavior supports).

For purposes of this definition, we would only consider programs formally mandated, designed, and/or contracted to provide services across a state to be truly statewide. Private, regional centers may offer excellent services across a region but, absent a formal mandate, we cannot expect them to ensure reasonable access to these services to all residents of a state.

We have also only considered programs established in the United States. Whereas many developed nations have a regional layer of service organization (e.g., départements in France, provinces in Canada, etc.), descriptions of variations from country to country in the organization of this layer are beyond the scope of this entry. Nonetheless, the range of opportunities and challenges offered by statewide service programs in the United States is likely to be comparable to those apparent elsewhere (Doehring & Becker-Cottrill, in preparation).

Historical Background

As part of the broader national trend in the United States between 1890 and 1930, many states developed specialized centers for specific populations that (it was believed) could not be easily accommodated in society: for example, state psychiatric hospitals, state schools for the deaf and for the blind, etc. The development of these centers coincided with the increasingly prominent role of the state in health and education, and was spurred by advances in treatment. Some of these centers grew to be very large, serving thousands of patients who often resided there for much of their lives. With the rise of the disabilities rights movement, the passage of Public Law 94–142, and the move toward deinstitutionalization beginning in the mid-1970s, many states moved away from a reliance on large, stand-alone centers to the development of multisite, community-based programs.

Throughout much of this period, autism remained too rare a disorder to merit its own specialized statewide centers, and we believe that this had a significant impact on the quality of services available. Moreover, because the needs of persons with autism span education and psychiatry, programs often developed in separate service systems, and persons with autism were served in other programs that often failed to recognize the full spectrum of their needs. For example, some adults with autism were served in statewide centers designed to serve adults with schizophrenia, and these programs did not always recognize and address the fundamental deficits in social and other skills of

adults with ASD. Other adults with autism were served in statewide centers designed to serve adults with intellectual disabilities and other psychiatric or conduct disorders, and these programs did not always recognize and address areas of special interest or relatively intact ability. Asperger syndrome was not yet recognized, and the persons affected often received little or no services.

Despite radical changes in the design and delivery of services at the local and the statewide level in the last two decades, the vestiges of this traditional split between educational, health, and psychiatric /behavioral health service systems are still evident in the structure and funding at the statewide level. While we have witnessed an explosion in the range of services designed more specifically for persons with ASD, these are rarely organized via a unitary, statewide structure specific to ASD. They are more often organized via loose partnerships between universities and other specialized centers, or via programs designed to meet the needs of a broader population (see below). These partnerships and programs tend to address a narrow band of the spectrum of needs, and rarely integrate services and supports across traditional service system boundaries.

Rationale or Underlying Theory

With some exceptions (described below), statewide service programs tend to be distinguished less by a specific theoretical orientation than by a structure that ensures reasonable access to services to all eligible clients across the state, or training to the providers who support them. If state agencies seek to influence local service delivery, it is usually through the training provided, or via the broad parameters embodied in licensing and certification requirements.

We describe below various approaches to statewide service delivery. While our description is by no means exhaustive, we believe that these examples characterize the range of approaches used. And while some of the specific programs cited are among the most prominent, no doubt, there are other examples of innovative and effective programs that we have not described here.

The first, and perhaps best known, statewide service program is the TEACCH (Treatment and Education of Autistic and related Communication-handicapped CHildren) program based at the University of North Carolina (UNC) (Mesibov, Shea, & Schopler, 2005). While readers seeking more information about the specific theoretical approach are referred to the entry regarding TEACCH, some characteristics regarding their model of service delivery can be highlighted here. First, TEACCH is one of the first attempts to develop and strategically disseminate a specific educational model for persons with ASD across a state using a coordinated program of training. Every year, TEACCH faculty offer comprehensive training that follows a structured curriculum, at multiple sites and including summer sessions, to increase accessibility to educators. Second, TEACCH is also one of the first attempts to take full advantage of the state university infrastructure to increase accessibility to ASD-specific training and services: In addition to its headquarters at UNC-Chapel Hill, TEACCH sites can be found on other campuses of UNC. TEACCH remains one of the few university-based consortia to have offered specific services (e.g., consultation and assessment) in addition to training, and to provide training that spans traditional public school and adult service systems.

Since the establishment of TEACCH, a number of other university-based programs have sought to provide training or services on a statewide basis. The West Virginia Autism Training Center (WV-ATC) at Marshall University was established in 1983 by the state legislature, and has since undertaken a number of statewide programs through a combination of state and federal grants. For example, the Family Focus Positive Behavior Support program was established initially in 1996 through a grant from the Centers for Disease control, and has since expanded through support from the state legislature. The project provides education specialists to facilitate collaboration between family and school and other team members in the

development and implementation of behavior support plans across the state of West Virginia (Becker-Cottrill, McFarland, & Anderson, 2003). The Indiana Autism Resource Center (IRCA), established in 1985 at Indiana University Bloomington, serves as a hub for a wide variety of training events and information about ASD. Both WV-ATC and IRCA also serve statewide needs' assessment functions as designated by their legislatures: WV-ATC established the first state autism registry, and IRCA has conducted triennial needs' assessment to inform state planning. A wider variety of university-based centers providing training across a region have been established or have increased their emphasis on ASD within the past 10 years, many of which are part of the network of University Centers of Excellence on Developmental Disabilities (see www.aucd.org).

There are other examples of statewide service and training programs that are not university based, but that grow out of agencies for public education or welfare. The Delaware Autism Program (DAP) is a consortium of public school programs that together serve the majority of students with ASD in the state (please see the entry for DAP for more information). The Commonwealth of Pennsylvania has implemented a variety of ASD-specific training programs that are primarily organized and/or funded more directly by state agencies. For example, the Pennsylvania Training and Technical Assistance Network (PaTTAN), within the department of Education, has created a network of model classrooms using the verbal behavior and the competent learner models. PaTTAN also helps to convene the National Autism Conference, which includes specific tracks for family members and professionals. The Pennsylvania Bureau of Autism Services was established within the Department of Public Welfare in 2003 to fund and coordinate a wide variety of statewide training and service programs. Many of these specifically complement education-based services by focusing on adults with ASD, or community-based early identification and behavioral support. In general, the most common statewide training programs impacting ASD would be those addressing the implementation of positive behavior supports; though not specific to ASD, these have great potential because challenging behaviors are perhaps the most likely reason for persons with ASD to be excluded from public schools and other community-based settings.

More recently, a number of federal grant-funded programs have sought to disseminate training in a coordinated way at a statewide level. The National Professional Development Center for Autism (NPDC), funded by the Office of Special Education Programs, U.S. Department of Education, currently involves the collaboration of the University of North Carolina at Chapel Hill (Frank Porter Graham Child Development Institute), the University of Wisconsin (Waisman Center), and the University of California at Davis (M.I.N.D. Institute). The NPDC supports the development of ASD programs within the public schools by helping states to create statewide teams. These teams create model classrooms and develop training programs within their state. The Act Early Campaign orchestrated by the Centers for Disease Control (Daniel, Prue, Taylor, Thomas, & Scales, 2009) has sought to create cross-agency statewide teams to identify opportunities to improve early detection and intervention in ASD.

Goals and Objectives

In addition to the goals and objectives set by individual clients and their caregivers, the goals most distinct to statewide service programs are those intended to make designated services directly accessible to the full range of eligible clients. In some cases (e.g., early education and intervention services), specific regulations mandate the rapidity with which such services are provided. Consistent with research documenting disparities in early identification and various aspects of intervention (Liptak et al., 2008), we would expect that some statewide service systems may face significant challenges when trying to ensure equal access for individuals and families from racial and ethnic minorities, at or near poverty level, and from rural regions.

Treatment Participants

Eligibility requirements vary from program to program, and usually reflect the general criteria for accessing the service (e.g., only individuals between 3 and 21 years of age are eligible for services provided or funded via public schools). Because publicly funded statewide service programs are otherwise often designed, if not explicitly mandated, to be freely accessible, eligibility criteria are kept to a minimum. Some of the training programs (e.g., PBS) are intended to support a broad range of children and adolescents.

Treatment Procedures

Recommended treatment procedures reflect the specific focus of the training or service program.

Efficacy Information

While there may be data regarding the efficacy of specific treatment procedures employed or recommended by statewide service programs, there are at present no data that clearly demonstrate the specific efficacy of statewide service programs in providing or facilitating the use of these treatment procedures across a sample of clients that is representative of the population of the state.

Outcome Measurement

While outcome measures for specific treatment procedures employed or recommended by statewide service programs may be described elsewhere, there are at present no models for defining the acceptable outcomes for statewide service programs per se. Statewide service programs seeking to evaluate outcomes related to access could estimate the proportion of eligible individuals who receive services, or who experience significant barriers in accessing services.

Qualifications of Treatment Providers

ASD-specific qualifications for service providers are rarely defined for a specific statewide service or training program. Regulations established by the state for specific categories of providers (e.g., special education teacher certification, psychologist licensure, etc.) usually represent minimal criteria, and rarely reference ASD-specific competencies. Exceptions include ASD teacher certification requirements or endorsement opportunities implemented in several states with statewide service programs (e.g., teachers in the Delaware Autism Program must complete a graduate-level teaching certificate in ASD to continue teaching students with ASD). The increasing recognition of behavior analysts by state licensure boards, the growing consensus that Board Certification is a minimal entry criteria, and the central role played by behavior analysts in treatment, all suggest that ASD-specific competencies are likely to be first established by states for behavior analysts.

See Also

- ▶ Board Certified Associate Behavior Analyst
- ▶ Delaware Autism Program
- ▶ Positive Behavioral Support
- ▶ Regional Centers

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Statistical Approaches to Subtyping

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Definition

Subtyping or *clustering* is a type of data analysis that seeks to assign elements of a set into groups, or clusters, that are similar (in some sense) to each other, but different from elements in other clusters. It is distinct from *classification*, in which one or more group labels already exist and the algorithm attempts to explain these labels using observed variables; instead, clustering procedures attempt to create such labels from the observed variables directly. For this reason, classification methods are sometimes called "supervised" methods because there are group labels available to "supervise" the partitioning of the data, while clustering methods are termed "unsupervised" because no such labels exist.

Historical Background

As long as there has been data, there has been a desire to find subtypes within data. The historical roots of this emphasis can be seen in taxonomy, where the interest in clustering species into different phylogenic categories extends back to ancient Greece. However, the statistical approach to subtyping is a relatively recent phenomenon, made possible primarily by the modern computer, which made numerical analysis of large datasets possible. Since then, there has been increasing interest in searching for and understanding subtypes in a wide variety of scientific disciplines, including psychology, where the subtyping of individuals based on their measurements on psychological markers and the categorizing of different types of psychiatric disorders have been frequent topics of research.

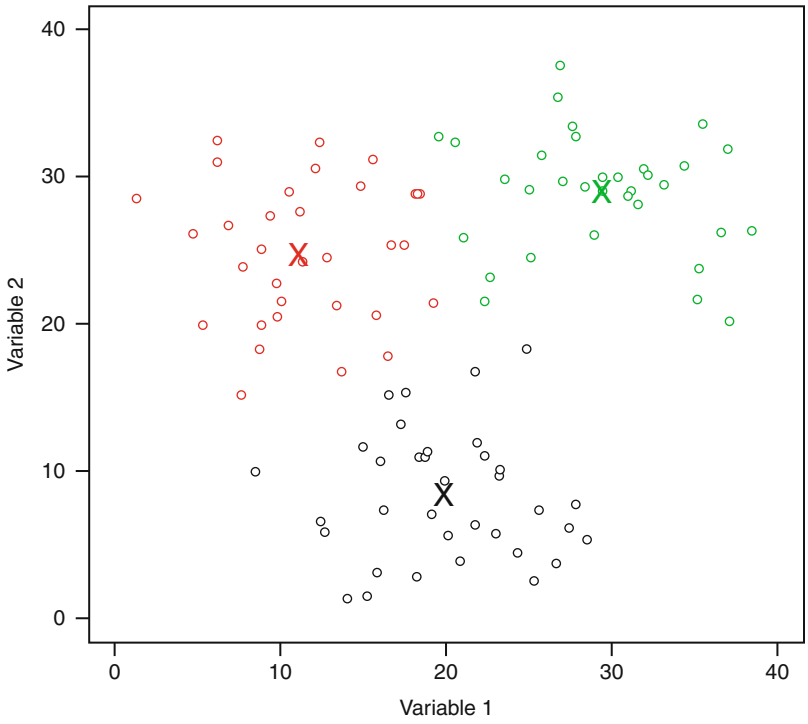
Current Knowledge

Three of the most popular and useful approaches to clustering are *k*-means, mixture modeling, and hierarchical clustering. They are all readily available in common statistical software packages such as SPSS, SAS, and R.

K-Means

K-means is a popular clustering algorithm that assigns observations to clusters based on how close they are to cluster centers. The algorithm takes the data in matrix form, with the n observations as rows and the p variables/measurements as columns, and computes distances from each observation to each of k cluster centers using Euclidean distance, the classic distance formula taught in school. *K*-means then assigns each observation to its closest center, recalculates the k cluster means (hence the name), and repeats this back-and-forth process until the cluster assignments do not change anymore and the algorithm has "converged." An example of a set of clusters obtained via *k*-means with two variables, 100 data points, and $k = 3$ clusters is shown in Fig. 1.

The *k*-means algorithm is computationally very fast, and the clusters it provides tend to be roughly comparable in size and shape. It requires specification of the number of clusters (see section "Determining the Number of Clusters," below), and making the wrong choice can yield poor clustering results. Also, because it uses Euclidean distance, it works best when all measurements are on the same scale, or else the variable with the largest range will dominate the distances between points; the data can always be scaled to adjust for this, however. Another



Statistical Approaches to Subtyping, Fig. 1 *K*-means results using $k = 3$ on a sample two-dimensional dataset with 100 observations, with the clusters differentiated by color. The X's indicate the centers of each cluster

limitation is that *k*-means is not designed to handle categorical measurements (because the distance between categorical labels, e.g., "Yes," "No," and "Maybe," is undefined).

Mixture Modeling

A broad set of clustering methods are collectively known as *mixture models*. In these methods, a number of "latent" or unknown subgroups are assumed, and a probability distribution for each subgroup is specified. For example, the observations from each cluster may come from a multivariate Normal distribution, with an unknown mean and standard deviation. Then, for each observation, the model can calculate the probabilities of belonging to each cluster: 90% for Cluster 1, 5% for Cluster 2, etc. The final cluster assignment for each observation is chosen as the cluster with the largest probability.

Mixture models have a lot of advantages. First, unlike in *k*-means where clusters tend to be compact and circular in shape, the latent clusters found in a mixture model can take any arbitrary shape, which provides a lot of freedom for the researcher. Second, the cluster assignments in *k*-means and other methods are absolute – an observation either belongs to a given cluster or it does not, and each observation can only belong to one cluster at a time. In mixture modeling, on the other hand, there is a measure of uncertainty in the cluster assignments, so if an observation is on the border between two cluster regions, it can have a 50–50 chance of belonging to either one. This can be very helpful in understanding how well the cluster assignments describe the data, and in identifying outliers that do not fit easily into any of the clusters.

Like other clustering algorithms, mixture models require you to specify the number of clusters, *k*. In addition, they also require that the distributions of each cluster be specified as well, which can yield a poor fit to the data if they are chosen incorrectly. While this can make the use of mixture models somewhat more complicated, the added complexity also allows clustering of more interesting and complex types of data, such as longitudinal data. By placing certain assumptions on the correlations between variables, mixture modeling can find clusters in sets of curves;

popular variants of mixture modeling that do this are latent cluster analysis and latent trajectory analysis, and they have extensive applications to the longitudinal analysis of autism spectrum disorders.

Hierarchical Clustering

Methods like *k*-means build their clusters by calculating the distance of each cluster to some cluster center. The cluster centers are not observations themselves, they are just arbitrary points. Alternatively, one could build clusters by grouping together observations that are close to each other, and far apart from the others. This is the strategy employed by hierarchical clustering.

The hierarchical clustering algorithm takes the set of all pairwise distances – distances from every observation to every other observation – and merges observations together into sets if they are very close to each other. The two closest observations get merged first, followed by the next two, and so on. The algorithm also needs one other piece of information: instructions on how to define the distance from a set to other observations (or other sets), given the pairwise distances. This piece is called the *linkage criterion*, and there are many to choose from. Using *single linkage*, the distance from an observation to a set is the minimum distance to any of the members of the set – two sets are close if they have a "single link" making them close together. *Complete linkage* instead uses the maximum distance to any member of the set, and two sets will be close under this criterion only if every pair of observations is close to each other. *Average linkage* attempts a compromise between single and complete linkage, and averages the minimum and the maximum distances. Ward's method takes a different approach, and combines the observations/sets together that give the smallest increase in variability by merging, so that each new cluster has the smallest possible variance.

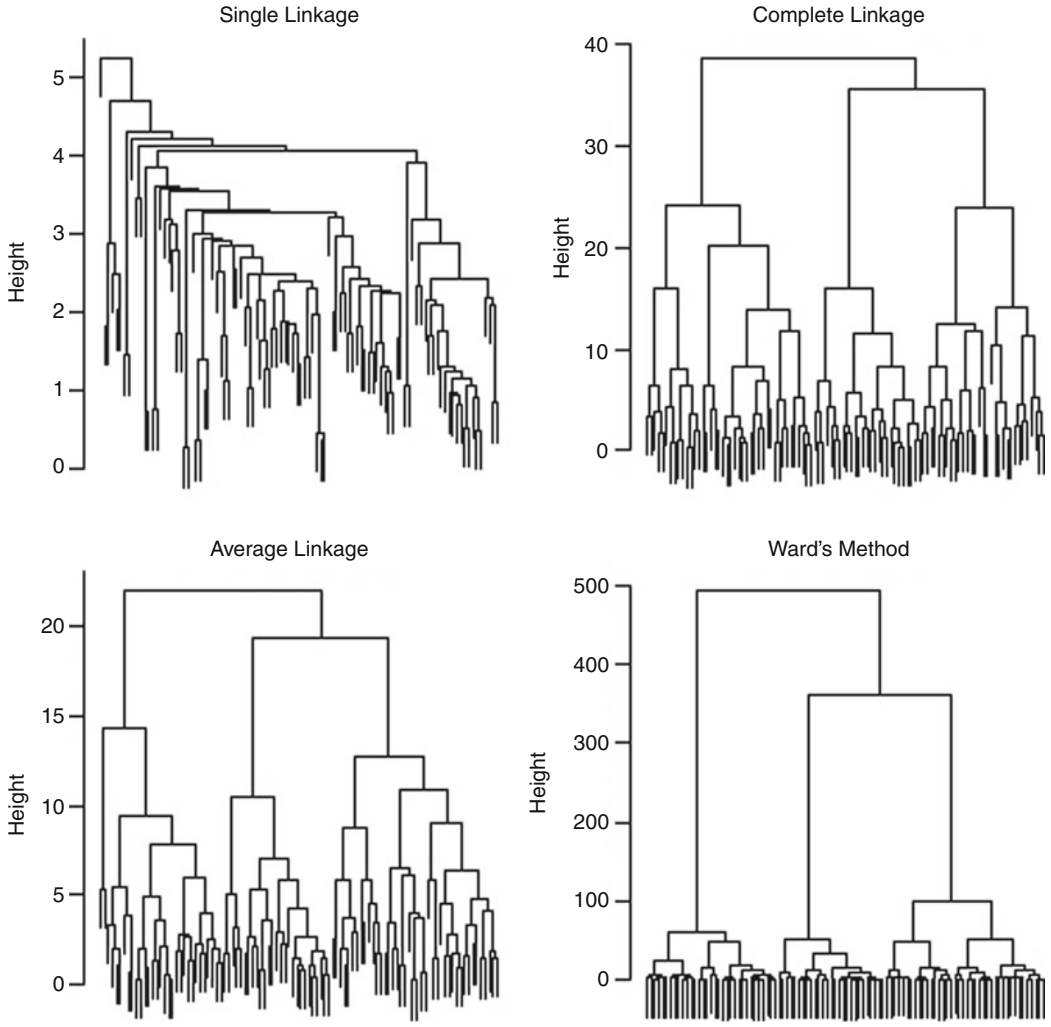
Hierarchical clustering continues combining sets until all observations have been merged into a single, all-encompassing cluster. The end result is a *cluster tree* or *cluster dendrogram* made up of nested sets of clusters, where a pair of clusters is merged to give the cluster solution with one fewer label. As such, it provides the cluster solution for all values of k simultaneously, although it is still up to the researcher to determine which value of k to choose. Examples of cluster trees using four different linkage criteria are shown in Fig. 2.

Determining the Number of Clusters

Determining the "correct" number of clusters is one of the most difficult aspects of clustering. Because there is no known "true" grouping in the data (if there were, clustering analysis would not be necessary), there is no way to know how correct any clustering result actually is, and instead alternative means of assessing the validity of a clustering result must be used. Such methods can be internal, by looking at the statistical differences between clusters on the same variables used to make the clusters, or external, by relying on other variables not included in the clustering analysis to validate the clusters.

Choosing the number of subgroups using internal aspects of the cluster solution is commonly done by means of a *scree plot*. A scree plot graphs the number of clusters, k, on the x-axis, and a measure of variability or dispersion of the data on the y-axis. Typically the y-axis is the *sum of squares*, which is an unscaled version of the sample variance. An example of a scree plot is given in Fig. 3. When $k = 1$, the sum of squares gives the default amount of variability in the data; for larger values of k, the sum of squares will be smaller because the clusters explain some of this variability. The scree plot shows how much explanatory power (measured by a drop in variability) is gained by each additional cluster, with big drops in variability for the first few clusters, but much smaller drops as more and more clusters are added because much of the variability is already captured by earlier clusters. A scree plot can suggest the best choice of k if it displays a "kink" or "elbow," where the marginal benefit of adding more clusters is relatively small and a more parsimonious clustering is preferable.

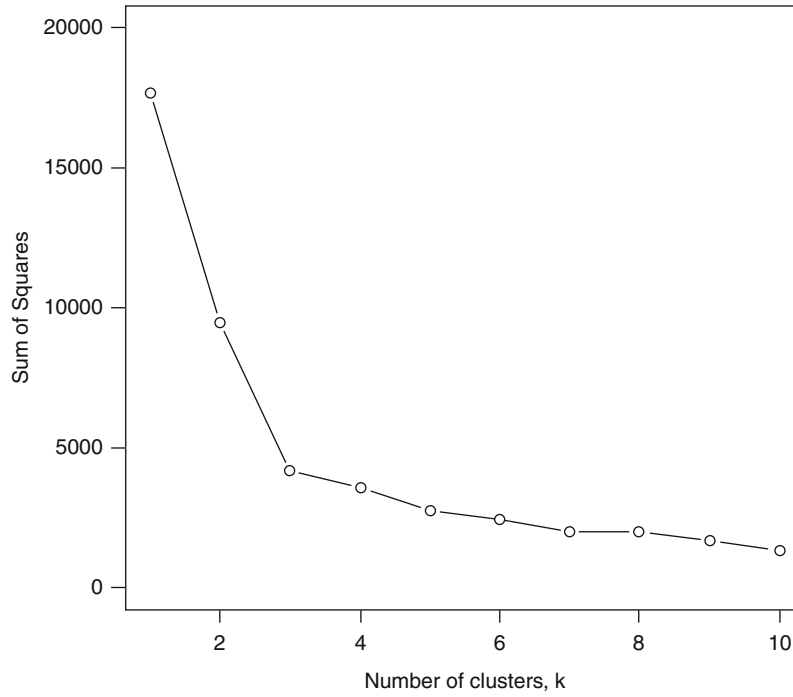
External information can also be very useful in choosing the preferred number of clusters. A set of clusters can be validated though hypothesis



Statistical Approaches to Subtyping, Fig. 2 The results of hierarchical clustering using four different linkage criteria on the same dataset used in Fig. 1. Notice that single linkage tends to produce many tiny clusters, while average linkage and Ward's method favor larger groups. While the overall tree structures are markedly different, on this particular dataset complete linkage, average linkage, and Ward's method give nearly the same subgroupings if the tree is cut into three clusters. This is because the data strongly displays a three-cluster structure, as seen in Fig. 1

testing, e.g., comparing differences in means between clusters using Student's *t*-test (for two clusters) or an analysis of variance (for three or more clusters). Statistically significant differences between some or all of the clusters on variables not used in the clustering algorithm can indicate meaningful differences between the subgroups. If some clusters do not exhibit statistically significant differences from each other, then they can perhaps be merged together. Care should be taken not to read too much into differences among the variables used to create the clusters, however, because the clustering procedure is designed to maximize differences on these variables, so they cannot serve as outside sources of validation.

Ultimately, the determination of the number of clusters is an art, not a science, and the strategies described here should be treated as rules of thumb. While scree plots and hypothesis tests can



Statistical Approaches to Subtyping, Fig. 3 A scree plot showing the decreasing sum of squares with increasing k, using k-means on the same data as in Fig. 1. Notice the "kink" at $k = 3$, suggesting three subgroups in the data

give some insight into the right number of clusters, equally important are the principles of parsimony and interpretability. If two clusters appear different on a few variables but not others and are small in size, then they can (and perhaps should) be merged to give fewer subgroups that are easier to understand. Choosing between five and six subgroups, for instance, is far less important than understanding what these subgroups represent to the researcher and to his or her scientific field.

Future Directions

The subtyping methods described here work well for datasets in which the number of variables, p, is relatively small compared to the number of observations, n. When the number of variables is much larger than the number of observations, the data is said to be *high-dimensional*, and these methods may become computationally slow, or fail to give satisfactory results at all. Such datasets are increasingly more common in genetics and eye-tracking studies, so statistical research is currently ongoing to develop subtyping methods that work well in the high-dimensional setting. A few of these newer methods are subspace clustering, projected clustering, and correlation clustering.

See Also

- ▶ Asperger Syndrome
- ▶ Autism
- ▶ Broader Autism Phenotype
- ▶ Pervasive Developmental Disorder Not Otherwise Specified

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Statistical Significance

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Definition

Statistical vs. Clinical Significance: Statistical significance means simply that a result in a given comparison occurs beyond what one would expect by chance alone. Here, and by accepted convention, a comparative result is declared statistically significant if it occurs at or beyond the 5% level. By simple subtraction, this means that there is a 95% possibility that the result did not occur by chance.

The caveat here, and one that many journal editors and even some unenlightened biostatisticians fail to grasp, is that given a large enough number of cases or N, a given comparative result will inevitably occur *beyond chance*, at the 5% level of statistical significance.

In order to guard against this so-called big N phenomenon, enlightened biostatisticians have devised guidelines for defining a result as having reached a level of clinical, as well as statistical significance.

A concrete example, albeit an apocryphal one, can be derived easily from the field of autism spectrum research.

Suppose an inexperienced clinician on a scale of 0–100% agrees with the diagnosis of childhood autism, in 500 cases at 10%. With such a large N of cases, the result turns out to be statistically significant with a chance probability at the scientifically acceptable level of 5%.

Well, any self-respecting autism expert would tell you that 10% chance-corrected agreement, from a clinical perspective, is poor or trivial.

Clinical significance to the rescue comes in the form of a set of clinical criteria developed by Cicchetti and Sparrow (1981) by which:

- Agreement Clinical
- Level of significance:
  <40%, Poor
  40–59%, Fair
  60–74%, Good
  75–100%, Excellent

See Also

► Clinical Significance

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Stay-Put Requirement

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Synonyms

Placement-pending requirement

Definition

In General

"Stay-put requirement" refers to a provision in the Individuals with Disabilities Education Act (IDEA) (20 U.S.C. § 1415(j) (2011) that gives a child the right to "stay put" in his or her current educational placement pending resolution of a dispute between the child's parents and the school district. Under the IDEA, school districts must provide special education and related services to "children with disabilities," which specifically includes children with autism. When parents and the school district cannot agree on the special education and related services provided to a child, parents and the school district have the right to file a "due process" complaint requesting a hearing before an impartial hearing officer. Once a due process complaint is filed, the child must "stay put" unless the parents and school district agree otherwise (or unless the school district places the child in an "interim alternative educational placement"). For example, if a school district notifies the parents of a child with autism that their child is no longer eligible for special education and related services, the parents have the right to file a due process complaint. Under the IDEA's stay-put requirement, the child will continue to receive special education and related services pending resolution of the dispute. Similarly, if a school district notifies the parents of a child with autism that the district wants to remove the child from a private special education placement and place the child back in the public schools, and if the parents disagree, the parents have the right to file a due process complaint and invoke "stay put" pending resolution of the dispute.

In the Disciplinary Context

The stay-put requirement has special importance in the disciplinary context. If a child with a disability violates a code of student conduct, school districts are free to suspend the child for up to 10 consecutive days. The rules governing discipline of children with disabilities for *more* than 10 consecutive days are complex. Generally speaking, if a school district determines that the child's misconduct was not a "manifestation" of his or her disability, the district may expel a child with a disability or suspend the child for more than 10 consecutive days so long as it provides educational services in an alternative setting. (If the misconduct involves weapons, drugs, or serious bodily injury, the school district may suspend the child for up to 45 days even if his or her behavior *was* a manifestation of his or her disability.) Importantly, in the disciplinary context, the filing of a due process complaint does not require that the child "stay put" in his or her "predisciplinary" placement. Rather, the child will remain in his or her alternative educational placement pending resolution of the dispute.

See Also

- ▶ Due Process
- ▶ Individuals with Disabilities Education Act (IDEA)
- ▶ Special Education

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Stelazine™

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Steps

▶ Objective

Stereotyped Movement Disorder

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Synonyms

Repetitive behavior; Self-injurious behavior; Self-stimulatory behavior; Stereotypy

Short Description or Definition

Stereotyped movement disorder (SMD) refers to motor behaviors characterized by repetition of the same movements that are seemingly driven and which have no obvious purpose or function (APA, 2000, DSM-IV TR). Prior to 1994, SMD was referred to by the American Psychiatric Association as stereotypy/habit disorder. Examples of SMD-related behaviors include hand flapping, body rocking, head rolling, twirling or spinning objects, as well as behaviors that can be self-injurious (e.g., self-hitting, head banging, self-biting). To meet diagnostic criteria for SMD, the behavior needs to interfere with normal activities or result in injury requiring medical treatment and last longer than 4 weeks. Additional criteria require that if mental retardation (currently intellectual and developmental disability) is present, the behavior must be of sufficient severity to become a focus of treatment. In addition, to warrant the diagnosis of SMD, the behavior is not better accounted for by a compulsion (obsessive-compulsive disorder), tic (tic disorder), or stereotypy that is part of a pervasive developmental disorder (PDD) or is not hair pulling (trichotillomania). Finally, the behavior should not be due to the effects of a substance (e.g., a psychostimulant like amphetamine or cocaine) or general medical condition.

In the proposed DSM-V, the relevant work group is recommending that SMD be classified as a neurodevelopmental disorder or an anxiety and obsessive-compulsive spectrum disorder. In addition, in the case of self-injurious responding, the behavior will likely no longer require medical treatment to meet diagnostic criteria. In addition, specification of 4 weeks or longer duration and the requirement that the stereotyped behavior be the focus of treatment will likely not be required for the diagnosis to be made. Instead, the behavior will need to result in clinically significant distress or impairment in important (e.g., social, occupational) areas of functioning (Stein et al., 2010). As in DSM-IV, the stereotypy cannot be consequent to the use of a particular drug or substance or restricted to the

symptoms of another disorder (e.g., autism spectrum disorder or ASD, trichotillomania).

The hierarchical exclusion criteria operative in DSM-IV precludes the diagnosis of SMD if stereotypy is part of a pervasive developmental disorder. With regard to ASD, however, SMD maps on to what has been characterized as the "lower order" or repetitive sensory-motor behavior factor of restricted, repetitive behavior (e.g., Szatmari et al., 2006). Repetitive sensory-motor behaviors are more characteristic of younger or lower functioning individuals with ASD.

Categorization

The SMD diagnosis is most frequently associated with intellectual and developmental disability (IDD), with the occurrence of stereotyped and self-injurious behavior being inversely correlated with degree of intellectual disability (Bodfish & Lewis, 2002). Despite this, there has been little or no attempt to ascertain SMD in this population based on the diagnostic criteria reviewed in the previous section, particularly the criterion specifying that stereotyped behavior be the focus of treatment. In individuals with intellectual disability, SMD involving SIB is frequently accompanied by forms of self-restraint (e.g., binding hand or arms in clothing) designed to avoid self-injury, although self-restraint is only temporarily effective (Powell, Bodfish, Parker, Crawford, & Lewis, 1996). The available evidence suggests little difference in form or pattern between repetitive motor behaviors in ASD and IDD, although the frequency appears to be higher in the ASD group (Bodfish, Symons, Parker, & Lewis, 2000).

There is growing evidence of the applicability of the SMD diagnosis in non-developmentally delayed individuals (Singer, 2009). These stereotypies have been referred to as "primary" stereotypies or "physiological" stereotypies to distinguish them from those associated with a specific clinical disorder. It should be noted, however, that SMD appears to be comorbid with hyperactive behavior or attention-deficit problems as well as anxiety or affective problems. Although there has been little systematic attempt to differentiate stereotyped motor behavior in non-developmentally disabled individuals versus those with autism and related neurodevelopmental disorders, there seems to be considerable overlap in topographies or forms.

Stereotyped motor behavior has also been documented as a common consequence of psychosocial deprivation such as being reared in institutional environments (Bos, Zeanah, Smyke, Fox, & Nelson, 2010), severe sensory deficits such as blindness, traumatic brain injury, and dementia, particularly the frontotemporal variety. In addition, stereotyped motor behaviors are commonly observed among typically developing young children. These developmentally appropriate behaviors include thumb-sucking, body rocking, hand flapping, and even transient head banging. These behaviors are self-limited and rarely result in tissue damage. The factors contributing to the progression of normative stereotyped behavior in infants and toddlers to persistent, developmentally inappropriate stereotyped motor behavior are unknown. The frequent expression of topographically similar forms of stereotyped behaviors in typically developing children presents an important challenge to identifying potential SMD in non-developmentally delayed children.

Epidemiology

Prevalence estimates for individuals who meet DSM diagnostic criteria for SMD are not available. There have been attempts, however, to estimate the rates of stereotypy and SIB in samples of individuals with IDD and in non-IDD individuals with "primary" or "physiological" stereotypies. In the former case, stereotypies have been observed in up to 80 % of individuals with severe or profound intellectual disability residing in a state residential facility (Bodfish et al., 2000) whereas much lower rates (10–20 %) have been observed in individuals who

live in the community and have milder intellectual impairment. Self-injury is less common, being observed in 20–25 % of individuals who are institutionalized and have severe or profound mental retardation (Bodfish et al.) whereas overall SIB rates vary from 4 % to 10 % (Arron et al., 2011). Interestingly, SIB rates ranging from 45 % to 93 % have been reported for individuals with specific genetic syndromes including fragile X, Angelman, cri du chat, Cornelia de Lange, Prader-Willi, Lowe, and Smith-Magenis (Arron et al.).

The prevalence of complex motor stereotypies in a non-developmentally disabled population has not been established. In a retrospective study of referrals to pediatric neurology-movement disorders clinic, 100 children were identified with persistent "primary" or "physiological" stereotypies. Of these children, 62 % were boys, age of onset was 24 months or younger in 80 % of cases, and about half displayed comorbid conditions (ADHD, tics, OCD). Castellanos, Ritchie, Marsh, & Rapoport (1996) identified 12 non-IDD adults who met DSM-IV criteria for SMD. Body rocking or thumb-sucking was present in 8 of these 12, and a lifetime history of an affective or anxiety disorder was found for 11 of 12 SMD individuals. A family history of stereotypies, anxiety or mood disorders, tics, and ADHD has also been documented in non-IDD individuals exhibiting complex motor stereotypies (Harris, Mahone, & Singer, 2008).

Natural History, Prognostic Factors, and Outcomes

Little is known about the developmental timing of the transition from normative to pathological stereotyped behavior. In addition, little is known about environmental, behavioral, or genetic factors that influence or predict the developmental progression of stereotyped behaviors. It does appear, however, that when stereotypies persist beyond what is expected in typical development, they are usually chronic, although not worsening over time. In individuals with ASD, there is some evidence that repetitive sensory-motor behaviors decrease across development (Esbensen, Seltzer, Lam, & Bodfish, 2009; Richler, Huerta, Bishop, & Lord, 2010).

Unlike tics or OCD, stereotypies do not appear to have a natural history of waxing and waning. Stereotypies can be interrupted, however, and may vary in frequency depending on the emotional state of the individual. The factor most predictive of a diagnosis of SMD is IDD, with severity of SMD varying with intellectual impairment. Boys are more likely than girls to develop the disorder with other predictive factors being early psychosocial deprivation, profound sensory impairment, a family history of stereotypies, tics, compulsions, or ADHD, and a comorbid disorder that includes tics, OCD, or ADHD. There is no evidence for birth history being a predictive factor.

Clinical Expression and Pathophysiology

Repetition of invariant sequences of behavior that appear to serve no obvious purpose has long been considered an important dimension of psychopathology. Abnormal repetitive behavior is part of the clinical presentation of a variety of disorders including ASD, OCD, Tourette syndrome, IDD, frontotemporal dementia, schizophrenia, Parkinson's disease, and substance abuse. Such behaviors have been labeled as stereotypies, compulsions, rituals, obsessions, punding, complex tics, self-stimulatory behavior, habits, and perseveration. SMD is more circumscribed, however, and refers to discrete motor responses such as body rocking, head rolling, finger flicking, hand flapping, and repeating the same words or phrases. In some cases, the stereotypy will involve repetitive object manipulation such as spinning or twirling a toy or household object. Other topographies are associated with self-inflicted tissue damage including head banging, biting, head or face slapping, and eye poking. In individuals

with IDD, stereotypies can occupy a great deal of the individual's time and interfere with ongoing habilitative efforts and activities. SIB can be quite severe with potential loss of digits or lips from self-biting (e.g., Lesch-Nyhan syndrome) to delivery of self-inflicted blows to the head that have the force of a boxer's jab (Newell, Challis, Boros, & Bodfish, 2002).

Beyond its general association with IDD, specific forms of SMD have been associated with specific genetic syndromes: skin picking in Prader-Willi syndrome; self-biting of the lips and fingers in Lesch-Nyhan syndrome; midline hand clasping in Rett syndrome; and hand flapping in fragile X syndrome to name but some (Lewis & Kim, 2009). Understanding the pathophysiology of these genetic syndromes will help inform the neural bases of SMD.

There is only one postmortem study that has linked SMD with a specific neuropathological finding (Lloyd et al., 1981). In this report of three Lesch-Nyhan cases, severe SIB was associated with markedly reduced striatal dopamine concentrations. Later, positron-emission tomography (PET) studies confirmed the loss of dopamine innervation to striatum in Lesch-Nyhan patients (Ernst et al., 1996; Wong et al., 1996). A number of clinical and animal model studies have provided additional support for the importance of alterations in basal ganglia dopamine function in stereotypy and SIB (Turner & Lewis, 2002). Neuroimaging findings in ASD have linked repetitive behavior to altered caudate volume although this association involved "higher order" behaviors reflecting resistance to change or insistence on sameness not sensory-motor repetitive behaviors. Kates, Lanham, and Singer (2005), however, compared boys with stereotypies but no other known neurological or neurodevelopmental disorder with matched controls. Decreases in frontal white matter were observed in the stereotypy group even after controlling for total white matter. Caudate volumes did not differ between groups, however, after taking total brain volume into account.

Much of what we know about the pathophysiology of stereotyped motor behaviors comes from studies using various animal models (Lewis, Tanimura, Lee, & Bodfish, 2007). These models can be categorized as induction of stereotyped behavior by (1) targeted CNS insults, (2) pharmacological agents, and (3) environmental restriction or deprivation. These models generally support a preeminent role for alterations (dopaminergic and non-dopaminergic) in cortical-basal ganglia circuitry in the expression of stereotyped behavior. This circuitry involves projections from select areas of cortex to striatum and then on to other basal ganglia (globus pallidus, substantia nigra), then to thalamus and finally back to cortex. At least three parallel but interacting loops have been identified that make up this cortical-basal ganglia circuitry: the motor, limbic, and associative loops. Of these, the motor loop appears to be the best candidate for mediation of SMD. This loop involves both a direct and indirect pathway from striatum back to cortex. Dysregulation of cortico-striato-thalamocortical circuitry associated with motor disorders is thought to be due to an imbalance between the direct and indirect pathways comprising this circuit. Recent evidence from an animal model suggests that decreased activity of the indirect pathway is associated with higher levels of stereotyped behavior (Lewis & Kim, 2009). A review of relevant animal models suggest that stereotyped and self-injurious behavior can result from a variety of perturbations (e.g., drugs, lesions, gene deletions) to this cortical-basal ganglia circuit.

Evaluation and Differential Diagnosis

As SMD should not better be accounted for by a compulsion, tic, or PDD-related stereotypy, careful assessment of the individual will be required to assess the presence of these other disorders. In addition, given the high prevalence of SMD in developmentally disabled individuals, careful assessment of IDD is also required. The diagnosis of SMD may be particularly challenging with regard to differentiation from complex motor tics. Stereotypies, however, typically have an earlier age of onset than tics; involve hands

and arms versus face, head, and shoulders; and tend to be longer in duration and often rhythmic in expression. Careful attention should also be paid to assessment of conditions reported to be comorbid with stereotyped motor behavior (e.g., tics, ADHD, OCD). It will also be critical to differentiate developmentally appropriate and developmentally inappropriate stereotyped movements.

Although there is no "gold standard" diagnostic assessment tool for SMD, there are specific instruments designed to assess stereotyped and other repetitive behaviors. One of the more useful is the Repetitive Behavior Scale-Revised (RBS-R; Bodfish et al., 2000) which includes stereotypy and SIB subscales. The RBS-R is an informant-based rating scale with good psychometric properties that provides for both an endorsement of specific forms of stereotyped and self-injurious behavior as well as ratings of intensity or severity of each item. Other options for assessment include the Childhood Routines Inventory (CRI; Evans et al., 1997), which includes items that load on a "just right" factor and a "repetitive activities" factor, and the Repetitive Behavior Questionnaire (RBQ; Arron et al., 2011), which has been used to examine stereotypy and self-injury in a number of genetic syndromes. Observational measures have also been used to provide more detailed assessments of frequency and duration.

Treatment

Both behavioral and pharmacological interventions have been used to treat stereotyped and self-injurious behavior. With regard to psychotropic medication, the two drug classes most commonly employed include atypical antipsychotics (e.g., risperidone) and selective serotonin reuptake inhibitors (SSRIs; e.g., fluoxetine). A recent multisite study of the SSRI citalopram provided no evidence for its efficacy in treating repetitive behavior in autism (King et al., 2009). There is limited evidence for the utility of atypical antipsychotics in treating stereotyped and self-injurious behavior. Risperidone, the most widely studied drug in this class, appears to have some efficacy for SMD but may be better suited to the treatment of irritability and aggression. In addition, risperidone carries the risk of adverse effects including weight gain and metabolic syndrome. Aripiprazole appears to be useful in the treatment of stereotypies, but significant adverse effects have also been reported. Finally, the opiate antagonist naltrexone has been used in the treatment of self-injury, but reports are mixed as to its efficacy.

Behavioral treatments for SMD are generally based on operant learning principles and administered by behavior analysts (Rapp & Vollmer, 2005). These interventions often follow completion of a functional analysis of the stereotyped or self-injurious behavior which is designed to identify existing socially mediated consequences that maintain the behavior. An example of such an assessment might show that whereas stereotypy is not affected by socially mediated consequences, the self-injury of a particular individual results in either attention or escape from demands and is thereby reinforcing. Alternative appropriate behaviors designed to result in attention or escape can then be shaped and reinforced. This strategy is referred to as differential reinforcement of other (or alternative or incompatible) behaviors (DRO/DRA/DRI). This treatment can also be used in conjunction with response interruption. Another intervention strategy is functional communication training (FCT) which is designed to replace stereotyped or self-injurious behaviors by providing the individual with more appropriate and effective ways to act on the environment and achieve the individual's desired ends. This strategy is particularly useful with nonverbal individuals. Finally, environmental enrichment is used as a way to provide alternative response or behaviors for the individual that can be reinforced.

See Also

- ▶ Citalopram
- ▶ Habit Reversal
- ▶ Repetitive Behavior

- Risperidone
- Sameness, Insistence on
- Self-injurious Behavior
- Stereotypic Behavior

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Stereotypic Behavior

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Synonyms

Repetitive behavior; Repetitive movements; Self-injurious behavior; Self-stimulatory behavior

Definition

Stereotypies

Etymology: Gk, *stereos* + *typos* mark

Stereotypies are repetitive, persistent, non-goal, and apparently purposeless motor actions and speech patterns which are carried out in a rhythmic and uniform way that serves no obvious adaptive functioning. On the basis of DSM-IV criteria, the repetitive, nonfunctional behaviors must be present for at least 4 weeks and markedly interfere with normal activities or possibly cause self-injury. They are usually associated with periods of stress, excitement, fatigue, or boredom and readily suppressible by distraction or initiation of another action. Stereotypies usually begin in the first several years of life, the movements are paroxysmal, last for seconds to minutes, appear multiple times a day, and have a fixed pattern. The movements usually abruptly cease when the child is distracted, though they may immediately return. They are not usually present during the sleep and phonation may occur during the performance. Stereotypies are usually maintained by the reinforcement of the behavior itself and the child usually does not try to stop them.

They are common in people with developmental disabilities, sensory deprivation, and in mental disorders such as schizophrenia and Autistic Spectrum Disorders (ASDs). They have also been described in typically developing infants and children in the form of head banging, head rolling, and body rocking but they become less varied and frequent with age. In ASDs, usually stereotypies have a sensory-motor quality, have a lifelong course, and markedly interfere with normal development. In ASD, sensory-motor stereotypies include arm, hand, finger, and other complex mannerisms (hand-finger flapping, waving, turning in circles, rhythmic body rocking, jumping), repetitive use of objects (spinning or flipping of objects), and unusual sensory interests. Most common unusual sensory interests are visual (staring at lights, moving fingers in front of eyes, waving objects in front of the eyes), auditory (tapping ears, repetitive vocal sounds), tactile (rubbing the skin, scratching), taste (placing objects in mouth, licking), and smell (sniffing people and objects). In autism and developmental disabilities, stereotypies are often associated with self-injurious behavior.

Stereotypies are usually divided into two categories, pathologic and physiologic, on the basis of the existence of other behavioral or neurologic findings. Physiologic stereotypies are also subdivided according to the body parts involved and the complexity of movements.

The basic pathophysiologic mechanism of motor stereotypies is unknown but an abnormality of dopamine neurotransmission has been implicated based on abnormalities located within corticostriatal-thalamo-cortical pathways.

With respect to treatment behavior modifying techniques, habit reversal and differential reinforcement of other behaviors are the most frequently used treatments although pharmacological treatments are also used without a firm evidence of effectiveness.

They are different from mannerisms which are unusual repeated performances of goal-directed motor actions or maintenance of an unusual modification of adaptive postures. They are also different from tics that tend to be rapid, random, and associated to premonitory urges or desires to reduce an inner tension.

See Also

▶ Repetitive Behavior
▶ Stereotyped Movement Disorder

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Stereotypy

► Stereotyped Movement Disorder

Steroids

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Definition

Steroids are naturally occurring hormones in the body that carry out many important biological functions. Medications that have been developed for steroids are primarily used as anti-inflammatory medications or hormone replacement therapy. Early case studies suggested that steroid medications could be helpful in children with autism or related developmental disabilities (Lerman, Lerman-Sagie, & Kivity, 1991; Stefanos, Grover, & Geller, 1995). In addition, a case study in a child with concurrent autism and a rare autoimmune disorder condition reported remission of the developmental delays following treatment with prednisone. However, it is generally agreed that steroids are unlikely to be useful in children or adults with autism who do not have other medical conditions that require their use. Steroid medications are well known for adverse effects that are behavioral in psychiatric nature. For example, steroids can cause increased anxiety, depressed mood, or mania in some patients. This may be important in children or adults treated with steroids for medical reasons who suddenly develop psychiatric symptoms.

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Stigmatization

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Synonyms

Social stigma

Definition

Stigmatization is the social disgrace or disapproval of a personal trait that goes against the norm. The label of "autism" is most stigmatizing when it is misunderstood or used to isolate individuals. For example, individuals with autism have been negatively characterized as being mentally retarded, not intelligent, and socially awkward. Parents of children with autism were incorrectly characterized as having poor parenting skills or not loving their child. These characterizations have led to social isolation and rejection. Fortunately, the stigma or disapproval for autism is decreasing as people learn more about the disorder.

See Also

► Refrigerator Mother

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Stimulant Medications

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Synonyms

Psychostimulants

Definition

Stimulants, also called psychostimulants, are medications that enhance dopamine and, to a lesser extent, norepinephrine in the brain. The two most common classes of stimulants are methylphenidate and amphetamines.

Amphetamine: Amphetamines are stimulant medications that enhance the release and block the reuptake of dopamine in the brain. Taken at large doses, this mechanism of action can produce euphoria and increased energy. Because of these effects, amphetamines are subject to abuse. In doses used to treat attention deficit/hyperactivity disorder, however, these stimulant effects are not usually present. The enhanced release of dopamine is presumed to be the source of improved attention and decreased activity.

Amphetamines are associated with many adverse effects that are relevant to children and adults with autism. For example, they can cause insomnia, decreased appetite, increased stereotypic behavior, and irritability. To date, the amphetamines have only been evaluated in small studies in children with autism with equivocal results. It appears that the potency of the amphetamine compounds makes it difficult to find a dose that is helpful, but not associated with dose-limiting adverse effects.

Methylphenidate: Methylphenidate is also a stimulant medication. Although methylphenidate also enhances release and blocks the reuptake of dopamine, it is less potent than the amphetamines. There are many preparations with methylphenidate including immediate-release compound in which the tablet is rapidly absorbed and the duration of action is approximately 4 h. When using the immediate-release compounds, it is likely that the dose will have to be repeated twice or even three times per day. There are also long-acting formulations marketed under several different trade names. These long-acting formulations do not have to be repeated throughout the day. However, various products may only come in particular strengths. Therefore, becoming familiar with the different brands of medications is important for using these long-acting formulations of methylphenidate in the clinic. Methylphenidate also comes in a transdermal skin patch. The skin patch can be worn for 8–9 h per day and replaced with a new patch each day. The skin patch comes

in several strengths and may require some trial and error to achieve comparable dosing with oral forms of methylphenidate. One drawback of the current skin patch preparation is the relatively high cost.

The immediate-release formulation of methylphenidate was studied in a large-scale, multisite trial in children with autism spectrum disorders (Research Units on Pediatric Psychopharmacology, 2005). The study included three doses of methylphenidate (low, medium, and high) and placebo in a crossover trial (each subject received the study treatments in random order under double-blind conditions). All active doses of methylphenidate were superior to placebo in this short-term study. In contrast to the benefits observed in typically developing children with attention deficit/hyperactivity disorder, however, the beneficial effects were modest in children with autism spectrum disorders who were hyperactive, impulsive, and distractible. Furthermore, the study showed that methylphenidate doses that are well tolerated in typically developing children with attention deficit/hyperactivity disorder were less well tolerated in children with autism spectrum disorders. Intolerable adverse effects included irritability, insomnia, loss of appetite, and increased stereotypic behavior. These results suggest that when treating children with autism spectrum disorders accompanied by hyperactivity and impulsiveness, the low-to-medium dose range is likely to produce modest benefit. However, attempts to achieve a greater benefit by pushing the dose upward are likely to encounter dose-limiting adverse effects.

See Also

▶ Methylphenidate

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Stimulus

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Synonyms

Sensory stimuli

Definition

A stimulus is defined as an environmental event that affects an individual's behavior through their sense modes, such as vision, hearing, smell, taste, touch, kinesthesis, and balance. Additionally, events such as dreams, mental images, and hallucinations are also considered stimuli and may affect behavior; however, these do not activate a specific sense mode. This makes their study and detection more difficult. Stimuli are dynamic and often studied in terms of stimulus changes in the environment, such as a light turning on or off or a sudden loud noise. Stimuli can also be the effects of internal bodily events such as the onset of a toothache, stomach pangs, and dizziness.

Stimuli are important components of a variety of autism treatments. They can be used to provide the context for behavior to be expressed or withheld, delivered as prompts during learning trials, and – when overselected (as defined below) – can

even interfere with learning. In this regard, these stimuli are called antecedents because they happen before the behavior of interest.

A phenomenon termed "stimulus overselectivity" (Lovaas, Schreibman, Koegel, & Rehm, 1971) is often discussed in relation to individuals with a diagnosis of autism. Research has shown that when presented with a complex stimulus, individuals with autism may attend only to certain components of the stimulus (which may be irrelevant to the appropriate response). An implication of stimulus overselectivity is that many individuals with autism have difficulty in learning situations, requiring them to attend to more than one component of a stimulus (i.e., an instruction to put on a blue shirt).

In addition to its role before responding occurs, a stimulus can also influence behavior by following it. When this happens, the stimulus is called a consequence and can serve as a reinforcer or punisher. The use of certain stimuli both before and after the desired responding has been central to applied behavior analytic interventions aimed at enhancing learning, decreasing behavior problems, and improving quality of life for people with autism.

See Also

- ▶ Consequence-Based Interventions
- ▶ Punishment
- ▶ Reinforcer

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Stimulus Fading

▶ Fading

Stimulus Overselectivity

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Definition

Stimulus overselectivity is an attentional abnormality common to individuals with autism spectrum disorder characterized by hyper-attentiveness to selected stimuli in the environment and lack of attention to other relevant stimuli.

Various behavioral and cognitive theories offer explanations for this particular phenomenon. A behavioral perspective put forth by Lovaas, Schreibman, Koegel, and Rehm (1971), explains stimulus overselectivity as a narrowing of attention to a particular characteristic of a single stimulus or to distinct stimuli in a complex environment. Other authors have related this concept to the term "tunnel vision" (Rincover & Ducharme, 1987). The sensory overload hypothesis, another possible explanation for overselectivity, posits that children with autism become overloaded with sensory input and therefore can only attend to a limited amount of sensory information at a given time. Alternatively, cognitive theories suggest that this phenomenon is the result of a generalized attentional

bias in visual perception (such as a more detail-oriented style of information processing) in which they are unable to extract context-dependent relevant features from the stimuli or the environment (Hermelin, 1976). Treisman (1969) suggested that such a phenomenon might occur if a child failed to switch attention between multiple cues. Stimulus overselectivity is not unique to autism spectrum disorders and has been observed in individuals with intellectual disability as well (Dickson, Wang, Lombard, & Dube, 2006; Wilhelm & Lovaas, 1976).

In intervention settings, stimulus overselectivity can impact how the child learns new skills. For example, children with autism have been observed to fail to generalize newly learned skills across novel settings and individuals outside of the original treatment context (Rincover & Koegel, 1975). Additionally, if this strategy of processing and responding is not addressed early in treatment, progress in the areas of social behavior and language acquisition can be limited (Rosenblatt, Bloom, & Koegel, 1995). For this reason, some interventions have identified responding to multiple cues as a pivotal area that, if targeted, can have widespread effects on many areas of functioning (Koegel, Koegel, Harrower, & Carter, 1999).

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Story Grammar Analysis

▶ Story Structure Decision Tree

Story Grammar Assessment

▶ Story Structure Decision Tree

Story Structure Decision Tree

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Synonyms

Narrative analysis; Narrative assessment; Story grammar analysis; Story grammar assessment

Definition

In typical development, narrative skills progress from simple descriptive sequences to more complex and elaborated episodic structures. A story structure decision tree is a graphic tool for guiding the narrative analysis of children's stories. The decision tree is a flow chart

containing a series of yes or no questions. Each "yes" answer moves the user to the next question/level, while a "no" response prompts the user to exit the flow chart whereby the child's level of story grammar development is indicated. For an example, see Westby's (2005) Story Grammar Decision Tree based on Stein and Glenn's (1979) classic description of story grammar.

See Also

► Narrative assessment

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Strabismus

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Synonyms

Cross eye

Definition

Strabismus refers to misalignment of the eyes typically due to a lack of coordination between the extraocular muscles, which prevents bringing the eye gaze of each eye to the same point in space, thus preventing binocular vision. This will most notably affect stereopsis or depth perception and can have serious consequences with 30–50% of children with strabismus developing amblyopia or vision loss. Strabismus is one of the most common eye problems in children and affects about 4% of children less than 6 years of age. Strabismus can occur in one or both eyes and in any direction. For example, in esotropia, there is inward deviation of the nonfixing eye, and in exotropia, the nonfixing eye outwardly deviates. Strabismus is also classified based on time of onset, such as infantile, acquired, or secondary to another pathological process, such as cataract. Strabismus must be treated early in order to decrease the risk of amblyopia, maintain binocular vision, and minimize the psychosocial effects of looking different than one's peers. Treatment depends on the etiology and may involve a combination of eyeglasses, vision therapy, and surgery, depending on the underlying reason for the misalignment.

Stranger Anxiety

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Definition

Stranger anxiety, which typically involves an overt display of mild to moderate emotional distress, is identified by observing how infants respond to the approach of an unfamiliar adult. Demonstration of signs of anxiety, or wariness, in response to an approaching stranger is a significant, universally observed, adaptive response that occurs in the course of typical child development. Although there is significant individual variation in the onset and severity of

stranger anxiety, it is rare to observe such wariness during the first 6 months of life. However, by 8 months, stranger anxiety is commonly observed, and the phenomenon peaks around 12 months. Some factors that may influence stranger anxiety are temperament and attachment. Fussy, insecurely attached infants are more likely to respond negatively to the approach of a stranger, as compared to easy going, securely attached infants. Additionally, it is important to note that stranger anxiety is also influenced by a range of contextual factors, including whether or not the caregiver is present, the physical characteristics of the approaching stranger, the rapidity with which the stranger approaches, the physical positioning of the child during the approach, and the familiarity of the setting. Although individual differences impact the presentation of stranger anxiety, research suggests that children with autism do indeed display signs of stranger anxiety over the course of their development.

See Also

- ▶ Anxiety
- ▶ Attachment
- ▶ Separation Anxiety Disorder

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Straterra (TM)

- ▶ Atomoxetine

Strengthening

- ▶ Reinforcement

Stress Disorder

- ▶ Posttraumatic Stress Disorder

Striatum

- ▶ Caudate Nucleus

Strong Narrative Assessment Procedure (SNAP)

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Synonyms

SNAP

Description

The Strong Narrative Assessment Procedure (SNAP; Strong, 1998) is a criterion-referenced measure designed to assess narrative discourse skills through story retell. The manual indicates that it may be used to evaluate children from 6 to 13 years of age; however, comparison data are only available for children 7 through 10 years of age.

Included in the SNAP are four audiotaped narratives that correspond to the four wordless picture books *Frog, Where are You?* (Mayer, 1969), *Frog Goes to Dinner* (Mayer, 1974), *A Boy, a Dog and a Frog* (Mayer, 1967), and *One Frog Too Many* (Mayer & Mayer, 1975). The book *Frog Goes to Dinner* (Mayer, 1974) is administered first as a practice story that is not scored, and then the examiner may administer any one of the remaining stories to elicit a sample narrative. During administration, the child is instructed to listen to one of the audiotaped narratives while looking at the corresponding wordless picture book. The manual recommends that the image of a naïve listener be created by either having the child listen to the story through headphones or by having the examiner leave the room briefly (Rathvon, 2007). Immediately following this procedure, the child is asked to retell the story and answer a series of 10 comprehension questions (five factual, five inferential). During the story retell, the child may not refer back to the picture book for assistance. The child's narrative and responses to the comprehension questions are recorded and transcribed.

Once transcribed, the narrative sample is segmented by the examiner into communication units (C-units; Ward, 2007). C-units consist of a main clause, modifiers, and any subordinating clauses. For example, "the boy was riding his bike on the street" would be a complete C-unit. The examiner then counts the total number of words in each C-unit. Narrative length may be evaluated by the total number of C-units or total number of words. Each C-unit is then evaluated for fluency, cohesion, syntax, and story grammar (Ward, 2007). Fluency is assessed by counting the number of pauses per C-unit and determining whether elements such as self-corrections or abandoned utterances negatively impact the retelling (Ward, 2007). Cohesion refers to the linguistic devices (e.g., grammar, vocabulary) used by the child to tie together the sentences of the story. For example, coordinating conjunctions (e.g., and, but) are cohesive elements used to tie together two sentences of a story. The SNAP manual provides examples of several cohesive elements that can be evaluated. Syntax refers to the rules for constructing sentences. Syntax is measured by assessing the total number of clauses used in the story and the different types of clauses (e.g., subordinate, adverbial, nominal) utilized.

Finally, the child's narrative is evaluated for story grammar components. Story grammar components refer to the specific elements that are universal to a narrative. These include the setting, initiating events, internal responses, plans/attempts to solve the problem, and consequences. The initiating event refers to the problem in the story. For example, "the boy ran over a nail with his bike and got a flat tire" would be an initiating event. The initiating event leads to an internal response from the character(s) in the story. In this case, "the boy was very angry that his tire was flat" might be the internal response. The initiating event leads to a plan or an attempt to solve the problem. "The boy tried to fill the hole with a piece of gum" would be an example of an attempt. This plan might fail, leading to a second attempt at fixing the problem. Finally, each narrative should include the consequence of the attempt. In this story, the boy may have decided to buy a new tire for his bike. The consequence of this plan would be that his bike was fixed so he was able to ride home.

The manual provides instructions for calculating raw scores for frequency and percentage of narrative elements. Means and standard deviations for ages 7 through 10 are included in the manual for interpretation purposes (Rathvon, 2007). Scores that fall more than one standard deviation below the mean are considered "inadequate." The examiner must also score the child's responses to the story comprehension questions. Responses are judged by the examiner as either accurate or inaccurate. Means and standard deviations are provided in the manual for interpreting comprehension responses for children aged 7 only. Guidelines for scoring and interpreting the comprehension questions for other ages are included, but no empirical evidence is provided to support them (Ward, 2007).

Historical Background

The SNAP was developed by Carol J. Strong in 1998 to assess the narrative skills of children with language impairments (LI), who, in comparison to their typical peers, produce narratives that are shorter, contain more grammatical errors, and include fewer cohesive devices and elements of story grammar (Swanson, Fey, Mills, & Hood, 2005; Ukrainetz & Gillam, 2009). The SNAP was published by Thinking Publications but, as of 2010, is out of print. Although it was created to assess children with LI, the SNAP also has utility as an assessment tool for children with ASD, as they also demonstrate deficits in narrative discourse. Research indicates that compared to typical peers, children with ASD produce narratives that are shorter, include fewer statements that describe the relationship between events (Tager-Flusberg, 1995), are less complex syntactically, and contain fewer evaluations (interpretation of events not overtly evident in the story; Capps, Losh, & Thurber, 2000).

The SNAP was first field tested in 1988 using a sample of typically developing children ($N = 39$) and children with a recognized LI ($N = 39$). Children ranged in age from 8 to 10 years. The narrative samples collected at this time were analyzed to establish the stability of story length and cohesive adequacy over time (Strong, 1989; Strong & Shaver, 1991). Strong (1998) later received funding from the ASHA Foundation and Utah State University to reanalyze the field test samples using measures of fluency, syntax, and story grammar. Additional data for children aged 7 ($N = 26$) were collected in 1998. Data from these samples are provided in the SNAP manual for comparison purposes.

Psychometric Data

In the 1988 field test of the SNAP, a total of 312 narrative samples were collected and analyzed for 39 typically developing children and 39 children with a recognized LI ($N = 78$). Each group consisted of children aged 8–10 years, resulting in three subgroups of 13 children each within the typically developing group and the group with an LI. Similarly, the 1998 sample, which provides data for children aged 7, consisted of 13 typically developing children and 13 children with an LI. These sample sizes are not adequate to ensure statistical power, and therefore, the data should be interpreted with caution. Additionally, data from the two samples may not be generalizable due to their geographical homogeneity, as all participants resided in Utah.

Limited evidence is available regarding the reliability of the SNAP. Measures of interrater reliability are provided for both sample groups and are considered good. Agreement for transcription of 312 narrative samples in the 1988 study was 100% for 64% of the transcripts, and no more than a three-word disagreement was found for the other 36% of transcripts (Strong, 1998). Interrater reliability for segmentation of a selected number of transcripts was also calculated and averaged 99% agreement (Strong, 1998). For the 1998 sample, interrater reliability of transcription, segmentation, and coding was greater than 90% for all measures (Strong, 1998). In an independent investigation, John, Lui, and Tannock (2003) reported interrater reliability for segmentation and coding of transcripts as 81% and 87%, respectively. No evidence of test-retest reliability is provided for any of the samples discussed.

Evidence supporting the validity of the SNAP is also significantly limited. Construct validity of the SNAP was assessed by comparing mean scores of the typically developing sample groups and the language-impaired sample groups. In the 1988 sample, a statistically significant difference between groups was observed for only 62% of scores, and, in the 1998 sample, only 54% of scores were statistically significant (Strong, 1998). These results indicate that the SNAP may not reliably differentiate between typically developing children and those with language impairment. Similarly, when comparing children with ASD ($N = 17$) to typically developing children ($N = 17$), Young, Diehl, Morris, Hyman, and Bennetto (2005) found that the two groups did not differ significantly on narrative length, semantic and syntactic measures,

cohesion, clause development, story grammar, or number of complete episodes. The two groups did differ significantly in their ability to accurately answer the inferential comprehension questions. No investigation of the SNAP's criterion-related validity has been conducted.

The SNAP manual indicates that the four stimulus stories are equivalent in length, syntactic complexity, cohesive density, and story grammar complexity in order to allow for comparison of scores over time (Strong, 1998). However, in an independent investigation, John et al. (2003) found that participants ($N = 61$) were more accurate in retelling the story *A Boy, a Dog and a Frog* (Mayer, 1967) and had higher inferential comprehension scores when compared to the other two stimulus stories intended for scoring. The practice story, *Frog, Where are You?* (Mayer, 1969), was not included in this analysis. John et al. (2003) suggest that clinicians may want to use the story *A Boy, a Dog and a Frog* (Mayer, 1967) as the practice narrative and use the other three stories for test-retest purposes.

Clinical Uses

The ability to engage in narrative discourse is an important aspect of development, and narratives comprise an important component for assessing and treating social communication. Personal narratives are utilized on a daily basis to share information and detail events for others. Included in the skill set required for successfully relating a story are pragmatic skills. Pragmatics refers to the way one uses language in a social context. When telling a story, the speaker must take into account the listener's knowledge and understanding, and they must take notice of subtle cues indicating that the listener is bored or confused and adjust their communication appropriately. Thus, successful storytelling requires perspective taking and social communication skills.

As previously discussed, children with ASD demonstrate notable deficits in narrative discourse when compared to their typically developing peers. Children with ASD also exhibit deficits in theory of mind development (ToM; for a review, see Baron-Cohen, Tager-Flusberg, & Cohen, 1993). ToM refers to the ability to understand that people may have thoughts and beliefs that differ one's own and that other's feelings and desires are dependent on a multitude of situational variables. The deficits in ToM that children with ASD exhibit have been linked to impairments in narrative discourse. For example, a positive relationship has been demonstrated between children's performance on a standard measure of ToM and frequency with which they provide descriptions of a character's thoughts and emotions in a narrative (Capps et al., 2000; Tager-Flusberg & Sullivan, 1995). Additionally, the linguistic abilities of children with ASD impact the quality of their narratives, as children with ASD produce narratives with less syntactic complexity as compared to typically developing children (Capps et al.).

Because narratives are such an integral aspect of social communication and play a fundamental role in the development of meaningful relationships with others, the assessment of narrative competency should be considered essential for children with ASD. The SNAP provides a structured way to identify areas of weakness in narrative discourse, guide intervention goals, and measure progress over time. However, due to the small sample sizes used to field test the SNAP and limited psychometric evidence available to support its reliability and validity, it is recommended that clinicians use the SNAP in conjunction with a norm-referenced measure, such as the *Test of Narrative Language* (TNL; Gilliam & Pearson, 2004).

See Also

- ▶ Clinical Assessment
- ▶ Communication Assessment
- ▶ Criterion-Referenced Testing
- ▶ Dynamic Assessment
- ▶ Literacy
- ▶ Narrative Assessment
- ▶ Pragmatic Communication

- ▶ Pragmatic Language Impairment
- ▶ Pragmatic Language Skills Inventory
- ▶ Pragmatics
- ▶ Social Communication
- ▶ Theory of Mind

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Structural Equation Mixture Modeling

- ▶ Latent Variable Modeling

Structural Equation Modeling

- ▶ Latent Variable Modeling

Structured Behavioral Interventions

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Definition

Structured behavioral intervention is an umbrella term for interventions in which the therapist or teacher organizes the learning environment,

selects the activity, and directs the individual with autism. Structured behavioral interventions are often implemented in a one-to-one setting between a trained therapist and child. The therapist provides a clear cue or antecedent to initiate the desired behavior from the individual and uses positive reinforcement to strengthen the occurrence of the behavior following the antecedent. Often structured behavioral interventions are based on a breakdown of tasks into their component steps with a set plan for linking the steps together as the child masters each step and is gradually moving to more complex tasks. Structured behavioral interventions are often described as "didactic" and are contrasted with interventions in which the therapist follows the child's lead and aims to expand on activities that the child initiates. Many school- and home-based programs are considered to be structured behavioral interventions, among which approaches based on applied behavioral analysis (ABA) are the most common.

Historical Background

Structured behavioral interventions began to be used in the education of children with autism spectrum disorders in studies on ABA conducted in the early 1960s. These initial studies incorporated experimenter-led tasks showing that children with autism could learn new skills if they received systematic instruction. In the mid-1960s, investigators demonstrated that similar procedures could be implemented in clinical settings and developed an instructional format now called discrete-trial training (DTT). DTT consists of small units of instruction implemented by a teacher in a one-to-one setting with a child. These units of instruction are composed of a cue, prompt, response, consequences, and intertrial interval. For example, in a DTT session aiming to enhance imitative behavior, the instructor would give a verbal cue "Do this" and visual cue (taps head), perhaps with a prompt such as lifting the child's arm up to elicit the behavior and reinforce the child for displaying the desired behavior.

Other examples of structured behavioral interventions include (1) task analysis and chaining in which complex skills are broken down into their component steps to be taught individually and then strung together and (2) script training, which focuses on using words, pictures, videos, or live models to show a sequence of appropriate social and verbal responses. Structured behavioral interventions have been implemented in individual and group formats in a range of settings, such as home-based intervention programs, specialized schools, and integrated classrooms.

Rationale or Underlying Theory

The use of structured behavioral interventions is based on the view that individuals with autism require didactic, systematic instruction because they are unable to learn in the same ways young typically developing children learn (e.g., playing creatively and interacting with others) and often have little interest in doing so because they are unresponsive to social reinforcement (e.g., verbal praise from parents). Structured behavioral interventions involve carefully prompting and reinforcing successes and providing instruction at a rapid pace in order to provide many learning opportunities and teach a wide range of skills efficiently.

Goals and Objectives

Structured behavioral interventions aim to place an individual with autism in an environment that optimizes the rate of learning and promotes the individual's experiences of success. This is done by breaking complex tasks into component steps that can each be taught and built upon (e.g., identifying the steps involved in a task such as toothbrushing and teaching each task separately).

Treatment Participants

People with autism of any age are candidates for a structured behavioral intervention as long as a motivating positive reinforcer can be identified. Research suggests that the younger a participant

starts in the intervention, the more significant are his or her improvements.

Treatment Procedures

A number of interventions are considered to be structured behavioral interventions, so specific treatment procedures vary by intervention. As a therapist- or teacher-led intervention, procedures are usually implemented in a one-to-one setting. Generally, each behavioral instruction is cued by a specific antecedent and followed by a consequence designed to either reinforce a correct response or extinguish an incorrect response.

Efficacy Information

Numerous single-case studies indicate that structured teaching approaches such as DTT, task analysis/chaining, and script training can be effective. Early intensive behavioral intervention (EIBI) programs that emphasize such methods (such as the Ivar Lovaas's UCLA You Autism Project) have also reported high success rates such as significant increases in IQ test scores, Vineland adaptive behavior scale scores, and integrated classroom placements.

Outcome Measurement

In single-case studies of structured behavioral interventions, outcome is usually measured by repeated, direct observations of changes in the rate of a specific target behavior, such as an increase in the display of a language skill or a reduction in an aberrant behavior. In EIBI studies, outcome measures usually include standardized tests of intelligence and adaptive behavior.

Qualifications of Treatment Providers

Structured behavioral interventions may be implemented by a variety of treatment providers, such as paraprofessionals, educators, and residential care providers. The interventions are often delivered under the supervision of a behavioral analyst.

See Also

- ▶ Applied Behavior Analysis
- ▶ Chaining
- ▶ Early Intensive Behavioral Intervention (EIBI)

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Structured Classrooms

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Synonyms

Visually organized learning environments

Definition

Learning environments are organized so that the curriculum (activities, schedule, physical environment) is clearly visually communicated to both the students and educational personnel (Iovannone, Dunlap, Huber, & Kincaid, 2003). Structured environments have been demonstrated to be an essential part of programming for students with autism spectrum disorders (ASD) (Bodfish, 2004; Iovannone et al., 2003; Mesibov & Shea, 2010). Structured classrooms for students with ASD utilize the principles of Structured Teaching (an evidence-based approach devised by the TEACCH [Treatment and Education of Autistic and related Communication-handicapped CHildren] Program in North Carolina; Mesibov & Shea, 2010).

Key features of structured classrooms are (Ball, n.d.; Mesibov & Shea, 2010; Mesibov, Shea, & Schopler, 2004):

- Physical structure – using furniture to demonstrate expectations and reduce distractions.
- Visual schedules – using objects, pictures, or the written word to show the student the sequence of events.
- Visually structured individual tasks that incorporate object, picture, and/or written instructions.
- Organizing a sequence of individual tasks using visual work/activity systems – using objects, pictures, letters, numbers, or the written word; tasks are organized to show the student what they have to do, how many tasks they need to do, how they are progressing, when they will be finished, and what they are going to do next, for example, lining up the tasks on the students' left and having them move them to their right when completed.
- Using students' relative strengths to support weaker skills. For example, requiring a student to select a picture of the weather (utilizing strong visual skills) during a verbal discussion about the weather (thus supporting relatively weak verbal communication skills).
- Using students' special interests to increase engagement in learning. For example, teaching counting by having a student interested in trains count the number of train cars.
- Strategies to increase students' meaningful, spontaneous communication. For example, teaching a nonverbal student to hand the instructor a cup to request a drink.

Within these features of a structured classroom, the key to student success is that each is individualized according to the strengths and weaknesses of each student (Mesibov et al., 2004).

See Also

▶ Classroom Structure
▶ Culture and Autism
▶ Educational Interventions
▶ Pictorial Cues/Visual Supports (CR)
▶ Structured Teaching
▶ Visual Schedule
▶ Visual Supports

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Structured Descriptive Assessment

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Synonyms

SDA

Definition

A structured descriptive assessment (SDA) uses principles of applied behavior analysis to describe the causes and consequences of a given behavior. A SDA typically occurs in the child's natural environment (e.g., the child's classroom) with no manipulation of environmental variables. The examiner records the antecedent of the child's behavior, target behavior, and consequence. For example, if the child might be engaging in self-harm, the examiner will record the antecedent of this behavior (e.g., the teacher asking a difficult question to the child), the child's behavior (e.g., biting of his hand), and the consequence (e.g., the child is sent out of the classroom with his aide). This type of assessment is often used to determine the cause of maladaptive behavior. It differs from functional behavior analysis as the examiner does not control for environmental variables.

See Also

▶ Applied Behavior Analysis
▶ Functional Behavior Assessment

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Structured Environments

▶ Structured Teaching

Structured Teaching

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Synonyms

Organized work systems; Structured environments

Definition

Structured teaching (often associated with the Treatment and Education of Autistic and Related Communication-Handicapped Children [TEACCH] method) refers to strategies that

promote systematic and predictable instruction that supports individuals with autism spectrum disorders to better understand their environment and live in it more independently. Structured teaching provides an environment that is organized with clear concrete visual information that defines the environment. Structure is provided by the adults, the physical organization of the environment, materials, and routine. It is important to conceptualize that the structured teaching is not faded or removed over time if adjusted to meet the changing needs of the individual with autism spectrum disorder.

The components of structured teaching relate directly to the characteristics of autism spectrum disorder. Many individuals with autism spectrum disorder are visual learners, and structured teaching relies heavily on visual supports. Effective processing of information is often a challenge for individuals with autism spectrum disorders, and structured teaching highlights routines, beginnings, and endings. Attention and sensory deficits impact how individuals with autism spectrum disorders learn, and structured teaching ensures that the environment is modified to reduce distractions and excessive stimulation. Structure teaching benefits individuals with autism spectrum disorder by reducing anxiety through predictability, it increases learning through rule-based strategies, and it promotes independence by encouraging reliance on the system rather than people.

Structured teaching is an effective lifelong tool that capitalizes on organizing the individual with autism spectrum disorder's world, through organizational and temporal structure.

See Also

- ▶ Task Analysis
- ▶ Visual Supports

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Studies to Advance Autism Research and Treatment

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Definition

A federally funded network of studies was mandated by the Children's Health Act (2000) that was to include at least five centers of excellence in autism research. In response to this mandate, five NIH institutes (NIMH, NICHD, NINDS, NIDCD, and NIEHS) came together to develop a network program. This program of work was concerned with aspects of diagnosis, early detection, prevention, and treatment as well as the etiology of autism. This program was the successor to the original Collaborative Program of Excellence in Autism which had been funded by NICHD and NIDCD.

Following a competitive process, eight centers around the country were funded using the mechanism. These included:

- Boston University (Helen Tager-Flusberg, Ph.D., principal investigator)
- Kennedy Krieger Institute (Rebecca Landa, Ph.D., principal investigator)
- Mt. Sinai Medical School (Eric Hollander, M.D., principal investigator)
- University of California, Los Angeles (Marian Sigman, Ph.D., principal investigator)
- University of North Carolina, Chapel Hill (Joe Piven, M.D., principal investigator)

- University of Rochester (Patricia Rodier, Ph.D., principal investigator)
- University of Washington (Geri Dawson, Ph.D., principal investigator)
- Yale University (Fred Volkmar, M.D., principal investigator)

In addition to studies conducted at each site, the network also worked on a series of collaborative projects.

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Study Design Impact on Prevalence

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Definition

Prevalence of autism spectrum disorders (ASDs) consists in the number of people identified with an ASD in a defined population divided by the total number of people in the population at a given time. Prevalence is usually expressed as x people per 1,000 with an ASD in the area studied. Determining the prevalence of the ASDs depends on the identification of people with an ASD in a defined population. Prevalence studies must first define the "case definition" by describing who will be counted as having an ASD and by what standards. Some prevalence studies have sought to identify specific subtypes such as autistic disorder or Asperger's disorder, while others have focused on the whole spectrum. The way ASDs are defined and the methods used to identify the conditions can have an impact on prevalence estimates. One major difference among prevalence studies is whether the focus is on counting individuals who have already been diagnosed or classified as having an ASD or on identifying individuals who have the diagnostic profile of certain ASDs who may or may not have already been diagnosed. There are several methods used to identify people with an ASD in the population. These include counting the number of people already identified with an ASD either through service systems or registries or by conducting surveys asking if a person has an ASD diagnosis. Other methods include trying to not only count people already diagnosed with an ASD but also identify people who meet the diagnostic criteria but have not yet been diagnosed with an ASD. These efforts attempt to screen records or people in the population to find already-known and currently unknown cases of ASDs. All prevalence studies require that you know the base population of people

from whom you are trying to identify the individuals with an ASD.

The number of people receiving services for identified ASDs has increased substantially since the early 1990s. This has been documented in the US Department of Education counts of children identified with autism for special education purposes and among statewide service systems for people with developmental disabilities (Centers for Disease Control and Prevention [CDC], 2009; 2012; Newschaffer, Falb, & Gurney, 2005). However, the number of individuals receiving services for ASDs is likely to be an underestimate of all people with ASDs in the population. In fact, methods that rely on service systems, registries, and surveys of people already diagnosed underascertain people without a diagnosis. Epidemiologic studies which systematically screen the population to also identify individuals who meet the case definition but who were not previously classified as having an ASD generally result in higher and more complete prevalence estimates. Screening can focus on groups at risk who have been identified for some type of developmental concern in order to maximize resources and minimize false positives. A multisite study using this method found that 21% of the children identified with ASDs did not have a previous classification documented in their records (CDC, 2012). Screening can try to identify ASDs among the general population. These studies generally report the highest prevalence estimates of ASDs (Baron-Cohen et al., 2009; Kim et al., 2011), but also must address challenges of low response rates and the possibility of over identification of people who have autism-like traits who may not have the constellation of functional impairments necessary to identify autism as a developmental disability. Overall, studies using a variety of methods have recently estimated about 1% of children with ASDs; however, estimates vary based on the methods used. The fact that there have been changes in the conceptualization of autism coupled with gains in community awareness over the past two decades poses challenges in knowing exactly how many people have really had autism or a related condition throughout history. However, it is clear that more people are identified with an ASD today than ever before, resulting in major needs for supports and services across the life span.

See Also

- ▶ Incidence
- ▶ Prevalence

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Stuttering

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Synonyms

Disfluency

Definition

Stuttering is a speech disorder in which the flow of speech is disrupted by involuntary repetitions (e.g., a-a-a-apple) and prolongations of sounds (e.g., Ssssit down), syllables (e.g., pat-pat-patriotic), words, or phrases; involuntary fillers (e.g., "um," "like") or silent pauses in which the speaker is unable to produce sounds. Stuttering can be variable in certain situations depending on the anxiety level connected with that activity. Although the precise etiology is not known, both genetics and neurophysiology are thought to contribute. It does tend to run in families. Speech therapy is the primary treatment. It generally aims to increase fluency or modify the stuttering behaviors.

Stuttering typically begins during childhood – approximately 2.5% of children under the age of 5 stutter. It can last throughout the lifetime, although approximately 70% of individuals who begin stuttering during the preschool years recover by their early teens. The overall prevalence of stuttering is approximately 1% of the population. If severe and persistent, it can significantly impact academic, social, and vocational outcomes. Differential diagnosis is required to distinguish between word retrieval and language formulation difficulties which can also cause disfluent speech.

See Also

- ▶ Fluency and Fluency Disorders
- ▶ Speech Therapy

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Substantia Grisea

▶ Gray Matter

Substantia Nigra

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Definition

The substantia nigra consists of large dopamine-producing nerve cells in the midbrain, adjacent to the striatum. The structure is part of the basal ganglia and consists of two subdivisions, the pars compacta and pars reticulata. This region has functional implications in reward, addiction, and movement, as damage to this area is associated with disorders such as Parkinson's disease.

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Substantial Gainful Activity

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Synonyms

Substantial gainful employment

Definition

Substantial gainful activity is a term used to describe a level of work activity and earnings. It is used by the social security administration to

determine if a person is eligible for social security benefits. It refers to any work that is generally performed for pay or profit or intended for profit (even if there is none). It applies to full- or part-time work. It can also apply to self-employment.

Substantial gainful activity is not about whether you can perform your job. It is not about whether you can or cannot find work. It is about whether you can work at any employment activity that is generally available. It includes salaried positions, attending school, or a volunteer activity even if you receive no salary. An activity qualifies as substantial gainful activity based on the amount of income that is or could be earned. You are not eligible for disability benefits if you can perform any work that someone could have been paid for.

The Social Security Administration defines a dollar amount yearly that a person can earn and still maintain their eligibility for SSI or social security benefits. Those who earn (or could earn) over this minimum dollar amount are considered to be engaging in substantial gainful activity and, therefore, ineligible for Social Security benefits.

See Also

► Employment

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Substantial Gainful Employment

► Substantial Gainful Activity

Subtest Scatter

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Definition

Subtest scatter refers to a pattern or profile across subtests in which subtest scores on a standardized test vary a great deal. Most standardized subtest scores have a mean, or average, score of 10. Children will often score within three points above or below the mean of 10 (i.e., scores between 7 and 13) (or above and below their own mean score across subtests, which may be higher or lower than 10). If significant scatter exists, meaning the difference between the highest and lowest subtest scores is greater than six points, this suggests that the test taker has areas of strength and weakness that need to be further explored. When interpreting standardized test results of an individual with an autism spectrum disorder, it is important for educators, the individual, and/or parents to understand the nature of the weak areas or areas of relative weakness, what skills need to be learned to strengthen those areas (e.g., utilizing strengths to develop skills in area of weakness), and what specific accommodations should be implemented to facilitate the remediation of the weak areas. Understanding areas of strength or relative strength can often inform remediation of weaknesses.

Historical Background

Researchers have been analyzing IQ subtests for more than 70 years (Zachary, 1990). Early researchers hypothesized that subtest scatter would predict academic potential. Additionally, uneven subtest scores were assumed to be indicative of psychopathology. Specifically, psychologists speculated that subtest scatter of an individual's scaled scores across subtests on

an intelligence battery might be a sign of neurological dysfunction (Drebing, Satz, Van Gorp, Chervinsky, & Uchiyama, 1994), learning disability (McLean, Reynolds, & Kaufman, 1990), or emotional disability (Drummond, 2000). While some studies found subtest scatter to be associated with clinical groups, differences tended to disappear when adequate comparison samples were used (Zimmerman & Woo-Sam, 1985). Furthermore, subtest scatter was also found to be unrelated to academic achievement (Hale & Saxe, 1983; Kline, Snyder, Guilmette, & Castellanos, 1992).

A source of data that has greatly contributed to the understanding of IQ subtest analysis is the Dunedin Multidisciplinary Health and Development Study (DMHDS; Silva, 1990). The DMHDS included a sample of more than 1,000 New Zealand children assessed with a battery of psychological, sociological, and medical measures every 2 years from birth to adulthood. Its representative sample, comprehensive assessment battery, and longitudinal design make DMHDS IQ test results unique in the professional literature.

Using data from the DMHDS, Moffitt and Silva (1987) reported on the clinical significance and stability of Wechsler Intelligence Scale for Children-Revised (WISC-R; Wechsler, 1974) VIQ and PIQ scatter. They concluded that perinatal, neurological, and health problems did not cause extreme VIQ-PIQ discrepancies and found that neither behavior problems nor motor problems were significantly related to VIQ-PIQ scores. Furthermore, VIQ-PIQ score discrepancies were unreliable across time. That is, the majority of children with extreme VIQ-PIQ score discrepancies did not maintain such a large difference when tested with the WISC-R 2 years later. Thus, they concluded that VIQ-PIQ scatter may not be stable and does not adequately predict psychological diagnoses. The combined results from 94 studies, including 9,372 total participants, also demonstrated that subtest scatter and scatter between VIQ and PIQ failed to uniquely distinguish children with learning disabilities (Kavale & Forness, 1984). For example, the average VIQ-PIQ difference for children with learning disabilities was only 3.5 points – a difference found in 79% of the normative sample.

Even though subtest scatter was not found to indicate psychopathology or predict academic achievement, psychologists continued to examine individual subtest patterns. Specifically, examining an individual's scaled subtest scores began to be used to identify specific cognitive strengths and weaknesses (Zeidner, 2001). Following this logic, a high degree of subtest variability or specific patterns of subtest scores were presumed to substantially invalidate global intelligence indices (Groth-Marnat, 1997) so that subtests, rather than IQ composites, became the focus of interpretation. Psychologists believed that such a multidimensional view of intelligence would provide greater insight into the nature of human ability than summary intellectual indices (Zimmerman & Woo-Sam, 1985), particularly when trying to describe an individual's pattern of cognitive performance. Based on these principles, intricate subtest profile interpretation systems have achieved wide popularity in psychological training and practice (Aiken, 1996; Groth-Marnat, 1997; Kaufman, 1994; Sattler, 2001). For example, approximately 74% of school psychology training programs place moderate to great emphasis on the use of subtest scores in their individual cognitive assessment courses, and almost all use texts that advocate subtest analysis (Alfonso, Oakland, LaRocca, & Spanakos, 2000). As would be expected from such training, school psychologists frequently analyze cognitive subtest profiles in their practice (Pfeiffer, Reddy, Kletzel, Schmelzer, & Boyer, 2000). Among their sample of clinicians, for example, Pfeiffer et al. found that almost 70% reported factor scores/profile analysis to be a useful feature of intelligence tests and 29% reported that they derived specific value from individual subtests. Matarazzo and Prifitera (1989) noted that while some supportive WAIS-R subtest scatter research had been published, lack of cross-validation and replication deems interpretation of subtest scatter useful for creating hypothesis about an individual, but the results are not conclusive in and of themselves.

Current Knowledge

Subtest scatter has continued to receive clinical attention despite previous literature reviews demonstrating that it was ineffective for distinguishing clinical from typically functioning groups. Recent research results are remarkably consistent with past reviews, in that results indicate that subtest scatter is an invalid diagnostic indicator and incapable of reliably predicting academic achievement. Several studies are particularly important because they demonstrated no relationship between subtest scatter and academic achievement in large, nationally representative samples of students without disabilities (Kahana, Youngstrom, & Glutting, 2002; McDermott & Glutting, 1997; McGrew & Knopik, 1996; Watkins & Glutting, 2000; Youngstrom, Kogos, & Glutting, 1999). Based on their review of IQ subtest scatter research, Kline et al. (1996) suggested that psychologists have pursued scatter analysis with little success and that it is time to move on; this suggestion was further supported by McGrew and Knopik (1996). Given the body of research to date, it seems as though there is no scientific support for the use of subtest scatter to inform diagnosis or prediction.

Future Directions

Although there is general agreement that diagnoses based on IQ subtest scatter should be avoided, the use of subtest profiles and subtest scatter for hypothesis generation is frequently recommended (Sattler, 2001; Kaufman & Lichtenberger, 1998, 2000; Kamphaus, 2001; Groth-Marnat, 1997). Specifically, the examiner must first generate hypotheses about an individual's assets and deficits. Next, the examiner must confirm or deny these hypotheses by exploring multiple sources of evidence. Finally, well-validated hypotheses must then be translated into meaningful, practical recommendations, concerning interventions, instructional strategies, and remediation activities (Groth-Marnat, 1997).

Treatment recommendations resulting from the hypotheses generated from interpretation of subtest profiles and subtest scatter should follow three basic guidelines. First, subtest profiles must be strongly associated with performance in such socially important endeavors as academic achievement and psychosocial behavior. If subtest profiles are not substantially related to important social criteria, then hypotheses generated from subtest variation may not be useful. Second, hypotheses based on subtest scatter or subtest profiles should be consistently confirmed by multiple pieces of other information, including pursuing additional testing to corroborate observed areas of weakness. Finally, interventions that result from hypotheses based on subtest performance must exhibit treatment validity; that is, they must selectively assist in the improvement of cognitive, achievement, or behavioral weaknesses.

Subtest interpretation systems provide hundreds of hypotheses to consider when IQ subtest patterns are obtained (Kaufman, 1994; Sattler, 2001). For example, some comparisons that have been highlighted include the following: low performance on the Picture Arrangement (PA) and Comprehension (CM) subtests suggests poor social adjustment, as seen in autism spectrum disorders; equal VIQ and PIQ scores may indicate an absence of emotional distress; a large difference in performance between digits forward and digits backward indicates anxiety; and low scores on Digit Span (DS), Arithmetic (AR), and Coding (CD) subtests identify anxiety, attentional deficits, or both (Banas, 1993; Drummond, 2000; Groth-Marnat, 1997; Kellerman & Burry, 1997).

The relationship between social adjustment and performance on PA and CM subtests has received considerable attention. Lipsitz, Dworkin, and Erlenmeyer-Kimling (1993) administered Wechsler scales and two measures of social adjustment to groups of high-risk and typical comparison children. PA scores showed no relation with either measure of social adjustment. Further, Campbell and McCord (1996) found that PA scores were not significantly better than FSIQ scores in predicting

participants' ability to interpret the nonverbal behavior of others. These negative results for the PA subtest have been replicated with different samples, criterion tests, and IQ tests (Beebe, Pfiffner, & McBurnett, 2000; Campbell & McCord, 1999). Consequently, making an inference regarding social adjustment/judgment based on PA scores is contraindicated by research.

See Also

- ▶ WISC-IV
- ▶ WPPSI-III

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Subtyping Autism

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Definition

Subtypes of autism can be defined as groups of persons with autism spectrum disorders (ASD) who are posited to be more similar to each other than to the larger group of individuals who fall under the broad diagnostic category of ASD. Identification of subtypes may facilitate efforts to understand etiology of ASD as well as differential response to treatment. These subtypes are most often defined by a particular behavior or set of behaviors, such as cognitive or language abilities. However, they may also be defined by other characteristics, such as patterns of development or physical features.

Historical Background

Autism spectrum disorders (ASDs) are characterized by impairments in communication and reciprocal social interaction and the presence of restricted and repetitive behaviors and interests. Although ASDs are defined based on this triad of impairments, the presentation of these symptoms varies widely from one individual to another. Behaviors are further impacted by variability in other factors, such as age, level of language, and cognitive ability. This heterogeneity makes it difficult for researchers seeking to elucidate causes or risk factors for ASD or develop and test the efficacy of interventions. Common sense would suggest that it is unlikely that the same etiological factors would explain two vastly different phenotypes (e.g., a nonverbal child with profound intellectual disability and a verbally fluent child with a superior IQ). Similarly, it would not be expected that those two individuals would respond equally to the same type of intervention. However, at this point, there is relatively little data to answer these questions.

In an attempt to reduce the variability observed in ASDs, researchers have sought to identify groups of individuals within the autism spectrum with the hope that these "subtypes" may represent a more homogeneous group that has a greater likelihood of being etiologically distinct (Newschaffer, Fallin, & Lee, 2002) or responsive to a certain type of intervention (see Schreibman & Ingersoll, 2011). A summary of some subtypes is provided below; however, it is important to recognize that subtypes in ASD are still being actively researched and definitions are continually being modified to reflect the most recent findings. The question still remains as to whether these subtypes will lead to increased

understanding of the etiology or prognosis for some individuals with ASD and whether these will ever have clinical utility, allowing clinicians to better explain the causes of a child's difficulties or choose the most appropriate treatment for that child.

Categorical Diagnoses

The earliest descriptions of autism described by Kanner in 1944 noted the variability in symptom manifestation and severity. Yet, it was not until 1980, with the American Psychiatric Association's publication of DSM-III, that such variation was noted in the diagnostic criteria with the category of "Atypical Pervasive Developmental Disorder" included to capture children who did not meet full criteria for infantile autism. This category was renamed "Pervasive Developmental Disorder-not otherwise specified" in DSM-III-R (1987). In addition to Autistic Disorder and PDD-NOS, other categories of ASD (i.e., Pervasive Developmental Disorders) were added in DSM-IV, including Asperger's disorder, Child Disintegrative Disorder, and Rett's disorder.

These diagnostic categories were among the early attempts to capture the behavioral heterogeneity observed in ASD by distinguishing subtypes of persons showing different kinds and levels of symptoms and/or patterns of onset. However, over time, it has been increasingly recognized that, even within these diagnostic subtypes, there remains a great deal of variability in symptom presentation and course. Furthermore, although ASDs are reliably distinguished from typical development and other non-ASD developmental disabilities, differentiations within the autism spectrum (i.e., Autistic Disorder, Asperger's disorder, and PDD-NOS) have been generally inconsistent (Lord et al., 2012). Efforts to demonstrate measureable differences between groups have not been particularly successful. For example, studies comparing the cognitive profiles of individuals with Asperger's to those deemed as having "high-functioning autism" (i.e., a diagnosis of Autistic Disorder and IQ in the average to above average range) have provided mixed results. In general, these studies have not supported the categorical distinction made between these two groups (see Joseph, 2011).

Given that these diagnostic categories have not yielded meaningful subgroups, the Neurodevelopmental Disorders Work Group has proposed that DSM5 includes a single diagnostic category of ASD with clinical specifiers (e.g., to indicate severity and verbal ability) and associated features (e.g., known genetic etiologies, such as fragile X, intellectual disability, etc.). Previously differentiated categories of Autistic Disorder, Asperger's, and PDD-NOS will no longer be used in clinical practice.

Cognitive Subtypes

Cognitive abilities observed in ASD range from severely intellectually disabled to performance in the superior range on tests of intellectual functioning. In contrast to early studies suggesting that 75% of children with ASD have intellectual disability (ID), recent estimates are closer to 25–50% (Charman et al., 2011; Joseph, 2011). In an early study comparing children with ASD and ID to those who did not have cognitive impairments (i.e., IQs <70 and >70), Bartak and Rutter (1976) reported group differences in ASD-related symptoms as well as educational and employment outcomes. These authors hypothesized that the origin of autism may differ for children with and without intellectual disability and highlighted the importance of considering intellectual functioning in studies assessing etiological factors in autism. Although studies have found differences in genetic transmission of ASD for individuals with IQs over 70 (see Joseph, 2011), results must be interpreted cautiously, as is possible that the identified loci are more generally related to IQ than ASD (Liu, Paterson, Szatmari, & The Autism Genome Project Consortium, 2008). It is also important to note that, while some studies have reported familial clustering of IQ in twin and sibling studies, conclusions are often based upon moderately sized correlations with wide confidence intervals (e.g., Szatmari et al., 2008), and, in many multiplex families, there are vast discrepancies in children's cognitive abilities (see LeCouteur et al., 1996).

Aside from general level of functioning, investigators have also questioned whether particular cognitive profiles, such as a large discrepancy between verbal and performance IQ, might reflect etiological differences in ASD (Joseph, 2011). Early studies emphasized strengths in nonverbal abilities compared to language skills in children with ASD (Lockyer & Rutter, 1970). Since then, researchers have sought to understand how the early development and severity of symptoms of children with this profile may differ from children with ASD who do not demonstrate this discrepancy. There is some evidence that discrepant cognitive profiles may be associated with enlarged head circumference and increased gray matter volume (see Joseph, 2011). While there is no doubt that consideration of large differences in IQ is important to long-term outcomes (e.g., comparing individuals with and without ID; Howlin, Goode, Hutton, & Rutter, 2004), the existence of categorical cognitive subtypes is not yet clear.

Language Subtypes

A substantial body of research has focused on whether age of language acquisition should be used to differentiate between Autistic Disorder and Asperger's and whether children with or without a language delay may represent etiologically different subtypes. These subtypes have generated a great deal of interest, given that increased associations with various chromosomal abnormalities have been found in quantitative trait loci (QTL) analyses for age of language acquisition and linkage analyses using samples stratified by whether or not the proband had delayed language (see Cantor, 2011; Lamb, 2011 for reviews). However, not all studies using this method have yielded positive results. These inconsistencies could be related to differences across samples. Group comparisons of children with and without language delays show differences in age, cognitive level, and overall severity of symptoms, suggesting that if samples differ on these characteristics, associations with biological mechanisms may not be replicated across studies (Hus, Pickles, Cook, Risi, & Lord, 2007). There is also evidence that error in retrospective recall of language milestones, upon which most studies rely, could result in children being inaccurately grouped as language delayed, particularly for children with cognitive delay (Hus, Taylor, & Lord, 2011). Bennett and colleagues (2008) have suggested that current language level may be a more meaningful marker than history. While these considerations may help to explain inconsistencies across studies, they also suggest that age of language acquisition could be an index for general level of functioning, rather than a more specific subtype. While children with cognitive impairment may be a group of interest in and of themselves, highlighting associations between biological mechanisms and language subtypes can be misleading if these subtypes actually indicate more global impairments.

A range of current language abilities, apart from different histories, are observed in conjunction with ASD. Tager-Flusberg and colleagues (2011) briefly highlight three language subtypes within ASD – (1) individuals who are verbally fluent and do not have difficulties with structural aspects of language (e.g., vocabulary, syntax, phonology); (2) individuals who acquire varying degrees of functional language, though acquisition may be delayed, development may be slowed, and they may have ongoing difficulties in different areas of language; and (3) individuals who remain nonverbal (i.e., do not develop the ability to speak).

Many researchers have been particularly interested in the second group, i.e., those who acquire functional speech but exhibit difficulties that overlap with those associated with specific language impairment (SLI). Although definitions of SLI generally require that language difficulties are independent of ASD, some researchers have questioned whether this criterion is appropriate or if some children should be considered as having a comorbid diagnosis of ASD and SLI (see Tomblin, McGregor, & Bean, 2011 for review). Similar patterns of neuroanatomical asymmetry have been reported in children with SLI and children with ASD and language impairments. Moreover, genetic variation within CNTNAP2 has been associated with both ASD and SLI;

most interestingly, the same genetic polymorphism on this gene was related to parent-reported age of language acquisition in children with ASD and phonological short-term memory in children with SLI (see Tomblin et al., 2011).

In spite of evidence that failure to develop functional speech by age 5 is associated with poorer outcomes for children with ASD (e.g., Venter, Lord, & Schopler, 1992), much less research has focused on understanding nonverbal children. There is some evidence that children who have not developed language by age 5 are more impaired on early measures of social, communication, and imitation skills (Thurm, Lord, Lee, & Newschaffer, 2006). However, there has not yet been enough research on nonverbal individuals to know whether they may represent a useful unitary subtype. Several studies have shown a high concordance rate for verbal/nonverbal status in sibling and twin pairs (e.g., Spiker, Lotspeich, Dimiceli, Myers, & Risch, 2002), though results have not been consistent. However, little is known about the biological mechanisms underlying the failure to acquire spoken language (Tager-Flusberg, Edelson, & Luyster, 2011).

Repetitive Behaviors Subtypes

The domain of restricted, repetitive behaviors (RRBs) encompasses a variety of behaviors, ranging from repetitive sensorimotor behaviors (RSM), such as hand and finger mannerisms, to insistence on sameness (IS, e.g., difficulties with changes in routine). Factor analyses of the Autism Diagnostic Interview-Revised support a division of these subtypes of RRBs (Rutter, LeCouteur, & Lord, 2003). While RSM behaviors are frequently associated with lower cognitive and adaptive functioning, IS has been shown to be relatively independent of other phenotypic features (see Richler, Huerta, Bishop, & Lord, 2010 for review). Differences in correlates and predictors of change, as well as differences in patterns of change for each subtype of RRB, provide further evidence for distinct profiles of repetitive behaviors in persons with ASD. Several studies have demonstrated genetic associations with IS, further supporting its utility as a distinct subtype; recent evidence for a relationship between distinct genetic regions and RSMA has also been reported (see Coon et al., 2010).

Patterns of Onset

There has been a great deal of interest in patterns of onset of ASD, particularly in children who exhibit a loss of language and/or social skills in the first few years of life. Pickles and colleagues (2009) provide evidence that regression is highly specific to ASD and suggest that the phenomenon underlying loss may be related to brain development in a subtype of autism. In a sample of multiplex families in which both affected family members had a history of regression, Molloy and colleagues (2005) found evidence of linkage on 7q and 21q, including regions containing genes expressed in fetal brain. However, several studies have reported that, by later childhood, children with a history of regression do not differ from children without regression on a variety of outcome measures, including intellectual functioning, symptom severity, adaptive behaviors, seizures, and gastrointestinal difficulties. As with language milestones, many studies have relied on retrospective parent report of regression, which may not capture the more subtle losses observed in prospective studies (Ozonoff, Heung, & Thompson, 2011).

Physical Phenotypes

In addition to subtypes defined by specific patterns of behavior, some researchers have hypothesized that physical phenotypic features may reflect abnormal processes during embryogenesis or related to the genes involved in early development of the brain stem and face (Miles & Hillman, 2000; Rodier, Ingram, Tisdale, Nelson, & Romano, 1996). Although dysmorphic features are neither sensitive nor specific to ASD, they may provide insight into the etiological process contributing to risk and/or development of ASD, as well as the prenatal period in which exposure to a teratogen occurred (Dufour-Rainfray et al., 2011).

Miles and colleagues (2005) have hypothesized that children with congenital anomalies

(i.e., significant dysmorphology or microcephaly) may represent an etiologically distinct subtype which they refer to as "complex autism." In contrast, children with no evidence of dysmorphology define "essential autism." Compared to children with essential autism, those with complex autism are more cognitively impaired and more likely to have seizures and abnormal brain structures. Children with essential autism were noted to have a higher likelihood of being male and a family history of autism as well as a higher sibling recurrence risk (taking into account specific known genetic disorders). Miles and colleagues suggest that removing children with complex autism (which include children with specific identifiable syndromes, such as Fragile X Syndrome) from linkage and sib-pair analyses will provide a more homogeneous subgroup.

Others have focused on macrocephaly and accelerated trajectories of brain growth as a putative subtype. Pierce and Eyler (2011) posit three types of brain growth in ASD: (1) children who meet criteria for macrencephaly and have persistently enlarged brains; (2) those whose brains demonstrate large changes in size relative to head circumference at birth; and (3) those who do not demonstrate dramatic changes in brain size. However, neither the mechanisms contributing to enlarged brains and/or accelerated patterns of growth nor the relationship between these subtypes and functional outcomes in ASD is well understood (see Miles, 2011 and Pierce & Eyler, 2011). Associations with genes implicated in other disorders (e.g., PTEN) have been demonstrated in children with autism, suggesting that studying the overlap between autism and other genetic disorders associated with macrocephaly may further the understanding of this subtype (Miles, 2011). Further studies of the developing brain at the cellular and molecular level will be important to gain insight into gene expression and mechanisms contributing to accelerated patterns of brain growth (Pierce & Eyler, 2011).

In addition to physical phenotypic features, a large body of research has investigated neurochemical subtypes in ASD. One neurotransmitter that has received a significant amount of interest is serotonin (5-HT). Since early studies demonstrated that children with ASD had higher levels of whole blood 5-HT, numerous studies have sought to understand the role that 5-HT may play in ASD (see Posey, Lodin, Erickson, & Stigler, 2011). Serotonin challenge studies have demonstrated differences in both neuroendocrine function and behavioral symptoms (e.g., increased repetitive and self-injurious behaviors) in some participants with autism compared to controls. In contrast, studies examining the effects of selective serotonin reuptake inhibitors (SSRIs) on reducing RRBs have had mixed results (see King et al., 2009). With respect to underlying mechanisms, genes associated with whole blood 5-HT levels have been posited to play a role in autism susceptibility. Numerous studies have also indicated associations between the 5-HT transporter gene (SLC6A4) and autism, though the region implicated has varied across studies. Results suggest a complex relationship between this gene and autism; it is possible that associations with the short or long allele may represent two differing subtypes (which may explain the variability in effectiveness of SSRIs). Nonetheless, associations between SLC6A4 variants and more severe impairments in nonverbal communication and repetitive behaviors, as well as increases in cortical gray matter, suggest that this gene may increase susceptibility to autism in certain groups of children (see Posey et al., 2011; Veenstra-VanderWeele & Anderson, 2011).

Sex

Many researchers have hypothesized reasons for the discrepancy in prevalence of ASD in males versus females, suggesting that affected males and females may demonstrate different cognitive or behavioral phenotypes. Early studies comparing sexes reported that females with ASD were more impaired than males in cognitive functioning (see Hartley & Sikora, 2009 for review). Recent research has begun to suggest that sex differences in cognitive ability may be present in families with one child with ASD and one or more unaffected siblings (i.e., simplex samples),

but not multiplex samples (i.e., families with more than one child with ASD; Banach et al., 2008; Spiker et al., 2002).

Studies examining sex differences in ASD-related impairments have provided mixed results. While some studies have found no differences between males and females, others have suggested that, after controlling for cognitive functioning, females may demonstrate milder ASD-related impairments, particularly in terms of RRBs and imitation and play skills (see Hartley & Sikora, 2009). Interestingly, behaviors comprising IS have been shown to be relatively independent of sex (Hus et al., 2007; Richler et al., 2010). Retrospective parent report of behaviors during the preschool years suggests that males may have more impaired social and communication skills than females, whereas parental reports of their child's current functioning at older ages indicated that females had more social and communication difficulties than males; other studies reported no differences (see Hartley & Sikora, 2009 for review). Although findings with respect to RRBs are somewhat more consistent, it is important to note that these findings have been limited to a few studies of repetitive behaviors in toddlers or preschool- to school-age children. Thus, sex-RRB associations may be somewhat different in adolescents and adults. In contrast, studies examining social and communication impairments tended to have a somewhat wider age range, which may explain the variability in results. Moreover, measures used to diagnose ASD have not been specifically validated in female samples and may not fully capture the behavioral variability demonstrated by females with ASD (Huerta et al., 2011).

There is some evidence for sex-based etiological differences, though results have also not always been consistent. Genetic studies have indicated specific linkage associations with male-only families and others with families including females (e.g., Lamb et al., 2005; Stone et al., 2004). Furthermore, proportion of individuals carrying de novo CNVs is lower (2:1 male to female) than the overall ratio of affected males to females in the population (Xu et al., 2008).

Responders to Treatment

Paralleling the behavioral heterogeneity observed in ASD, there is a great deal of variability in response to treatment. Some researchers have begun to try to understand what factors may influence a child's responsiveness to a given treatment. In young children with autism, baseline child characteristics such as IQ, language level, interest in objects/activities, and initiation of joint attention have predicted response to different treatments. Importantly, certain interventions have been differentially predicted by these characteristics. For example, children who initiated joint attention prior to treatment made more gains in response to responsive education and prelinguistic milieu teaching (REPMT), a naturalistic behavioral language intervention; in contrast, children with more limited joint attention skills responded better to the picture exchange communication system (PECS), a structured augmentative communication intervention (see Schreibman & Ingersoll, 2011 for review).

Although subgroups of treatment "responders" (i.e., those who have made the most gains in response to receiving an intervention) have been identified based upon behavioral characteristics, because these characteristics are often defined relative to the "nonresponders," it is difficult to know how to define these subtypes outside of the context of the intervention study. That is, if we wanted to decide whether to refer a child to REPMT or PECS, at what point do we decide that his or her level of joint attention skills is sufficient to suggest response to REPMT or impaired enough to recommend that PECS may be more appropriate? While clearly there is no sufficient data to inform such clinical decisions just yet, studies that did not find expected moderating effects of child characteristics (e.g., joint attention) speculate that the absence of effects may be due to the behavior not being sampled in a sufficient number of contexts (Carter et al., 2011).

Current Knowledge

The goal of subtyping in autism – reducing phenotypic heterogeneity to produce groups

more likely to share a common etiology or to predict response to treatment – seems logical. However, this approach has not always yielded the anticipated results, particularly with respect to identifying behaviors that reflect distinct etiologies. While some studies using subtypes to stratify samples have shown increased associations in genetic studies and identified QTLs related to particular subtypes, results have varied. Sometimes associations have not been significant, whereas in other studies, areas implicated have differed. On the other hand, defining subtypes of "responders" to different treatments has yielded promising results in the sense that some behaviors seem to differentially predict responses to certain treatments. However, thus far, only a few studies have characterized "responders" to treatment; many of these subtypes have yet to be replicated, and more research is needed to determine how "responders" to a given treatment respond to similar types of interventions (e.g., naturalistic interventions delivered by a therapist vs. a parent).

Small sample sizes present a significant challenge in the interpretation of discrepant results across studies (Charman et al., 2011). As noted above, finding subtypes that are independent of other characteristics, such as age and IQ, has also been challenging. An additional concern is whether the instruments used to define subtypes result in accurate classification.

Future Directions

Autism research has rapidly expanded over the last several decades, and the development and refinement of diagnostic measures now widely used across studies will facilitate our investigations of subtypes in ASD. Efforts should be made to establish subtypes using multiple measures (i.e., direct observation and parent report), with a focus on current information or corroborating information from retrospective reports with prior documentation whenever possible. The formation of multisite collaborations and national databases, such as the Simons Foundation Autism Research Initiative (SFARI) and National Database for Autism Research (NDAR), will further promote these types of studies by providing larger samples and increased statistical power. However, we must be cognizant of factors that may influence interpretation of our results from these studies, such as ascertainment biases and site-specific effects. Thus, it will also be important for investigators conducting population-based studies to compile their samples to allow for sufficiently sized samples in which to test subtypes. Collaboration across longitudinal studies is also needed to allow examination of subtypes across several points in time as well as to take a developmental approach to identify subtypes based upon changes in behavior over time (Richler et al., 2010).

With advances in technology providing more sophisticated and sensitive measures of biological mechanisms, our understanding of how brain systems relate to behavior in both clinical and nonclinical samples has increased exponentially in the last decade, thereby enhancing our ability to investigate how behavioral subtypes in ASD may relate to neurobiological mechanisms (Charman et al., 2011). It is important that we use this knowledge to begin to draw and test hypotheses as to how some of the noted genetic variations may influence the behavioral phenotypes with which they are associated. Although some studies have begun to investigate how genes implicated in autism may affect neural mechanisms, there is still a great deal of interest in connecting behavior with particularly genotypes, which overlooks the complexity of the relationship between genes and behavior. It will be important for future investigations of subtypes to examine how gene expression influences brain structure and function to produce behavior in particular groups of individuals as well as how interactions between genes and between genes and the environment influence the brain (Abrahams & Geschwind, 2008).

As behavioral subtypes are defined, it is important to remember that not all subtypes will be strongly associated with specific genotypes (Meyer-Lindenberg, 2010). Thus, it is also important that future efforts be made to investigate the clinical utility of a given subtype

(e.g., whether certain behavioral subtypes are differentially responsive to particular types of treatment). To facilitate the identification of subtypes of "responders" to treatment, it may be necessary for intervention researchers to establish an agreed upon set of measures that will be considered as potential moderators to treatment. Similar measures across studies will facilitate the establishment of clear-cut parameters to define subtypes of treatment "responders." Clearly defined subtypes will be particularly important in translating these results to clinical practice, as references to "more impaired skills" relative to the "nonresponders" are not useful in the context of deciding whether a young client is likely to benefit from a given intervention. Furthermore, requiring all studies to collect similar information will allow for comparison of how a subtype of "responders" to one treatment may benefit from other interventions. This would allow for the treatments to which the child is least likely to respond to be "ruled out" while still providing options that can then be considered with respect to other factors influencing response to treatment (e.g., parent and family characteristics, cultural factors, etc.; see Schreibman & Ingersoll, 2011). It is also important to highlight that, in addition to defining subtypes of "responders," significant efforts must also be dedicated to understanding "nonresponders" and to ensure that alternative treatments are identified for these groups. Future studies should also examine treatment response in older children and may consider examining subtypes of children who benefit from group interventions, such as social skills groups.

The search for subtypes to decrease heterogeneity in ASD may lead to a better understanding of the pathophysiology contributing to this complex disorder and enhance our ability to recommend the most appropriate treatments for certain groups of children. While much research has been done in this area, few subtypes have been definitively linked to biological mechanisms and there is not yet sufficient data to clearly define parameters of child characteristics predicting response to treatment. Research in the next decade will be crucial to determining whether and how subtypes can be used in clinical practice.

See Also

- ▶ Endophenotypes
- ▶ Factors Affecting Outcomes

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Suicide Rates in Adults with Autism

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Definition

Suicide may be defined as the act of deliberately causing one's own death. It is the most extreme end of a spectrum of behavior that ranges from suicidal thoughts and to completed suicide. While suicide itself is not classified as a psychiatric (mental) disorder, it is commonly associated with one, such as depression. Precipitants and life events also play an important role, in particular, those associated with loss, such as bereavement, breakup of a relationship, etc.

Current Knowledge

Suicidal Behavior in Persons with ASD

Though rarely reported, suicidal behavior sometimes occurs in persons with autism spectrum disorders. It can be divided into two broad categories as follows:

Suicidal Behavior in More Able Persons with ASD

In the last few years, there has been an increasing recognition that persons with autism spectrum disorders (ASD) can also develop a variety of psychiatric conditions during their life span, such as depression and other mood disorders. As data from longitudinal follow-up studies have shown, they tend to develop these conditions especially after they reach puberty (Howlin, 2000). Depression is probably the most common disorder that affects persons with ASD. While the symptoms of depression vary with age and the level of verbal/cognitive skills, they can range from social withdrawal and sadness to catatonia and suicide.

A review of the literature suggests that very little has been published on suicidal behavior in ASD. However, several anecdotal reports have appeared in the news media recently. A Google

search based on selected keywords yielded several reports published during the past 5 years. For example, Nikki Bacharach, the 40-year-old daughter of the singer Burt Bacharach and Angie Dickinson, committed suicide by suffocating herself using a plastic bag and helium (2007). She reportedly had a diagnosis of Asperger syndrome and had a long history of struggling with depression and other psychiatric issues. According to the reports, she "loved kittens, meteor showers and science" and had studied geology at the university. Following this tragedy, several more reports were published on blogs and discussion forums focusing on suicidal behavior in persons with Asperger syndrome and autism. It has been speculated that persons with higher functioning ASD may be more prone to depression and suicidal behavior because of their greater insight into their condition. However, there is no evidence that this is indeed the case.

Apart from media reports, incidents of suicidal behavior can be gleaned from descriptive and longitudinal follow-up studies of persons with ASD, especially those who are more able or high functioning, that is, those who have normal intelligence and have reasonably good verbal skills. For example, two of the patients described by Lorna Wing in her seminal paper on Asperger syndrome had made a suicidal attempt and another had talked about doing so (Wing, 1981). In their sample of "schizoid" men and women, many of whom were probably on the autistic spectrum, Wolff and McGuire found that 10 out of 17 women and 17 out of 32 men had attempted suicide, a rate higher than that in the general population (Wolff & McGuire, 1995). Clarke and colleagues (1989) also described a man with ASD and suicidal thoughts. Mouridsen and colleagues (2008) examined the causes of death in a sample of patients aged 2–17 years seen in a clinic in Denmark. They found that the rate of mortality was increased in persons with autism and its variants compared to the rest of the population. Among the 26 deaths recorded, 5 patients died from unnatural causes, 3 in accidents (suffocation and drowning), and 2 by suicide. Both patients were male of average intelligence. One, with a diagnosis of atypical autism, took an overdose of medications, while another, with a diagnosis of Asperger syndrome, jumped to his death (Mouridsen et al., 2008). In a survey of the health needs of adults with ASD done in the UK by the National Autism Society (NAS, 2001), 32% of the sample had experienced psychiatric problems. Of these, 56% had suffered from depressive illness, and 8% had either felt suicidal or made suicidal attempts (Barnard, Harvey, Potter, & Prior, 2001). Thus, several reports have described the occurrence of suicidal behavior in more able or verbal persons with ASD, although the exact dates are not available. It is important for caregivers and professionals to be aware of this risk. In a recent study, Raja and colleagues (2011) described the occurrence of suicidal behavior in 26 adults with ASD. Out of this sample, 2 (7.7%) committed suicide. Although about 30% presented with suicidal ideation, suicidal attempts were far less common. Two patients (3.7%) had one or more relatives who had completed suicide emphasizing the importance of genetic factors. In addition, most of the patients presented with psychotic features underscoring the role of psychiatric comorbidity in the precipitation of suicidal behavior in persons with ASD (Raja et al., 2011).

Suicidal Behavior in Less Able Persons with ASD

A few reports of suicidal behavior and completed suicide have been described in persons with mental retardation (intellectual disability), some of whom may have comorbid autism.

Walters (1990) described four individuals with an IQ under 50 who had exhibited suicidal behavior. Although none of them had a comorbid diagnosis of autism, some of the patients showed repetitive behaviors, such as head banging and smelling objects, which suggests the possibility of autism. It is possible that some suicides are reported as accidental deaths in persons with ASD, especially in those with intellectual disability. In the Mouridsen study, two of the participants who had accidental deaths "lived in specialized institutions for autistic people. In both cases, the patients managed to swallow dangerous objects and choke on them during

an unsupervised period" (Mouridsen et al., 2008; p. 412). In another study investigating the causes of death in 13,111 ambulatory patients living in California, USA, Shavelle et al. (2001) found higher mortality rates in persons with autism compared to the general population. Elevated death rates were observed for accidents such as drowning although were not provided. While none of the patients had a diagnosis of completed suicide, the authors stressed the need for investigating the apparently high number of unexplained deaths in persons with autism (Shavelle et al., 2001).

Causes of Suicidal Behavior in ASD

The most common cause of suicidal behavior in the general population is psychiatric illness, particularly depression. The same appears to be true of persons with ASD. In fact, depression is probably the most common psychiatric disorder in ASD throughout the life span, especially after puberty. Both high- and low-functioning individuals with ASD may suffer from comorbid depression, although the signs and symptoms are relatively easy to elicit in those who are higher functioning, that is, have relatively normal intelligence and verbal skills. In addition to depression, bipolar disorder can also occur in persons with ASD, especially in late adolescence and early adulthood. In a small number of cases, this can also be associated with suicidal behavior. Rarely, psychotic disorders can also occur in the setting of ASD that, in turn, may lead to suicidal behavior and completed suicide (Raja, Azzoni, & Frustaci, 2011). Finally, in a small number of cases, it may not be possible to elicit a cause for the suicidal behavior as in those who cut themselves in a repetitive manner.

Management

Crisis Intervention/Inpatient Admission The first step is to ensure the safety of the affected person. Although every case has to be judged on its own basis, all suicidal threats and gestures should be taken seriously. While persons with profound mental retardation may not be able to carry on their threats, they should still be screened for suicidal thoughts. If the patient is actively suicidal and/or the family is not able to guarantee the patient's safety, then a brief psychiatric admission, lasting no more than a week, to a specialized unit may be necessary. When available, such units can be extremely useful. The objectives of hospitalization are to ensure the safety of the patient, clarify the reasons for the suicidal threat or gesture, screen for any psychiatric disorders, and give relief and support to the family.

A detailed psychiatric assessment should be performed taking into account the previous history of any suicidal attempt; the presence of any risk factors such as the family history of psychiatric illness and suicidal behavior; and the presence of psychiatric signs and symptoms, especially those of depression. As discussed above, depression of various types is common in persons with ASD. A history of recent life events and environmental stressors should also be elicited, paying particular attention to even such ostensibly trivial events as staff changes. Adolescents with high-functioning forms of ASD may be at particular risk. Many of them face bullying because of their social deficits. Problems relating to sexual and dating behavior can also cause serious adjustment problems leading sometimes to depression and suicidality.

Clinicians working with lower functioning individuals should be particularly trained in screening for depression and other psychiatric symptoms in this population because the symptoms differ from those that occur in the higher functioning group. For example, persons with ASD who have significant verbal and cognitive impairment may choose to express their feelings in indirect ways. Also, they may show more vegetative features of depression such as weight loss and incontinence. Severe behavioral regression can also occur as an index of underlying depression. In extreme cases, the affected person may stop eating and drinking and starve himself to death. Catatonia occurring in the context of depression in persons with ASD has been reported. However, depression is not the only psychiatric disorder that can lead to suicidal behavior in persons with ASD. Reckless and

suicidal behavior can also occur as a result of other psychiatric disorders, such as bipolar illness. In addition to doing a thorough mental status examination, a detailed medical examination should also be performed to rule out any contributory factors such as thyroid disease.

Outpatient Treatment The purpose of outpatient treatment is to help the patient build on the skills learned on the inpatient unit and also to continue with and monitor the treatments. These usually consist of a combination of medications and supportive psychotherapy. Use and choice of the medications depend on the target symptoms, such as those of depression. Therapy consists of teaching suitable cognitive skills and making appropriate changes in the environment. For example, if the suicidal act occurs as a result of bullying at school, all efforts should be made to involve the school authorities in the treatment program in order to provide support and protection to the affected person.

Care of the Family Parents and caregivers go through a severe stress and trauma when they realize, often for the first time, that their son/daughter not only has a chronic disability (autism) but also a psychiatric disorder. Sometimes, because of the stigma surrounding psychiatric disorders in general, parents may delay seeking help for their child and also for themselves. In addition, there is enough evidence to suggest that because of a variety of reasons, immediate family members of persons with ASD may themselves suffer from a range of psychiatric disorders including depression. Issues of guilt and anger should be recognized and discussed tactfully by the clinician. Nursing and other trained staff on the inpatient unit should be directly involved in devising a plan not only to clarify the current risk but also to prevent any such incidents in the future.

Patients Who Indulge in Repetitive Self-Harm A small number of persons with ASD repeatedly harm themselves, sometimes with the intent of committing suicide. This is a challenging group of patients to treat. Common methods consist of self-cutting and taking overdoses. These should be differentiated from low-functioning individuals who indulge in repetitive self-injurious behaviors such as head banging and self-biting. In the latter group, the intent to commit suicide is not clear or at least not expressed openly.

Prevention It is critical to recognize the first clues of an impending suicidal attempt and take all preventative steps. This may consist of a series of steps ranging from getting locks on the doors and windows to taking care of any weapons in the house. As stated above, all suicidal threats should be taken seriously. Caregivers should also be alert to the presence or emergence of features of depression such as persistent feelings of sadness, crying spells, increasing social withdrawal, abnormal ideas or beliefs, and extreme slowness of movements. Those patients who have a past history of suicidal behavior and those with a family history of completed or attempted suicide should be particularly targeted for observation.

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Sulfatide Lipidosis

► Metachromatic Leukodystrophy

Sulfatidosis

► Metachromatic Leukodystrophy

Superior Parietal Lobule

► Parietal Lobe

Superior Temporal Sulcus

► Superior Temporal Sulcus Region

Superior Temporal Sulcus Region

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Synonyms

Superior temporal sulcus

Definition

The superior temporal sulcus is the sulcus separating the superior temporal gyrus from the middle temporal gyrus in the temporal lobe of the brain. Single-cell recordings in monkeys, and neurophysiological and neuroimaging studies in humans, reveal that cerebral cortex in and near the superior temporal sulcus region plays an important role in social perception. As defined by Allison, Puce, and McCarthy (2000), social perception "refers to initial stages in the processing of information that culminates in the accurate analysis of the dispositions and intentions of other individuals." In man and monkey, the superior temporal sulcus regions respond vigorously to biological motion (the motion characteristic of living, animate beings) including movements of the eyes, mouth, hands, arms, and whole body.

See Also

► Biological Motion
► Fusiform Face Area

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Support Trust

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Definition

A support trust is a type of discretionary trust used for estate planning whereby the creator of the trust (the *settlor*) transfers the assets to another (the *trustee*), who then has a duty to hold and manage the assets for the benefit of a third party (the *beneficiary*). If the trust is established by a living settlor, rather than through a will, the trust acts as a will substitute and the transferred estate avoids probate and some estate taxes.

A pure discretionary trust empowers the trustee with absolute discretion to authorize any distributions the trustee considers advisable. The trustee may decide the "time, purpose and amount of all distributions" to one or more beneficiaries (POMS SI §01120.200.B.10). Because the trustee can only be compelled to distribute money from the trust under very restricted circumstances, the assets are protected against invasion by the beneficiary, or the beneficiary's general creditors.

In contrast, a support trust grants limited discretion upon the trustee allowing distributions solely for the "comfortable support, education, health and maintenance of the beneficiary" (Leslie & Sterk, 2006). "Food, shelter, education, and medical care" are eligible categories, but the trustee may still have the discretion to determine the timing and amount of assets to assign to each category (Begley & Canellos, 2010).

A common type of support trust provides care for a surviving spouse in "the manner and style to which they are accustomed" (In re Estate of Brown, 1987, p. 754). In other instances, a support trust can drafted to meet the special needs of a minor child, or a mentally incompetent individual.

Special needs trusts are established to provide supplemental funds for a beneficiary who may also be eligible to receive public benefits including SSI or other government benefits. Trust fund distributions must only supplement public funding; the beneficiary must have no control over the assets, or ability to compel distributions. Administration of such trusts can be complex, requiring specialized knowledge of the entitlement programs available over the course of the incompetent beneficiary's lifetime.

A support trust may be an effective estate planning tool, depending on the intent of the settlor, the objectives of the trust, and the specific needs of the beneficiary. However, the trust must be carefully drafted to consider potential conflicts between the availability of trust assets to potential creditors, as well as eligibility for public assistance programs. Additionally, problems may arise such as a trustee's breach of duty to manage the trust in "good faith," or "in accordance with its terms and purposes," or "in the interests of the beneficiary" (Uniform Trust Code § 801 et. seq.). This may be demonstrated when the trustee abuses the assigned discretionary power, and the beneficiary is not competent to address the breach. Therefore, one must carefully evaluate the goals of the settlor, the competence and trustworthiness of the trustee, and the long-term needs of the beneficiary in order to determine which type of discretionary trust is the best estate planning option.

See Also

▶ Discretionary Trust

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Supported Employment

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Definition

The term supported employment has been traced back to the early 1980s when advocates and

service providers for individuals with intellectual disabilities became increasingly aware that students were not making the transition from school to the workforce. The official government definition appeared in the mid-1980s and provided the parameters of the concept that still exists today.

Supported employment means:

1. Competitive employment in an integrated setting with ongoing support services for individuals with the most severe disabilities:
   (a) For whom competitive employment has not traditionally occurred or for whom competitive employment has been interrupted or intermittent as a result of a severe disability
   (b) Who, because of the nature and severity of their disabilities, need intensive supported employment services from the designated state unit and extended services after transition in order to perform this work
2. Transitional employment for individuals with the most severe disabilities due to mental illness

Some of the major terms in the definition such as competitive employment and ongoing services will be examined more closely in the following section when supported employment is described as a state's vocational rehabilitation service option known as supported employment services.

A number of models emerged over the years. The one promoted here is the individualized approach where a person with a significant disability receives one-to-one assistance with gaining or maintaining employment in his or her community, a real job for real pay, by using an array of supports provided and/or facilitated by a vocational rehabilitation professional known as a job coach or employment specialist. It has been described as a strategy for changing the mismatch between employment expectations for people with severe disabilities and the limited options in their communities (i.e., workshops or unemployment, etc.).

Historical Background

For many years, individuals with significant disabilities were served within a continuum model of vocational rehabilitation which included day centers, sheltered workshops, and transitional programs. The premise behind this approach was to teach individuals with disabilities the skills needed to become "ready to work." However, movement out of these segregated settings into employment in the community rarely took place, and eventually, the system came under criticism (Wehman, 2006; Whitehead, 1979). At this time, the belief that all individuals including those with significant disabilities should have the opportunity to achieve as much independence as possible including working in their communities was also beginning to flourish. In addition, a number of researchers were demonstrating that people with moderate to severe intellectual disabilities could learn complex real work tasks and furthermore that these tasks could and should be taught on the job (Bellamy, Horner, & Inman, 1979; Gold 1972a 1972b, 1978; Rusch & Scutz, 1979; Wehman, 1981; Wehman, Hill, & Keohler, 1979), instead of in segregated settings. The approach used applied behavior analysis and systematic instruction (Test & Wood, 1997). This requires breaking tasks down into stimulus response chains and using prompting hierarchies and reinforcement to teach them (Bellamy et al., 1979).

At last, no longer were individuals with significant disabilities required to learn prerequisite skills in segregated settings prior to going to work. Instead of training an individual with a disability outside of a workplace to get ready to work (i.e., work readiness) and then locating employment, now research backed the effectiveness of a model that emphasized the effectiveness of obtaining employment first and then training the newly hired employee the skills needed on the job. In the years that followed, a number of projects were funded that demonstrated the effectiveness of training individuals with significant disabilities on the job. The results of these efforts revealed promising practices for a supported employment approach to assist individuals with developmental disabilities with employment (Vogelsberg, 1990).

Again, up until this time, most individuals with significant disabilities had often been

denied the option to work in their communities. Because of discrimination and oppression and unfounded beliefs regarding personal skills, capacities, and capabilities, individuals with disabilities had often been relegated to segregated environment like day centers and sheltered workshops.

Passage of legislation, such as the Developmental Disabilities Assistance and Bill of Rights Act of 1984 and Title VI, Part C of the Rehabilitation Act Amendments of 1986, in combination with systems change grants funded through Title III of the Rehabilitation Act, provided the basis for the initiation of a series of federal- and state-funded demonstration projects designed to provide opportunities and supports for individuals with severe or significant disabilities to work alongside other citizens in their communities.

Current Knowledge

Through the years, the supported employment approach has been used to assist individuals with developmental disabilities with gaining and maintaining "real work for real pay" (Wehman, 2012). Although initially conceived as an employment support service for individuals with intellectual disabilities, today supported employment has also been instrumental in assisting individuals with mental illness (Bond et al., 2001; Drake, Becker, Clark, & Mueser,1999), traumatic brain injury (Wehman et al., 1993), autism (Howlin, Alcock, & Burkin, 2005; Wehman, Smith, & Schall, 2009), cerebral palsy, physical disabilities (Inge, Wehman, Strobel, Powell, & Todd, 1998), and other disabilities (Wehman & Revell, 1996).

States offer this service under the State Supported Employment Services Program which is under the Authority: 29 U.S.C. 795j–q, unless otherwise noted. What follows are the specifics about the program and the definitions from the Source: 59 FR 8331, Feb. 18, 1993, unless otherwise noted.

Under the State Supported Employment Services Program, the secretary provides grants to assist states in developing and implementing collaborative programs with appropriate entities to provide programs of supported employment services for individuals with the most severe disabilities who require supported employment services to enter or retain competitive employment (Authority: 29 U.S.C. 795j).

A state may provide services under this program to any individual if:

(a) The individual has been determined eligible for vocational rehabilitation services in accordance with the criteria in section 102(a) (1) of the Act
(b) The individual has been determined to be an individual with the most severe disabilities
(c) Supported employment has been identified as the appropriate rehabilitation objective for the individual on the basis of a comprehensive assessment of rehabilitation needs, including an evaluation of rehabilitation, career, and job needs (Authority: 29 U.S.C. 795 m)

Under this program, the following activities are authorized:

(a) Any particularized assessment that is needed to supplement the comprehensive assessment of rehabilitation needs done under 34 CFR part 361 and that is provided subsequent to the development of the individualized written rehabilitation program. The supplementary assessment may be provided in circumstances such as the following:
    1. A reassessment of the suitability of the placement is warranted.
    2. There is a change in the individual's medical condition.
(b) Development of and placement in jobs for individuals with the most severe disabilities.
(c) Provision of supported employment services that are needed to support individuals with the most severe disabilities in employment, such as:
    1. Intensive on-the-job skills training and other training provided by skilled job trainers, coworkers, and other qualified individuals, and other services specified in Section 103(a) of the Act in order to achieve and maintain job stability

2. Follow-up services, including regular contact with employers, trainees with the most severe disabilities, parents, guardians or other representatives of trainees, and other suitable professional and informed advisors in order to reinforce and stabilize the job placement
3. Discrete postemployment services following transition that are unavailable from an extended services provider and that are necessary to maintain the job placement, such as job station redesign, repair and maintenance of assistive technology, and replacement of prosthetic and orthotic devices (Authority: 29 U.S.C. 795l)

The following regulations apply to the State Supported Employment Services Program:

(a) The Education Department General Administrative Regulations (EDGAR) as follows:
   1. 34 CFR part 76 (State-Administered Programs)
   2. 34 CFR part 77 (Definitions that Apply to Department Regulations)
   3. 34 CFR part 79 (Intergovernmental Review of Department of Education Programs and Activities)
   4. 34 CFR part 80 (Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments)
   5. 34 CFR part 81 (General Education Provisions Act-Enforcement)
   6. 34 CFR part 82 (New Restrictions on Lobbying)
   7. 34 CFR part 85 (Governmentwide Debarment and Suspension (Nonprocurement) and Governmentwide Requirements for Drug-Free Workplace (Grants))
   8. 34 CFR part 86 (Drug-Free Schools and Campuses)

(b) The regulations in this part 363

(c) The following regulations in 34 CFR part 361 (The State Vocational Rehabilitation Services Program): §§361.31; 361.32; 361.33; 361.34; 361.35; 361.39; 361.40; 361.41; 361.42; 361.47(a); 361.48; and 361.49

Note: Many of the regulatory provisions cross-referenced in §363.5(c) are affected by statutory changes made by the Rehabilitation Act Amendments of 1992. If these provisions conflict with statutory language, they are superseded by the statutory language. Program regulations for part 361 are being amended to implement statutory changes. When final regulations for part 361 are published, these cross-references will be corrected, if necessary

(Authority: 29 U.S.C. 795j and 711(c)):

(a) Definitions in 34 CFR part 361. The following terms used in this part are defined in 34 CFR 369.4(b):
   Act
   Designated state unit
   Individual with disabilities
   Individual with severe disabilities
   State plan

(b) Definitions in EDGAR. The following terms used in this part are defined in 34 CFR 77.1:
   Fiscal year
   Nonprofit
   Private secretary
   State

(c) *Other definitions*. The following definitions also apply to this part:
   1. *Supported employment* means:
      (i) Competitive employment in an integrated setting with ongoing support services for individuals with the most severe disabilities:
         (A) For whom competitive employment has not traditionally occurred or for whom competitive employment has been interrupted or intermittent as a result of a severe disability
         (B) Who, because of the nature and severity of their disabilities, need intensive supported employment services from the designated State unit and extended services after transition in order to perform this work

(ii) Transitional employment for individuals with the most severe disabilities due to mental illness

2. As used in the definition of "supported employment":
   (i) *Competitive employment* means work:
      (A) In the competitive labor market that is performed on a full-time or part-time basis in an integrated setting
      (B) For which an individual is compensated at or above the minimum wage, but not less than the customary or usual wage paid by the employer for the same or similar work performed by individuals who are not disabled
   (ii) *Integrated setting* means a setting typically found in the community in which an individual with the most severe disabilities interacts with nondisabled individuals, other than nondisabled individuals who are providing services to that individual, to the same extent that nondisabled individuals in comparable positions interact with other persons.
   (iii) *Supported employment services* means ongoing support services provided by the designated state unit with funds under this part:
      (A) For a period not to exceed 18 months, unless under special circumstances a longer period to achieve job stabilization has been jointly agreed to by the individual and the rehabilitation counselor and established in the individualized written rehabilitation program, before an individual with the most severe disabilities makes the transition to extended services
      (B) As discrete postemployment services following transition in accordance with §363.4(c) (3)
   (iv) *Extended services* means ongoing support services and other appropriate services provided by a state agency, a private nonprofit organization, employer, or any other appropriate resource, from funds other than funds received under this part, part 381, part 376, or part 380, after an individual with the most severe disabilities has made the transition from state vocational rehabilitation agency support.
   (v) *Transitional employment* means a series of temporary job placements in competitive work in an integrated work setting with ongoing support services for individuals with the most severe disabilities due to mental illness. In transitional employment, the provision of ongoing support services must include continuing sequential job placements until job permanency is achieved.
3. *Ongoing support services* means services that are:
   (i) Needed to support and maintain an individual with the most severe disabilities in supported employment
   (ii) Based on a determination by the designated state unit of the individual's needs as specified in an individualized written rehabilitation program
   (iii) Furnished by the designated state unit from the time of job placement until transition to extended services, except as provided in §363.4(c) (3) and, following transition, by one or more extended services providers throughout the individual's term of employment in a particular job placement or multiple placements if those placements are being provided under a program of transitional employment. Ongoing support services must include, at a minimum, twice-monthly monitoring at the work site of each individual in supported employment to assess employment

stability, unless under special circumstances; especially at the request of the individual, the individualized written rehabilitation program provides for offsite monitoring and, based upon that assessment, the coordination or provision of specific services at or away from the work site that are needed to maintain employment stability. If offsite monitoring is determined to be appropriate, it must, at a minimum, consist of two meetings with the individual and one contact with the employer each month. Ongoing support services consist of:

(A) Any particularized assessment needed to supplement the comprehensive assessment of rehabilitation needs
(B) The provision of skilled job trainers who accompany the individual for intensive job skill training at the work site
(C) Job development and placement
(D) Social skills training
(E) Regular observation or supervision of the individual
(F) Follow-up services such as regular contact with the employers, the individuals, the parents, family members, guardians, advocates or authorized representatives of the individuals, and other suitable professional and informed advisors, in order to reinforce and stabilize the job placement
(G) Facilitation of natural supports at the work site
(H) Any other service identified in the scope of rehabilitation services described in 34 CFR part 361
(I) Any service similar to the foregoing services

(Authority: 29 U.S.C. 706(18), 711(c), and 795j)

[59 FR 8331, Feb. 18, 1993, as amended at 62 FR 6363, Feb. 11, 1997]

Future Directions

Today, with the right type, level, and intensity of support, more and more individuals with intellectual disabilities are living and working in their communities (Wehman, 2006; Wehman, Revell & Brooke, 2003). Since its inception, supported employment has assisted individuals with significant disabilities with achieving positive employment outcomes (Wehman et al. 2006; Wehman, Revell, & Kregel, 1998). However, challenges remain for those who want to work. These individuals lack access to the support needed to gain and maintain work in their communities due to the slow conversion of day programs, slow expansion of program capacity among day programs that now offer integrated options (i.e., supported employment), no or limited individualized supported employment service options in such settings in favor of group models, and a lack of consumer choice and self-determination to help ensure meaningful employment outcomes. In addition, greater attention needs to be paid to employers. It is necessary to further investigate their perceptions, as well as examine more ways to motivate them to hire a person with a significant disability, such as customizing a job.

See Also

- ▶ Employment
- ▶ Entrepreneurial Model
- ▶ School to Work Transition Process
- ▶ Sheltered Workshops
- ▶ Transition Planning

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Supported Employment Group

▶ Mobile Work Crew Model

Supported Work

▶ Entrepreneurial Model

Supporting

▶ Reinforcement

Sustained Treatment Benefits

▶ Maintenance of Treatment Effects

Symbol

▶ Icon

Symbol Use

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Definition

The term "symbol use" is often used to describe the deficits in communication that characterize individuals with autism spectrum disorders (ASD; Marans, Rubin, & Laurent, 2005). The capacity for symbol use refers to an individual's ability to use one thing to represent another. Symbolic behavior is evident in verbal as well as nonverbal communication through the use of words as labels, and the use of gestures. An additional domain of symbol use relevant to ASD is that of symbolic play, in which non-present elements are represented by objects, gestures, or language during the play (Rogers, Cook, & Meryl, 2005).

A deficit in symbol use is a core social communication deficit that distinguishes young children with ASD (Wetherby & Woods, 2008). At a prelinguistic level, this is seen in a deficit of symbolic behavior. This includes gestures, pretend or imaginative play, and the ability to imitate others (Paul & Sutherland, 2005). In higher-functioning individuals, the deficit in the capacity for symbol use is seen in difficulties with using language in a flexible manner, such as responding to language that includes words with multiple meanings, nonliteral language, and irony (Marans et al., 2005). An additional area of social communication that might be affected includes symbolic conventions, such as rules of politeness.

See Also

▶ Symbolic Behavior
▶ Symbolic Play

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Symbolic Behavior

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Definition

Symbolic behavior is an encoding process in which items or actions are used to represent something different (Huttenlocher & Higgins, 1978). Engaging in symbolic behavior elicits a network of experiences that is a result of the history of actions that are associated with that

particular symbol (Volkmar, Paul, Klin, & Cohen, 2005). The development of a symbol is related to adaptation, in which somatosensory experiences and perceptually guided actions are integrated, and turns the symbol into a substitute for the action (Volkmar et al., 2005). Imitation is also believed to be a prerequisite for the development of symbolic behavior (Volkmar et al.). Language is the most important type of symbolic behavior; it is also evident in storytelling, play and games, and gestures (Greenberg, 1971; Jones, 1996).

Symbolic behavior functions to create and maintain a common meaning that is shared socially. It validates norms for behaviors and allows individuals to engage in behaviors that connect them together (Harris & Nelson, 2007; Jones, 1996). Symbolic behavior can also create and maintain social interactions. The use of symbols is reliant upon the expected response from others (Volkmar et al., 2005). It is the expectation of shared meaning that both initiates and perpetuates an interaction when one seeks to engage with others and interpret the symbol to represent the same meaning.

Early symbolic behavior can be seen in pretend play and imitation, where an object or person is used to represent another (Volkmar et al., 2005). It is concurrent with the development of language, and "marks the existence of a vivid and active internal world for the young child" (Berg & Sternberg, 1985, p. 68). Symbolic play usually develops around 2–3 years, although the use of symbolic gestures as a function of communication has been observed in children as young as 11 months of age (Acredolo & Goodwyn, 1988). A child's current level of symbolic behavior can be determined by examining the highest level of play that is spontaneously exhibited by the child (Paul, 2007), and is closely related to the child's understanding of a symbolic system, such as language (Christie, 1991).

Historical Background

Children with ASD have difficulties demonstrating symbolic behavior (Baron-Cohen, 1987; Charman & Baron-Cohen, 1997; Libby, Powell, Messer, & Jordan, 1998; Stahmer, 1995; Wing, Gould, Yeates, & Brierley, 1977). The diagnostic criteria for autism include a deficit in symbolic play, particularly in pretend and imitative play, observed before the age of 3 years (American Psychiatric Association [APA], 2000). Given the importance of symbolic behavior in the development of linguistic, social, and cognitive skills, several studies have been conducted to both examine the symbolic play skills of children with ASD and develop interventions to improve those skills.

In early studies of symbolic play among children with ASD (Hammes & Langdell, 1981; Wing et al., 1977), they were found, overall, to have a lack of spontaneous symbolic play. Those children with ASD who did exhibit symbolic play also had more repetitive and stereotyped play (Wing et al.). Although children with ASD were able to imitate video-modeled play acts similarly to children with intellectual disability, they had significantly fewer spontaneous symbolic acts (Hammes & Langdell, 1981). A common theme in the symbolic play literature appears to be that scaffolding (prompting) improves the ability of children with ASD to engage in symbolic play; however, this type of play is still lacking in their spontaneous play (Blanc, Adrien, Roux, & Barthelemy, 2005; Blanc et al., 2000; Lewis & Boucher, 1988; Sigman & Ungerer, 1984; Volkmar et al., 2005).

There are several areas of symbolic play which can be affected for children with ASD. In general, children with ASD do not spontaneously exhibit symbolic play as frequently as other children (Blanc et al., 2005; Hammes & Langdell, 1981; Wing et al., 1977). There is also a lower complexity and variety in the type of symbolic sequences used by children with ASD (Blanc et al., 2005; Wing et al., 1977). It has been hypothesized that these deficits may be a result of dysregulation (Blanc et al., 2005), difficulty with metarepresentation (Baron-Cohen, 1987; Volkmar et al., 2005), or a lack of generativity of ideas (Lewis & Boucher, 1988). Limited symbolic play abilities may also be a result of a lack of social opportunities or more general symbolic thought and language difficulties (Volkmar et al., 2005).

Current Knowledge

Children with ASD have been observed to demonstrate less symbolic behavior compared to their typical peers or peers with other disabilities (Baron-Cohen, 1987; Charman & Baron-Cohen, 1997; Libby et al., 1998; Stahmer, 1995; Volkmar et al., 2005; Wing et al., 1977). Research suggests that children with ASD use less complex nonverbal behavior to communicate, and they demonstrate a disordered pattern that suggests the misuse and misunderstanding of nonverbal communication (APA, 2000). Children with ASD are able to imitate symbolic behavior but seem to have more difficulty producing their own symbolic actions (Blanc et al., 2005; Hammes & Langdell, 1981; Wing et al., 1977). Additionally, deficits in functional and pretend play have been observed, even after they have been modeled by others (Chawarska, Klin, & Volkmar, 2008).

Children with ASD also demonstrate a qualitatively different symbolic play than typically developing children or those with other disabilities, with more object substitutions, fewer attributions of false properties, and no references to absent objects (Blanc et al., 2000, 2005; Lewis & Boucher, 1988; Sigman & Ungerer, 1984; Volkmar et al., 2005). Significant differences in the types of symbolic behaviors used to communicate (i.e., gestures, eye gaze, requesting, and commenting) have also been observed (Stone, Ousley, Yoder, Hogan, & Hepburn, 1997). It has also been found that children with ASD use unconventional gestures and do not use gestures spontaneously (Chawarska et al., 2008). Overall, children with ASD seem to communicate for different reasons, using different types of symbolic and nonverbal behaviors to communicate, and these differences can be detected as early as 2–3 years of age (Stone et al., 1997).

Children with ASD who are able to demonstrate symbolic play behaviors have significantly higher verbal and nonverbal IQs compared to those who do not (Baron-Cohen, 1987). However, even when children with ASD are able to demonstrate symbolic play skills before starting school, they still show poorer play abilities relative to typical peers (McDonough, Stahmer, Schreibman, & Thompson, 1997). Various studies have suggested that symbolic play improves after modeling and that children with ASD are able to engage in symbolic play when the symbol is suggested by another person (Blanc et al., 2000, 2005; Lewis & Boucher, 1988; Sigman & Ungerer, 1984; Volkmar et al., 2005). However, during spontaneous play conditions, children with ASD demonstrate fewer different play behaviors, as well as less functional and sensorimotor play (Volkmar et al.).

Early studies suggested that a relationship existed between language development and symbolic play skills in children with autism (Sigman & Ungerer, 1984); however, more recent studies have reported the absence of a relationship between functional and symbolic play and verbal language (Blanc et al., 2005; Charman & Baron-Cohen, 1997; Volkmar et al., 2005). Linguistic abilities can remain intact, while symbolic behaviors continue to be a challenge for children with ASD (Blanc et al., 2005). There may be distinct communication difficulties associated with autism (e.g., pragmatic joint attention or unusual lexical patterns) that specifically underlie problems with symbolic behavior (Miller, 2007).

Symbolic behavior is commonly measured using the Communication and Symbolic Behavior Scales (CSBS), developed by Wetherby and Prizant (1998). The CSBS consists of a caregiver questionnaire and direct assessment and examines the communicative, social, and symbolic functioning of children up to 6 years old with communication skills between 6 and 24 months old. The CSBS is used to identify at-risk children, guide interventions, and establish profiles that can be monitored over time (Volkmar & Marans, 1999).

In addition, the CSBS Developmental Profile (CSBS-DP) is another standardized tool developed by Wetherby and Prizant (Wetherby, Allen, Cleary, Kublin, & Goldstein, 2002) to evaluate the communication and symbolic behavior of children from 6 to 24 months old. Based on the CSBS, the CSBS-DP consists of a behavior sample, which is a face-to-face evaluation of a child's interaction with a parent and clinician. Three categories of skills are assessed: social, speech, and symbolic scales. The CSBS-DP has been found to be valuable for predicting later

language based on the child's social-communication skills, and positive predictive values for communication delays above 70% for children of ages 9–24 months (Barton, Carr, Herlihy, Knoch, & Fein, 2010; Wetherby, 2006). A copy of the caregiver questionnaire used for the CSBS-DP can be found online: http://www.brookespublishing.com/tools/csbsdp/caregiverquestionnaire.pdf.

Another method used to evaluate symbolic play in nonverbal children is the Carpenter's Play Scale (Carpenter, 1987), which infers a child's symbolic play during four 8-min play scenes with a parent. Using appropriate prompt materials (e.g., tea cups), the actions of the nonverbal child are interpreted to evaluate the presence of symbolic play with those materials (e.g., pretending to drink from the cup). Parents are asked to follow the child's lead throughout the sessions. Similarly, McCune (1995) developed a hierarchical scale on which to rate spontaneous symbolic play behaviors during interactive sessions with a familiar adult using standardized items (e.g., bed and covers, toy food, cars). Both methods use interactional observations to determine the presence of symbolic play behaviors, and have relatively strong validity and reliability.

Another assessment of play skills in children with autism has been adapted from those used with typically developing children. The Structured Play Assessment (SPA; Ungerer & Sigman, 1981) is a developmental play assessment that uses several standardized toy sets that are placed in front of the child sequentially to examine how the child plays with the toys. Children are presented with each toy set for approximately 3–4 min, for a total of a 15–20-min videotaped observation. Several features of play are coded, such as the number of different play acts and the diversity of play, which can ultimately provide a developmental profile of the child's play activity level (Kasari, Freeman, & Paparella, 2006).

Future Directions

Given the difficulties of children with ASD to master symbolic play skills, it seems critical to continue focusing both assessment and intervention studies in this area. It remains unclear exactly why children with ASD struggle with symbolic behavior skills, although several hypotheses have been proposed. While some studies suggest that children with ASD lack the ability to manipulate symbols purposefully and meaningfully (Hammes & Langdell, 1981), other studies propose dysregulation as a more fundamental challenge underlying symbolic play skills (Blanc et al., 2005). Especially given the mixed nature of the literature on the relationship between communication and language with symbolic play skills, additional studies are needed to better evaluate this area. More information is clearly needed to better identify the multiple underlying issues relevant to symbolic behavior that are specifically affecting children with ASD.

In addition, to identify the underlying causes for difficulties in symbolic play, there are several associated areas that relate to symbolic behavior, which remain to be explored by the current literature. For example, the relationship between symbolic behavior and social interest, social orientation, imitation, developmental skills, etc., among children with ASD has not been fully examined (Volkmar et al., 2005). Both child-specific (e.g., neuropsychological) and environment-specific (e.g., exposure to symbolic play practice) areas should be explored (Volkmar et al.).

Better identification of symbolic behavior difficulties can also aid in the early diagnosis of children with ASD. Given that difficulties in this area are a core feature of ASD (APA, 2000), there is good reason to use this skill as an early marker of the disorder (Blanc et al., 2005). There is also a great need for early intervention strategies to address this core deficit. Recent studies targeting symbolic play among children with ASD have been successful in improving this skill (Kasari et al., 2006; Stahmer, 1995; Thorp, Stahmer & Schreibman, 1995); however, more studies are needed to replicate and expand these findings. Naturalistic behavioral procedures, such as Pivotal Response Training, appear to be promising approaches to teaching symbolic play skills to children with ASD (Kasari et al., 2006;

Stahmer, 1995; Thorp et al., 1995). Given that there are now models of interventions to follow in teaching symbolic play skills, those methods should be examined across populations of children with ASD to identify for whom the methods work best.

See Also

- ▶ Pretend Play
- ▶ Symbolic Thought

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Symbolic Play

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Definition

Play emerges in a specific developmental sequence (Belsky & Most, 1981). First, children handle toys in manipulative ways by touching, mouthing, and smelling. Functional play or appropriate play with objects develops at approximately 14 months of age in typically developing children. At about 24 months of age, symbolic play emerges. Symbolic play is behavior that is simulative or nonliteral (Fein, 1981) and involves acting as if something is the case when in reality it is not (Leslie, 1987). Definitions of symbolic play used in the majority of research with children with autism typically involve the following three symbolic forms of pretense (Leslie, 1987): object substitution, in which one object is used to represent another (e.g., using a hairbrush as a telephone); attribution of absent/false properties (e.g., pretending that a stove top is hot when it is not); and imaginary objects present (e.g., pouring tea from an imaginary tea pot). A number of terms have been used interchangeably with symbolic play, including "pretend, fantasy, imagination, and nonrepresentational play" (Jarrold, Boucher, & Smith, 1993). These terms, however, do not have consistent definitions and may include actions with objects, such as pretending to feed one's self or a doll with a spoon, that do not show true evidence of symbol use since the child may actually perceive the toys as smaller versions of real objects (Baron-Cohen, 1987).

Historical Background

Children with autism exhibit significant deficits in the development of symbolic play (Jarrold et al., 1993). Indeed, a "lack of varied, spontaneous, make-believe play" is a diagnostic criterion for autism in the DSM-IV (American Psychiatric Association, 2000). The view that children with autism have impaired symbolic play was first noted by Kanner in 1943 and has subsequently been supported by a number of studies that have compared the ability of children with autism to engage in symbolic play with other groups of children (e.g., typically developing, language delayed, intellectually disabled), matched in a variety of ways (e.g., chronological age, mental age, language age). Symbolic play has been traditionally measured by observing the child interact with a standard set of toys and

recording the number of play actions produced of various types (e.g., functional, symbolic). A commonly used play measure is the Lowe and Costello Symbolic Play Test (Lowe & Costello, 1976). Children are presented with four sets of toys, and their spontaneous engagement with the toy is observed. If the child does not spontaneously engage with the toy set, then they are provided with a prompt such as "what can you do with these" (Stanley & Konstantareas, 2007). The child's score from this test is used to determine their play age.

These studies have typically demonstrated that children with autism are significantly less likely to spontaneously produce symbolic play acts than children without autism functioning at a similar developmental level (see Jarrold et al., 1993 for review). The ability to engage in symbolic play appears to be closely related to both nonverbal and verbal skills. For example, in Baron-Cohen's (1987) study, children with autism who did engage in symbolic play had significantly higher nonverbal mental ages than those who did not. This finding supports a relationship between symbolic play and cognitive development. Further, Stanley and Konstantareas (2007) found that children with autism who exhibited greater cognitive impairment showed lower symbolic play skills, and higher expressive language abilities were associated with better symbolic play skills. However, symbolic play was not significantly related to social development.

Interestingly, although deficits in the spontaneous use of symbolic play have been consistently observed across studies, there is evidence that children with autism can produce symbolic play acts in a structured, elicited setting. For example, Charman and Baron-Cohen (1993) found that children with autism were able to produce a similar number of object substitutions in response to a prompt as children with mental retardation matched on verbal mental age. However, Sigman and Ungerer (1984) found that although children with autism were able to produce some symbolic acts in response to a prompt, they still produced fewer acts than the control group. In general, studies have found that deficits in the spontaneous production of symbolic acts during play are more pronounced than the ability to produce symbolic acts in a structured situation; however, deficits in both of these abilities appear to be present, particularly in younger children with autism.

A number of theoretical accounts of autism have attempted to explain the deficit in symbolic play (see Jarrold et al., 1993 for review). The *metarepresentational* or *theory of mind* hypothesis holds that children with autism have a specific deficit (Leslie, 1987) or delay (Baron-Cohen, 1989) in the ability to form metarepresentations or symbolic second-order representations. It is this underlying cognitive deficit that produces the observed lack of symbolic play in children with autism. Several researchers have suggested that an underlying social deficit, either in the ability to affectively connect with others (Hobson, 1990) or in intersubjectivity (Rogers & Pennington, 1991), disrupts early emotion sharing and attunement between the infant and the parent and leads to later emerging deficits in symbolic play via its impact on the child's ability to recognize others as having differing views of the same situation. The *executive functioning* or *generativity* hypothesis (Harris, 1993; Jarrold, Boucher, & Smith, 1996) suggests that executive functioning problems interfere with the child's ability to generate internal representations or schemas in the absence of prompts or cues. Thus, their spontaneous play remains highly repetitive and stereotyped. Although symbolic play deficits are one of the defining features of the disorder, there is evidence that children with autism exhibit deficits in functional play as well (Jarrold et al., 1993), which has been used to support the view that symbolic play deficits may be the result of a more general deficit in executive functioning.

Current Knowledge

A number of more recent studies on the symbolic play skills in children with autism have clarified a number of questions regarding the scope and underlying causes of symbolic play deficits.

One question is whether symbolic play deficits are due to difficulty in understanding the underlying symbolic representation (competence) or whether they are due to difficulty in generating play ideas (performance). Research with young (Rutherford, Young, Hepburn, & Rogers, 2007) as well as older (Bigham, 2010) children with autism has suggested that children with autism have difficulty both with the spontaneous use as well as the prompted use of symbolic actions, suggesting a difficulty with competence rather than performance. However, there is also evidence that children with autism's spontaneous symbolic play is more impaired than their prompted symbolic play, suggesting that the ability to generate play ideas may also be impaired.

Another issue in the field is whether play deficits in autism are specific to symbolic actions or are more general, involving functional actions as well. To date, the field has been mixed. Several studies, particularly those involving young children with autism, have suggested that play deficits extend to functional actions as well (Rutherford & Rogers, 2003), whereas other studies have found deficits only on symbolic play tasks (Baron-Cohen, 1987; Libby, Powell, Messer, & Jordan, 1997). One recent longitudinal study found that children with autism exhibited impairments in both functional and symbolic play when compared to children with typical development or developmental delay in the early preschool period. However, 1 year later, deficits in functional play were no longer present; yet symbolic play skills remained impaired (Rutherford et al., 2007). Thus, there appears to be an improvement in functional play with time, but not in symbolic play.

Several recent studies have attempted to directly test theories proposed to explain symbolic play deficits in children with autism. In one study, longitudinal predictors of symbolic play were examined in preschoolers with autism, developmental delay, and typical development. Predictors included a spatial reversal task (a task thought to tap executive functions in preschoolers), joint attention (thought to be a precursor to metarepresentation or theory of mind), and imitation. Joint attention skills were predictive of gains in symbolic play over time, whereas spatial reversal and imitation performance were not. In a second study with older children with autism, intellectual disability, and typical development, performance on a false belief task (an index of theory of mind ability) was concurrently associated with understanding of symbolic play acts, but not response inhibition (an aspect of executive function). Thus, current work is more supportive of a metarepresentation explanation for symbolic play deficits.

Due to the prevalence and persistence of symbolic play deficits in children with autism, a number of intervention approaches have been used to teach symbolic play skills to children with autism (see Lang et al., 2009 for review). For example, Kasari, Freeman and Paparella (2006) used a randomized controlled trial to evaluate a symbolic play intervention that used structured and naturalistic teaching strategies in young children with autism. Children were randomly assigned to receive symbolic play training, joint attention training, or a control group. After 6 weeks, children in the symbolic play training group showed a significantly greater number of different, novel, child-initiated symbolic play acts and higher play level than children in the other two groups. Finally, the researchers found the children were able to generalize their skills from the individualized treatment with a therapist to playing with their caregiver (Kasari et al., 2006). In a follow-up study (Kasari, Paparella, Freeman, & Jahromi, 2008), children in the symbolic play training group (and joint attention training group) made greater gains in language on standardized measures than the children in the control group 1 year later, suggesting that improving symbolic play skills can lead to improvements in language skills. Interestingly, although symbolic play and expressive language ability appear to be closely related in children with autism (Stanley & Konstantareas, 2007), training in language skills did not produce changes in use of symbolic play acts (Stahmer, 1995), indicating that symbolic play skills may need to be directly targeted.

Future Directions

The vast majority of research on symbolic play in children with autism has examined these skills at a single time point. Future research is needed that can examine changes in symbolic play over time. In particular, it is important to examine both predictors of gains in symbolic play skills as well as outcomes of gains in symbolic play. Further research that can examine effective methods for improving symbolic play skills in children with autism is needed.

See Also

- ▶ Executive Function (EF)
- ▶ Play
- ▶ Play Intervention
- ▶ Pretend Play
- ▶ Symbolic Behavior
- ▶ Theory of Mind

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Symbolic Thought

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Synonyms

Intuitive thought

Definition

Symbolic thought refers to the use of symbols (e.g., words and images) and mental representations of objects or events to represent the world (Hockenbury & Hockenbury, 2002; Rathus, 2007). Symbolic thought is one of the major developmental outcomes of language acquisition, and the ability to understand and use symbols allows children to engage in intellectual and social activities that are unique to humans (Carlson & Zelazo, 2009; Karpov, 2005).

There are two constructs of symbolic thought: mediation and intentionality. In mediation, a symbol is substituted for a real stimulus, and behavior can be controlled by the symbol rather than the stimulus. Intentionality refers to the awareness of the relationship between the symbol and the stimulus (Karpov, 2005).

Symbolic thought gradually develops throughout infancy and early childhood and is evident in a child's use of imagination while playing (Carlson & Zelazo, 2009; Hockenbury & Hockenbury, 2002). The capacity for symbolic thought allows a child to begin abstract thinking and act independently of what he or she sees and to begin abstract thinking (Karpov, 2005). Its development is related to the development of self-reflection and social interaction (Carlson & Zelazo, 2009). It is a precursor to sociodramatic play, such as role-playing (Karpov, 2005). Children with an immature understanding of symbols may not understand the relationship between symbols and the objects they represent (Hockenbury & Hockenbury, 2002).

See Also

- ▶ Piagetian Stages
- ▶ Symbolic Behavior
- ▶ Symbolic Play

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Synapses

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Definition

A synapse is the area forming the junction between two neurons where an action potential passes from the axon terminal of one neuron to the dendrite of another. There are two types of synapses, chemical and electrical, differentiated by the method by which these action potentials travel between neurons. In chemical synapses, neurotransmitters are required to pass an action potential across the synaptic cleft, the space between the axon terminal and the dendrite. In electrical synapses, two neurons are physically connected via gap junctions allowing for action potential transmission.

See Also

- ▶ Dendrite
- ▶ Neurotransmitter

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Synaptic Proteins

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Structure

The synapse is a highly specialized junction between two neurons, consisting of a presynaptic cell, a postsynaptic cell, and a space between the membranes of the two cells. There are two kinds of synapses, chemical (neurotransmitter-driven) and electrical, both occurring between neurons; to date, the synaptic proteins implicated in autism are involved in chemical synapses. In a chemical synapse, the presynaptic neuron is responsible for creating chemical neurotransmitters in small membrane-sealed droplets called vesicles, storing these in the presynaptic axon terminal (the part of the presynaptic neuron abutting the synaptic cleft) and releasing them into the synaptic cleft to bind to receptors on the membrane of the postsynaptic density, the specialized portion of the postsynaptic neuron on the synaptic cleft directly opposite the presynaptic axon terminal (Dubin, 2002; Peça, Ting, & Feng, 2011; Purves et al., 2001; Sherwood, 2010). Voltage-modulated calcium ion channels on the presynaptic terminal allow an influx of calcium ions which prompts the stored vesicles to fuse with the cell membrane and release their neurotransmitter contents into the cleft (Lodish et al., 2000; Purves et al., 2001). Synapses can be excitatory or inhibitory, depending on whether they involve the release of an excitatory neurotransmitter or an inhibitory neurotransmitter. Binding of excitatory neurotransmitters to their specific receptors on the postsynaptic density causes ion channels linked to the receptors to open, allowing an influx of sodium ions to enter the cell, depolarizing it and increasing the likelihood that it will fire a signal, or action potential, across its synapse to the next neuron in the pathway, and so on. The binding of inhibitory neurotransmitters to their specific receptors on the postsynaptic density, conversely, results in the channels opening to allow influx of chloride ions or efflux of potassium ions, resulting in increasing polarization of the cell and reducing the probability that it will fire an action potential and transmit a signal to the following neuron (Alberts et al., 2002; Lodish et al., 2000; Sherwood, 2010). Synaptic proteins play roles in all of this, from synaptic formation and development to synapse maintenance and signal transmission, and are responsible for the structure of both the presynaptic terminal and the postsynaptic density, as well as structural connections spanning the synaptic cleft.

Function

Synapses are essential to neural function and thus all brain activity. By relaying signals from one neuron to another and modulating the strength of the relayed signal (keeping it the same, attenuating it, or amplifying it), they allow for highly complex signals and "messages" between neurons and over long distances (neurologically speaking, i.e., along connections millions of cells long).

In a structure as specialized and involved as the synapse, understandably, synaptic proteins will vary widely in form and function. Some of the proteins are involved in large-scale structural alignment of the synapse, connecting with each other across the cleft anchoring the synapse together, as well as relaying the received signal on the postsynaptic side; these include CASK, neurexins, ERC, Piccolo, Bassoon, and catenins (presynaptic) (Waites & Garner, 2011; Ziv & Garner, 2004), and various neurotransmitter

receptors, neuroligins, PSD95, SAP97, SAPAP, and SHANK genes (postsynaptic). Some, such as cadherins, which interact with each other across the synaptic cleft, and catenins, which interact with the cadherins inside the cell, occur on both sides of the synapse (Peça et al., 2011; Waites & Garner, 2011; Ziv & Garner, 2004). Others are involved in vesicle trafficking and secretion; these include syntaxin, Snap25, Rim, Rab3a, Munc13, and Munc18 (Ziv & Garner, 2004).

Pathophysiology

Given the vital role synapses play in neural function, it is easy to understand how synaptic dysfunction could result in neuropsychiatric conditions. In recent years, a growing number of synaptic proteins have been implicated in the pathogenesis of autism. Nearly all of those that have been associated with autism have been so in the context of rare, likely highly deleterious mutations that would severely disrupt the function of the protein in question. When mutations in synaptic proteins are reported in association with autism, typical implicated pathologies are problems in neuronal migration and connection, as well as abnormal dendritic spines (the protruding structure of which the postsynaptic density is the end) (Waites & Garner, 2011). The interacting neurexins (presynaptic) and neuroligins (postsynaptic) neurexin-1 (NRXN1) and neuroligin 4 X-linked (NGLN4) have been implicated several times and have the strongest evidence for involvement in ASD. Mutations in neuroligin 3 have also been identified in patients with ASD, and a mouse model of one mutation identified in an ASD family demonstrated changes in synaptic function. Downstream of neuroligins in the postsynaptic density are the SHANK genes, binding indirectly to the neuroligins (Südhof, 2008). Mutations/deletions in SHANK3, as part of 22q13.3 deletion syndrome, make it one of the most convincing and replicable autism genes (see ▶ SHANK 3 entry). More recently, SHANK2 has also emerged as an autism candidate (Berkel et al., 2010, 2012, reviewed in Penzes, Cahill, Jones, VanLeeuwen, & Woolfrey, 2011). Cadherins have also been recently implicated in autism, including through the finding of a significantly associated SNP mapping between the genes encoding CDH9 and CDH10 (Wang et al., 2009) in the first large-scale genome wide association study in ASD. As noted, this finding has yet to be independently replicated. These types of proteins interact with each other across the synaptic cleft and are the cytoplasmic binding partners of the catenins (Waites & Garner, 2011; Ziv & Garner, 2004).

The notion that ASD is, at least in part, a reflection of synaptic pathology is supported by the increased rates of autism spectrum disorders in fragile X syndrome and in tuberous sclerosis. The genes that cause these syndromes, namely, FMRP (fragile X mental retardation protein), TSC1 (tuberous sclerosis complex 1), and TSC 2 (tuberous sclerosis complex 2), are known to play important roles in synaptic function.

Further research into these synaptic proteins will result in a greater understanding of their precise roles in synaptic function, and thus clarify how they are involved in autism. This will in turn hopefully allow for better diagnostic methods and treatment options, informed by the presence or absence of causative mutations in specific synaptic genes.

See Also

- ▶ Fragile X Syndrome
- ▶ Neuroligins
- ▶ NLGN3
- ▶ NRXN1
- ▶ SHANK 3
- ▶ Tuberous Sclerosis Complex

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Synaptic Pruning

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Definition

Synaptic pruning is the process by which synaptic connections that are weak, usually as a result of being underused, are eliminated. This process of eliminating weak connections allows the brain to process more frequently encountered and relevant information with greater efficiency. It is part of the developmental process and results in changes in cortical thickness over time.

See Also

► Synapses
► Synaptogenesis

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Synaptogenesis

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Definition

Synaptogenesis is the formation of synapses between neurons. This process begins in gestation and continues throughout life. The greatest amount of synapse formation occurs early in life, during what is referred to as a "critical period" in development, during which sensitivity to developmental influences is heightened. Synaptogenesis in early development is coupled with synaptic pruning, the deletion of excess synapses.

See Also

► Synaptic Pruning

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Syndrome of Deficits in Attention, Motor Control, and Perception (DAMP)

► Attention Deficit/Hyperactivity Disorder

Syntax

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Synonyms

Grammar; Sentence structure

Definition

Syntax is the set of rules and principles that govern the organization of words into sentences in any individual language. In typical development, adultlike syntax is acquired by age 5. In ASD, it has long been thought that syntax is relatively spared and usually on par with cognitive development. However, recent research suggests that a subgroup of speakers with ASD have syntactic deficits above and beyond their cognitive limitations that resemble the deficits seen in specific language disorders.

See Also

► Expressive Language

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Systemizing

► Systems Intervention

Systems Intervention

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Synonyms

Empathizing-systemizing theory; Organizational prevention; Systemizing

Definition

Systems are a set of interacting or interrelated entities forming an integrated whole or larger, more complex formation. Interventions are acts of intervening or coming between two or more things or acts that occur between two or more points in time. When combined, the terms systems and intervention describe actions that either purposefully or incidentally interfere with a larger organizational configuration. Systems intervention can occur at macro and micro levels.

Systems approaches at the larger, macro level are organizational arrangements that enhance and diminish treatment effectiveness. Volkmar, Paul, Klin, and Cohen (2005) describe systems as being a part of the environment and are found within six classifications, each with its own set of rules and regularities: technical, natural, abstract, social, motoric, and organizational. The interactivity of these six components, each working separately within its own unique parameters and then as a collective whole, coordinate to form a system. In developing systems intervention, consideration for the larger system and each interlocking component with surrounding parameters needs to be analyzed and evaluated for causal roles and relationships.

At the micro level, the concept of systems intervention applies to specific treatments, interventions, or evidence-based practices aimed at intervening by aligning with particular approaches and methodologies that focus on a systematic delivery of intervention following a standardized protocol. For example, the Picture Exchange Communication System (PECS) is a training protocol that is based on applied behavior analysis (ABA) techniques, whereby functional communication is systematically taught using prompting and reinforcement strategies that lead to independent communication. PECS also teaches discrimination of symbols and then sequencing to create simple sentences. In the most advanced phases, individuals are taught to comment and answer direct questions.

Further, with respect to systems and organizations represented within the individual with ASD, it is hypothesized that input-output systems are affected by the disability and the systemizing of information may be compromised given deficit areas involving communication, behavior, and social reciprocity.

See Also

- ▶ ABA
- ▶ Empathizing-Systemizing Theory
- ▶ Organizational Prevention
- ▶ Social
- ▶ Systemizing

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