Chapter 3
Autism Spectrum Disorder

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3.1 Introduction

Autism spectrum disorder is characterised by persistent deficits in (1) reciprocal social interaction and social communication, and (2) a range of restricted, repetitive, and inflexible patterns of behaviour and interests in the International Classification of Diseases (ICD-11; World Health Organization, 2018) and the Diagnostic and Statistical Manual of Mental Disorders (DSM-5; American Psychiatric Association, 2013). Since social communication difficulties are core diagnostic symptoms of ASD, it is understandable that pragmatic language difficulties are also a feature of persons on the autism spectrum. The onset of ASD typically occurs in early childhood, but features may only become fully manifest later in childhood, when social demands increase. Deficits cause harm in many important areas, such as personal, family, social, educational and occupational functioning. As difficulties in social communication increase, so too does the risk of peer discrimination and difficulties with integrating into society (see also Finke, 2016).

In recent years, there have been changes in how communication and interaction deficits in ASD have been viewed. Current diagnostic criteria in ICD-11 and DSM-5 combine social interaction and communication. Thus, the triad of features of the autism spectrum (i.e. impaired in 1. communication, 2. social interaction, and 3. behavioral flexibility) is no longer used. Instead, it is referred to the dyad of symptoms. This is reasonable since social reciprocity is needed in both verbal and nonverbal communication and thus, especially in real-life situations, they are difficult to separate (see also Vaughan & Hogg, 2014; Baron-Cohen, 2009).

The prevalence of ASD has increased over time which, it is suggested, is mainly due to increased awareness. Nowadays, the population prevalence of ASD is found to be as high as 1.5% in developed countries (Lyall et al., 2017; Christensen et al.

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2016; Baxter et al., 2015). The male: female ratio for ASD prevalence is lower today than in the past and is currently about 2–5:1 (see Lai et al., 2015). The lower gender ratio may be caused by the fact that current diagnostic criteria allow more females to be categorised on the spectrum. It is probable that features of the autism spectrum vary to some extent between genders and females' features are not always as easy to detect as features in males. Accordingly, more research is needed into the female phenotype of the autism spectrum (van Wijngaarden-Cremers et al., 2014).

Concern about language development is often the first issue that parents of children that are later diagnosed with persons on the autism spectrum raise (Herlihy et al., 2015). Even if some persons on the autism spectrum have preserved or superior language abilities, most persons have structural language difficulties (Ellis Weismer & Kover, 2015; Tek et al., 2014; Boucher, 2012). According to the large data set (N = 2568) from the Autism and Developmental Disabilities Monitoring Network, a population-based public health surveillance programme in the US, around 63% of eight-year-old children on the autism spectrum also have a diagnosis of language disorder (Levy et al., 2010). About 30% of persons on the autism spectrum remain minimally verbal, which means that they do not develop phrase-level speech (see Tager-Flusberg & Kasari, 2013). Inevitably, this also affects their pragmatic functioning.

Persons on the autism spectrum also show high frequencies of comorbid developmental, psychiatric, neurological, and medical diagnoses (Levy et al., 2010). Previously, it was thought that most persons on the autism spectrum had intellectual disability, but recent studies have shown that less than half have a co-occurring intellectual disability (e.g. Postorino et al., 2016). In the Developmental Disabilities Monitoring Network Surveillance (2014), the frequency of an intellectual disability (IQ $\leq$ 70) in autism was as low as 31%. Comorbid diagnoses of persons on the autism spectrum also affect pragmatic language skills and affect the intervention of these skills. Thus, when looking at the pragmatic skills of these persons, it is important to keep possible comorbid conditions in mind.

Although the aetiology of ASD is not yet fully explained, remarkable progress has been made in the last decade. Various neurobiological and genetic risk factors exist (Lyall et al., 2017). It is known that ASD is highly heritable and complex genetic components have a role to play in most cases (Bralten et al., 2018; Lyall et al., 2017; Yoo, 2015). However, it has also been recognised that there are many environmental factors that may increase the risk of ASD. To date, there is evidence that parental age, preterm birth, prenatal exposure to air pollution and short interpregnancy intervals are potential risk factors for ASD (Lyall et al., 2017). In addition, there is a need for more research to examine whether certain prenatal nutrients, metabolic conditions, and exposure to endocrine-disrupting chemicals have an effect on the risk of ASD.

3.2 Pragmatic and Social Communication in Persons on the Autism Spectrum

3.2.1 Features and Background Factors

Since the diagnosis of ASD requires deficits in social communication, it follows that persons on the autism spectrum have difficulties in pragmatic language, an important component of social communication. According to DSM-5, difficulties in social communication in ASD include:

1. Deficits in social-emotional reciprocity ranging, for example, from abnormal social approach and failure of normal back-and-forth conversation to reduced sharing of interests, emotions or affect and failure to initiate or respond to social interactions.
2. Deficits in non-verbal communicative behaviours used for social interaction ranging, for example, from poorly integrated verbal and non-verbal communication to abnormalities in eye contact, body language or deficits in the understanding and use of gestures, to a total lack of facial expressions and non-verbal communication.
3. Deficits in developing, maintaining, and understanding relationships ranging, for example, from difficulties in adjusting behaviour to suit various social contexts to problems with sharing imaginative play or making friends and the absence of interest in peers.

When looking at these three criteria, it is obvious that pragmatic language deficits play a role in all of them. For example, reciprocity is central to conversation skills, non-verbal communication is important when inferring and expressing intentions, and difficulties in adopting an appropriate listener's and speaker's role in different contexts can cause difficulties in relationships. Thus, when looking at these criteria, it is important to keep in mind that pragmatic skills and other social communication skills (social cognition, social interaction, and language processing) operate together and often it is almost impossible to separate them from each other. This is also seen in methods used in autism spectrum research. For example, one of the most widely used methods to measure the ability to provide context-appropriate explanations for story characters' non-literal statements is Happé's Strange Stories Test (Happé, 1994). It has been developed to measure the skills of advanced theory of mind. However, when looking at the test scenarios and questions, it is obvious that answering contextually challenging questions demands pragmatic inference abilities and an interplay between theory of mind and pragmatic skills.

During the last twenty years, researchers have increased our knowledge of pragmatic skills in persons on the autism spectrum (e.g. Deliens et al., 2018; Dindar et al., 2021 Loukusa et al., 2018; see also Volden, 2017). Most studies have focused on specific skills of the pragmatic language domain (e.g. speech acts or contextual comprehension) and have been conducted in clinical settings. At the same time as interpreting the results of these studies, it is important keep in mind that functions

of the pragmatic language domain should not only be based on studies performed in clinical settings, but research should also be done in multi-dimensional, real-life contexts (see also Volden et al., 2009; Adams, 2002). Gibbs and Colston (2012) describe pragmatic functioning as a continuously changing process in which a person adapts to the world in a communication situation. In the light of this definition, it is easy to understand that studies done in clinical settings do not give the whole picture of the phenomenon.

If we look at the pragmatic language domain from a wide-ranging viewpoint, it helps us see that pragmatic communication is not only disturbed in persons on the autism spectrum because of social communication difficulties. In real-life situations, stereotyped, restrictive, and repetitive patterns of behaviour, interests or activities and hyper- or hyporeactivity to sensory inputs also affect pragmatic communication in persons on the autism spectrum (Fig. 3.1). For example, imagine a situation where a child has hyperreactivity to auditory and/or visual stimuli and his classmates start to talk to him in a noisy corridor where there are lots of children walking and talking to each other, and at the same time there is the sound of closing doors, clattering of things, etc. The child who has hyperreactivity to sensory inputs may feel this kind of environment is overwhelming, chaotic, and even scary. This may make communication with classmates impossible. In this way, sensory hyperreactivity affects the child's pragmatic functioning, at least in certain contexts. It may also cause the child to withdraw from communication situations, which results in them not having communication experiences with their peers. This affects their pragmatic communication development.

This is an example of how sensory abnormalities may disrupt pragmatic functioning in persons on the autism spectrum more often than it is thought. This also shows that when looking at the pragmatic functioning of an autistic person, it is

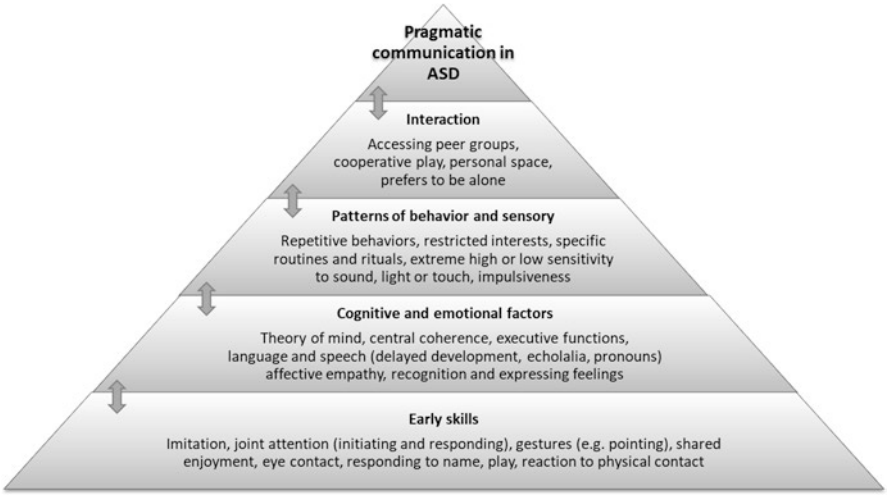

Fig. 3.1 Some factors affecting pragmatic communication in persons on the autism spectrum

important to assess their functioning as a process of adapting to changing communication situations and not only their abilities in separate pragmatic functions. One way to look at pragmatic communication disability is Perkins' (2007) emergentist model of pragmatic ability. It shows how there may be multiple cognitive, linguistic, and sensory sources behind pragmatic impairment and how pragmatics is a product of many interacting variables (see also Fig. 3.1).

It is known that pragmatic language in persons on the autism spectrum is affected by basic language abilities (Whyte & Nelson, 2015; Volden et al., 2009). However, it is good to keep in mind that the relationship is not always straightforward. For example, the study by Volden et al. (2009) showed that although pragmatic language skills in children on the autism spectrum were strongly related to structural language skills, they were not dictated by them. This suggested that pragmatic language scores on the Test of Pragmatic Language (TOPL; Phelps-Terasaki & Phelps-Gunn, 1992) measure additional language skills that are not captured by structural language competence. In earlier studies, pragmatic communication features in persons on the autism spectrum have been interpreted using cognitively-oriented pragmatic theories such as relevance theory (Happé, 1993; Loukusa, Leinonen, Jussila, et al., 2007) and Gricean maxims (Surian et al., 1996). However, the most common social and pragmatic communication difficulties in persons on the autism spectrum have been explained using theory of mind (ToM) (Martin & McDonald, 2004; Happé, 1993), weak central coherence theory (Noens & van Berckelaer-Onnes, 2005; Jolliffe & Baron-Cohen, 1999b, 2000), and executive dysfunction theory (Hill, 2004). Executive dysfunction of persons on the autism spectrum compromises planning and mental flexibility. It affects the ability to use and interpret language in a flexible way according to situation and the ability to direct one's attention to relevant factors (see also Papp, 2006). Working memory is one important component of executive function and works as a tool to integrate information from different sources, which is important in pragmatic language inference. It has been found that autistic persons have weaknesses in working memory, such as in tasks that require cognitive flexibility, planning, and greater working memory load (Kercood et al., 2014).

Empathizing-systemizing theory (Baron-Cohen, 2009, 2010) could also offer a fruitful background for interpreting pragmatic communication difficulties in persons on the autism spectrum, even if to the author's knowledge it has not yet been fully utilised in pragmatic language studies. According to empathizing-systemizing theory, autistic persons perform weakly in tasks requiring cognitive and affective empathy, but their ability to use systemising skills is average or above average (Baron-Cohen, 2009, 2010; Wakabayashi et al., 2007; Goldenfeld et al., 2005). Superior systemising skills do not just show up in understanding systems, but they widely affect the behaviour of autistic persons. According to Baron-Cohen (2009), this discrepancy between weak empathising skills (e.g. the inability to utilise social context in the comprehension of others' emotions) and intact or even superior systemising skills results in a specific processing style that may cause many kinds of strengths (e.g. easily understanding the syntax of different languages, good technical skills) but also weaknesses. Discrepancy (e.g. weak social understanding and

strong technical understanding) may also make young autistic adults vulnerable to social manipulation (Al-Attar, 2016).

From a clinical point of view, different pragmatic theories used in studies should not be viewed as competing approaches. Instead, it is better to consider them as connected views and ideas to better understand the complex nature of pragmatic communication in persons on the autism spectrum. Because many kinds of neuropsychological weaknesses (e.g. Elsheikh et al., 2016), psychiatric symptoms (e.g. Mattila et al., 2010), and savant skills (e.g. Howlin et al., 2009) may persist in autistic persons in addition to the core features of the autism spectrum, every individual has a unique collection of strengths, weaknesses, and symptoms which in part affect the individual's pragmatic communication in different contexts. Currently, most pragmatic studies have been carried out with autistic children who have average or above average intelligence without comorbid disorders. It is important to keep this in mind when reading this chapter to understand that probably our current research does not provide a proper picture of the whole spectrum.

3.2.2 Pragmatic Comprehension in Persons on the Autism Spectrum

Pragmatic comprehension difficulties vary considerably in children and adults on the autism spectrum. The fact that the population with ASD is very heterogeneous and mild difficulties in pragmatic comprehension are not always easy to detect in structured test situations has sometimes caused contradictory results between studies. Researchers have achieved different kinds of results in terms of whether some types of difficulties belong to autism spectrum (e.g. Deliens et al., 2018; MacKay & Shaw, 2005) and what the reasons are behind pragmatic difficulties (see e.g. Martin & McDonald, 2004).

However, if we look at abilities across the whole spectrum, it is obvious that pragmatic comprehension difficulties vary from severe (e.g. the child understands only short literal expressions such as "take a book") to mild (e.g. difficulties understanding complex humour). It is also possible that background factors may vary. Mild difficulties are not always easy to detect in structured test situations, even if they may be present and cause harm in complex, real-life communication situations. It is also possible that qualitative analysis may show more differences than quantitative analysis can show. For example, in the study by Norbury and Bishop (2002), typically developing children performed better than children on the autism spectrum and children with language impairment in tasks involving story comprehension that required inferencing and understanding of the literal meaning. Although the scores between the clinical groups were quite similar, qualitative analysis showed that children on the autism spectrum gave most answers that were not relevant to the story context. It is also suggested that linguistically talented children on

the autism spectrum are more able to use compensatory strategies in demanding tasks, which help them in their performance (Fisher et al., 2005; Happé, 1994).

Clinically, it is well known that many autistic persons tend to interpret utterances literally (see also Rapin & Dunn, 2003; Kaland et al., 2002). Children on the autism spectrum have shown pragmatic deficits in their ability to infer the implication of an utterance and to make inferences from social scripts, metaphors, and speech acts (Dennis et al., 2001). In Dennis et al.'s study, the differences between the groups increased in relation to the amount of inferencing and intentionality of the tasks. The same effect of intentionality and inferencing load for comprehension was also seen later in studies by Loukusa et al. (Loukusa, Leinonen, Kuusikko, et al., 2007; Loukusa et al., 2018) and Angeleri et al. (2016). Loukusa, Leinonen, and Kuusikko (2007) showed that children on the autism spectrum had difficulties in contextually complex processing, such as detecting implicatures, but not in comprehension of reference assignments.

In a later study (Loukusa et al., 2018), children on the autism spectrum differed from typically developing (TD) children in all question types in the Pragma test (contextual inference with ToM, contextual inference without ToM, relevant use of language, recognition of feelings, and understanding false beliefs). However, the biggest difference between the groups was in the questions that demanded contextual inference with mind-reading, showing that difficulty in understanding increased in relation to the intentionality of the tasks (see also Deliens et al., 2018; Heavey et al., 2000). In many kinds of situations, it is very common to use utterances that demand multi-level processing. In these kinds of utterances, processing load is not determined by only one factor, such as understanding mental states or interpreting verbal or physical context, but there is a need to interpret and connect multi-level information at the same time. This kind of processing demands many cognitive abilities and world and social knowledge, as well as the interplay between them, as the analysis of the following example shows. The item shown below is taken from the Pragma test (Loukusa et al., 2017, 2018).

Scenario (presented with paper dolls): There has been a race at school. Vera was the slowest runner in the whole class. Vera goes to Tina's house after school. Maddie is also there. Tina and Maddie suggest playing tag. Vera says, "I have to go home", and leaves right away.
Question: Why did Vera say "I have to go home"?
Visually- and physically-given context: Showing the scenario with Vera, Tina and Maddie as paper dolls.
Verbally-given context: Vera was the slowest runner in the race at school. When Tina and Maddie suggest playing tag, Vera wanted to go home.
World knowledge: If you are the slowest runner, you will easily be caught. You will also have difficulties catching other children who are faster than you.
Social knowledge: It is not nice to be "it" all the time. If you have to be "it" for a long time, you start to feel bad about yourself.
↓
Conclusion: She wants to go home because she does not want to play tag.
Example of a correct answer (from a six-year-old boy with TD): "She doesn't want to play tag."

Example of an incorrect answer (from a six-year-old autistic boy): "Because she is in a hurry to get home."
Example of an incorrect answer (from an eight-year-old autistic boy): "It's her dinner time."

To answer the question correctly, the child must use the relevant information. Using working memory, the child must connect relevant verbally-given information with his or her world knowledge and take Vera's mental states and emotions into account by utilising social knowledge. It is probable that in the typically developing boy, the processing of this multi-level information happens automatically and in a parallel way (processing is not sequentially ordered) (see e.g. Wilson & Sperber, 2004). When looking at the incorrect responses of the autistic boys, it is obvious that the younger boy interpreted the scenario literally and had not connected the verbally-given information with his world and social knowledge. It is also possible that he was lacking world or social knowledge about this topic. A literal interpretation may mean that pragmatic inferencing (context utilisation) is missing.

When looking at the answer from the older autistic boy, it is possible to see that he had tried to infer an answer by using his world knowledge (often children must go home for dinner) (see also Loukusa, Leinonen, Jussila, et al., 2007). However, he has not connected verbally-given information with his social knowledge (or he is lacking social knowledge), and the interpretation of Vera's mental state is missing, which lead him to provide an incorrect answer. Thus, the comparison of these two answers showed that in the younger autistic boy, there was no attempt to use contextual information or world knowledge. The older autistic boy tried to use his knowledge about the issue but failed to answer correctly since he did not interpret and connect all the relevant factors.

These two examples show how children's incorrect answers may give us a clue about what goes wrong in the interpretation of utterances (see also Loukusa, Leinonen, Jussila, et al., 2007). The interpretation difficulties of children with ASD increase in relation to the amount of inferencing and intentionality of the tasks. Thus, it is not surprising that many studies have shown that autistic persons have difficulties in understanding irony (e.g. Deliens et al., 2018; Wang et al., 2006) and humour (e.g. Emerich et al., 2003). Interpreting irony and humour demands an ability to derive an intended meaning based on world and social knowledge and other information available in the context. Emerich et al. (2003) found that adolescents on the autism spectrum had difficulties understanding cartoons and jokes. They also had difficulties handling surprise and coherence aspects of humour simultaneously.

Kaland et al. (2002, 2006) conducted studies that contained different kinds of questions demanding the ability to infer non-literal meanings and intentions. They found that compared to physical states, inferring mental states was more problematic for children and adolescents on the autism spectrum. Compared to their control peers, they did not just have more incorrect answers, but they also needed more prompt questions and they had longer reaction times. Slower reaction times for answering have also been found in other studies (Saarinen et al., 2012; Nakakachi et al., 2008; Pijnacker et al., 2009; Bowler, 1997). In Saarinen et al.'s (2012) Finnish

study, a difference between small groups of children on the autism spectrum (n = 15) and control children (n = 15) was evident, especially with regard to correct answers. This may suggest that in children on the autism spectrum, the processing of pragmatically challenging utterances does not always happen as automatically as it does in typically developing children, but to derive utterance meaning, more cognitive effort is needed. Longer processing of utterance meaning may cause problems in quickly moving between communication situations in real life.

By examining the ability to understand idioms (phrases that express an idea or sentiment that cannot be determined by what the individual words mean), homographs (words that have different meanings but share the same spelling) and scalar implicatures (e.g. all/many/some), it is also possible to increase our knowledge of the ability of children on the autism spectrum to utilise contextual information. Most studies of scalar implicatures have found that persons on the autism spectrum interpret and produce scalar implicatures well when they are explicitly required by the task to do so (Schaeken et al., 2018; Hochstein et al., 2017; Chevallier et al., 2010). However, Schaeken et al.'s measure revealed that when the option 'I agree a bit' was available in addition to "I agree" and "I disagree", the children on the autism spectrum showed a dichotomized attitude toward the speaker's meaning by tending to either fully agree or fully disagree with under-informative statements, whereas children with typical development preferred the middle option.

It has been found that at least some children on the autism spectrum show weaknesses in some kinds of homograph tasks (Hala et al., 2007; López & Leekam, 2003). In the study by López and Leekam (2003), children on the autism spectrum performed as well as controls if the context required common interpretation of a homograph. However, when the context required uncommon interpretation of a homograph, children on the autism spectrum showed weaknesses. This showed that autistic children may also have difficulties using sentence context in a homograph task. Hala et al. (2007) used an alternative approach to study whether autistic children utilise meanings of prime words when disambiguating a target homograph. In their study, children on the autism spectrum and their controls were presented with semantically related and semantically unrelated word pairs. The results showed that autistic children are usually able to draw connections between primes and targets. However, in the second presentation of the homographs, autistic children had the tendency to repeat their first pronunciation although the prime had changed. Researchers concluded that autistic children utilise meanings of related word primes, but that they have difficulties in inhibiting prior responses when a homograph presents later with different primes, which may tell us something about executive dysfunction.

Currently, it is not possible to say how and when pragmatic inference abilities develop in children on the autism spectrum. However, there are some findings that difficulties in utilising contextual information in comprehension are milder in older children on the autism spectrum (Loukusa, Leinonen, Kuusikko, et al., 2007). In addition to the number of incorrect answers, changes may be seen in the type of incorrect answers, since irrelevant answers and topic drifts diminish with increasing development (Loukusa, Leinonen, Jussila, et al., 2007). Even though pragmatic

comprehension abilities progress with age in individuals on the autism spectrum, some difficulties usually persist into adulthood in even the most capable persons on the autism spectrum (Lönnqvist et al., 2017; Jolliffe & Baron-Cohen, 1999a, 1999b, 2000; see also Loukusa & Moilanen, 2009; Rapin & Dunn, 2003).

Studies using Happé's Strange Stories Test (Jolliffe & Baron-Cohen, 1999a; Happé, 1994) or part of the test (Heavey et al., 2000) have shown that adults on the autism spectrum do not differ in terms of their performance in physical control stories, but they do differ in mental state stories when they have to justify the story characters' nonliteral speech. This shows that these individuals have problems in providing contextually relevant mental state explanations. Jolliffe and Baron-Cohen (1999a) suggested that difficulties may arise in inferring a speaker's intended meaning from context or in understanding some mental states. Heavey et al. (2000) presented their Awkward Moment Test to adults on the autism spectrum with a view to measuring subtle difficulties in mental understanding. In the test, subjects had to answer mental state questions that required them to infer the film character's understanding of the social situation and the social significance of the character's actions. There were also control questions that were not related to the social content of the film. Like in Happé's Strange Stories Test, it was evident that adults on the autism spectrum had difficulties answering mental state questions and especially explaining the motives and intentions of film characters.

3.2.3 Prosody in Persons on the Autism Spectrum

Prosody is the patterns of stress and intonation in a language and includes both expressive and receptive aspects. From the framework of pragmatics, prosody can influence the meaning of a sentence by indicating a speaker's attitude to what is being said. It can indicate sympathy, irony or humour, for example. Prosody also conveys information about the speaker's emotional state. Thus, in communication prosody has an impact on linguistic, pragmatic, and emotional levels. Persons on the autism spectrum have often been reported as having unusual prosodic features (e.g. Olivati et al., 2017; Olejarczuk & Redford, 2013; Kaland et al., 2013; Diehl & Paul, 2012). However, even if unusual prosody is a feature of the autism spectrum, not all autistic persons have unusual prosody. For example, in the study by Nadig and Shaw (2012), six out of fifteen persons on the autism spectrum had typical prosody.

It has also been shown that unusual prosodic features in persons on the autism spectrum vary from the use of monotonous speech to the use of exaggerated "sing-song" intonation (DePape et al., 2012). In Olivati et al.'s (2017) study of persons on the autism spectrum, speech was louder and lower than in individuals with typical development. Interestingly, in Kaland et al.'s (2013) study, autistic persons and their typically developing controls produced functionally similar contrastive intonation, since both groups took their own and their listener's perspective into account. However, controls used a greater pitch range and were perceived as speaking more dynamically than autistic individuals, suggesting differences in the use of prosodic

form. Some preserved prosodic features in the comprehension of prosodic cues have also been found (Wang et al., 2006). Children who showed weaknesses in tasks where it was central to utilise contextual knowledge of the event performed comparably with typically developing peers in tasks where prosodic cues were central. The researchers concluded that autistic children have difficulties in tasks where the interpretation of non-literal language is required and that their difficulties do not lie with prosodic cues.

3.2.4 Discourse and Narration in persons on the autism spectrum

Since discourse is essential for the expression of opinions, feelings and ideas, it is also essential for establishing relationships (Dipper & Pritchard, 2017). Thus, discourse difficulties usually cause severe harm to individuals who have these difficulties. It is generally known that persons on the autism spectrum have difficulties in discourse skills (e.g. Paul et al., 2009; Ziatas et al., 2003; Adams et al., 2002), and failure of normal back-and-forth conversation is even mentioned in the diagnostic criteria for ASD under social communication (see Sect. 3.2.1 in this chapter). Discourse skills are also included in many diagnostic or screening instruments for ASD, such as the Autism Diagnostic Observation Schedule-2 (ADOS-2; Lord et al., 2012), which shows that these are one of the core social communication features of ASD.

According to research performed by Paul et al. (2009) in adolescents on the autism spectrum, atypical conversation behaviours persist primarily in the management of topics and information, reciprocity, intonation, and eye gaze. It has been shown that in structured conversation, children on the autism spectrum predominantly refer to their desires and make less reference to their thoughts and beliefs compared to children with language impairment and typically developing children (Ziatas et al., 2003). Using applied discourse analysis, it has been found that children on the autism spectrum respond to comments and questions. However, the content of the responses is often pragmatically problematic in that the responses of children on the autism spectrum do not always fit well with the social or communicative context (Adams et al., 2002). Children on the autism spectrum gave responses that reflected problems in knowing what the other listener knew about the subject (shared information).

A systematic review of pragmatic difficulties in conversation in ASD found that persons on the autism spectrum often have difficulty staying on topic and providing novel and relevant information (Sng et al., 2018). In addition, during conversation they initiate and respond less often, and they also tend to perseverate more in conversation. However, the review also showed that persons on the autism spectrum offered a similar number of turns to partners, and that there was little difference in

the way communication breakdowns were repaired or clarified. Findings on the use of eye gaze during conversation were contradictory.

Research has shown that in narration there are both typical and deviant features in children and adults on the autism spectrum (Mäkinen et al., 2014; Norbury et al., 2013; Barnes & Baron-Cohen, 2012; Rumpf et al., 2012; Colle et al., 2008). When looking at the pragmatic aspect of narration, studies have reported many weaknesses in persons on the autism spectrum, even if the results are not entirely consistent with each other. This may be due to different methodologies, age of the participants, and heterogeneity of the personson the autism spectrum. The following two examples (translated from Finnish) show how young autistic man (average IQ) and a young neurotypical man relate the content of a videoclip from the Finnish family TV series Ruusun Aika. These examples show how much it is possible to collect information about communication using narration in autistic persons. The video shows two women walking together, and one is boasting about how people are always looking at her and how hard it is because she would like to be alone. Then, at the end of the video the women meet a man who is interested in the other woman, and then this woman goes off with the man. At the end of the video the second woman says that her friend wants to be alone. The first woman leaves and stands quietly, looking at the couple in an astonished way.

24-year-old neurotypical man:

> There were two (.) female friends it seemed (.) in som- some kind of school and err (.) they were talking with each other and one of them had some kinda (.) err (.) one of them was just talking and was having a kinda identity crisis I mean she wanted to put herself forward and (.hh) wanted attention and then the other (.) friend just listened quietly and until then err (0.6) they met a man on the street who then just talked to the (.) quiet friend and she was surprised (.) the other girl that (.) this is how it went then that I'm not really so (.) electrifying and that it's not.

24-year-old autistic man:

> So (1.0) they walked err (1.4) err (0.5) towards the lift and then they err (1.6) came out of the lift .hh I think it was somehow err (1.4) mmh a stupid sce- scene because it looks like they had just walked through the (1.0) doo::r (.) the door (0.4) and hadn't (1.0) hadn't been in the lift long (1.2) and then (.) then that (.) man came to get the one wearing the woollen (.) jumper.

When examining these two examples of narratives, it is worth remembering that every individual would produce their own unique narrative after looking at the video clip. However, by comparing these two examples, it is possible to detect some core features of the autism spectrum and find some similarities and differences between narratives.

First, before examining pragmatic aspects, let us take a quick glance at the duration and other aspects of narration. The narration times in these two examples were each approximately 30 s, and both narrations contained disfluencies. However, earlier studies have shown that there might be more disfluencies in persons on the autism spectrum (de Marchena & Eigsti, 2016; Suh et al., 2014). In addition, both narrations contained pauses, but they were longer in the narration by young autistic man. His narration also contained fewer words. Some earlier studies have found that

stories told by persons on the autism spectrum contain a reduced number of words (Norbury et al., 2013; Rumpf et al., 2012), but there are also studies showing that persons on the autism spectrum use a similar number of words as controls (Novogrodsky, 2013; Suh et al., 2014). If we look at the syntax of the stories, it is possible to see that simpler syntax is used by the autistic man (see also Norbury et al., 2013; Norbury & Bishop, 2003).

Both young men used reference (e.g. pronominal reference) in their stories. In the study by Mäkinen et al. (2014), children on the autism spectrum displayed similar referential accuracy to their peers. However, many earlier studies have shown that the use of reference may be weak in children on the autism spectrum and they may use more ambiguous pronouns than their controls (Suh et al., 2014; Norbury et al., 2013; Novogrodsky, 2013; Norbury & Bishop, 2003). Additionally, the use of references may be pedantic even if they have used accurate references (Arnold et al., 2009), and they may use noun phrases more often than their controls (Rumpf et al., 2012).

Barnes and Baron-Cohen (2012) detected that narratives by adults on the autism spectrum concentrated more on specific details than the overall gist of the story. This was also the case in the story in the example given above. The autistic man concentrated on the door of the lift and the time spent in the lift, which was not relevant to the story (see also Norbury et al., 2013). This may tell us something about the difficulty that persons on the autism spectrum have in processing relevant information. According to relevance theory, the story of the autistic man ran counter to the presumption of optimal relevance. Concentrating on specific details (in this case, irrelevant, visual details) and not on the gist of the story may also tell us about weak central coherence or executive dysfunction that causes difficulties with focusing on and choosing between relevant contextual factors.

To understand the content of the video clip, many kinds of social cognition skills are required, including the ability to interpret a person's mental states such as emotions, beliefs, and desires. It is generally known that persons on the autism spectrum have weaknesses in social cognition (e.g. Loukusa et al., 2014), and problems in theory of mind are even suggested to be one factor behind the symptoms of the autism spectrum (see Sect. 3.2.1 in this chapter). While narrating, the autistic man produced fewer mental state expressions than the neurotypical man (see also Rumpf et al., 2012). However, even though this example and some other studies have reported a reduced number of mental state expressions, there are also plenty of studies that have not (e.g. Mäkinen et al., 2014; Suh et al., 2014; Norbury et al., 2013). It is also possible that weak inferencing skills affect narration (see Norbury & Bishop, 2002). In this case, it could mean that the autistic man did not understand the story and thus he concentrated on an irrelevant, visual part of the video clip. It is also possible that poor working memory could affect narration in the setting of the example.

These two stories could also be interpreted from the viewpoint of empathizing–systemizing theory. Contrary to the story by the neurotypical man, the story by the autistic man may suggest difficulties both in affective and cognitive empathy. It may also suggest that this autistic man is focusing on analysing the details in the video

clip and that he cannot concentrate on the gist of the story at the same time. This may show extreme visual systemising. Thus, the narration by the man with ASD may show a discrepancy between empathising and systemising skills that is characteristic of the unique cognitive processing style of persons on the autism spectrum (see Baron-Cohen, 2009).

In addition to the above analyses, the stories could be interpreted using other methods or frameworks such as story grammar. Many studies have shown, for example, that persons on the autism spectrum use fewer story elements in their narrations (Suh et al., 2014; Rumpf et al., 2012; Smith Gabig, 2008). This was also case in the narration by the autistic man. It is clear from the above analyses that narration is an effective way of collecting a wide amount of information that can be interpreted in different ways. Even if our sample narration showed many common features of the autism spectrum, it did not show all of them. It is also reported that idiosyncratic speech, such as the use of scripted or overly formal language (Suh et al., 2014), is often seen in the autism spectrum. It is also possible that the elicitation method influenced the narration. Losh and Capps (2003) reported the use of irrelevant comments by persons on the autism spectrum only in less structured personal narratives, but not in a picture-based story generation task, and Losh and Gordon (2014) found that the use of off-topic or irrelevant utterances only occurred in retelling tasks but not in story generation tasks.

3.2.5 Neural Background of Pragmatic Communication Features in Persons on the Autism Spectrum

In recent years, significant progress has been made in describing both structural and functional abnormalities associated with ASD (e.g. Pereira et al., 2018; Yamada et al., 2016). However, there is still a need for studies of neural-level processing of pragmatic communication in persons on the autism spectrum in order to better understand the background of pragmatic impairment. The processing of social cognition tasks is closely related to pragmatic communication. Understanding neural activation of social cognition tasks can, therefore, also increase our knowledge of the processing of pragmatic language. Studies have found atypical neural activation or organisation, for example, in facial affect recognition (Ciaramidaro et al., 2018; Mennella et al., 2017) and social and emotional processing during interactions (Oberwelland et al., 2017; Salmi et al., 2013). Studies focusing on inferences and the comprehension of irony have found increased activation in right hemispheric regions, which may suggest that inferencing and irony comprehension are more demanding to persons on the autism spectrum and that more cognitive effort is needed (Wang et al., 2006; Mason et al., 2008).

Using functional magnetic resonance imaging (fMRI), Hubbard et al. (2012) studied the neural processing of co-speech beat gestures in children on the autism spectrum and their control peers. *Beat gestures* are *gestures* that do not carry any

specific content but accentuate the topic that is being conveyed by emphasising certain words and phrases. In their study, children with typical development showed increased activity in the right superior temporal gyrus and sulcus when listening to speech with beat gestures, whereas children with ASD did not. Compared to typically developing children, children on the autism spectrum showed greater activity within visual areas when processing co-speech beat gestures, and the severity of their social and communicative impairment was connected with increased activity in the visual region. Researchers suggested that the increased activity observed in children on the autism spectrum in visual regions may indicate a deficit in multisensory integration (auditory and visual speech integration).

Kotila et al. (2021) investigated synchrony of neural network activity in a group of neurotypical young adults and a group of autistic young adults when participants were looking at simple pragmatic non-verbal video clips containing speech acts (e.g. request, statement, and order) from the Assessment Battery of Communication (ABaCo; Sacco et al., 2008). The results showed that when looking at simple communicative-pragmatic actions, correlation of brain activity was greater within the neurotypical adults than within autistic adults in several brain areas (especially in the right dorso-central insula, the left superior frontal gyrus, the left supramarginal gyrus and the posterior insula). This may show that in neurotypical adults, brain activity has synchronised because they automatically assume and focus on similar perspectives during stimulus viewing. Atypical activation in insular regions belonging to the salience network has been linked to ASD (Odriozola et al., 2016). In the behaviour tests there were no differences between groups in these simple communicative-pragmatic items (Kotila et al., 2021). This suggests that autistic persons may use different kinds of processing styles (compensatory strategies) to interpret the speaker's speech acts.

3.3 Assessment of Pragmatic Language Skills in Persons on the Autism Spectrum

The assessment of pragmatic language skills in persons on the autism spectrum should be comprehensive and multidisciplinary in nature. Thus, it should not just consist of structural language assessment and parental reports of pragmatic aspects of language. To obtain a complete picture of a child's or adult's pragmatic communication, clinicians should connect information collected using observation, parental reports, assessment methods developed to detect features of the autism spectrum, tests for neuropsychological skills including theory of mind and affect recognition skills and, of course, tools developed for pragmatic language skills. The purpose of the assessment also affects the measures used. It is a different process to assess skills for diagnostic purposes than for educational ones.

Because of the complex nature of pragmatics, it may be challenging to capture pragmatic difficulties in a structured test situation (Volden et al., 2009; Adams,

2002). An individual may perform well in a structured test situation even if they have significant pragmatic difficulties in real-life situations. In this review, it is mostly focused on methods that are research-based and commercially or generally available (e.g. via websites). However, it is important to be aware that this review does not encompass all possible measures to assess pragmatic language in the autism spectrum. There are also other methods such as the Pragma test (see Loukusa et al., 2018) and the ABaCo (see Angeleri et al., 2016), which are used in research with good results. In future, these measures might also provide important knowledge about pragmatic functioning in the autism spectrum if they were easily available to clinicians and researchers in different languages (at present, there are only Finnish and Italian norms of the Pragma test, and the test is recently translated into English for example). Since knowledge of pragmatic communication in the autism spectrum is increasing rapidly, there is a constant need to develop sensitive, research-based measures that are directed to the study of the most central pragmatic communication difficulties in the autism spectrum.

There are many instruments available for detecting to traits of the autism spectrum for diagnostic purposes (Table 3.1). These tests also include several pragmatic tasks or questions that usually belong to the social interaction or communication part of the measure. From the viewpoint of pragmatic communication, tasks concerning routines, restricted interests, and sensory abnormalities also provide important information since they may affect a person's pragmatic functioning in real life (see Sect. 3.2.1 in this chapter). With many diagnostic instruments, such as the Autism Diagnostic Interview-Revised (ADI-R; Lord et al., 1995), the Gilliam Autism Rating Scale (GARS-3; Gilliam, 2013), the Diagnostic Interview for Social and Communication Disorder (DISCO; Wing et al., 2002) and the Developmental, Dimensional and Diagnostic Interview (3di; Skuse et al., 2004), information about a person's behaviours and social communication is collected from interviews with parents (or caretakers). The Childhood Autism Rating Scale, second edition (CARS-2; Schopler et al., 2010) combines observations of the child with interviews with parents or caretakers. In the Autism Diagnostic Observation Schedule, second edition (ADOS-2; Lord et al., 2012), a trained professional observes a child's behaviour while performing specific tasks. In Randall et al.'s (2018) review of diagnostic tests in preschool children with ASD, only ADI-R, ADOS, and CARS met the inclusion criteria for review. All three tests performed similarly for specificity. However, ADOS was the most sensitive in diagnosing ASD in preschool children.

As mentioned earlier, pragmatic performance may be difficult to assess in clinical settings. As a result, standardised checklists of pragmatics and social communication have often been used, especially for screening purposes. The Children's Communication Checklist-2 (CCC-2; Bishop, 2003) is one of the most widely used checklists in clinical practice and research. CCC-2 comprises ten scales, of which eight assess structural language and pragmatic language, and two assess the social impairments and restricted interests that are more typical of in children on the autism spectrum. CCC-2 gives a score for General Communication Composite (GCC) and a score for the Social Interaction Deviance Composite (SIDC). The SIDC identifies social communication abilities that are disproportionately impaired

relative to structural language skills, as can be found in children and adolescents on the autism spectrum. Many studies have confirmed that CCC-2 accurately identifies children with social communication impairments as in the autism spectrum (Loukusa et al., 2018; Volden & Phillips, 2010; Norbury et al., 2004). There are also other standardised rating scales for the assessment of social communication skills in the autism spectrum, such as the Social Responsiveness Scale-2 (SRS-2; Constantino & Gruber, 2012) and the Social Communication Quotient (SCQ; Rutter et al., 2003). Both instruments are concerned to assess features that are typically found in ASD.

There are also tests that assess pragmatic language skills which may be suitable for assessing these skills persons on the autism spectrum. They include the Test of Pragmatic Language-2 (TOPL-2; Phelps-Terasaki & Phelps-Gunn, 2007), the Strong Narrative Assessment Procedure (SNAP; Strong, 1998) and the Expression, Reception and Recall of Narrative Instrument (ERRNI; Bishop, 2004). Young et al. (2005) investigated how TOPL and SNAP detected pragmatic impairments in children on the autism spectrum and found that TOPL scores differentiated children on the autism spectrum from matched controls. However, the researchers observed that variance within the group of children on the autism spectrum was large, resulting in some of the children on the autism spectrum performing comparably with controls. Volden and Phillips (2010) reported that TOPL identified nine of 16 children on the autism spectrum as pragmatically impaired, whereas the CCC-2 identified 13 as impaired.

In the SNAP, children on the autism spectrum performed more poorly than controls in inferential questions, but similarly in tasks assessing syntax, cohesion, story grammar, and completeness of episodes. As a result, SNAP did not clearly differentiate language abilities among children on the autism spectrum from those in typically developing children (Young et al., 2005). Volden et al. (2017) used the ERRNI in their study of 74 children aged 8–9 years on the autism spectrum. They found that among children on the autism spectrum, average performance was poorer in the ERRNI than in a language test. These authors concluded that the ERRNI revealed discourse impairments that might not be identified by tests that focus on individual words and sentences. Overall, the ERRNI provided a useful measure of communicative skill beyond sentence level in school-aged children on the autism spectrum.

Since discourse difficulties are one of the core pragmatic features of ASD, assessment should also include them. Diagnostic instruments such as ADOS-2 give some information about discourse skills but it would be useful to measure them in deeper way to get information about where exactly intervention should take place. Conversational and discourse analysis could provide a valid tool for assessing discourse skills in ASD (Reilly et al., 2016). However, they remain rather time-consuming and complex assessment methods, which may limit their clinical use. There are also some promising measurements, such as the Targeted Observation of Pragmatics in Children's Conversation observation scale (TOPICC; Adams et al., 2011) which can be useful in rating the quality of conversational exchanges (Table 3.1).

Table 3.1 Examples of methods for assessing pragmatic language skills and social communication abilities in persons suspected or diagnosed

Name of measure		Authors and year	Aspects covered	Age	Other information
General ASD screening tools and rating scales	Modified Checklist for Autism in Toddlers (M-CHAT-R/F)	Robins et al. (2014)	Early signs of ASD (e.g. pointing, responding to name, eye contact)	16–30 months	Form and instructions for free download translated in many languages can be found at: https://mchatscreen.com/mchat-rf/translations/
	Early Screening of Autistic Traits Questionnaire (ESAT)	Swinkels et al. (2006)	Early signs of ASD (e.g. joint attention, eye contact and smiling at other people)	14–15 months (0–36 months)	Link to the form for free download can be found at: http://disabilitymeasures.org/ESAT/
	Autism Spectrum Quotient AQ	Baron-Cohen et al. (2001)	ASD features in social interaction, communication and restrictive or repetitive activities and interests	From 16 years onwards	Self-assessment downloadable from: https://www.autismresearchcentre.com/arc_tests
	Autism Spectrum Screening Questionnaire (ASSQ)	Ehlers et al. (1999)	Features that are common in school-aged children on the autism spectrum (e.g. literal understanding and lack of empathy)	7–12 years	Form can be downloaded from: https://gillbergcentre.gu.se/english/research/screening-questionnaires/assq
Rating scales focusing on social communication in ASD	Social Responsiveness Scale-2 (SRS-2)	Constantino and Gruber (2012)	Discriminate autism spectrum disorder from other child psychiatric conditions by identifying presence and extent of autism spectrum social impairment	From 2.5 years onwards	

Name of measure		Authors and year	Aspects covered	Age	Other information
	Children's Communication Checklist-2 (CCC-2)	Bishop (2003)	Focus areas of communication such as speech, vocabulary, sentence structure and social language skills of children, and screening for general language impairments. Identifying children with pragmatic language difficulties and detecting children who need deeper assessment for autism spectrum	4–16 years	Also available: Communication Checklist - Adult (CC-A), Whitehouse and Bishop (2009)
	Social Communication Quotient (SCQ)	Rutter et al. (2003)	Screen for features of autism spectrum	Mental age 2 years and above	Designed as a questionnaire version of the ADI-R. Caregivers can rate the individual's "lifetime" features (used to support a diagnosis) or "current" features (used as an evaluation of current difficulties).
Diagnostic tests	Autism Diagnostic Observation Schedule, Second edition (ADOS-2)	Lord et al. (2012)	Accurately assesses and diagnoses ASD across age, developmental level and language skills. Focus on social interaction, communication and restrictive and repetitive interests and activities	From 12 months onwards	Standardised behaviour observation and coding. Includes Toddler Module and Modules 1–4. Cut-off scores for autism and autism spectrum classifications
	Childhood Autism Rating Scale, Second edition (CARS-2)	Schopler et al. (2010)	Identifies children on the autism spectrum and determines symptom severity	From 2 years onwards	Includes rating scales completed by the clinician based on direct observation and an unscored Parent/Caregiver Questionnaire

(continued)

Table 3.1 (continued)

Name of measure		Authors and year	Aspects covered	Age	Other information
	Developmental, Dimensional and Diagnostic Interview (3di)	Skuse et al. (2004)	Computer-based interview for the diagnosis of autism and related disorders in children	From early childhood onwards	Computes the severity of features associated with a diagnosis of autism and establishes co-morbidity across the range of child psychiatric disorders
	Autism Diagnostic Interview-Revised (ADI-R)	Lord et al. (1995)	Diagnostic instrument for assessing ASD. The instrument focuses on behaviour in three areas: 1. reciprocal social interaction, 2. communication and language, and 3. restricted and repetitive, stereotyped interests and behaviours	From 2 years onwards	ADI-R is an interview method which focuses on behaviours that are rare in unaffected individuals. It provides categorical results (not scales or norms).

Name of measure		Authors and year	Aspects covered	Age	Other information
Formal language tests and structured observations containing pragmatic language	Clinical Evaluation of Language Fundamentals®, Fifth Edition Metalinguistics (CELF®-5 Metalinguistics)	Wiig and Secord (2014)	Subtests include ambiguous sentences, listening comprehension: making inferences, oral expression: recreating speech acts, figurative language, and a supplemental memory subtest	From 9 to 21 years	A revision of the Test of Language Competence – Expanded Edition (TLC-Expanded), Wiig and Secord (1989)
	Targeted Observation of Pragmatics in Children's Conversations (TOPICC)	Adams et al. (2011)	Includes categories: reciprocity, taking account of listener knowledge, turn-taking, verbosity, topic management, discourse style, response problems	6–11 years	
	Test of Pragmatic Language, Second edition	Phelps-Terasaki and Phelps-Gunn (2007)	Subcomponents of pragmatics: physical setting, audience, topic, purpose (speech acts), visual-gestural cues, and abstraction	From 6 years to 21 years	
	Expression, Reception and Recall of Narrative Instrument (ERRNI)	Bishop (2004)	Assesses the ability to relate, comprehend, and remember a story	6 years to adult (norms available from 4 years)	
	Communication and Symbolic Behavior Scales (CSBS DP)	Wetherby and Prizant (2001)	Includes the Infant Toddler Checklist, Caregiver Questionnaire and Behavior Sample. Focus on communication and symbolic development, including gestures, facial expressions and play behaviours	Functional communication age between 6 and 24 months (chronological age from 6 months to 6 years)	The Infant Toddler Checklist is available as a free download from the publisher's website (other parts must be purchased): https://brookespublishing.com/product/csbs-dp-itc/
	Strong Narrative Assessment Procedure	Strong (1998)	Narrative generation and comprehension	7–12 years	

3.4 Pragmatic Intervention in Persons on the Autism Spectrum

Wide-ranging and careful assessments build a basis for planning an intervention in ASD. In children on the autism spectrum, early intervention is shown to be effective (Zwaigenbaum et al., 2015; Koegel et al., 2014). When intervention occurs at the point of maximal neural plasticity, it has a long-term impact on the child's development (Bradshaw et al., 2015). Since intervention should start as early as possible, it should be targeted at at-risk toddlers who do not yet have an official ASD diagnosis. Early intervention in children on the autism spectrum usually aims to increase communication and social skills (e.g. joint attention and turn-taking) that are also crucial for pragmatic communication. In addition, early intervention often aims to decrease maladaptive symptoms (e.g. stereotypes and self-injurious behaviour) and support young children's development in a comprehensive way.

Based on the research findings, best practices for providing interventions for children with suspected or diagnosed ASD have been created (e.g. Zwaigenbaum et al., 2015; Myers & Johnson, 2007). According to them, interventions should begin early, be systematically planned and intensive, involve parents and other caregivers, include both developmental and behavioural approaches, promote interaction with peers, and develop children's skills and functionality in the core and associated features of ASD. It should also include a high degree of structure and secure the generalisation of learnt skills to other situations. Finally, it should consider family circumstances, and a child's medical and other comorbid disorders.

Currently, there are many evidence-based interventions available for children on the autism spectrum that include or focus on supporting communication skills (see reviews from Will et al., 2018; Tachibana et al., 2017; Wong et al., 2015). For example, Pivotal Response Training (PRT; Koegel & Koegel, 2006) and the Picture Exchange Communication System (PECS; Bondy & Frost, 1994) are focused, evidence-based intervention practices, whereas Applied Behavior Analysis (ABA; Cooper et al., 2014) and the Early Start Denver Model (ESDM; Rogers & Dawson, 2009) can be considered comprehensive, evidence-based methods.

As intervention in children on the autism spectrum should start early, many existing methods also focus on toddlers. The ESDM is a behavioural therapy for children on the autism spectrum between the ages of 12 and 48 months (Rogers et al., 2019; Rogers & Dawson, 2009). It is based on the methods of ABA. In the ESDM parents and therapists use play to build a positive relationship with the child and through play and joint activities, they boost the child's language, social and cognitive skills. The method is based on the understanding of a normal toddler's learning and development. Parental involvement is a key part of the ESDM programme. In the intervention the therapists explain and model the strategies that they use so that families can practise them at home. As a comprehensive method, the ESDM is focused on the child's development in its entirety. The intervention style and many areas in the practice develop pragmatic skills (e.g. communicative acts) or are important building blocks for pragmatic development (e.g. joint attention). The ESDM has been

shown to be an effective method for supporting children on the autism spectrum, especially in the areas of communication and language. However, it is only one of several effective methods. In their study, Rogers et al. (2019) remarked that regardless of the brand name involved, when young children on the autism spectrum receive an adequate level of high-quality, developmentally suitable intervention, their skills will develop (see also Watkins et al., 2017; Wong et al., 2015).

Providing high-quality intervention depends on consistent methods and the content of teaching, which are derived from empirical bases and delivered with acceptable treatment fidelity in terms of implementation across staff members. There is also a requirement that the treatment is altered as needed based on an ongoing evaluation of the child's progress and is delivered at adequate intensity to allow for the child's goals to be accomplished within set timelines. A review by Watkins et al. (2017) reported that it is important that evidence-based intervention strategies for social communication in children on the autism spectrum are also selected based on a variety of factors, including the child's age and the desired outcome. The increasing empirical evidence for various interventions provides both a strong knowledge base and the confidence to support persons on the autism spectrum in achieving intervention goals.

Because the area of pragmatics is understood and defined in different ways, the focus of intervention studies varies considerably. Parsons et al. (2017) undertook a systematic review of pragmatic language interventions for children on the autism spectrum and found 20 different intervention programmes that were reported across 21 studies, of which four were modifications of the Joint Attention, Symbolic Play and Engagement Regulation model (JASPER; see Kasari et al., 2006). JASPER is an evidence-based method targeting social communication (joint attention, imitation, play). It uses naturalistic strategies to develop social communication. Research has shown that JASPER develops children's joint engagement, social communication and emotion regulation and increases parental co-regulation strategies (e.g. Kasari et al., 2012).

In their review, Parsons et al. approached pragmatics from a broad perspective and included methods such as therapeutic horse-riding (Gabriels et al., 2015) and emotion recognition training (Ryan & Charragain, 2010). These methods also support many aspects of pragmatics, even if the focus is more on interaction and/or social cognition than pragmatics. Since pragmatic development interacts strongly with development of social cognition, interaction and language, supporting these skills may develop pragmatic skills also. Because in persons on the autism spectrum there are often weaknesses in all areas of social communication, intervention methods often target these areas in general and do not focus simply on the area of pragmatics. However, since in this chapter we are concentrating on pragmatic communication, it may be worth highlighting one promising intervention programme where pragmatics is an important focus area of intervention.

The Social Communication Intervention Project (SCIP; Adams et al., 2012) is a manualised intervention framework developed for 6- to 11-year-old children who have pragmatic language impairments. It is also suitable for verbal children on the autism spectrum. In the SCIP, intervention consists of three components: 1. social

understanding and social interpretation (e.g. understanding social context cues, thoughts, and intentions); 2. pragmatics (e.g. understanding and managing topics in conversation and understanding information requirements); and 3. language processing (e.g. narrative construction and understanding and using non-literal language). Adams et al. (2012) reported that a significant treatment effect was found in children with pragmatic impairment in terms of perceptions of conversational competence, both in parent-reported measures of pragmatic functioning and social communication, and teacher-reported ratings of classroom learning skills.

Since emphasis is placed on interventions with children, it is important to highlight that social communication intervention can also be effective during adolescence and adulthood. It has been shown that methods such as PEERS (Laugeson & Frankel, 2010) and LEGO®-based therapy (Legoff et al., 2014) can support social communication skills, such as discourse abilities and responsiveness. PEERS is a social skills training intervention for social challenges and it has shown to be effective for use with adolescents and young adults on the autism spectrum (Laugeson et al., 2012). LEGO®-based therapy is a social skills programme for children and adolescents with social communication difficulties such as in autism spectrum. Key to this approach is building LEGOs collaboratively and at the same time developing social and communication skills. Therapy utilizes strong systemizing skills of persons on the autism spectrum and is effective and fun for participants (Owens et al., 2008; Legoff & Sherman, 2006).

Although there are many evidence-based interventions available, with increasing knowledge of autism spectrum features there is a constant need to develop new intervention strategies. For example, it is known that persons on the autism spectrum show significant deficits in relation to recognizing and processing human stimuli whereas many of them show a heightened interest in non-social stimuli (see Atherton & Cross, 2018). In their review, Atherton and Cross discussed how persons on the autism spectrum can even show preserved theory of mind when they are dealing with animals, robots, or human cartoons. The review also stated that reduced oxytocin neurohormonal release during human interaction in persons on the autism spectrum may make eye contact too sensitizing, as one of the purposes of oxytocin is to reduce anxiety during social interaction. Thus, in the future it would be interesting to explore more, for example, the use of animals to compensate for reduced oxytocin release when practicing eye gaze, gestures, and other social communication skills with persons on the autism spectrum and to investigate if animals could function as a natural bridge for persons on the autism spectrum to interact and communicate with humans.

3.5 Summary

Knowledge of pragmatic and other features of ASD has increased substantially over the last twenty years. As a result, diagnosis is more reliable and children on the autism spectrum are recognised more effectively. It is known that social

communication, including pragmatic skills, belong to the core features of ASD and there are various theories that try to explain pragmatic difficulties. It is also known that children on the autism spectrum may have many kinds of developmental and neuropsychological difficulties, such as memory, attention and linguistic difficulties, which do not match their intelligence level. There is also some knowledge of atypical neural functioning during pragmatic tasks in persons on the autism spectrum. With this increasing knowledge, intervention methods are also being developed and the prognosis in ASD is better than it has been in the past. It is now known that intensive intervention should start as early as possible and the focus should be on social communication (including pragmatics), not forgetting other features of ASD and the child's possible comorbid disorders.

Current research has focused mainly on weaknesses in persons on the autism spectrum. However, in the future it would be good to focus more on the strengths of persons on the autism spectrum as well. Because of their uniquely good systemising skills (Baron-Cohen, 2009), many persons on the autism spectrum could make an important contribution to our society. To help them use this capacity, it is also important to gain more knowledge about the processing mechanisms of persons on the autism spectrum. For example, currently we do not know enough about how possible atypical neural activation affects their learning of pragmatic communication skills. Today's technologically-oriented world offers persons on the autism spectrum a good opportunity to communicate via the internet without the need for direct social interaction. This offers persons on the autism spectrum the opportunity to have contact with other people and to build new relationships. While this is a good thing, we must also be aware that the internet has made it easy to contact and manipulate socially vulnerable people in new ways. Therefore, intervention or support for social and pragmatic inferencing is needed throughout a person's development, and not just during early childhood.

ASD is a complex disorder and, in the future, more research into pragmatic communication is required in a wide-ranging multidisciplinary framework. To date, there are not enough studies that connect multi-level information such as self-assessment, behaviour tests, and neural measures. Currently, pragmatic communication research is mostly focused on persons on the autism spectrum with average or above average intelligence. We need more studies to be undertaken at the other end of the spectrum (severe cases) to get a better understanding of the whole spectrum. If research is centred on the mildest cases, it distorts the clinical picture. Accordingly, despite impressive development in our understanding of the nature of pragmatic communication in the persons on the autism spectrum, there is still a lot to do to better understand individuals' features and their developmental pathways across this complex spectrum. Also the terminology of autism research is changing. In this chapter, when referring individuals diagnosed with ASD, it is used identity-first term "persons on the autism spectrum" or "autistic persons" as peferrad by persons on the autism spectrum (Bottema-Beutel et al., 2021; Bury et al., 2020; Kenny et al., 2016). When talking about diagnosis or diagnostic criteria, official diagnostic term (ICD-11, DSM-5) autism spectrum disorder, ASD, is used.

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