Functional Analysis and Challenging Behavior

10

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Abstract

Many children diagnosed with ASD engage in challenging behavior, which can interfere with relationships, academic success, and daily functioning, or pose a safety risk to the individual or others (e.g., aggression, self-injury). Challenging behavior may develop and persist because of the consequences it produces, such as gaining access to attention or activities or ending undesired situations. When treating challenging behavior, therapists often perform assessments to identify why the behavior occurs (i.e., the function). A variety of functional behavior assessment (FBA) methods are discussed in this chapter, including indirect assessments (e.g., interviews), descriptive assessments (e.g., naturalistic observation of a client's behavior), and functional analysis (i.e., manipulation of the environment to determine reinforcers maintaining challenging behavior). Functional assessments help therapists identify interventions that are likely to be effective and avoid those that would be contraindicated or ineffective. We recommend that therapists incorporate the function of challenging behavior into intervention planning, particularly when behavior is maintained by idiosyncratic variables or is not quickly responsive to well-established manualized interventions.

10.1 Prevalence of Challenging Behavior for Children with ASD

Challenging behavior (sometimes called problem behavior or externalizing behavior) generally refers to repeated instances of behavior that interfere with learning or social interactions. Some examples of challenging behavior include physical aggression, self-injury, tantrums, verbal aggression, property destruction, and noncompliance (e.g., McClintock, Hall, & Oliver, 2003). These and other forms of challenging behavior can interfere with academic success (Neitzel, 2010), contribute to teacher and family stress (Baker, Blacher, Crnic, & Edelbrock, 2002; Hastings et al., 2005; Lecavalier, Leone, & Wiltz, 2005), and predict out-of-home placements (McIntyre, Blacher, & Baker, 2002). In addition to the potential negative effects on relationships and functioning, some forms of challenging behavior (e.g., self-injury or physical aggression) can result in physical harm to the client or others.

Although challenging behavior is not a formal component of the diagnostic criteria for autism

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spectrum disorder (ASD; American Psychiatric Association, 2013), children diagnosed with ASD are more likely to exhibit clinically significant challenging behavior than their typically developing peers (Brereton, Tonge, & Einfeld, 2006; McClintock et al., 2003). For example, Hartley, Sikora, and McCoy (2008) found that 27% of parents of children with ASD rated their child's externalizing challenging behavior in the clinically significant range. Addressing challenging behavior is critical in part because the severity of challenging behavior is significantly correlated with parental stress (Baker et al., 2002; Hastings et al., 2005; Lecavalier et al., 2005), which may lead to parents becoming less effective intervention agents, and eventually lead to increased levels of challenging behavior (e.g., Lecavalier et al., 2005).

10.2 Relation Between Problem Behavior and Environment

A fundamental assumption of the functional assessment approach is that the consequences of behavior affect the future likelihood of that behavior. Therapists who want to have the most dramatic and lasting improvements of challenging behavior can do so by disrupting the relation between challenging behavior and the consequences that maintain it. To do so, therapists must determine which environmental events are likely to maintain which forms of challenging behavior for a particular individual. One way of making this determination is through the use of functional behavior assessment, including functional analysis. The consequences maintaining behavior can occur in the external environment or as sensory consequences inside the behaving person. For example, an individual might scream to gain access to attention from others, to escape an aversive situation, or to feel the vibrations in their throat. The consequences that maintain the behavior are called the "function" of the behavior.

10.2.1 Etiology of Behavioral Function

Environments exert a strong influence on challenging behavior. For example, suppose that a child whines when parents are not attending to the child. If parents attend to the whining, that whining becomes likely to occur when the child is not receiving attention. In other words, the child learns to use whining as a way to request parental attention, and that parental attention *reinforces* the whining. Although most forms of challenging behavior are reinforced by attention, access to items, or escape from aversive situations (see Beavers, Iwata, & Lerman, 2013, for a review), any event that follows challenging behavior might be a reinforcer maintaining that behavior, including events like "getting my way" (Hanley, Jin, Vanselow, & Hanratty, 2014) or being able to engage in repetitive behavior (Falcomata, Roane, Feeney, & Stephenson, 2010).

In addition to the consequences that maintain behavior, the events that occur before behavior (*antecedents*) also influence challenging behavior. In the whining example above, parental inattentiveness serves as a trigger for problem behavior. That is, whining is more likely to occur when the parent is not attending to the child. Therapists call these motivational events *establishing operations* (Laraway, Snycerski, Michael, & Poling, 2003). Establishing operations have two influences on behavior: they increase the value of a consequence (i.e., make it more reinforcing), and evoke behavior that previously resulted in that consequence. In the example above, removal of attention for some period of time makes attention more reinforcing and leads to the child engaging in behavior that has resulted in attention in the past. Establishing operations can take a variety of forms, including removal of attention or items, over- or under-stimulation, or presentation of aversive situations.

Events that signal that a reinforcer is available also influence the likelihood of responding. If

behavior is more likely to be reinforced in the presence of one event than another, the child will be more likely to engage in the behavior in the presence of that event. Events that have been associated with reinforcement and therefore evoke behavior are called *discriminative stimuli*. Continuing with the example of parental attention from the paragraphs above, if withdrawal of attention is an establishing operation for whining, but the child's father is much more likely to attend to whining than is the child's mother, then the child is likely to whine when the father does not attend, but not when the mother does not attend. In technical language, the father is a discriminative stimulus for whining because his presence signals the availability of attention for whining. Like establishing operations, discriminative stimuli can take a variety of forms. Any stimulus that is correlated with the availability of reinforcement can become a discriminative stimulus, including locations and people.

For individuals with ASD or developmental disabilities, the most common establishing operations that evoke challenging behavior are removal of attention, removal or denied access to items, or presentation of difficult demands (Beavers et al., 2013). Although these events are the most common establishing operations, individuals' varied reinforcement histories result in idiosyncratic differences across individuals that are difficult or impossible to predict based on the form of the behavior or the diagnosis of the individual. As examples, challenging behavior may be evoked by harshly presented demands but not the same demand presented in a different tone of voice (Borrero, Vollmer, & Borrero, 2004) and may be maintained by atypical reinforcers, like access to talking about preferred topics (e.g., Roscoe, Kindle, & Pence, 2010). More information about idiosyncratic functions of behavior appears in the section on functional analysis, below.

The events that evoke and maintain behavior need not occur in the external environment. Sensory events that occur "inside the skin" can also evoke and maintain challenging behavior. Some forms of behavior, particularly self-injurious behavior (e.g., head banging, hand mouthing) or stereotypic behavior (e.g., body rocking, repeated nonfunctional vocalizations), are often maintained by sensory consequences (Beavers et al., 2013). In the behavior-analytic literature, these internal reinforcers are called *automatic* because the behavior automatically produces the reinforcer without involvement of another person. Even when the reinforcer occurs externally, the establishing operation may be internal. For example, individuals might be more likely to engage in challenging behavior that has previously resulted in the delivery of food (an external event) when they have not eaten (that is, when they are hungry), or engage in behavior that terminates aversive events when they have not slept (Kennedy & Meyer, 1996).

10.2.2 Common Functions of Challenging Behavior

Regardless of whether the reinforcers occur inside or outside of the skin, they can be categorized as being pleasurable stimuli added to the environment or aversive stimuli being removed from the environment. In other words, individuals engage in behavior to produce desirable consequences or escape or avoid undesirable consequences. When stimuli are added after a behavior that result in increases in the likelihood of behavior, the behavior is said to be maintained by *positive reinforcement*. Common positive reinforcers include gaining parents' attention or gaining access to items or activities following a behavior. For example, a parent may intend for attention to reduce the behavior (such as when parents reprimand a child), but that attention can actually serve as a positive reinforcer if the child continues to engage in the behavior to gain the parent's reprimands. Similarly, a parent may intend to reduce the behavior by providing comfort or items meant to have a calming effect, but these consequences may also serve as positive reinforcers. Such discrepancies between the form or intention of the consequence and the function that the consequence actually serves are common for individuals with ASD; a robust literature on functional analysis (described in more detail in

the sections that follow) has shown that reprimands can serve as potent positive reinforcers for challenging behavior (e.g., Iwata, Dorsey, Suifer, Bauman, & Richman, 1982/1994). Recent studies suggest that about 33% of assessments of behavioral function show that behavior is maintained by a socially mediated positive reinforcer (i.e., reinforcers delivered by another person; Beavers et al., 2013).

Behavior can also be maintained by removal of aversive stimuli after the behavior. When aversive stimuli are removed after a behavior and the behavior becomes more likely, the behavior is said to be maintained by *negative reinforcement*. Termination of demands (i.e., instructions or tasks) is the most common negative reinforcer assessed (Beavers et al., 2013), but behavior can also be maintained by the removal of other stimuli that the individual finds aversive, like loud noises (e.g., McCord, Iwata, Galensky, Ellingson, & Thomson, 2001) or even attention from others (e.g., Marsteller & St. Peter, 2012). For example, consider a situation in which a parent gives a child an instruction to put his or her clothes away, but then stops delivering the instruction when the child refuses. The parent discontinuing his or her instructions may inadvertently serve as a (negative) reinforcer for the challenging behavior. Even a very brief termination of aversive stimuli like demands to complete a task can function as a negative reinforcer. For example, termination of a demand for a period as brief as 30 s can effectively reinforce challenging behavior for some individuals (e.g., Iwata et al., 1982/1994).

Negative-reinforcement contingencies can sometimes be difficult to identify because individuals may begin to engage in the challenging behavior as soon as "warning stimuli" are present (i.e., events that signal an upcoming aversive event will occur, even before the actual event occurs). For example, a child may begin screaming as soon as a parent takes out materials associated with difficult work, even before the parent has actually asked the child to do the task. Recent studies suggest that about 32% of assessments of behavioral function show that behavior is maintained by a socially mediated negative reinforcer (Beavers et al., 2013).

Notably, it is difficult to predict the function of behavior from its form alone. For example, in the published literature on functional analysis of *aggression*, about 18% of cases showed maintenance by positive reinforcement, 20% of cases showed maintenance by negative reinforcement, and about 7% showed maintenance by sensory/automatic reinforcement (notably, a clear function could not be obtained for all cases; Beavers et al., 2013). Thus, even though the *form* of behavior was similar (aggression), the *function* of behavior differed across cases. Function cannot be inferred from the form of the response or the diagnosis of the individual but must be individually determined. Additionally, the function of behavior can shift over time. For example, Lerman, Iwata, Smith, Zarcone, and Vollmer (1994) demonstrated that the function of behavior changed for three of four participants across a span of time ranging from 2 months to 2 years. Thus, function is not a static property of a particular behavior.

Understanding the function of behavior is important because function-based interventions have at least five advantages over interventions not based on behavioral function. First, therapists using function-based interventions can teach individuals more appropriate ways to access the reinforcer that is already maintaining challenging behavior rather than simply overriding those existing contingencies with other potent reinforcers or punishers. Interventions that are based on teaching a new, communicative response and reducing or eliminating the reinforcer maintaining challenging behavior are known as functional communication training (see Kurtz, Boelter, Jarmolowicz, Chin, & Hagopian, 2011, and Mancil, 2006 for reviews). Functional communication training was first described by Carr and Durand (1985) and has since been established as a highly effective intervention strategy with considerable generality (Kurtz et al., 2011; more information on functional communication training appears in Chap. 11). Thus, function-based interventions can strengthen communication skills, an area of known weakness for children with ASD. Second, the combination of reinforcement for an alternative behavior with

cessation of reinforcement (extinction) for challenging behavior results in more robust treatment outcomes than interventions that do not involve extinction (e.g., Fisher et al., 1993). Third, interventions that use reinforcers identified in a functional analysis may prevent the child from experiencing long periods of deprivation from those reinforcers by teaching the child a new, more appropriate method for accessing the reinforcer (e.g., Michael, 2000). Fourth, the use of function-based interventions may reduce the reliance on punishment-based procedures, like time-out or the loss of privileges (e.g., Kahng, Iwata, & Lewin, 2002; Pelios, Morren, Tesch, & Axelrod, 1999). Such reductions in the use of punishment may increase the extent to which consumers find the interventions acceptable (e.g., Miltenberger, Lennox, & Erfanian, 1989). Finally, function-based interventions may be more humanistic than standardized interventions because they are necessarily tailored to meet the needs of the individual client (see Hanley, 2010 for a description of how individualizing interventions is a humanistic approach). For more information on function-based interventions, see Chap. 11 in this text. The remainder of this chapter discusses how to identify behavioral function, which is the first step to developing a function-based intervention.

10.3 Functional Behavior Assessment

Functional behavior assessment (FBA) refers to all of the assessment methods that are used to identify a function of behavior. The three categories of FBA are indirect assessment (e.g., interviews), descriptive analysis (e.g., ABC observations), and functional analysis. A primary purpose of indirect and descriptive assessments is to develop hypotheses about the function of the behavior. Functional analysis is the only FBA method that can show a functional (rather than correlational) relation between a hypothesized function and challenging behavior. There are pros and cons to each method, and it is sometimes recommended that therapists use a combination of methods as part of the assessment process (O'Neill et al., 1997).

10.3.1 Indirect Assessments

Indirect methods of FBA are used to gather information related to challenging behavior from those who are familiar with the client (e.g., caregivers). Indirect assessments can include questions that are open or close ended and are conducted as interviews, rating scales, or questionnaires. Unlike the assessment methods described later in this chapter, indirect assessments do not involve the direct observation of the client's behavior.

Because the validity and reliability of close-ended assessment tools are questionable (Dufrene, Kazmerski, & Labrot, 2017), some researchers now recommend open-ended interviews as a method of indirect assessment (e.g., Hanley, 2014). Open-ended interviews consist of asking the caregiver about aspects of the behavior, including the form of the behavior, common triggers, and what the caregiver does to stop the behavior. One such open-ended scale is the functional assessment interview (FAI), a semi-structured interview that typically takes 45–90 min to complete (O'Neill et al., 1997). Questions in the FAI ask caregivers to describe the challenging behavior, provide information about potential setting events (i.e., establishing operations), describe the typical antecedents and consequences for challenging behavior, identify reinforcers, and discuss the effects of previous interventions. Based on these responses, the therapist can derive hypotheses regarding antecedents and maintaining reinforcers for each challenging behavior and gather other important information to be used in the intervention-planning process.

Indirect assessments may be advantageous because they do not require extensive time or resources to complete. Many indirect assessments could be easily incorporated into intake meetings with parents. For therapists using

parent-child interaction therapy (PCIT), indirect assessments could be conducted before the start of the child-directed interaction phase, at the same time that the therapist might do other parent-report measures like the child behavior checklist. Through the use of indirect assessments, therapists can easily gain an array of information that might support various other aspects of the assessment and intervention process.

Therapists can use indirect assessments to identify and operationally define challenging behavior. Designing operational definitions helps therapists plan for a data collection system for direct observations (e.g., descriptive analysis) and for tracking treatment progress. Interviews can help therapists narrow down the situations (e.g., settings, activity, time of day) during which the challenging behavior is more and less likely to occur. This information helps to develop hypotheses about the function of behavior and the plan for direct observations. Other advantages include gathering information leading to potential medical rule-outs, such as identifying health conditions or medications contributing to challenging behavior. For example, chronic ear infections can contribute to self-injury directed toward the ear because the behavior can result in the temporary reduction in pain caused by the infection. Likewise, medication can influence behavior by affecting motivation (e.g., a medication that increases appetite may also increase challenging behavior that is maintained by access to food).

Indirect methods can be helpful for assessing behavior that is not conducive to direct observation. For example, indirect methods may be appropriate for low-frequency challenging behavior or challenging behavior that would pose a serious health risk should it occur even one time (e.g., forms of self-injury, such as eye gouging, that may cause irreversible tissue damage). Low-frequency challenging behavior is difficult to capture during direct observation or functional analyses (e.g., a child who engages in physical aggression once or twice per month; O'Neill et al., 1997).

Therapists can also use indirect methods to prepare for descriptive and functional analyses. The events identified by caregivers can then be used to design procedures that explicitly evaluate the role of those events in regard to the problem behavior (Hanley, 2014; see more about this in the section on functional analysis, below). For example, the open-ended functional assessment interview (Hanley, 2009) can be used to directly inform the development of functional analysis conditions (see discussion of the interview-informed synthesized contingency analysis, in the Variations on Functional Analysis section, below). Additionally, indirect assessments provide an opportunity for the therapist to build rapport with the caregivers (Hanley, 2014).

Indirect assessments also include some noteworthy limitations. First, indirect assessments are only useful for determining behavioral function if the informants provide accurate information. One approach is to select interviewees who have considerable knowledge of the client and presenting problem (Hanley, 2014). However, recent research suggests that when multiple caregivers are interviewed, they are unlikely to report similarly about behavior; experts are better able to identify possible functions of behavior following brief observations of the client than are caregivers (Dracobly, Dozier, Briggs, & Juanico, 2017). Second, indirect assessments can only suggest possible correlations between possible reinforcers and behavior. In the absence of direct observation, it is exceedingly difficult to develop effective interventions from these reports alone.

10.3.2 Descriptive Assessments

When conducting a descriptive assessment, therapists directly observe the client in the setting(s) in which the challenging behavior occurs. This is typically in natural settings, such as the child's home or classroom, but observations could also occur during clinic appointments. Therapists collect data on instances of challenging behavior and the events that surround the behavior (e.g., setting events, antecedents, consequences). Unlike a functional analysis, therapists typically do not change any aspects of the environment during a descriptive analysis (but, see our description of structured descriptive assessment at the

end of this section). Rather, they observe the client's behavior under the conditions that would typically be present.

As mentioned in the previous section, therapists can use the information from an indirect assessment to identify appropriate observation periods. Ideally, descriptive analyses include observations during times and locations where the challenging behavior is likely to occur naturally. If this is not possible (for example, if the assessment is done during clinic appointments), therapists should structure the assessment to resemble the natural environment as much as possible. In many cases, it is also useful to observe (at least briefly) during situations that are unlikely to evoke the challenging behavior. Observing situations that both increase and reduce the likelihood of challenging behavior can allow the therapist to identify possible differences across those environments that might be impacting the behavior. For example, if an open-ended interview reveals that a child engages in challenging behavior at the table when he or she eats lunch with his or her mother, but not during dinner when his or her father is also present, observing during both of these situations may help the therapist identify the different variables potentially contributing to the target behavior.

A common observation method for descriptive analysis is called antecedent–behavior–consequence (A–B–C) data collection (e.g., Bijou, Peterson, & Ault, 1968). ABC data collection often involves recording the date, time, and setting of target behavior and the events surrounding the occurrence of challenging behavior. Specifically, therapists record the antecedent and consequence events of the target behavior (i.e., events that occur directly before behavior and events that occur during or directly following behavior, respectively). For example, suppose a therapist observed an instance of target behavior that occurred directly after a parent told their child to turn off the television. After the parent's instruction, the child engaged in a tantrum and the parent walked away. The therapist would record the instruction to turn off the television as the antecedent, the tantrum as the target behavior, and the removal of the instruction as the consequence (see Fig. 10.1).

Different styles of ABC data recording can be used during a descriptive analysis. ABC recording can be narrative, in which the observer describes the ABCs in his or her own words (e.g., Lerman, Hovanetz, Strobel, & Tetreault, 2009; see Fig. 10.1 for an example). Alternatively, therapists can use a structured method with a data sheet with pre-arranged categories of responses. For example, a structured data sheet may include a line for the time and date of an occurrence of challenging behavior, along with checkboxes and prelisted options for the antecedents, behavior, and consequences (e.g., Functional Assessment Observation Form [FAOF]; O'Neill et al., 1997). Figure 10.2 gives

Date/Time	Setting	Antecedent	Behavior	Consequence
January 3 3:04pm	Living room – Billy was watching TV	Father told Billy to turn off TV	Scream, yell, laid on floor	Walked away, TV remained on
January 5 2:32pm	Clinic visit – Billy leading child-directed play	Mother tells Billy to clean up	Says "no" and "I hate you." Runs away from mother.	Keeps toys in hand, mother follows him around room and says "stop" in firm tone.

Fig. 10.1 A narrative ABC recording form

Date/Time	Setting	Antecedent	Behavior	Consequence
Jan 3 3:04p	☐ Car ☐ Outside ☑ Living area ☐ Bedroom ☐ Bathroom ☐ _____	☐ No attention ☐ Alone ☐ Attention provided ☑ Preferred activity interrupted ☐ Request denied ☑ Instruction/demand delivered	☐ Whining ☐ Aggression ☑ Tantrum	☐ Attention provided ☑ Activity or access to preferred item returned ☐ Ignored/adult left the area ☑ Instruction/demand discontinued ☐ No change
Jan 5 2:32pm	☐ Car ☐ Outside ☐ Living area ☐ Bedroom ☐ Bathroom ☑ Clinic	☐ No attention ☐ Alone ☐ Attention provided ☑ Preferred activity interrupted ☐ Request denied ☐ Instruction/demand delivered	☑ Whining ☐ Aggression ☐ Tantrum	☐ Attention provided ☑ Activity or access to preferred item returned ☐ Ignored/adult left the area ☑ Instruction/demand discontinued ☐ No change
Jan 5 2:54pm	☐ Car ☑ Outside ☐ Living area ☐ Bedroom ☐ Bathroom ☐ _____	☐ No attention ☐ Alone ☐ Attention provided ☐ Preferred activity interrupted ☐ Request denied ☑ Instruction/demand delivered	☐ Whining ☑ Aggression ☑ Tantrum	☐ Attention provided ☐ Activity or access to preferred item returned ☑ Ignored/adult left the area ☐ Instruction/demand discontinued ☐ No change
Jan 7 2:18pm	☐ Car ☐ Outside ☐ Living area ☑ Bedroom ☐ Bathroom ☐ _____	☐ No attention ☐ Alone ☐ Attention provided ☐ Preferred activity interrupted ☐ Request denied ☑ Instruction/demand delivered	☑ Whining ☑ Aggression ☐ Tantrum	☐ Attention provided ☐ Activity or access to preferred item returned ☐ Ignored/adult left the area ☑ Instruction/demand discontinued ☐ No change
Jan 9 4:25p	☐ Car ☐ Outside ☐ Living area ☐ Bedroom ☐ Bathroom ☑ Clinic	☐ No attention ☐ Alone ☐ Attention provided ☑ Preferred activity interrupted ☐ Request denied ☑ Instruction/demand delivered	☑ Whining ☐ Aggression ☐ Tantrum	☐ Attention provided ☑ Activity or access to preferred item returned ☐ Ignored/adult left the area ☑ Instruction/demand discontinued ☐ No change

Fig. 10.2 A structured ABC recording form

an example of a structured data sheet that includes multiple observations. For each episode of behavior, the observer notes the date and time and categorizes events occurring before and after behavior, as well as any forms of behavior that occurred. Structured ABC data sheets may allow more rapid data collection and quantitative analysis than narrative ABC because events are grouped into categories during data collection. However, structured data sheets may also restrict information about idiosyncratic or unusual variables that occur surrounding behavior. In highly structured training situations, therapists generally collect more accurate data using structured data sheets than narrative data sheets, and also prefer the structured format (Lerman et al., 2009; Pence & St. Peter, 2018). Therapists interpret ABC data by looking for patterns in the information collected on the antecedents and consequences for each form of challenging behavior (see Pence, Roscoe, Bourret, & Ahearn, 2009 for additional examples of ABC data collection and analysis). When a target behavior reliably occurs with specific antecedents and consequences, the therapist can hypothesize the function of behavior. For example, if the data show that challenging behavior most often occurs directly after an instruction and is followed by the removal of the demand, it may be hypothesized that the target behavior is maintained by negative reinforcement in the form of escape from demands (see Fig. 10.2). Similarly, if challenging behavior most often occurs when a caregiver is not paying attention to the child and is then followed by attention (e.g., scolding), one may hypothesize that target behavior is reinforced by positive reinforcement in the form of attention. Some therapists also use more complex analyses, which involve calculating conditional probabilities (Lerman & Iwata, 1993; Mace & Lalli, 1991; Vollmer, Borrero, Wright, Van Camp, & Lalli, 2001). Such methods can be helpful but require more intense forms of data collection, such as taking time-stamped data several times per minute, even when the target behavior is not occurring (Mace, Lalli, & Lalli, 1991).

Descriptive analyses have several advantages. First, they eliminate the problems associated with retroactive self-report that are present for indirect assessments by having the therapist capture data on these events as they occur. Second, descriptive assessments do not require modifications to the environment, so they may be useful when therapists are particularly interested in naturally occurring caregiver-child interactions, or when modifications to the environment are not possible (for example, due to safety reasons). Third, descriptive analyses can identify possible idiosyncratic variables influencing behavior (Mace & Lalli, 1991; Tiger, Hanley, & Bessette, 2006), which can lead to a more successful functional analysis when those idiosyncratic events are incorporated (Hanley, Iwata, & McCord, 2003; Tiger et al., 2006). Perhaps for these reasons, descriptive assessment is the most commonly used FBA method by behavior-analytic therapists (Oliver, Pratt, & Normand, 2015).

Descriptive assessments may be particularly useful for therapists who wish to gain additional hypotheses about behavioral function while attempting other forms of treatment, such as PCIT. When treatment involves observation of parent-child interactions, particularly when those interactions are coded by the therapist, it may be possible to extract descriptive data from the existing codes. For example, presume that treatment coding suggests that a child often refuses when a parent makes a direct command. Rather than restating the demand, the parent sends the child to timeout after each refusal. The likelihood of the child refusing increases rather than decreases across treatment sessions. Sequences of events like these could be analyzed from observational coding and might suggest a potential function of behavior. In the example above, the therapist might speculate that the behavior was maintained by escape from demands, and that the timeout was sufficient escape to maintain the behavior. The therapist might work with the parent to remove the timeout after the problem behavior and ensure that the parent follows through on the original command. Alternatively, the therapist might use this information to inform a brief functional analysis (described below) to confirm the hypothesis before making treatment modifications.

Like the indirect assessment methods, there are several drawbacks to the use of descriptive analyses. Perhaps the most concerning limitation is the lack of validity for correctly identifying the function of challenging behavior (St. Peter et al., 2005; Thompson & Iwata, 2007). Descriptive analyses are less accurate in identifying the function of challenging behavior than functional analysis (described below; Lerman & Iwata, 1993; Thompson & Iwata, 2007). For example, because challenging behavior (particularly severe behavior) is often followed by some form of attention, descriptive analyses have a high rate of false positives for attention as a maintaining variable (St. Peter et al., 2005; Thompson & Iwata, 2007).

Additionally, although it seems easy to record the antecedents and consequences for behavior, research suggests that individuals are surprisingly inaccurate at the task (e.g., Pence & St. Peter, 2018). Individuals are particularly inaccurate when recording events like escape (Pence & St. Peter), perhaps because these events do not have a clear onset. For example, parents rarely explicitly remove a demand, but rather often fail to restate the demand following noncompliance. Thus, therapists are actually scoring the absence of a parent behavior rather than an explicit parental response. Additionally, analysis of descriptive data can be complicated because more than one antecedent or consequence often occurs in close proximity to the behavior. For example, in Fig. 10.1, the parent removes the demand (instruction to turn off the television) while simultaneously allowing continued access to a preferred activity (the television). This makes it difficult to determine whether the child is motivated by escaping instructions or accessing preferred items.

Another problem with descriptive analysis is that some caregivers learn to avoid situations that evoke undesired behavior (Carr, Taylor, & Robinson, 1991; Gunter et al., 1994); this can lead to long periods of observation during which the challenging behavior is never observed. For example, if asking a child to do chores led to challenging behavior in the past, caregivers may

have learned to avoid asking the child to complete any chores. When caregivers avoid certain tasks during a descriptive analysis, it can lead to a false negative for an escape function (Hanley, 2012).

To some extent, these disadvantages can be reduced by structuring antecedents in the descriptive analysis. For example, a therapist might ask a parent to show what happens when the parent is busy (to evoke attention-maintained behavior) or when the child needs to complete work (to evoke escape-maintained behavior). *Structured descriptive assessments* (SDA) involve controlling antecedent events like those described above while allowing consequences to vary (e.g., Anderson & Long, 2002). Structured descriptive assessments may allow therapists to isolate variables that evoke challenging behavior and observe a wide range of possible antecedents, including those that parents might otherwise avoid. Although structured descriptive assessments still only identify correlated variables (unlike the functional analysis procedures described below), they have successfully identified reinforcers leading to effective treatments for diverse individuals across several studies (e.g., Anderson, English, & Hedrick, 2006; Anderson & Long, 2002; Dolezal & Kurtz, 2010).

10.3.3 Functional Analysis

Functional analysis (FA) is the most accurate assessment method for identifying maintaining variables of a challenging behavior displayed by children with ASD and is considered the current gold standard for determining behavior function. Functional analysis involves both the direct observation of the client's behavior and control of environmental variables (Hanley, 2012). During an FA, the therapist arranges test scenarios that each present the antecedents that potentially evoke challenging behavior (e.g., not attending to the client) and consequences potentially maintaining it (e.g., delivering attention following the behavior). Each possible maintaining variable is presented systematically so the therapist can determine the effects each has on challenging behavior. Functional analyses are tailored to the individual client, but the general procedures developed by Iwata et al. (1982/1994) are still the most commonly used (Beavers et al., 2013).

Beavers et al. (2013) identified 435 published research studies on FA. Of those studies, 26.7% were conducted with individuals diagnosed with autism. In the FA literature, some of the most researched forms of challenging behavior include aggression (43.2% of studies), vocalizations (22.5%), self-injury (54.7%), property destruction (20%), and disruptive behavior (21.8%; Beavers et al., 2013; note that some studies include multiple forms of challenging behavior, which is why the sum of the percentages exceeds 100%). Other forms of behavior for which FA procedures have studied include elopement, noncompliance, stereotypy, tantrums, and pica (Beavers et al., 2013).

Functional analyses are typically broken into distinct sessions, with highly controlled antecedents and consequences for behavior varying across sessions. The assessment sessions of an FA are each designed to test a possible function of behavior, and conditions are arranged to isolate variables in a similar manner to an experiment (which is why functional analyses are sometimes referred to as *experimental functional analyses*). The therapist arranges the establishing operation for the particular consequence being tested in that session. For example, when testing for attention-maintained behavior, the therapist arranges the antecedent by diverting attention away from the client. This increases the reinforcing value of attention if it indeed functions as a reinforcer. Any time the target behavior occurs, the therapist delivers the consequence associated with the test condition. In the case of the attention condition, the therapist would deliver attention each time the target behavior occurs.

Functional analyses often include multiple test conditions and, generally, each condition is tested several times across repeated sessions. The test sessions are typically 5–15 min in duration and conducted in rapid succession (Beavers et al., 2013). During each session, the therapist or assistant records data on occurrences of the

target behavior. The therapist compares the rates or durations of target behavior during each condition to a comparison condition (i.e., *control* condition) in which the potential reinforcers are provided freely (i.e., there is no motivation to engage in challenging behavior). During a successful functional analysis, the challenging behavior is "turned on and off" by the antecedents and consequences arranged across conditions. Target behavior occurs more often in the condition including the antecedent(s) and maintaining reinforcer(s) than in the control condition.

10.3.3.1 Common Functional Analysis Conditions

Although conditions in a functional analysis should be selected based on hypothesized reinforcers for that particular client's behavior, several conditions are commonly reported in the literature. These conditions are briefly described below.

Attention Condition

The attention condition is arranged to test for positive reinforcement in the form of attention as a potential maintaining reinforcer. To arrange the antecedent and motivating conditions, the therapist begins the session by announcing to the client that he or she has some work to do (e.g., paperwork), and then directs his or her attention to a task so he or she appears to be occupied. All responses except for the targeted form of challenging behavior are ignored. Each time the client engages in the target challenging behavior (e.g., hitting), the therapist provides brief attention (e.g., 20 s), mimicking the form of attention that is typically provided in the natural environment (e.g., reprimands, comforting statements). The therapist then withdraws his or her attention and continues to attend to his or her task until another instance of target behavior occurs.

Tangible Condition

The tangible condition tests for positive reinforcement in the form of gaining access to an item or activity. A tangible condition is only included when there is evidence from the indirect or descriptive analysis indicating that the client sometimes gains access to items during or after target behavior (e.g., food, iPad, toys); without this evidence, inclusion of a tangible condition may result in a false positive (Galiatsatos & Graff, 2003; Rooker, Iwata, Harper, Fahmie, & Camp, 2011; Shirley, Iwata, & Kahng, 1999). At the beginning of the session, the therapist removes the child's access to the preferred item but keeps the item in sight. All behavior is ignored by the therapist unless the child emits the target behavior. Following each instance of the target behavior (e.g., a tantrum), the therapist provides access to the items for a set period of time (e.g., 20 s), and then restricts access again until the next occurrence of target behavior.

Escape Condition

The escape condition assesses for negative reinforcement as the maintaining variable, and it is usually arranged as escape from "chores" or academic activities. The activity should mimic demand situations that are present in the natural environment. At the beginning of the session, the therapist provides an instruction to complete the task (e.g., a math worksheet). He or she continues providing instructions and prompts throughout the session until the client emits the target behavior (e.g., whining) in which case he or she removes the task and stops providing instructions for a specified period of time (e.g., 20 s). The therapist then resumes presenting demands until another instance of target behavior occurs.

Alone/ignore Condition

The alone condition tests for automatic (sensory) reinforcement of the target behavior. The client is either left alone in a room or the therapist may be in the room with the client (the latter variation is often called an "ignore" condition, given that the client is not technically alone). Regardless, there are no social interactions or consequences delivered during the session. This situation is designed to mimic a period of time with low sensory input, which might evoke self-stimulation.

Play/control Condition

The play condition serves as a "control condition" for the assessment. During these sessions, the motivating operations for engaging in target behavior should be absent and there are no planned consequences for challenging behavior. Typically, this condition is arranged as including frequent, high-quality attention, no instructions or demands, and free access to preferred items and activities. If the target behavior does occur, the therapist continues the session without providing any special consequences. Because the motivation for attention-, escape-, and tangible-maintained behavior should be low, it is expected that very little target behavior will occur during this condition. Data on target behavior from each of the conditions (e.g., rate of responding) are compared to this condition.

10.3.3.2 Utility of Functional Analysis

By revealing the function of problem behavior, the results of a functional analysis narrow down the types of treatment procedures that are likely to be effective for decreasing an individual's challenging behavior (Hanley et al., 2003). Conducting a functional analysis can help therapists avoid prescribing an intervention that would be contraindicated. For example, timeout is often effective in cases of attention-maintained challenging behavior (Barkin, Scheindlin, Ip, Richardson, & Finch, 2007). If the challenging behavior is escape maintained, however, timeout would be a contraindicated intervention (Iwata, Pace, Cowdery, & Miltenberger, 1994). Because timeout procedures remove the child from the current activity or environment, using it under the wrong conditions can accidentally reinforce the challenging behavior. For example, parents who allow a child to run away when the child is asked to do an activity may be accidentally reinforcing the behavior. A similar situation may apply when a child vocally refuses to comply with parental directives, and the parent puts the child in timeout (thereby removing the demand for a period of time).

10.3.3.3 Considerations When Attempting a Functional Analysis

Functional analyses should not be undertaken lightly, as they may require considerable time, training, and resources. Additionally, FA technologies are not currently well developed for all forms of presenting challenging behavior (for example, behavior that is intense but very infrequent or that does not occur when others are nearby), and may pose a risk to the client due to the deliberate reinforcement of challenging behavior during the analysis. Several considerations for the implementation of FA procedures are briefly described below.

Material and Intellectual Resources Required

Therapists should consider whether they have the necessary resources in place prior to beginning a functional analysis. There are several resources required, the first of which is having a sufficient amount of available time with the client. Having some flexibility with the timeframe can also be helpful because it is difficult to predict the exact amount time that will be needed to complete an FA. The time requirement varies based on the case, number of test conditions, duration of test sessions, and number of times each condition is presented, the latter of which often depends on how clear the differences in responding are across conditions.

Sufficient and safe physical spaces are also needed to conduct an FA. The first requirement for a space is that the client and therapist are safe during the analysis. For example, sharp and hard objects should be removed from the area when assessing challenging behavior that involves using objects for self-injury or aggression. The space should also be relatively free of distractions to ensure that the antecedent and consequence conditions can be carefully controlled.

Finally, the analysis should be conducted by, or directly supervised by, a professional with direct training and expertise in functional analyses.

The individual overseeing the functional analysis should have previous experience with developing and implementing functional analyses, interpreting FA results, and function-based intervention planning. The therapist should also have expertise related to case-specific characteristics including the client's diagnostic category and form of challenging behavior.

Safety Concerns

In addition to arranging a safe space for the analysis (described above), therapists must incorporate additional safety procedures, especially when conducting a FA on potentially harmful forms of behavior (e.g., aggression or self-injury). Examples of safety procedures can be found in the literature (starting with Iwata et al., 1982/1994), but there are no standardized guidelines for safety procedures for FA (see Weeden, Mahoney, & Poling, 2010). The planning and execution of the FA should be done by, or with close consultation with, an individual who has specific training and experience with safety procedures. As part of the planning process, therapists should predetermine criteria for when an FA session would be terminated due to risk or injury. These criteria vary depending on the circumstance, and the decisions can sometimes be made with the assistance of a healthcare professional (e.g., Iwata et al., 1982/1994). Additional safety protocols may be needed, such as safety intervention techniques for blocking or avoiding instances of risky behavior. For example, a therapist may wear protective gear when the target behavior is aggression, or the surfaces in the room may be covered by a soft padding for self-injurious behavior that involves hitting surfaces. When dealing with potentially risky behavior, it is sometimes appropriate to speak with other health professionals, such as a physician, to determine the risk of harm (Hanley, 2012; Iwata et al., 1982/1994).

Design of Test and Control Conditions

Early steps in the development of client-specific FA procedures include selection of a target response and measurement system (Hanley, 2012). The target response should be of significance to the client and other stakeholders. When possible, therapists may try to target the lowest intensity challenging behavior that they believe serves the same function as other, more intense, forms of challenging behavior (Fritz, Iwata, Hammond, & Bloom, 2013). Selecting a lower intensity challenging behavior may reduce some of the safety concerns mentioned above. For example, if a child tends to stomp his or her feet and clench his or her fists before he or she engages in physical aggression, these precursor forms of behavior may share a function with aggression. When this is the case, a therapist can deliver consequences for the less severe forms of behavior (foot stomping and fist clenching) and avoid the occurrence the more severe behavior (aggression). Whatever challenging behavior is selected should be observable and measurable so that the frequency of the behavior can be compared across conditions (Hagopian, Dozier, Rooker, & Jones, 2013). Thus, the behavior should include a specific operational definition (for instance, "striking another person with an open hand") rather than a vague descriptor (like "aggression" or "becomes angry"). The operational definition of the behavior will help to inform the measurement system; does the response have a short duration and can be easily counted, or are other measurement strategies necessary?

After selection and definition of the target behavior, the therapist must determine what events might function as reinforcers for the behavior. As described above, therapists can develop initial hypotheses about possible reinforcers through indirect or descriptive assessments. Constraints on time or other resources might also impact the number of possible reinforcers that are tested in the FA; when therapists do not have much time, the number of test conditions must be limited. The form of the events in the FA should be analogous to those actually experienced by the client if possible. If this is not done, the reinforcers identified may differ from those maintaining the behavior in the natural environment (e.g., Lang et al., 2008). However, the possible reinforcers must be arranged such that the therapist can restrict access to those

reinforcers (as an establishing operation) and present them only when prescribed by the FA protocol. For example, therapists often choose to use demands during an escape condition for which the child can be guided to comply (in an attempt to prevent unauthorized escape). Additionally, at least one control condition, in which the client has access to the possible reinforcers without having to engage in challenging behavior, should be included.

Other important considerations in the design of a client-specific FA procedure include the use of stimuli to signal the condition in place (Conners et al., 2000), the duration of sessions (Wallace & Iwata, 1999), the order of sessions (Hammond, Iwata, Rooker, Fritz, & Bloom, 2013), and the analysis of data (Hagopian et al., 1997). Each of these variables has been shown to systematically impact the outcomes of FA procedures. Thus, development of an appropriate functional analysis requires extensive training and expertise, and should not be undertaken by individuals without such training.

10.3.4 Variations of FA

Recall that variations of the procedures described by Iwata et al. (1982/1994) are still among the most commonly used (e.g., Beavers et al., 2013). These procedures use rapidly alternating conditions in which behavior is turned on and off across sessions, typically as shown by changes in response rate, to demonstrate what events functioned as reinforcers. Although there is a relatively strong demonstration of functional relations, this arrangement can require extensive time to complete (Iwata, Pace, Dorsey et al., 1994; Wallace & Iwata, 1999) and response rates can sometimes be unacceptably high (Thomason-Sassi, Iwata, Neidert, & Roscoe, 2011; Weeden et al., 2010). Thus, in some circumstances, other methodological variations of the FA are better suited to the environment or form of challenging behavior.

One such variation is the *brief functional analysis*. An early version of the brief functional analysis was described by Northup et al. (1991), who needed to complete a functional analysis in the span of a 90-min clinic visit. In one method for conducting a brief FA, the therapist conducts one session for each reinforcer hypothesized to maintain behavior. These initial sessions are used to identify the reinforcer that resulted in the highest rate of responding. The therapist alternates between sessions using this reinforcer and a control condition in which the reinforcer is provided for appropriate behavior rather than challenging behavior (a "contingency reversal"). For example, if a child's target behavior (refusals) occurred most often during the initial attention condition, the therapist would alternate between the attention condition (i.e., attention delivered after each refusal) and the contingency reversal condition (i.e., attention delivered after compliance). When successful, this brief assessment shows that behavior can be evoked and eliminated, and also demonstrates the possible treatment utility of reinforcing an alternative response. The entire analysis can be completed within the 90-min clinic appointment (Northup et al., 1991). Notably, however, outcomes of brief assessments may not match those obtained through longer FA procedures (Derby et al., 1992; Kahng & Iwata, 1999).

Another variation of typical FA procedures is the *trial based FA* (Sigafoos & Saggers, 1995). Trial-based FA procedures arrange antecedents and consequences in short, discrete units of time (typically, about 1–2 min). Trials end after a single target behavior occurs. Trials are conducted in two-trial blocks consisting of a brief exposure to a presumed establishing operation (a "test trial") and a brief exposure to a presumed reinforcer (a "control trial"). For example, in a trial-based FA of hitting, a therapist might test for an attention function by ignoring the child for 2 min (or until the first instance of hitting occurs), and then attending to the child for 2 min (or until an instance of hitting occurred; cf., Sigafoos & Saggers, 1995). This arrangement would be repeated for any other possible reinforcers; ten or more blocks of test and control trials are conducted for each possible reinforcer. The therapist measures the percentage of each kind of trial (e.g., attention test trials, attention control trials)

during which the target behavior (e.g., hitting) occurred, and graphs the outcomes as grouped bars that directly compare test and control trials for each of the possible reinforcers. Functions of behavior are identified when target behavior occurs in a greater percentage of test trials than control trials for a particular reinforcer.

A more recent advance in FA methodology is the *Interview-Informed Synthesized Contingency Analysis*, or *IISCA* (Hanley et al., 2014). The IISCA uses on open-ended interview and brief observation to design individualized test and control conditions. The assumption of IISCA technologies is that single reinforcers (such as attention or escape in isolation) are unlikely to be sole forces in the maintenance of challenging behavior. Therefore, IISCA procedures often combine potential reinforcers into a single test condition; the combination of reinforcers is provided after each instance of challenging behavior. For example, if the interview suggests the parent attempts to soothe the child after a tantrum by talking and giving the child items, the test condition would arrange contingent delivery of both attention and tangibles following the challenging behavior. The control condition in this case would be arranged to provide constant access to attention and tangibles regardless of the child's behavior. Recent evaluations suggest that IISCA outcomes are unlikely to match those of more traditional FA methodologies (Fisher, Greer, Romani, Zangrillo, & Owen, 2016). Despite these mismatches, individualized treatments developed following IISCA procedures tend to be effective (Slaton, Hanley, & Raftery, 2017).

Although an array of FA procedures exist (see Iwata & Dozier, 2008 for an overview of common procedures used in practice), there is no standardized or manualized set of procedures that would be useful for all clients or presenting problems. In most cases, the procedures need to be modified to best capture the function of behavior within the constraints on available therapist resources. These modifications could include the duration of the session (Wallace & Iwata, 1999), the arrangement of sessions across time (see Iwata & Dozier, 2008, for some examples), and the particular forms of potential establishing operations and reinforcers that are arranged. An array of variables that are idiosyncratic to specific cases have been shown to influence FA outcomes (see Schlichenmeyer, Roscoe, Rooker, Wheeler, & Dube, 2013 for a review), and not all maintaining reinforcers are among those commonly tested. For example, challenging behavior can be maintained by access to rituals (Hausman, Kahng, Farrell, & Mongeon, 2009), parent compliance to the client requests (Bowman, Fisher, Thompson, & Piazza, 1997), and access to music (Carey & Halle, 2002). Thus, therapists must have a full understanding not only of how frequently described conditions might be conducted (see the previous section on the descriptions of common conditions) but also how to modify conditions to address the needs of a particular client.

Therapists also must have a thorough understanding of potential behavior-environment relations because there are no clearly established FA procedures for some forms of behavior. The currently established FA technologies may not be useful for behavior that occurs infrequently or that does not occur while others are watching. For example, it is difficult to conduct an FA on challenging behavior such as meltdowns that only occur once or twice per week, or aggression toward peers that happens only when adults are absent. For low-rate behavior, researchers have suggested extending the duration of the FA session to the entire day (Kahng, Abt, & Schonbachler, 2001) or conducting sessions only following an instance of challenging behavior (e.g., Tarbox, Wallace, Tarbox, Landaburu, & Williams, 2004). Although effective (e.g., Davis, Kahng, Schmidt, Bowman, & Boelter, 2012), such modifications are not always practical when staffing resources are limited.

There are at least three strategies that may be appropriate for covert behavior. One, therapists could determine what reinforcers maintain an arbitrarily selected response (like touching a card), in the hopes that a similar reinforcer maintains the covert behavior (Hanley, 2014). Two, it may be possible to measure responding during sessions using the products of the behavior rather than direct observation (similar to strategies used

by Maglieri, DeLeon, Rodriguez-Catter, and Sevin, 2000), but such strategies have not yet been directly tested in the context of controlled research studies. Three, a therapist may rely on the hypothesized function derived from an indirect or a descriptive assessment and analyze the effects of a treatment based on the hypothesized function.

10.4 Conclusion

Incorporation of function into treatment planning may be particularly important when behavior is maintained by idiosyncratic variables or is not quickly responsive to well-established manualized interventions. Identifying the function of challenging behavior allows therapists to build interventions that are more effective and better meet the needs of the individual than interventions based on the form of the behavior. Although many methods exist for identifying function, FA technologies currently provide the best identification of behavioral function. However, developing and implementing appropriate FA procedures, and analyzing the results, requires extensive previous training and considerable knowledge of the client. In our opinion, the benefits that can be gained from understanding the function of behavior for individuals typically outweigh the costs. Thus, we recommend that therapists who regularly deal with challenging behavior exhibited by individuals with ASD or related disabilities seek explicit, high-quality training in functional analysis or collaborate with individuals who have such training, particularly when challenging behavior is resistant to manualized forms of intervention.

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