Functional Assessment

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Problem behavior is a common concern among clinicians who work with children diagnosed with intellectual and developmental disabilities or psychiatric disorders. Problem behavior encroaches on the safety of the child and those in their immediate surrounding and chronic problem behavior can have a substantial impact on a child's quality of life (Chiang & Wineman, 2014; Kamio et al., 2013). The topography of problem behavior can vary on an individual basis including more common variants such as aggression, self-injurious behavior, or property destruction to idiosyncratic variants such as elopement, pica, and fecal smearing. That is to say, there are not necessarily any topographical identifiers for defining the occurrence of problem behavior and behavioral interventions have been designed to address operant mechanisms regardless of how the problem behavior is formally expressed.

One of the biggest developments in the assessment and treatment of psychologically based problems in children is functional assessment. Functional assessment is a general term that encompasses any pretreatment evaluations of problem behavior that are intended to improve a clinician's understanding of the influence of any possible environmental determinants for said problem behavior. The assumptions being that primary causes for problem behavior can be found in the proximal environmental events and an appeal to these operant mechanisms as an explanation for the problem behavior is sufficient to develop treatment. If a child is exhibiting problem behavior, a clinician can use a functional assessment to investigate potential causes in antecedents that have historically evoked and consequences that have strengthened problem behavior to individualize subsequent treatment procedures. Appreciation for the clinical utility of functional assessment for informing treatment has grown to the point of a nationwide mandate for its use in severe cases (Individuals with Disabilities Education Act, 1997, 2004).

Clinical utility broadly refers to the importance of a set of procedures for improving the socially relevant treatment outcomes of a client. When applied to functional assessment, it means that clinicians should select the assessment methods that best inform the design of the most effective and

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acceptable set of treatment procedures (Hayes et al., 1987). In that regard, a functional assessment can only be validated as having clinical utility by evaluating the subsequent treatment it has informed. Therefore, a functional assessment is more than just an analytic tool for identifying relations between environmental events and problem behavior (i.e., contingencies). There are a seemingly infinite number of contingencies that can be assessed if clinicians were so inclined: from general classes that are believed to impact the average child to the everyday events specifically experienced by a particular child. The purpose of the functional assessment is not to determine what *can* influence problem behavior. If that were the case, clinicians would spend an absurd amount of time exposing the child to an endless catalog of potential contingencies. The purpose of a functional assessment in clinical practice, and indeed its usefulness, is determined by its ability to (a) identify the ecologically relevant contingency in a reasonable amount of time and (b) influence the clinician's decision-making process when developing a treatment package (Kratochwill & Shapiro, 2000).

The arduous task begins for the clinician when determining under what circumstances a functional assessment is necessary and has clinical utility. That is because there is no decisive set of rules that inform decisions of when to use a functional assessment and the clinician is typically left to rely on their professional judgment. Concluding that a functional assessment should be conducted to improve treatment outcomes is not an inconsequential decision to make considering the time and resources that must be diverted toward individualized supports. Furthermore, many functional assessment methods require specialized training with supervision from a Board Certified Behavior Analyst (BCBA) or licensed psychologist. A concrete decision-making process may, therefore, hold particular value for clinicians and help guide evidence-based practice.

Guiding Evidence-Based Practice of Functional Assessment

Evidence-based practice requires a multifaceted approach that is informed not only by the external scientific literature but by the clinician's expertise and client-specific values (Smith, 2013). Determining the need and level of services for a particular client is a highly specialized and individualized process, which integrates the experiences of the clinician and client in each case with the extant evidence for particular behavioral procedures. Whenever a clinician is presented with a child who exhibits problem behavior, they should be asking themselves five main questions to determine whether or not a functional assessment is necessary and appropriate given the situation:

1. Have universal strategies failed?
2. Is the topography of problem behavior dangerous?
3. Is the occurrence of problem behavior socially impactful?
4. Will the functional assessment result in a unique and more effective intervention?
5. Is the functional assessment feasible given the current staff and resources?

These five questions are designed to inspire critical interpretations of potential treatment paths and improve a clinician's confidence that the appropriate procedures were considered. However, the questions are by no means meant to be a staunch set of rules, as if answering a certain number in the affirmative necessitates the use of a functional assessment. Evidence-based practice is meant to be flexible, allowing the clinician to make informed decisions on a case-by-case basis. Because there are no objective criteria for informing the decision to conduct a functional assessment, the questions are intended to guide the decision-making process and ensure that the clinician reviews all relevant information before implementing any subsequent procedures.

Have Universal Strategies Failed?

All children are likely to experience difficult situations in their lifetime and may resort to problem behavior in an attempt to return to a historically reinforcing environment. In fact, problem behavior is highly prevalent when children first transition away from the home to the classroom setting (Powell et al., 2007). These transitions in early childhood can create challenging moments that depend on healthy coping strategies; however, even if these strategies are lacking, problem behavior for most children is still likely to return to characteristic levels once sufficient experience with the novel context and contingencies has occurred. That is because universal strategies for reducing problem behavior in groups tend to work (Reinke et al., 2014) and if they didn't, each child would require costly individualized services. Therefore, a child may simply require exposure to contingencies that favor appropriate behavior, and general strategies such as differential reinforcement with praise and classroom rewards usually suffice.

A functional assessment becomes a viable consideration when universal classroom and general behavioral strategies have been used unsuccessfully. Consistent and sustained problem behavior is potentially indicative of a far more chronic issue and may not be so easily addressed with an improvement in classroom milieu. Therefore, a clinician who is presented with a child who has been known to exhibit problem behavior across multiple contexts with professionals trained in behavioral management over long periods of time may come to the conclusion that traditional reinforcement-based strategies have failed and further individualized supports informed by a functional assessment will be necessary to achieve intended goals.

Is the Topography of Problem Behavior Dangerous?

Some problem behavior is manageable and to be expected. A child may cry when a toy is removed and others may get into fights with classmates at school, to some limited extent. However, severe problem behavior can interfere with a child's ability to create lasting friendships or even attend a classroom with other students. The topography of problem behavior can become so dangerous that it necessitates the use of mechanical, physical, or pharmacological restraints (Trader et al., 2017). Severe SIB often falls into this category of dangerous topographies because any response, regardless of how often it occurs, could result in irreparable physical harm (Schroeder et al., 2002). For example, even a single instance of eye gauging could result in permanent blindness.

Dangerous problem behavior has also been found to be sensitive to a variety of environmental variables, making functional assessment an important consideration. That is because the topography of problem behavior is not associated with a particular function in most cases. Hanley et al. (2003) reviewed the functional assessment literature, delineating between five general classes of reinforcement that dangerous behavior was found to be sensitive to (i.e., escape, attention, tangible, automatic, and multiply controlled). The authors found that in most cases dangerous behavior was unlikely to have clear indicators of function determined by the topography. In fact, problem behavior has been known to be sensitive to far more idiosyncratic variables and individualized contingencies (Jessel et al., 2016; Schlichenmeyer et al., 2013). This diversity in functions of dangerous problem behavior creates a unique barrier for clinicians attempting to develop an intervention. In these situations, functional assessments may be an indelible tool for sifting through the convoluted variables that could influence dangerous problem behavior.

In some cases, the topography of problem behavior may not be directly harmful to the child, but places them in a dangerous situation. For example, a child may exhibit the problem behavior of eloping from certain contexts without consent of the adult. Although elopement could be as innocent as leaving a workstation to play with preferred toys in a classroom setting, it is not difficult to envision the danger of elopement from a caregiver's home at night, near a busy intersection, or a public area with many strangers. Aside from the potential to place a child into a dangerous position without adult supervision, elopement shares the same aforementioned concern regarding functional heterogeneity (Falcomata et al., 2010; Piazza et al., 1997; Traub & Vollmer, 2019). That is, a treatment's efficacy is directly related to behavioral function and not behavioral topography.

Is the Occurrence of Problem Behavior Socially Impactful?

This is not to say that the topography needs to be dangerous to be considered a concern. The frequency with which problem behavior occurs could also influence the necessity of a functional assessment. For example, screaming may not result in any physical injury, but if it occurs frequently throughout the day, the child may have to receive services isolating them from others because of the potential for disrupting classroom activities. Furthermore, the constant screaming in the home could create a stressful environment for other family members, thereby influencing the quality of caregiver relationships. Determining the level of social impact is not limited to, and can be influenced by, multiple factors beyond the risk of severe injury.

The intensity of problem behavior could also be initially low, but remains a concern considering the potential for harm if the intensity were to increase to unsafe levels. A child may chronically hit a caregiver at a young age without causing any significant bodily harm. Although caregivers may find this behavior to be a nuisance for the time being, without proper intervention the problem behavior is likely to shape up and become more difficult to manage as the child grows up. The common misconception being that problem behavior is something that a child will "grow out of," when in fact early problem behavior is far more indicative of increased risk of isolation from peers and exclusion from community activities (Horner et al., 2002).

There may be other dimensions beyond frequency, intensity, and severity of problem behavior that could be socially impactful. The clinician needs only to become informed of the restrictiveness of the environment and intensity of services that are or will be required to manage problem behavior in determining whether or not a functional assessment seems appropriate. In addition, this question is highly influenced by the subjective experiences of those involved to ensure that the behavioral services provided will directly result in meaningful improvements in the child's life. The totality of determining what behavior change would be considered *meaningful*, and how the change is achieved, exists on three main levels regarding the intended goals, appropriateness of the procedures, and satisfaction with potential outcomes (Wolf, 1978). The question of social impact is intended to provide the clinician with the mindset of providing relevant services that others will find acceptable for improving their current circumstances.

Will the Functional Assessment Result in a Unique and More Effective Intervention?

The functional assessment is designed to reduce assumptions regarding environmental influence over problem behavior. Therefore, its purpose is to identify relevant variables that are not readily known by the clinician to be included in any subsequent intervention. By its very nature, the term *function-based*

intervention refers to the value of conducting a functional assessment for informing treatment procedures. This infers that in many cases a functional assessment will result in a unique and more effective intervention for problem behavior. Without a functional assessment, the clinician is left to speculate on relevant environmental variables contributing to problem behavior and may have to wait to happen on a set of effective intervention procedures through the highly inefficient process of trial and error. Beyond the process being inefficient, the treatment designed without a functional assessment is often less effective (Heyvaert et al., 2014; Campbell, 2003) and could even worsen problem behavior if the procedures used are contraindicative of the function (Iwata et al., 1994d). Therefore, it is highly important for a clinician to understand the conditions under which a functional assessment will be truly informative of a given set of environmental circumstances.

Of course not all problem behavior may be influenced by enigmatic environmental variables in need of further investigation. Furthermore, interventions for problem behavior may be quite homogenous in some contexts that the results of functional assessment would have nothing to contribute to the specific circumstances. For example, Saini et al. (2019) conducted a meta-analysis of the behavioral intervention for inappropriate mealtime behavior. While inappropriate mealtime behavior can encompass an eclectic array of potential topographies of problem behavior (e.g., aggression, swiping food, tantrums, food refusal), the authors found that (a) treatment procedures tended to rely on a standard practice of praise for cooperation and escape extinction for problem behavior regardless of if a functional assessment was conducted and (b) pretreatment functional assessments were unlikely to improve the efficacy of the behavioral intervention. This question that a clinician will ask themselves is a reminder to remain committed to focusing on that which can inform treatment design.

Is the Functional Assessment Feasible Given the Current Staff and Resources?

Depending on the functional assessment used, some models may be resource heavy and time-consuming (Iwata & Dozier, 2008). Clinicians may find it difficult to conduct a functional assessment in given circumstances. Feasibility may be a concern for clinicians working in more rural areas with large caseloads where they may have difficulty finding the time or resources to devote to an individualized assessment for each of their clients. However, the consideration of feasibility is continuously becoming difficult to defend as the functional assessment technology develops with elements of practicality of particular interest.

In some cases, it may be possible for the clinician to supervise the functional assessment via telehealth while it is being implemented by a caregiver (Wacker et al., 2013). Recent trends in the utilization of virtual meetings afford the clinician the ability to train caregivers and observe therapy sessions from anywhere in the world. Supervising the functional assessment via telehealth reduces travel that may be necessary when the child is admitted to an inpatient or outpatient clinic, while also ensuring the functional assessment is conducted in the ecologically relevant context of the child's home.

Even though virtual services have the potential benefit of reducing costs (Lindgren et al., 2016), concerns regarding feasibility may still remain for some clinicians. That is because caregivers will have to be trained and coached on how to implement potentially complex procedures and the clinicians will not be available to help in case of emergency, a perceptible risk when working with children who exhibit problem behavior. In such circumstances, problem behavior cannot be fully addressed until the clinician has the necessary resources available to arrange the environment in a manner they deem safe. Thus, feasibility should be a consideration for all clinicians before conducting a functional assessment. It is important to point out that concerns regarding the feasibility of conducting a functional assessment are carried over into the decision on implementing a subsequent intervention. A clinician is not to assume that an intervention will be any more safe, necessary, or feasible. Therefore,

answering this question in the negative does not infer that an intervention should be introduced immediately in place of the functional assessment. This is especially considering that a functional assessment will often improve the socially relevant qualities of an intervention.

Functional Assessment Models

After determining that a functional assessment is necessary and should be conducted for the problem behavior of a given child, the clinician must then choose between a particular model to implement. Functional assessment is an umbrella term that could refer to different models depending on two properties of the procedures. First, the results of a functional assessment can be interpreted based on direct observation of the problem behavior or based on verbal reports. This is dependent on if the clinician (a) chooses to schedule to see the child and problem behavior with their own eyes or (b) is comfortable obtaining information regarding problem behavior via questioning of those who experience the problem behavior, such as caregivers. Second, the environmental events believed to be influencing problem behavior can be systematically manipulated in an experimental design or there may be no systematic changes involved. Of course, any systematic changes will inevitably involve direct observation of problem behavior as well (i.e., the clinician would not ask the caregiver to conduct a formal analysis with their child without some form of direct supervision). This allows for a potential of three functional assessment models based on the combination of those two procedural properties.

Indirect Assessment

The indirect assessment is the least intrusive model in that it does not include direct observation of problem behavior or systematic manipulation of environmental events. Indirect assessments do not require any contact with the client being evaluated and typically involve family members, caregivers, teachers, direct support personnel, or other professionals who interact with the individual. Indirect assessments can include a variety of methods such as interviews, checklists, and questionnaires (Sturmey, 1994). The overall goal is to ascertain information regarding the context in which problem behavior occurs or hypotheses regarding variables contributing to problem behavior from the verbal reports of others who have direct experience with the specific client of interest.

There are two general categories of indirect assessment depending on how information is gathered (i.e., closed-ended and open-ended). Closed-ended assessments prespecify options from which the respondent can choose and score using a legend, while open-ended assessments allow free-form responses and require more interpretation on the part of the clinician. For example, The Questions About Behavioral Function (QABF) includes 25 questions with a four-point rating scale pertaining to the problem behavior (Paclawskyj et al., 2001). Each question on the QABF is assigned a potential function (i.e., attention, escape, physical, tangible, and nonsocial) such that a score in the affirmative would contribute to a higher score implicating those variables as relevant to the occurrence of problem behavior. These scores can be interpreted to suggest potential function for the target behavior, with the highest scoring categories reflecting the most likely function.

Clinicians may often consider the closed-ended, indirect assessment as the primary means of identifying behavioral functions for multiple practical benefits. That is, there is often no formalized training or sophisticated knowledge of behavior analytic principles needed to implement the closed-ended approach. In addition, the questionnaires can often be completed in quite an efficient amount of time without the necessity of observing or evoking problem behavior. Nevertheless, reservations exist when considering using indirect assessments to replace other functional assessment models because

of the lack of an empirical demonstration of environmental control over problem behavior and limited information regarding the individual circumstances that can be obtained with closed-ended questioning. Clinicians may find it more beneficial to use indirect assessments to inform rather than replace further assessments.

Open-ended assessments include interviews in which there are no prespecified options, providing the respondents with the opportunity to present descriptive information regarding particular experiences with the problem behavior of interest they may have had in the past. Open-ended assessments allow the respondents to provide additional context and details that are not collected in a closed-ended assessment, such as specific antecedents or consequences that the child has historically been exposed to. For example, Hanley (2012) developed an open-ended interview that consists of 20 questions designed to guide the respondent to provide qualitatively rich information regarding the context in which problem behavior occurred. The goal of the open-ended interview was not to identify function, but to inform the design of the subsequent functional analysis. In other words, the open-ended interview establishes a caregiver-informed test condition to be validated as a relevant context influencing problem behavior during a subsequent functional analysis. Any limitation regarding the treatment utility of the indirect assessment is therefore avoided when the assessment is used as a supplemental procedure to other more direct methods of assessment.

Descriptive Assessment

Rather than obtaining information regarding problem behavior through secondary means of reports from others, descriptive assessments involve direct observation of problem behavior. There are several formats of descriptive assessments, providing significant flexibility to practitioners using this method. However, similar to indirect assessments, the descriptive assessment continues to avoid the systematic manipulation of environmental events. The descriptive assessment tends to collect information regarding problem behavior as it occurs in the context of interest, aiding the clinician in recognizing (a) antecedents that precede problem behavior, (b) range of topographies of problem behavior, and (c) consequences that follow problem behavior.

Ecologically relevant descriptive assessments involve no interference with naturally occurring events in the observed setting and can be conducted at select times of the day or during specific activities in which problem behavior is reported to occur at higher rates. In ideal situations, each instance of problem behavior that is observed can be recorded in a continuous fashion, along with any correlated environmental events (Bijou et al., 1968). During the observation, the clinicians can decide to collect information using closed or open-ended methods. For example, a clinician may use an ABC format to collect information on observed antecedents, behaviors, and consequences (Groden, 1989). An ABC assessment with closed-ended options will have prespecified events and behaviors to choose from. This will limit the clinician's recordings to a selection of target problem behavior (e.g., aggression, property destruction, self-injury) and generic antecedents (e.g., instruction provided, diverted attention, removal of tangible) and consequences (e.g., escape from instructions, access to attention, or access to tangible) to simplify interpretability. The open-ended options, often referred to as an ABC narrative, will leave availability for the clinician to expand on any specifics to the encounter with problem behavior that may not be represented in a standard list.

Observations of problem behavior during descriptive assessments can also be supplemented using conditional probability analyses to quantify correlations between problem behavior and particular environmental events (Vollmer et al., 2001). A conditional probability analysis calculates a probability of events given the occurrence of a target problem behavior. The temporal proximity of antecedents and consequences informs the identification of potential naturally occurring contingencies. The

conditional probability is then compared to the background probability, which refers to the chances of an event or behavior occurring independent of any other variables. While conditional probability analyses can provide more precise interpretation of data collected in a descriptive assessment, it is important to point out that it is quite effortful and requires specialized training to conduct. It also requires the initial data collection to be accurate and extensive enough to provide the quantifiable information needed for clinicians to analyze.

Although potentially reducing ecological relevance, descriptive assessments can be structured to increase contact with problem behavior and improve the efficiency of the assessment period. That is to say, clinicians can request caregivers or staff to introduce the child to contexts that are reported to result in problem behavior. As an example, Anderson and Long (2002) systematically introduced a child and caregiver dyad to four general conditions and asked the caregiver to respond to problem behavior as they naturally would. The researchers were attempting to arrange commonly presented antecedents to observe interactions of problem behavior and caregiver consequences. The results indicated that problem behavior could be observed in a semi-structured environment without having to spend extended amounts of time waiting for the environmental events to naturally arrange in the presence of problem behavior.

It is important to point out that exposure to certain environmental events does not necessarily infer that a contingency is contributing to the occurrence of problem behavior. Environmental events can be present in close temporal approximation to problem behavior without influencing its continued occurrence as evocative events or reinforcers (e.g., saying "god bless you" does not commonly reinforce sneezing but does tend to closely follow the response). Therefore, descriptive assessments, whether supplemented with quantified correlations or structured to ensure the child readily contacts certain antecedents and consequences, share the similar concern with indirect assessments regarding empirical demonstrations of control. For that reason, descriptive assessments may find better use as a collective process informing continued assessment.

Jessel et al. (2020b) designed a brief contingency probe that unsystematically arranges the context reported by the caregivers to be problematic as a way of calibrating (i.e., minor modifications to antecedents, behaviors, consequences) a hypothesized contingency to be evaluated in a subsequent functional analysis. The authors employed a three-part functional assessment process (i.e., open-ended indirect assessment, brief contingency probe, functional analysis) that collectively obtained qualitative information from each child to support the identification of a unique and individualized contingency contributing to problem behavior. The brief contingency probe allows the clinician to introduce potentially relevant conditions and directly observe the child's reaction to these events. The benefit being that unsystematic changes can be made in real time to improve (a) operational definitions of problem behavior or (b) ecological relevance of the contingency. That is, the brief contingency probe can be used collectively with other functional assessment methods to improve the precision of functional interpretations, which may better inform treatment outcomes.

Functional Analysis

The functional analysis is the only model to include the direct observation of problem behavior and systematic manipulation of environmental events, thereby giving it the status as the most informative approach. Indirect assessments force the clinician to rely on the experiences of others and their ability to describe those experiences to develop hunches regarding functional accounts of problem behavior; whereas descriptive assessments can only go so far as to provide indications of environmental variables in the temporal vicinity of problem behavior but not the level of their influence. The functional analysis raises the clinical expectations to an empirical demonstration of controlling variables, creat-

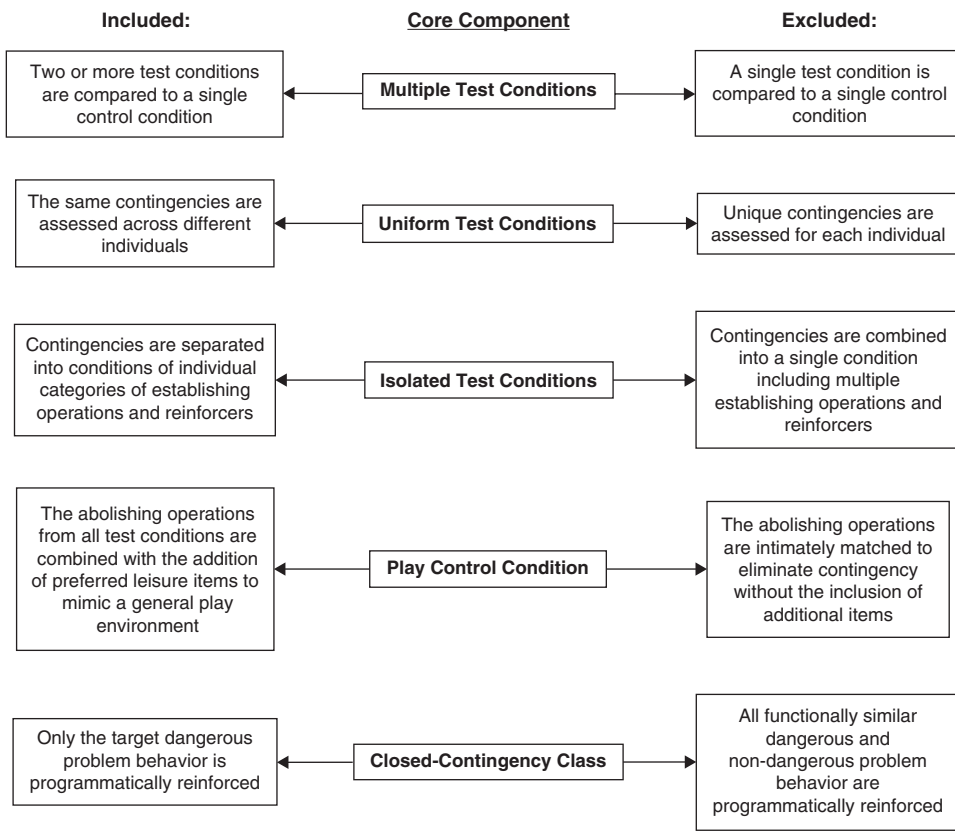

Fig. 19.1 Core procedural components of the functional analysis

ing a far more conservative account of what environmental events are contributing to problem behavior. The clinician can be more confident that a functional relation has been identified after conducting a functional analysis because they have (a) observed and measured the problem behavior for themselves and (b) used a single-subject experimental design during the assessment period.

From a methodological perspective, the functional analysis need only those two defining properties (i.e., direct observation and manipulation) and does not require adherence to a specific set of procedures. Some of the earliest demonstrations of functional analyses were particularly unique and used a more investigational approach (Lovaas et al., 1965; Lovaas & Simmons, 1969). However, a specific set of procedures began to emerge in the applied research literature as the functional analysis technology grew in popularity. The progressive development toward a standard set of procedures was likely a product of the ease of implementation and improved dissemination among researchers in applied laboratory settings. Contemporary functional analysis formats are now defined by the inclusion and exclusion of five core procedural components because they reflect adherence to a particular standard model (Jessel et al., 2020a). All five of the core components are presented and summarized in Fig. 19.1.

The first core component is the inclusion of multiple test conditions in a single functional analysis. The clinician may be interested in multiple contexts or separate contingencies that could influence problem behavior and conduct a functional analysis with a test condition for each of those contingencies, which are then compared to a single control condition. To improve the efficiency of the functional analysis, the test conditions and the control condition are typically rapidly alternated in a

multielement design. Any functional analysis that excludes this core procedural component is implemented with a single test condition that is compared to a single control condition. Reducing the functional analysis to a maximum of two conditions (i.e., one test and control) comes with the added benefit of eliminating analytic clutter that could impair discrimination of conditions, which is more likely to occur when the child is presented with multiple and varying alternating contexts (Iwata, Duncan et al., 1994b).

The second core component arranges a functional analysis to include a standardized set of contingencies assessing generic classes of reinforcement for every child regardless of individual differences. Functional analyses with these uniform test conditions often include at least one test condition assessing the influence of positive reinforcement and another assessing negative reinforcement. What defines the inclusion of this core component is that these two test conditions will not vary between participants. During the condition assessing positive reinforcement, the clinician will provide generic statements of concern or common reprimands contingent on problem behavior. The negative reinforcement condition, on the other hand, will include the presentation of academic instructions. While using a set of uniform test conditions could potentially reduce effort in training clinicians in conducting the functional analysis (i.e., the clinician need only be trained on how to conduct one functional analysis that is then implemented with all children), it is likely to impact the ecological validity of the procedures. Functional analyses that exclude this core component instead introduce test conditions that are specifically informed by the child's experiences based on open-ended interviews and observations (e.g., Jessel et al., 2016). Doing so creates an individualized functional analysis that must be designed based on an intimate understanding of a specific history of reinforcement that could be contributing to the problem behavior. Therefore, a clinician conducting the functional analysis with unique test conditions in place of uniform test conditions will improve the probability of assessing variables relevant to the individual.

The functional analysis could include a third core component whereby classes of reinforcement contingencies are separated into isolated test conditions, even if they are reported to naturally co-occur in the child's environment. A clinician who includes this procedural component is committed to attempting to understand the independent effects of each reinforcement contingency. For example, a child may exhibit problem behavior when their activities are interrupted and a clinician may be interested in isolating the type of request, such as interruptions with requests to do something else or interruptions with requests to simply not engage with a certain activity (Hagopian et al., 2007). Teasing apart minute differences in arrangements of isolated contingencies may be interesting from a conceptual standpoint; however, it is unlikely to improve treatment outcomes (Slaton & Hanley, 2018; Slaton et al., 2017; Holehan et al., 2020). A functional analysis that excludes this core component instead assesses the contingency as it naturally occurs in the child's environment, which is inevitably going to be a synthesis of multiple contingencies. A noted strength of including synthesized contingencies is the focus on the problem as a whole as it exists for the child and caregivers.

The fourth core procedural component of a standardized functional analysis is the inclusion of an omnibus control condition that arranges items and events to be representative of a general play context. Praise is provided on a time-based schedule and the child is given noncontingent access to highly preferred activities. The play control attempts to eliminate problem behavior by creating an environment we would typically associate with a child's enjoyment. Practitioners who conduct a functional analysis with multiple test conditions will often conduct a play control to improve analytic efficiency. The alternative excluding this procedural component would be to implement individualized control conditions that are matched to each test, with the contingency being the only difference between the test and control conditions (i.e., contingent delivery of reinforcers in the test condition; noncontingent delivery of the same reinforcers in the control condition). For example, the clinician may be attempting to isolate the effects of attention and tangible reinforcement. The play control would allow the

clinician to rapidly alternate all three conditions (attention, tangible, control) instead of a pairwise comparison of attention reinforcement with an attention-specific control and tangible reinforcement with a separate tangible-specific control. Of course, if the clinician were to assess a synthesized contingency in a single test condition (attention and tangible reinforcement) during the functional analysis, a single matched control with the identical synthesized reinforcement could be included without negatively impacting analytic efficiency while reducing potential confounds introduced in a play control. Therefore, when a practical option, the matched control is a far more experimentally rigorous procedural component.

The fifth and final core procedural component is designed to require low inferences regarding the function of the severe problem behavior by incorporating a closed-contingency class. A clinician conducting a functional analysis with a closed-contingency class will only reinforce the target problem behavior and, if multiple topographies of problem behavior are of interest, the clinician is committed to conducting multiple functional analyses specifically addressing each. This is juxtaposed with a functional analysis conducted with an open-contingency class, whereby all topographies of problem behavior that are assumed to be functionally related are reinforced. Using an open-contingency class is often considered when attempting to improve the practical utility of the functional analysis because it can reduce the probability of exposure to severe problem behavior (Jessel et al., 2021; Warner et al., 2020). Thus, the feasibility of conducting a functional analysis, especially in settings such as homes and classrooms, can be largely impacted by the decision to open the contingency class and reduce opportunities for escalation to dangerous and uncontrollable bursts of problem behavior.

Functional Analysis Formats

The functional analysis that embodies all five core procedural components has come to be termed the standard format and was introduced into the literature nearly 40 years ago. Iwata et al. (1982/1994a) conducted the standard functional analysis with nine participants admitted to an inpatient hospital who exhibited severe SIB. The researchers included three uniform test conditions assessing sensitivity of the rate of SIB to general classes of reinforcement (attention, escape, automatic) compared to a toy play control using a closed-contingency class.Although a highly replicated set of procedures in the applied literature, the standard format has often been regarded by clinicians to be burdened by multiple barriers to its widespread adoption in practice (Hanley, 2012; Oliver et al., 2015; Roscoe et al., 2015). For example, in one of the most extensive epidemiological collections of 152 applications, the authors found the standard functional analysis to require a mean of 6.5 hrs to conduct, reaching as high as 16.5 hrs (Iwata et al., 1994c). Considering that more efficient functional assessment methods exist without having to expose the child to hundreds of instances of severe SIB (e.g., indirect assessments), clinicians are unlikely to use a functional analysis that could pose a safety risk and requires days, if not weeks, to complete. Multiple functional analysis formats have since been developed to improve practical utility by adopting a different measure of problem behavior (Sigafoos & Saggers, 1995; Thomason-Sassi et al., 2011), reducing the number of sessions conducted (Northup et al., 1991), reducing the session duration (Wallace & Iwata, 1999); all the while maintaining the core procedural components of the standard functional analysis (see Fig. 19.2 for a summary of these modifications).

For example, Thomason-Sassi et al. (2011) evaluated the interchangeability of the measure of latency with rate for interpreting functions of problem behavior. Participants experienced the functional analysis with all five core components; however, the measure of latency allowed the researchers to terminate sessions after a single instance of problem behavior by measuring the time in which the response occurred from the beginning of the session. A functional relation was, therefore, determined based on the brief latencies to problem behavior observed in the multiple test conditions compared to

Format	Description	Core Components	Practical Importance
Standard	*Full functional analysis with repeated sessions and extended durations using rate as a measure of problem behavior*	☑ Multiple Test Conditions ☑ Uniform Test Conditions ☑ Isolated Test Conditions ☑ Play Control Condition ☑ Closed-Contingency Class	☐ Efficiency ☐ Safety ☐ Ecological Relevance ☐ Cost Effectiveness
Brief	*Abbreviated version of the standard conducted with a maximum of two sessions per condition*	☑ Multiple Test Conditions ☑ Uniform Test Conditions ☑ Isolated Test Conditions ☑ Play Control Condition ☑ Closed-Contingency Class	☑ Efficiency ☐ Safety ☐ Ecological Relevance ☐ Cost Effectiveness
Latency-Based	*Reduces sessions to a single instance of problem behavior and replaces the measure of rate with latency*	☑ Multiple Test Conditions ☑ Uniform Test Conditions ☑ Isolated Test Conditions ☑ Play Control Condition ☑ Closed-Contingency Class	☑ Efficiency ☑ Safety ☐ Ecological Relevance ☐ Cost Effectiveness
Trial-Based	*Trials conducted as they naturally occur and replaces measure of rate with percentage of trials*	☑ Multiple Test Conditions ☑ Uniform Test Conditions ☑ Isolated Test Conditions ☐ Play Control Condition ☑ Closed-Contingency Class	☐ Efficiency ☐ Safety ☑ Ecological Relevance ☐ Cost Effectiveness
IISCA	*Begins with an open-ended interview to inform a single test condition evaluating a unique, synthesized contingency using an open-contingency class compared to a matched control*	☐ Multiple Test Conditions ☐ Uniform Test Conditions ☐ Isolated Test Conditions ☐ Play Control Condition ☐ Closed-Contingency Class	☑ Efficiency ☑ Safety ☑ Ecological Relevance ☑ Cost Effectiveness

Fig. 19.2 Variations of the functional analysis

the extended latencies observed in the play control condition. The use of latency improved the efficiency of the standard functional analysis by 73% and reduced the instances of problem behavior observed during the entire functional analysis process to as few as three responses.Other functional analysis formats were designed to improve practical utility by avoiding the use of the core procedural components of the standard functional analysis (Hanley et al., 2014; Jessel et al., 2016). Hanley et al. introduced what has become known as the interview-informed synthesized contingency analysis (IISCA). The IISCA requires only a single test condition assessing a unique contingency informed by

an open-ended interview with the caregiver, which is then compared to a matched control with the same reinforcers provided noncontingently. In addition, all topographies of problem behavior, including non-dangerous precursors, are targeted during an IISCA in an open-contingency class (Slaton et al., 2017). The IISCA can be conducted in 15 min (Jessel et al., 2020b) and multiple variations exist that can reduce other practical barriers further (Metras & Jessel, 2021).

Special Considerations

Application of Functional Assessment Models

The functional analysis is often recommended to be used because of its unique ability to raise the level of understanding of environmental contributors to problem behavior from what would be conjecture (indirect assessments) or correlational (descriptive assessments) to an empirical demonstration of control. Clinicians often share this standard of care with other health professionals in that simply asking or observing a client is hardly ever recognized as a sufficient assessment for serious ailments. This is not to say that indirect and descriptive assessments should be abandoned. Quite the contrary, indirect and descriptive assessments are vital for informing the procedures of a functional analysis. In fact, a functional analysis should not be conducted without those preceding assessments. Therefore, an evidence-based approach to functional assessment involves obtaining qualitatively rich information regarding a particular child before the implementation of an individualized functional analysis assessing a unique contingency. This ensures a highly informed process that incorporates immediate clinical experiences with best scientific evidence when implementing the functional assessment. Although the different functional assessment models were historically developed independent of one another and were often given hierarchical status based on perceived effort (i.e., begin with the indirect assessment and only conduct the descriptive assessment and functional analysis when necessary), clinicians may benefit from seeing the functional assessment as a collective set of tools not to be disentangled from one another.

There are, of course, exceptions to using this collective approach to functional assessment when a functional analysis cannot be conducted. Pragmatic boundaries do exist and a clinician may find themselves in a position whereby the putative contingencies cannot be systematically manipulated. Sleep-interfering behavior (e.g., tantrums, verbal protests, elopement from the bedroom) serves as a particularly relevant example because the act of falling asleep (i.e., behavioral quietude) is considered operant behavior, while the reinforcement it produces is the complex physiological change to sleep (Bootzin, 1977). A functional analysis cannot be conducted because escape from sleep is essential in defining the contingency and sleep as a reinforcer cannot be systematically presented or removed.[1] Furthermore, the intricacy of the environmental variables that could be interacting with each other to establish (e.g., insufficient sleep, poor-quality sleep) or signal (e.g., lighting, room temperature, sleep dependencies) the onset of sleep makes it difficult to determine what variables should and can be evaluated in a functional analysis.

Information regarding environmental variables that contribute to sleep-interfering behaviors can still be obtained through other functional assessment means and would still serve an essential purpose for informing subsequent function-based intervention. Jin et al. (2013) developed an indirect assess-

[1]This is not to say that a clinician is unable to conduct a functional analysis of problem behavior to escape from the bedroom. However, this functional analysis can only identify an isolated piece of the contingency, not in its entirety regarding escape from sleep. Therefore, a clinician may be able to develop strategies for reducing elopement from the bedroom, but this does not infer that it will improve the child's sleep.

ment that included open-ended questions targeting specific variables that could be contributing to delayed sleep onset, sleep-interfering behaviors, and night awakenings. The authors used the information from the interviews to design an individualized treatment package for each of the three participants, which involved enhancing behavioral quietude and eliminating any contingencies that could be supporting the sleep-interfering behavior. This function-based comprehensive approach helped to improve sleep and reduce the use of sleep aides such as medication or parent presence. Therefore, while clinicians may not be able to conduct a functional analysis of problem behavior in all situations, other functional assessment models seem like a sufficient alternative that can inform effective and socially validated treatments in those cases.

Automatic Reinforcement

Results of functional assessments implicating a socially mediated function for problem behavior tend to be a preferred outcome because it suggests a level of control that can be exerted by clinicians over the maintaining variables. In one of the most common function-based treatments for socially mediated problem behavior, the reinforcers historically contributing to problem behavior are withheld and reserved for only the occurrence of an appropriate form of communication (Hagopian et al., 1998; Jessel et al., 2018; Rooker et al., 2013). A special consideration emerges when the functional reinforcers for problem behavior are not so easily controlled and are a unique property of the response itself; such is the case of automatic reinforcement.

Problem behavior sensitive to automatic reinforcement will occur across a wide variety of conditions and is not influenced by others. That is because the operantly maintained problem behavior is assumed to be producing its own source of reinforcement. An indication that problem behavior is automatically reinforced includes its continued occurrence when the child is left alone. Although the properties of automatic reinforcement are difficult to discern—the categorization of problem behavior as being maintained by automatic reinforcement is more so a default designation rather than an informative implication of a particular function—clinical utility can still be improved through the use of functional assessment methods to delineate different subtypes of automatically reinforced problem behavior (Hagopian et al., 2015, 2017).

Indirect and descriptive assessments will first guide the clinician to postulate that the problem behavior is sensitive to automatic reinforcement using verbal reports from caregivers and direct observation, respectively. However, these approaches are limited to informing general hunches regarding the influence of automatic reinforcement. Further assessment with a functional analysis is required to delineate three subtypes depending on patterns of problem behavior observed during the systematic comparison of an enriched environment in one condition (i.e., child-directed play with highly preferred items) and a second condition devoid of external stimulation (i.e., alone or ignore condition without preferred items).

Potentially, problem behavior that is automatically maintained will be reduced when the child is presented with highly reinforcing stimuli in the enriched environment, indicating a categorization of Subtype 1. This differentiated pattern of responding suggests that problem behavior, although maintained by automatic reinforcement, is sensitive to environmental stimulation and that preferred items can successfully compete with the functional reinforcers produced by the problem behavior. In a second outcome, problem behavior may not be sensitive to enhanced stimulation in the environmental enrichment condition and problem behavior will continue to occur in both conditions. These patterns of undifferentiated and elevated levels of problem behavior across conditions of the functional analysis are indicative of a Subtype 2 categorization. The final delineated subtype, Subtype 3, is dependent on whether or not the child exhibits self-restraint (e.g., sitting on hands, covering limbs with blankets).

Problem behavior during the functional analysis may be reportedly low across conditions when the child has access to self-restraint and only observed when that self-restraint is blocked.

Conducting a functional assessment to delineate these three subtypes of automatically reinforced problem behavior is important to consider because the results may have implications for treatment (i.e., clinical utility). For example, problem behavior sensitive to the stimulation in an enriched environment (Subtype 1) would inform the design of a treatment that incorporates noncontingent access to preferred items that will compete with the automatic reinforcement produced by the problem behavior (Hagopian et al., 2015). On the other hand, such a treatment with reinforcement alone is unlikely to be effective when addressing Subtype 2 problem behavior and multiple components including response blocking or punishment will be necessary. Thus, functional assessment methods have widespread applicability for understanding operant influence of socially mediated and automatically reinforced problem behavior.

Conclusions

Functional assessment methodology has been a staple of behavioral intervention of problem behavior for decades because of its ability to inform effective action on the part of the clinician. The goal of the functional assessment is to provide the clinician with an operant understanding of environmental events contributing to problem behavior using indirect assessment, descriptive assessments, functional analysis, or any combination of those three broad methods. Although certain pragmatic boundaries may dictate the use of some methods over others, the functional assessment is a diverse set of procedures and is a sufficiently flexible technology that allows the clinician to assess environmental-behavioral relations in a wide variety of contexts. It is for these reasons that clinicians guided by evidence-based practice will often rely on functional assessment to inform the design of any further treatment for problem behavior.

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