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Idiosyncratic Variables Affecting Functional Analysis Outcomes: A Review (2001–2010)

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Abstract

Although typical functional analyses often produce clear outcomes, some studies have reported ambiguous results that cannot be interpreted. Such *undifferentiated outcomes* may occur if test conditions do not include relevant antecedent or consequent events. Clinicians then may try to modify the functional analysis conditions to include those events. Hanley, Iwata, and McCord (2003) reviewed the functional analysis literature through the year 2000 and described idiosyncratic variables included in modified functional analyses. The objective of the present review was to present a quantitative analysis of idiosyncratic antecedents and consequences in modified functional analyses during the past decade (2001 to 2010). We discuss the range of stimulus parameters tested and the assessment strategies used for informing the modified analysis conditions.

Keywords

functional analysis; problem behavior; idiosyncratic variables; undifferentiated outcomes

Functional analysis (e.g., Iwata, Dorsey, Slifer, Bauman, & Richman 1982/1994) allows for identification of functional relations. As such, it allows clinicians to determine the environmental cause(s) of problem behavior, leading to the development of effective reinforcement-based interventions. Typically, functional analysis involves the manipulation of commonly occurring antecedents (e.g., academic demands) and consequences (e.g., reprimands). Although functional analyses often result in clear outcomes, inconclusive findings are sometimes reported, precluding determination of behavioral function. Generally, these undifferentiated outcomes occur when there is little or no responding across conditions (e.g., Hagopian, Bruzek, Bowman, & Jennett, 2007), high and variable responding across conditions (e.g. Kahng & Iwata, 1999), or responding primarily in the

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control condition (e.g., Tiger, Fisher, Toussaint, & Kodak, 2009). The reported prevalence of these undifferentiated outcomes has varied across studies. For example, Iwata et al. (1994) obtained unclear results in 7 of 152 (5.3%) of cases, whereas Kurtz et al. (2003) reported undifferentiated outcomes in 12.5% of cases. Finally, Hanley, Iwata, and McCord (2003) reported that the maintaining reinforcer was not identified in 22 of 514 (4.2%) published cases.

One potential explanation for undifferentiated outcomes is that the relevant antecedents and consequences were not included in test conditions. Following such outcomes, clinicians may modify the functional analysis conditions to include those events. In a review of the functional analysis literature through 2000, Hanley et al. described idiosyncratic antecedent and consequent events that were included in modified functional analyses. In that review, it was unclear which strategies experimenters used to inform modified conditions (e.g., through indirect or descriptive analyses). The objective of the present review was to conduct a quantitative analysis of the idiosyncratic antecedents and consequences tested in modified functional analyses in the past decade (2001-2011), and of the assessment strategies used to inform modified functional analysis conditions.

Method

We identified articles from the years 2001-2010 through a search of *Current Contents*, *PsycINFO*, *PubMed*, *JABA*, *ERIC*, *Behavioral Interventions*, and *Google Scholar*, using the key words function, analysis, and behavioral assessment. As in Hanley et al. (2003), only studies with a pre-treatment experimental analysis were included. Specifically, these studies had to include environmental manipulations and an experimental design (e.g., multielement) that permitted determination of functional relations. We also included only those studies that evaluated idiosyncratic modifications to a standard functional analysis. For the purposes of this review, standard functional analysis refers to antecedents (e.g., task demands) and consequences (e.g., verbal reprimands) that are typically used in functional analyses and were originally reported by Iwata et al. (1982/1994). By idiosyncratic modifications, we are referring to manipulations that are specific to a participant (e.g., type of demand or form of attention). General modifications to functional analysis conditions that may inform best practice (e.g., restricting attention prior to the attention condition) were not included in this analysis. Finally, we excluded studies that included only a review, discussion, or commentary, a descriptive or indirect assessment, or that targeted only appropriate behavior.

Results

We identified 42 articles that met our criteria for inclusion. Table 1 shows the range of idiosyncratic antecedents and consequences tested. In some but not all of these studies, the modified conditions followed initially ambiguous functional analysis outcomes using typical procedures. Our search yielded several variations in antecedent and consequent events, organized below in terms of potential functional classes.

Social Negative Relations

Antecedents—The functional analysis test condition for negative reinforcement typically includes the presentation of task demands (e.g., Iwata et al., 1994). Ten articles (23.8% of sample) included variations in task demands. Two articles (Butler & Luiselli, 2007; Roscoe, Rooker, Pence, & Longworth, 2009) showed that the evocative effects of demands varied across types of tasks. Roscoe et al. (2009) described a systematic strategy (i.e., incorporating demand assessments) for identifying tasks for use in a functional analysis and found clearer outcomes for three of four participants. Butler and Luiselli (2007) identified demands

through staff report and found that a participant's escape-maintained problem behavior varied across three types of demands.

Three articles (7.1% of sample) described variations in task dimensions, such as difficulty (Boelter, Wacker, Call, Ringdahl, & Kopelman, 2007; Call, Wacker, Ringdahl, Cooper-Brown, & Boelter, 2004; Moore & Edwards, 2003), preference (Boelter et al., 2007), and magnitude (Call et al., 2004). More difficult tasks, defined as those that were completed with less accuracy, were shown to have evocative effects on problem behavior exhibited by six of eight participants across two studies (Call et al., 2004; Moore et al., 2003). Low preference demands, defined as those associated with low levels of engagement, evoked one participant's problem behavior (Boelter et al., 2007) whereas decreasing the amount of work (i.e., requiring participants to completed 50% of the task, such as half of a puzzle vs. a full puzzle) produced decreases in problem behavior for two of four participants (Call et al., 2004).

Five articles (11.9% of sample) described variations in instructional style. Borrero, Vollmer, and Borrero (2004) evaluated the extent to which abrasive instructions (i.e., exclamatory intonations, increased volume, and tense facial expression) versus pleasant instructions (i.e., smiling with a relaxed facial expression) evoked problem behavior for one individual after an initial functional analysis yielded unclear results. Elevated levels of problem behavior were observed with abrasive instructions. Similarly, Tiger, Fisher, Touissant, and Kodak (2009) showed that vocal prompting occasioned higher levels of problem behavior than did physical prompting after an undifferentiated initial functional analysis. Ebanks and Fisher (2003) showed that delivering a verbal reprimand ("No, that's not right.") plus corrective feedback immediately following errors resulted in higher levels of problem behavior than did a demand condition in which corrective feedback was delayed until the next presentation of the task and presented as a prompt. Northup, Kodak, Lee, and Coyne (2004) found that the format of instruction influenced responding during functional analysis conditions. Specifically, the instruction that problem behavior would result in a break ("If you exhibit problem behavior you might need to take a break.") produced higher levels of problem behavior than did the instruction that the problem behavior would result in "time out" ("If you exhibit problem behavior you will be in time out."), even though the escape contingencies were identical. Finally, two studies (Call et al., 2004; Moore & Edwards, 2003) evaluated the extent to which providing social attention during academic demands affected problem behavior. Moore and Edwards showed that higher levels of escape-maintained problem behavior occurred when attention was delivered during academic instruction. By contrast, Call et al. found that attention in the form of praise and encouragement delivered during demands resulted in lower levels of participants' escape-maintained problem behavior.

Five studies (11.9% of sample) examined variations in antecedents that were unrelated to academic instruction. Le and Smith (2002) found that elevated levels of problem behavior occurred in a condition where an individual was prompted to sit in a wheelchair. After observing that responding was elevated in the play condition, Hagopian, Wilson, and Wilder (2001) and Tiger, Fisher, Toussaint, and Kodak (2009) found that problem behavior occurred consistently in conditions where social attention was provided continuously. Similarly, following an inconclusive functional analysis, Volkert, Lerman, Call, and Trosclair-Lasserre (2009) showed that one individual's problem behavior occurred at elevated levels when the participant was prompted to walk. Finally, McCord, Thomson, and Iwata (2001) showed that for two participants, transitions (i.e., no change in activity with a change in location) evoked problem behavior.

Social Positive Relations

Antecedents—In the attention test condition, the putative motivating operation (MO) typically involves no attention (i.e., the therapist is present and acts busy). Seven studies (16.6% of sample) in our review evaluated idiosyncratic putative EOs for attention-maintained behavior by diverting attention to another individual (Call, Wacker, Ringdahl, & Boelter, 2005) or leaving the room (Edwards, Magee, & Ellis, 2002). Kuhn, Hardesty, and Luczynski (2009) employed similar strategies to evaluate two individuals' problem behavior. Staff anecdotally reported that a participant's problem behavior occurred when she was blocked from stealing food and when personal items (e.g. magazines) were restricted. Thus, clinicians consumed edibles that were restricted during the tangible test condition. In a separate tangible test condition, the experimenters presented magazines labeled with the participant's name for 2 min and then removed them prior to the start of the session. The other participant was reported to engage in problem behavior under periods of low attention or when his brother engaged in problem behavior. Therefore, during a modified attention condition, the therapist delivered attention contingent on a confederate's problem behavior. For the studies described above, problem behavior occurred consistently in the modified test conditions and rarely during the standard test conditions, showing that the modifications increased the value of the positive reinforcers.

In addition to the enhancements described above, Call et al. (2005) evaluated the utility of combining antecedent manipulations when problem behavior did not occur in test conditions. For one participant, the therapist presented task materials while diverting his attention, and problem behavior resulted in attention but not escape from demands. For the other participant, the therapist presented task materials and restricted access to a high-preferred (HP) leisure item (i.e., taking pieces apart from a marble game), and problem behavior resulted in escape from the task but not delivery of the HP item. For both participants, problem behavior occurred consistently in the combined antecedent conditions and rarely in the standard test conditions. These modifications were replicated by Dolezal and Kurtz (2010), who obtained similar findings.

Consequences—In the attention test condition, the consequence typically involves the delivery of brief vocal (e.g., a reprimand) and physical (e.g., shoulder touch) attention. Eleven studies (26.1% of sample) evaluated idiosyncratic positive reinforcers. Kodak, Northup, and Kelley (2007) assessed the reinforcing efficacy of various forms of attention for problem behavior, including reprimands, unrelated comments, tickles, eye contact, praise, and physical attention, in two individuals with attention-maintained problem behavior. Varied forms of attention functioned as a reinforcer for one individual's problem behavior (both reprimands and unrelated comments), but attention functioned as a reinforcer for another individual's behavior only when the specific form of attention was related to the behavior (reprimands only). In addition to the type of attention, the person delivering attention appeared to be an important variable in Tiger et al. (2009). Specifically, a participant's problem behavior occurred at low levels when it resulted in therapist attention and at high levels when his brother delivered attention. Similarly, Skinner, Veerkamp, Kamps, and Andra (2009), and Flood, Wilder, Flood, and Masuda (2002), showed that peer attention maintained problem behavior.

A wide range of activities have been shown to maintain problem behavior, including access to ritualistic behavior (Falcomata, Roane, Feeney, & Stephenson, 2010; Hausman, Kahng, Farrel, & Mongeon 2009), walks (Ringdahl, Christensen, & Boelter, 2009), movement in a wheelchair (DeLeon, Kahng, Rodriguez-Catter, Sveinsdottir, & Sadler, 2003), combative play (i.e., sword fighting; McLaughlin et al., 2003), and preferred conversation topics (Roscoe, Kindle, & Pence 2010). A range of tangible items also were reported, with problem

behavior maintained by access to violent play items (McLaughlin et al., 2003), high preference items (Mueller, Wilczynski, Moore, Fusilier, & Trahant, 2001; Wilder et al. 2007), and music (Carey & Halle, 2002). Finally, Mann and Mueller (2009) provided some evidence that one participant's problem behavior was potentially maintained by attention that produced access to tangible items as a combined consequence.

Automatic Reinforcement Relations

The test condition for automatic reinforcement is indirect and typically involves exposing the participant to repeated alone or no interaction conditions to determine whether responding persists in the absence of social contingencies. If responding does not persist, the conclusion generally is that problem behavior is socially maintained. Two studies (Carter, Devlin, Doggett, Harber, & Barr, 2004; Tiger et al., 2006) showed that incorporating appropriate items into these conditions may enhance detection of automatically reinforced problem behavior. In both studies, responding occurred consistently during alone or no interaction test conditions only when items were present, suggesting that the absence of items might have led to false negative outcomes.

Contextual Variables

As a result of our search, we also identified 10 articles (23.8% of sample) that included manipulations to the general context in which problem behavior occurred. Because these modifications may affect a variety of behavioral functions, we will classify them here as contextual variables. Examples include studies showing that the presence of noise (McCord, Iwata, Galensky, Ellingson, & Thomson, 2001) or illness (Carter, 2005) increased escape-maintained problem behavior. Another variable was rapport (i.e., relationship quality), measured through staff interview, subjective rating scales, and direct observation (Mclaughlin & Carr, 2005). The authors found that poor rapport between client and therapist yielded higher levels of problem behavior during demand conditions relative to no demand conditions of the functional analysis. The controlling variables for problem behavior also have been shown to change across settings (Lang et al., 2008, 2009, 2010) and across therapists conducting the sessions (English & Anderson, 2004; Huete & Kurtz, 2010; McAdam, Dicesare, Murphy, & Marshall, 2004). For example, a tangible function was revealed for one participant's problem behavior in a classroom setting whereas an attention function was revealed for that same participant's problem behavior in a playground setting (Lang et al, 2009).

Strategies to Identify Idiosyncratic Variables

Informal observation (i.e., information derived from casual observations) was utilized in 12 studies (28.5% of sample). Anecdotal report (i.e., information derived from casual conversations) was utilized in 11 studies (26.1% of sample). Descriptive assessments (i.e., information derived from direct observation and measurement) were utilized in eight studies (19% of sample). Manipulation and observation (i.e., information derived from direct observation of problem behavior in the context of an experimental manipulation), was utilized in seven studies (16.6% of sample). Indirect assessments (i.e., information derived from formal questionnaires and rating scales) were utilized in three studies (7.1% of sample). Finally, we were unable to identify the strategies used in 13 studies (30.9% of sample). That is, the experimenters modified conditions, but the source of information regarding events to test was not provided.

Discussion

Our review indicated that research published between 2001 and 2010 identified more than 30 idiosyncratic variables that influenced responding during functional analyses, a finding

that indicates the growth of functional analysis technology. In addition, experimenters used more rigorous methods of testing idiosyncratic variables than in previous years. For example, Hanley et al. (2003) noted that the reinforcement contingency was not in effect in most studies evaluating antecedent manipulations of negative reinforcement. By contrast, in this review, the reinforcement contingency remained in effect in the 15 studies that manipulated antecedent variables for negative reinforcement relations. These manipulations have aided in identifying several different classes of putative EOs to test in modified escape conditions (i.e. preference for certain tasks, amount of work required, tone used during instruction, specific prompting types, prompt timing, wording of instruction). Similarly, novel classes of putative EOs for positive reinforcers also have been identified (i.e., therapist leaves room, attends to another's problem behavior, consumes edibles in front of participant, or assigns ownership to tangibles; combined EOs). Finally, our review revealed various idiosyncratic positive reinforcers, including access to alternative behavior, ritualistic behavior, walks, wheel chair movement, preferred conversation, active play, high preference tangibles, and music.

The functional analysis process varied considerably across studies. In the majority of articles (36 of 42; 85.7% of sample), experimenters conducted standard functional analysis conditions. In 14 of these 36 articles, the initial functional analysis yielded inconclusive outcomes, whereas in 10 articles, the functional analysis showed clear outcomes and the experimenters modified conditions to identify the relative reinforcing efficacy of various event manipulations (e.g., types of attention for attention-maintained problem behavior). Alternatively, in 12 of the 36 articles, experimenters compared modified conditions to standard conditions in a multi-element design. Finally, in six of the 42 articles (14.2% of sample), the experimenters evaluated modified conditions without including standard functional analysis conditions. For example, Mclaughlin and Carr (2005) evaluated the extent to which three participant's problem behavior was sensitive to escape in the presence of preferred versus non-preferred staff. Although problem behavior was less likely to occur in the presence of preferred staff, it is unclear whether those modifications were necessary (i.e., problem behavior may have been observed in standard escape conditions). Although conducting modified conditions as a first step in the process may yield information quickly, it does not allow one to rule out behavioral maintenance by commonly identified maintaining variables. In addition, if the modified condition does not provide helpful information, it would have been more efficient to begin with a standard approach before testing idiosyncratic events. Incorporating both standard and modified test conditions into a single assessment may enhance efficiency by testing idiosyncratic variables while concurrently ruling out common sources of reinforcement. However, this approach will only prove efficient if the idiosyncratic event is in fact functionally related to problem behavior. By conducting a standard functional analysis prior to initiating modified conditions, clinicians may identify the maintaining variable more efficiently while ruling out frequently identified behavioral functions. Given the variety indicated above, further research is needed to determine which approach would be the most efficient and effective strategy for identifying behavioral function.

The expansion of relevant stimulus parameters indicates the need for a more systematic pre-assessment technology. Several different strategies and combinations of strategies were used to inform modified functional analysis conditions. For example, Hagopian et al. (2007), Hausman et al. (2009), and Kuhn et al. (2009) utilized both anecdotal report and informal observation to inform modified conditions, whereas Call et al. (2004), Ringdahl et al. (2009), and McLaughlin and Carr (2003) relied exclusively on anecdotal report. The range of strategies used to inform modified conditions, although seemingly advantageous, indicates the need for further research in this area. Specifically, it is unclear which strategy, or combinations of strategies, may be the most useful in identifying environmental variables

to empirically test.Results of seven articles (i.e., Butler and Luiselli, 2007; English and Anderson, 2004; Huete and Kurtz, 2010; Mcadam et al., 2004; Lang et al., 2010; Lang et al., 2009; Lang et al., 2008) suggested that the therapist or setting variables may impact the determination of behavioral function. A potential concern in manipulating these types of contextual variables is that it is unclear what aspect of the therapist or setting occasioned higher levels of problem behavior. Further research involving these types of analyses could focus on the conditions under which these differences would be observed. For example, some therapists or settings differentially predict the availability of certain reinforcers. It is also possible that some environments are devoid of certain reinforcers, enhancing the value of putative reinforcers. Further research devoted to manipulating particular MOs and discriminative stimuli associated with the type of therapist and setting will shed light on the behavioral mechanisms responsible for their effects.

The *process* of functional analysis involves an interaction between the clinician's behavior and the environmental consequences of that behavior, in a way that parallels Skinner's observations about the experimenter's behavior/environment interactions (Skinner, 1999). As clinicians continue to modify test conditions to identify functional relations between problem behavior and its maintaining reinforcers, we anticipate an evolving assessment technology that is shaped by the discovery of relevant environmental manipulations.

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Table 1

Range of Stimulus Parameters Assessed

Stimulus Parameter	Primary Author (Publication Year)
SOCIAL NEGATIVE REINFORCEMENT	
Antecedent Events	
Specific Type of Task	Butler (2007), Roscoe (2009)
Aspects of Task (Difficulty/Preference/Amount/)	Boelter (2007), Call (2004), Moore (2003), Ebanks (2003)
Instructional Style (Tone)	Borrero (2004)
Instructional Style (Prompt Type/Delay)	Tiger (2009), Ebanks (2003),
Instructional Style (Wording)	Northup (2004)
Level of Social Attention	Call (2004), Moore (2003)
Client Location	Le (2002)
Continuous Attention	Hagopian (2001), Tiger (2009)
Walking	Volkert (2009)
Transitions	McCord, Thomson (2001)
SOCIAL POSITIVE REINFORCEMENT	
Antecedent Events	
Therapist Leaves Room	Edwards (2002)
Attending to Another's Problem Behavior	Kuhn (2009)
Combine EOs	Call (2005), Dolezal (2010)
Therapist Consumes Edible (*Tangible*)	Kuhn (2009)
Assign Ownership (*Tangible*)	Kuhn (2009)
Consequent Events	
Specific Type of Attention	Kodak (2007)
Attention Delivered by Specific Person	Tiger (2009)
Alternative Behavior	Hagopian (2007)
Ritualistic Behavior	Falcomata (2010), Hausman (2009)
Walks	Ringdahl (2009)
Wheel Chair Movement	DeLeon (2003)
Preferred Conversations	Roscoe (2010)
Restraint Materials	Rooker (2005)
Active Play (*Tangible*)	McLaughlin (2003)
High Preference vs. Low Preference (*Tangible*)	Mueller (2001), Wilder (2007)
Music *(Tangible)*	Carey (2002)
Peer Attention	Skinner (2009), Flood (2002)
Combine Consequences	Mann (2009)
AUTOMATIC REINFORCEMENT	
Include Leisure Items in Alone Condition	Carter (Tiger (2006)
CONTEXTUAL VARIABLES	
Noise	McCord, Iwata (2001)
Illness	Carter (2005)
Rapport	Mclaughlin (2005)

Settings	Lang (2010, 2009, 2008)
Therapist	English (2004), Huete (2010), McAdam (2004), Butler (2007)