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Behavioral Language Interventions for Children with Autism: Comparing Applied Verbal Behavior and Naturalistic Teaching Approaches

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Several important behavioral intervention models have been developed for teaching language to children with autism and two are compared in this paper. Professionals adhering to Skinner's conceptualization of language refer to their curriculum and intervention programming as applied verbal behavior (AVB). Those primarily focused on developing and using strategies embedded in natural settings that promote generalization refer to their interventions as naturalistic teaching approaches (NTAs). The purpose of this paper is to describe each approach and discuss similarities and differences in terms of relevant dimensions of stimulus control. The discussion includes potential barriers to translation of terminology between the two approaches that we feel can be overcome to allow better communication and collaboration between the two communities. Common naturalistic teaching procedures are described and a Skinnerian conceptualization of these learning events is provided.

Key words: relational matching to sample, joint control, conditional discrimination.

Applied behavior analytic (ABA) language interventions often produce substantial gains for children with autism (Lovaas, 1987; Smith, 1998). Several different variations of early intensive behavioral intervention have been developed over the past 20 years. Many of these approaches share important core features and each has made a unique contribution to the treatment of autism. The first well-known model was initially developed by Ivar Lovaas in the '60s and '70s and was disseminated broadly in the '80s and '90s (Lovaas, 1987; McEachin, Smith, & Lovaas, 1993). The results of the UCLA program were extremely promising, with 47% of children indistinguishable from same-age peers. This model of intervention and curriculum has been recently updated in a new manual (Lovaas, 2003), but the earliest version sparked two important different variants of ABA that were designed in reaction to aspects of the model: (a) the psycholinguistic conceptual framework, and (b) the focus on discrete trial instruction over naturally occurring language learning opportunities and resulting limits in generalization evident in early studies (Lovaas, Koegel, Simmons, & Long, 1973).

Most ABA curricula follow a traditional psycholinguistic view of language (Leaf & McEachin, 1999; Lovaas, 2003) focused on a receptive-expressive and structural delineation. Interventions first emphasize the instruction of receptive skills (e.g., following directions, object identification) and later introduce expressive skills (e.g., repeating, naming, answering questions). A group of clinicians and researchers heavily influenced by B. F. Skinner's analysis of language (Skinner, 1957) have developed a curriculum and instructional approach to language training for children with autism based on his analysis (Sundberg & Partington, 1998; Sundberg & Michael, 2001). This approach, hereafter referred to as Applied Verbal Behavior (AVB), views language functionally with each verbal response defined by its unique antecedent and consequences (Skinner). Thus, AVB language instruction focuses on the acquisition of functional and distinct verbal operants (e.g., mand) rather than topographies (i.e., words) according to the traditional receptive/expressive dichotomy. Additionally, tools consistent with Skinner's approach guide assessment and intervention efforts. The Assess-

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ment of Basic Language and Learning Skills (ABLLS) is used to determine the strength of verbal and some non-verbal repertoires and guides a published curriculum for instruction (Sundberg & Partington, 1998).

For children with weak language skills, there is a strong preference among AVB practitioners for strengthening mand repertoires first based on Skinner's conceptual analysis of language and Michael's (1993) concept of the establishing operation. The establishing operation distinguishes the mand from other verbal operants in that it evokes a response that specifies a uniquely effective consequence and is the only verbal operant that directly benefits the speaker. Thus, AVB interventions typically involve manipulation of establishing operations (Michael), which may initially occur infrequently or are at insufficient intensity for the child with autism to develop a mand repertoire. Practitioners arrange a learner's environment to create optimal conditions under which the learner will mand for preferred items, missing items, information, and so on (Hall & Sundberg, 1987; Sundberg, Loeb, Hale, & Eigenheer, 2001). A final common feature of the AVB approach is pairing of antecedents of strong verbal operants with stimuli that weakly control other verbal operants (i.e., stimulus transfer procedures) to teach new verbal operants. For example, a picture that evokes a tact, "cat" will be used to teach the intraverbal "Can you name an animal?" and subsequently faded to transfer control to the verbal antecedent (Drash, High & Tudor, 1999; Finkel, & Williams, 2001; Sundberg, Endicott, & Eigenheer, 2000).

A different community of researchers and clinicians heavily influenced by the work of Stokes and Baer (1977) began developing interventions for children with autism in the 70's and 80's that included a pervasive emphasis on promoting skill generalization and emphasis on incorporation of natural change agents (e.g., parents) from the beginning of instruction. In contrast, typical traditional ABA programs do not conduct the majority of instruction in the natural environment until the second or third year of standard curricula when the emphasis shifts to socialization and integration programming (Smith, Donahoe, & Davis, 2001; Lovaas, 2003). Naturalistic teaching approaches (NTA) tend to value a developmentally normalized approach to instruction such that teaching activities can be readily employed in homes, daycares, and integrated educational environments rather than in separate teaching environments. Thus, many naturalistic teaching strategies are employed in the context of play or naturally occurring events (e.g., snack time) rather than a readily identifiable "work" or academic context (Charlop-Christy, LeBlanc, & Carpenter, 1999).

NTAs are designed to promote language that occurs across a variety of contexts (i.e., generalization) by following the general framework and recommendations of Stokes and Baer (1977). For example, teaching occurs in the target context or in an environment that includes salient stimuli from the target context (e.g., toys, siblings, other naturally occurring stimuli). Varied and natural change agents such as parents, teachers, and siblings employ the strategies and are taught to use multiple exemplars for training. Additionally, many experimental studies of naturalistic teaching strategies explicitly measure stimulus and response generalization as a measure of the effectiveness of the intervention and demonstrate superior effects of the intervention compared to more structured discrete trial teaching approaches (Koegel, O'Dell, & Koegel, 1987).

Generalization of treatment effects is an outcome also valued by users of the AVB approach and Sundberg and Partington (1998) offer recommendations and a rationale for incorporating naturalistic teaching strategies with discrete trials in a verbal behavior curriculum. They use the term natural environment training (NET) to refer to instruction that can occur throughout the day at opportune moments in naturally occurring contexts and state that NET is primarily based on the NLP model described by Koegel and colleagues. They suggest that effective stimulus control according to Skinner's verbal operants can be best achieved using a mix of more "highly specified and structured" trials and naturalistic teaching (Sundberg & Partington, p. 141) within a context of an AVB program. Thus, there is clearly compatibility between the NTA approach and the AVB approach, but some members of the growing community of practitioners using the AVB approach may be unfamiliar with the empirical studies and procedural descriptions for a range of naturalistic teaching approaches that have proven effective with children with autism. One purpose of this paper is to make users of the AVB

approach more familiar with the literature on NTAs. Clearly a parallel paper could be written to inform the NTA community about the benefits of the AVB approach, but that is not the intended purpose of this paper.

Although the compatibility between the AVB approach and NTAs have been noted, there are several important differences between the two approaches that may make it somewhat difficult for AVB users to consume the published literature of the NTA community. These conceptual and terminology barriers are important but not insurmountable and the potential benefits of effective collaboration between subgroups of the behavioral autism treatment community make it worthwhile to attempt to overcome these barriers. The following section attempts to describe several of the barriers and offer translations that may prove useful in overcoming them.

Conceptual and Terminology Barriers

The most readily apparent barrier is the clear difference in conceptual framework for language. NTAs retain the linguistic framework to describe many aspects of language (e.g., receptive/expressive, prepositions, labeling, mean length of utterance) with delineations according to form while AVB makes use of Skinner's conceptual approach with delineations according to function. Thus, the terminology of NTAs is more readily shared with the speech-language pathology community and special education community than readers of *The Analysis of Verbal Behavior* and many of the seminal publications on NTAs are in language and special education journals (McGee, Morrier, & Daly, 1999; Halle, 1982; Koegel, Carter, & Koegel, 2003) although many others are in the *Journal of Applied Behavior Analysis*. Expect published papers to refer to requests rather than mands, expressive labels rather than tacts, receptive labels rather than selection-based discriminations, and "wh" questions rather than mands for information (asking "wh" questions) or intraverbals (answering "wh" questions). This expectation will allow you to translate the terms but the reader should remain mindful there is a larger conceptual difference rather than just a terminology difference. Thus, AVB practitioners would not only talk about asking and answering "wh" questions differently but they would use very different procedures to teach the two skills while users of a linguistic framework view "questions" as an entity and would teach the two skills similarly. However, an informed examination of the specific procedures used may provide researchers and clinicians with new ideas for instructional strategies with the children they serve.

A second barrier is the frequent use of the terms "spontaneity" to describe language in the absence of explicit adult mediated prompts (e.g., say "I want juice"; "what do you want?"). The NTA community uses the term "spontaneous" to refer to language evoked by stimuli embedded within the child's ongoing activities, interactions, and general environment (Sigafoos & Reichle, 1993). Interoceptive stimuli are included as relevant controlling stimuli with control by contextual and interoceptive stimuli representing the greatest level of spontaneity while responses controlled by modeling and physical guidance are considered the least spontaneous on a continuum (Halle, 1987). Note that "interoceptive stimuli" is used where AVB users might use the term establishing operations and can readily be translated as such. However, a mand occurring in response to an establishing operation would not be considered more spontaneous than a tact that was controlled by a relevant non-verbal stimulus.

A third potential barrier is the use of the term "motivation" to refer to the explicit goal of many NTA interventions that a child demonstrate willingness to participate in instruction and "an increase in responsiveness to social and environmental stimuli" (Koegel, Koegel, Harrower, & Carter, 1999, p. 282). Koegel et al. suggest that a child is motivated to learn when response latencies are shorter, frequencies of verbalizations increase, and positive affect is clearly evident in the teaching environment. Thus, problem behavior should rarely occur when naturalistic teaching strategies are used and some studies provide evidence that naturalistic teaching is associated with lower rates of disruptive behavior than discrete trial training (Koegel, Koegel & Surratt, 1992). Several features of naturalistic strategies are designed to enhance motivation including interspersal of maintenance trials with acquisition trials, reinforcement of attempts in the form of a looser shaping criterion, and incorporation of child choice and child-initiated activities (Koegel et al., 1992; Koegel et al. 1999; Charlop-Christy et al., 1999). Additionally,

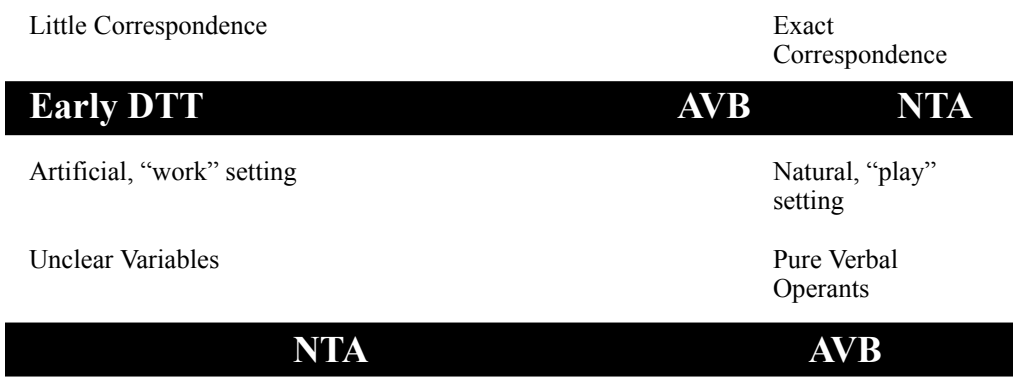

Fig. 1. The top panel depicts the degree of correspondence between training context and the eventual desired performance context for language for different intervention models. The bottom panel depicts the degree of correspondence between antecedents and consequences controlling responding during training and those occurring during desired performance for different intervention models.

NTAs typically use natural or "functional" reinforcers that are related to the child's vocalizations (Charlop-Christy, LeBlanc, & Carpenter, 1998). Thus, language-learning events typically include specific relevant reinforcers for verbalizations (i.e., say "ba" or "ball," receive ball) rather than highly preferred non-relevant stimuli (i.e., say "ba," receive M&M®).

These behavioral outcomes (e.g., short response latencies, minimal problem behavior) are also highly valued by users of AVB and may suggest to users of AVB that establishing operations are employed; the translation is not a completely accurate one. The terms establishing operations and mands are typically not used and the strategies are used to target many types of language other than requests. Additionally, there is typically no attempt to ensure that an establishing operation is the relevant controlling variable for language. Rather, within the NTA model these features are employed because they represent a developmentally appropriate means to make learning fun and highly reinforcing and to teach that language produces an impact on the environment that is linked to the meaning of language rather than arbitrary.

An examination of two important aspects of stimulus control involved in the respective instructional approaches may help clarify some of the translation difficulties and enhance understanding of the important similarities and differences between these approaches. Two different but parallel continua of stimulus control are evident and are differentially emphasized by these two approaches in the design and implementation of language training. One continuum refers to the degree to which the teaching environment corresponds to the environment in which we hope to eventually see language occur with structured discrete trials and naturalistic training representing the ends of the continuum. The second continuum refers to the degree to which the specific antecedents (e.g., motivative variables, verbal stimuli, and non-verbal stimuli) and specific consequences that will eventually control the child's responding are directly incorporated into ongoing instruction. All language interventions can be described as existing somewhere along both of these continua but the user of the intervention may be more accustomed to thinking of and speaking about their work along only one of these continua.

The continuum of stimulus control associated with similarities between the teaching environment and "speaking" environment is depicted in the top panel of Figure 1. This aspect of stimulus control was a primary motivating factor in the development of NTAs because early versions of discrete trial based behavioral interventions included almost no similarities with the natural environment (far left end of continuum). Users of NTAs are primarily concerned with this aspect of stimulus control and conduct virtually all teaching trials under natural conditions (far right end of the continuum) to maximize the likelihood of generalization. Users of AVB also consider this important aspect of stimulus control important but are typically more moderate in their approach, blending structured discrete trials and naturally occurring learning opportunities (Sundberg & Partington, 1999).

The continuum of stimulus control associated with specific antecedents and consequences for language is depicted in the bottom panel of Figure 1. The right end of the continuum is conceptualized by verbal behavior that occurs under the control of antecedent and consequence conditions that match Skinner's taxonomy (e.g., mand evoked by motivative variables and maintained by specific reinforcers, tact evoked by non-verbal stimuli and maintained by generalized social reinforcers). The left end of the continuum is conceptualized by verbal behavior that has unclear controlling variables or faulty controlling variables that will not lead to functional use (e.g., requests that only occur under the control of the question "What do you want?"). AVB users are critically concerned with this aspect of stimulus control and organize their curriculum and training according to Skinner's analysis to maximize the likelihood that the relevant antecedents and consequences for language are evident in instruction. Thus, behavior that occurs under the relevant controlling variables (AVB approach) meets the definition of the term "spontaneity" used by the NTA community and occurs without out extraneous prompts. NTA users typically are not aware of this particular continuum or its conceptual influence and typically blend stimulus control associated with mands with that of other operants resulting in multiple control (or perhaps mixed is the better term if each stimulus does not actually evoke responding when presented alone) for virtually all language learning opportunities due to the "motivation enhancing" strategies embedded within their instruction.

In NET a substantial effort is made to train under stimulus conditions specific to a given verbal operant, whereas these efforts are typically not evident with the other naturalistic approaches described here. Thus, with NET you might specifically conduct tact trials in a natural context and attempt to eventually achieve precise stimulus control such that a nonverbal stimulus is the only controlling stimulus. Initial trials in NET may be conducted with multiple controlling stimuli but stimulus fading occurs until the desired stimulus control is evident (Sundberg & Partington, 1999). With the other naturalistic procedures described here there may never be an emphasis on achieving "pure" tacts.

Naturalistic Teaching Approaches Procedural Descriptions

A select group of strategies are included because reasonable description of the procedures could be obtained from published sources such as empirical articles or curriculum and intervention manuals and because they represent excellent exemplars of NTAs. The strategies are presented generally in order of their development rather than by importance or similarity.

Incidental Teaching (IT)

Several versions of IT have appeared over a 35-year span with the most recent version referred to as multiple incidental teaching sessions (MITS) (Charlop-Christy & Carpenter, 2000; Hart & Risley, 1968; McGee et al., 1999). All versions have been implemented in the natural environment, have included access to child-selected reinforcers contingent on elaborated speech, and have focused on a primary goal of increasing spontaneous language and stimulus and response generalization of the acquired targets. Betty Hart and Todd Risley developed IT for disadvantaged preschool children during the late 1960's (Hart & Risley). IT procedures were later used to teach two children diagnosed with autism to receptively identify items presented during a daily lunch preparation routine (McGee, Krantz, Mason, & McClannahan, 1983) and to teach prepositions in a classroom setting (McGee, Krantz, & McClannahan, 1985). The Walden Toddler Program of the Emory Autism Resource Center uses IT methods as its foundation (McGee et al.) for all teacher- student interactions. Classrooms are divided into zones with each zone arranged to provide opportunities for multiple opportunities for IT trials around a specific event or skill. The adult implements training procedures when children initiate teaching episodes by requesting (i.e., gesturing for) a preferred item in the natural environment. The trainer prompts elaboration of responding, and eventually delivers the requested item.

Fenske, Krantz, and McClannahan (2001) describe the procedural steps of an IT episode. First, the trainer arranges a setting that integrates many child-preferred materials. Next, the trainer waits for the child to initiate an interaction with respect to one of the items. The trainer

then requests and may need to prompt more elaborate descriptive language or approximations of speech before providing the relevant object. A time delay procedure is often implemented to gradually fade trainer prompts and transfer stimulus control for correct responding to the preferred item and/or environment. Each teaching episode results in one learning trial and a brief period of engagement with the child and the preferred item before retrieving the item and waiting for a subsequent initiation. Progressively more elaborate or accurate approximations of the targeted verbal response (i.e., articulation, mean length of utterance) are shaped across teaching episodes.

One proposed disadvantage of IT is that only one trial is typically incorporated into a teaching episode while a large number of trials occur in discrete-trial methods (Charlop-Christy & Carpenter, 2000). In response to this potential weakness, Charlop-Christy and Carpenter developed MITS, which proved more effective for acquisition and generalization than simple IT or discrete trial instruction. The MITS procedure is identical to that described for IT with additional practice trials implemented following the first, child-initiated teaching episode resulting in three times the number of learning trials per episode.

Mand-Model Procedure.

The Mand-Model procedure was developed by Rogers-Warren and Warren (1980) as a "modified version of the incidental teaching procedure identified by Hart and Risley" (p. 362). Rogers-Warren and Warren evaluated this procedure with three children with moderate to severe language delays who had previously received structured one-to-one language training. For all three participants, the Mand-Model technique resulted in generalization of previously trained words to a different setting, as well as substantial increases in overall vocalizations and untrained words and phrases. In a later study, Warren, McQuarter, and Rogers-Warren (1984) used the Mand-Model procedure as the primary language training technique with language delayed children and observed increases in rate and mean length of utterance.

The procedures employed in the Mand-Model technique have been described in detail by various authors (Halle, 1982; Halle, Alpert, & Anderson, 1984; Duran, 1996) and Halle et al. provide a flowchart with step-by-step instructions for implementation of this procedure. The term *mand* as it is used here does not refer to the acquisition of this verbal operant by the child. Rather, the "mand" in Mand-Model refers to the verbal behavior of the therapist with the child as the listener. Generally, a typical Mand-Model training session begins with a therapist arranging various preferred toys around the room. Prior to training the therapist identifies an individualized criterion level response for reinforcement, with a goal of gradually shaping more complex vocal responses (i.e., longer phrases, adjective use, articulation).

When the learner attempts to engage with a toy, the therapist mands for a response from the learner (e.g., "What do you want?", "Tell me what this is."). Note that the child responses are not explicitly conceptualized as mands or tacts by the developers of the procedure. In a variation of this procedure, the therapist approaches the learner with a toy and mands for a vocal response. If the learner responds at criterion level, the therapist provides praise for talking and delivers the item. If the child responds below criterion level, the therapist may choose several courses of action: 1) provide a model (e.g., "It's a ball."), or 2) request the criterion response (e.g., "Ask me in a full sentence."). If a model is given and the learner responds appropriately, he or she receives praise and the toy. If the child does not respond at criterion level at that point, another model is provided. If the child again responds below criterion, the therapist offers corrective feedback and the toy, thus delivery of the toy is not contingent upon a correct response. If the therapist chooses to request the criterion response, the child may receive up to two mands and models for the criterion response and the therapist may either provide corrective feedback and the toy or present a different model (Halle et al., 1984).

Several characteristics of the Mand-Model procedure differentiate it from other naturalistic language strategies. First, this procedure primarily focuses on the generalization of previously acquired language rather than the acquisition of new language. Second, the initiation of learning opportunities is made in part by both learner and therapist (Halle et al., 1984). Third, this procedure typically includes more corrective feedback than other NTAs

though the child still receives access to the item even if an error occurs. The goals of the Mand-Model procedure as summarized by Halle et al. are "(a) establishing joint attention (topic selection) as a cue for verbalization, (b) training turn-taking skills, (c) training the child to provide information upon verbal request or instruction, and (d) training the child to respond to a variety of adult-presented cues" (p. 47). This technique may be especially appropriate for use with children who initiate language at low rates because in each trial the therapist vocally prompts, or presents a cue for, the child to speak.

Natural Language Paradigm (NLP) and Pivotal Response Training (PRT)

Koegel, O'Dell, and Koegel (1987) introduced NLP as a strategy that incorporated aspects of natural language teaching into intervention with children with autism. They compared NLP to a discrete trial baseline of vocal imitation using a multiple baseline design across participants and demonstrated improved language. In intervention, both children exhibited increases in imitations as well as spontaneous utterances in the training context and outside of the clinic setting. A second study on NLP incorporated parents as therapists to teach language to their echolalic and mute children with autism (Laski, Charlop, & Schreibman, 1988). Parents were taught to implement NLP after a discussion of the NLP procedures, two observations of therapists implementing NLP with the child, and *in vivo* training with immediate feedback. Gains were seen for all children with greater gains observed for children with echolalia than those with no vocalizations. Additionally, this study provided social validity evidence for NLP in that all parents reported that they enjoyed the sessions and thought their children enjoyed them as well. Sundberg & Partington (1998) cite NLP as the general basis for development of NET.

Procedurally, NLP involves several steps described in detail by Charlop-Christy et al. (1999). The adult and child sit facing each other with a variety of fun commonly occurring objects and toys (e.g., cup, toothbrush, fish, boat, car). The adult presents an array of three objects and asks the child to choose one (i.e., a preference assessment). The adult uses the selected item to model an appropriate play activity and spoken phrase (e.g., "fish swims") followed by a 5 second pause to allow utterances. All vocal imitation attempts result in access to the item with continued models of the descriptive phrase while the child plays. After the child has played briefly, the therapist retrieves the item and presents a different exemplar by modeling a different phrase for the same object (e.g., "blue fish"). After a few interchanges, a new stimulus array is presented and the child chooses again. Over time, vocal imitation attempts are shaped into closer approximations of the spoken model and the 5-second pause begins to occur while modeling the action but *before* the spoken phrase to allow the opportunity for "spontaneous" utterances to occur. That is, utterances occur in response to a modeled action but without any direct vocal model from the adult.

Variability in responses within and across children is expected and response variation controls the individually set response criterion. For a non-vocal child participating in NLP, one might initially expect responses that are guttural vocalizations that only roughly approximate the model provided by the instructor. Later vocalizations may correspond closely to the modeled vowel sounds, vowel-consonant blends, and eventually single words and multiple word phrases. The therapist or supervisor establishes the relevant response criterion based on response topography (e.g., "b" to "bah" to "ball" for ball) and the criterion may shift rapidly (i.e., within session) depending on child performance.

Koegel and colleagues have incorporated NLP as the first procedural step in their subsequent multi-component intervention, Pivotal Response Training (PRT). This intervention targets "pivotal" behaviors that may produce change across a variety of areas of functioning (Koegel, Koegel, Harrower, & Carter, 1999). The overarching goal of PRT is to increase social-communicative repertoires and responsivity to the environment by targeting motivation, self-regulation, responsivity to multiple cues, and self-initiation of social interactions (Koegel, Koegel, & McNerney, 2001). See terminology section above for a discussion of these terms. Critical features of PRT that are not directly included in NLP include interspersing maintenance and acquisition tasks, training parents to implement procedures. This intervention differs from other

NTAs in the degree to which social aspects of language are directly targeted with an explicit emphasis on social behavior. The intervention is manualized (Koegel et al., 1989) and meets the criteria for empirically supported treatments for children with autism on multiple measures, including problem behavior, spontaneous vocalizations, quality of peer relationships, and academic performance (Koegel, Koegel, & Brookman, 2003).

PRT has been successfully used to teach children to ask questions, answer questions, request items and many other language skills. For example, Koegel, Carter, and Koegel (2003) taught two boys diagnosed with autism to ask questions about past (i.e., "What happened?") and present (i.e., "What's happening?") activities in highly preferred pop-up books to receive access to the book and the requested information. Koegel, Koegel, and Brookman (2003) describe procedures for teaching a child to provide the names of objects. First, the trainer captures the attention of the child and presents a clear instruction or question related to child-selected stimulus materials (e.g., "What is this?"). Correct responses result in access to the item as a naturally occurring reinforcer that is "directly and functionally related to the task" (p. 346).

Conceptual Analysis

The procedures described above share some important similarities with respect to the verbal operants that are produced. These procedures are not aimed at establishing "pure" verbal operants and probably result in language under multiple control of tact, mand, and echoic. First, the presence of a nonverbal stimulus for learning events suggests aspects of stimulus control associated with Skinner's definition of the tact. The initiation of the learning event by the child (e.g., IT) or incorporation of a preference assessment (e.g., NLP) increases the chances that a relevant establishing operation is in effect and the delivery of the specified stimulus contingent upon language establishes a learning history consistent with Skinner's notion of the mand. Additionally, echoic prompts are often used if the child's initial response does not meet a success criterion and accurate imitation then resembles Skinner's notion of the echoic.

A procedure such as the mand-model can be used to target multiple verbal operants by slightly modifying the instructional context (Rogers-Warren & Warren, 1980; Warren, et al., 1984) perhaps increasing generality across verbal operants. They used the mand model procedure to teach children to answer questions from adults (e.g., "What are you doing?") using vocal prompts, to teach requests by providing stimulus access or assistance contingently, and to teach object labels by providing attention and feedback contingent upon the child's response. Finally, the mand-model procedure has been used to prompt progressively elaborated responses to increase the mean length of utterance and sophistication of grammatical structure (e.g., tell me what you are doing and use a whole sentence) (Hemmeter, Ault, Collins, & Meyer, 1996; Mobayed, Collins, Strangis, Schuster & Hemmeter, 2000). The mand-model procedure is designed to produce elaborated language under the control of the natural environment and can be applied to multiple verbal operants as long as responses already occur at some level. This strategy may share more features with NET than some of the other approaches discussed in this paper because of the emphasis on it's use as a supplemental strategy for existing language and because the specific form of the therapist's mand and model can be readily applied to each verbal operant.

Consider responses produced during NLP as an example of how the controlling variables for child responses may shift throughout the course of intervention. Responses during initial trials typically occur after a vocal model and are probably echoics because they directly correspond to the modeled vocalization, however, an object is always present and the situation is designed to increase the chance that an establishing operation is also in effect. Thus, these early trials might be conceptualized as an attempt to transfer control from a multiply controlled echoic/mand to a mand/tact. As the procedure progresses and the 5-second delay begins to occur prior to the vocal model, echoics are no longer evident and the mand and tact features of the child's response become more evident. As NLP progresses the therapist may be able to incorporate mildly to moderately preferred stimuli with the goal that nonverbal stimuli would evoke language, while social interaction and praise function as the

maintaining consequence even when a strong establishing operation is not present.

As children are taught to make 2-3 word utterances, NLP can be used to teach objects and actions relevant to a tact repertoire (e.g., "the ball rolls", "the cheetah runs"). Conversational interchanges during the child's access to the item can become the context for trials of other verbal operants (e.g., "The cheetah ran" — tact; "Can you make it run?" — receptive, "Can an elephant jump?"— intraverbal) with the child responses during access resulting in praise and additional attention in the form of conversation. Note that if NLP does not move towards use of slightly less preferred objects (i.e., weaker establishing operations) and incorporation of instructive conversational interchanges during item access, one would not expect tacts to emerge because of the continued presence of strong establishing operations and lack of generalized social reinforcers as the controlling variables.

A few other conceptual issues are worthy of note. First, the therapist may serve several different functions in NTAs. A reflexive CEO (Michael, 1993; Michael, 2000) may be established when the therapist presents a modeled action and waits for a vocal response before modeling the sound. The pause may increase the reinforcing value of and evoke vocalizations similar to when a child greets a person with "hello, Mrs. Jones" given a history of mild disapproval for silence and prompts for a greeting. Also, the play context and provision of access to highly preferred items may establish the therapist as a powerful conditioned reinforcer during initial trials allowing interactions during subsequent trials to serve the role of a generalized conditioned reinforcer. Second, the loose shaping criterion and flexibility in establishing the target criterion employed in most NTAs allows the therapist the opportunity to target multiple dimensions of child responding. For example, even emotional responses may be initially reinforced if no echoic repertoire exists, and gradually shaped into closer approximations to correct articulation. Additionally, a response variability criterion might also be employed in the form of a lag-x contingency to decrease rote responding. That is, a response of "blue ball" reinforced on the first trial will not be reinforced again until a certain number of different responses (e.g., "ball bounces", "catch the ball") are emitted.

CONCLUSIONS AND SUMMARY

In conclusion, there are several similarities and important differences between the AVB approach and NTAs that can be conceptualized in terms of different dimensions of stimulus control. One purpose of this paper was to illustrate the aspects of stimulus control most highly valued by users of each approach. A second purpose was to provide procedural descriptions of various NTAs for those AVB practitioners who might not be familiar with them and it is certainly true that a parallel paper might be written describing aspects of the AVB approach for NTA practitioners. A final purpose was to discuss several conceptual issues in NTAs that might prove interesting for the AVB community including the potential verbal operants in effect during NTA procedures and the potential role of the therapist in intervention.

Familiarity with this literature and the procedures described here may prove valuable to AVB practitioners for several reasons. First, procedures such as NLP/PRT have evolved to specifically target other aspects of responding than language. Social play behaviors such as initiations and joint attention are clearly important to the development of fluent social interactions with others and are explicitly targeted in many NTAs. Several strategies described here are explicitly designed to minimize the potential aversiveness of instructional contexts by incorporating fun ways to get children to willingly and happily engage in learning events. This goal is clearly stated as part of the rationale for NTAs and may be most important for children with moderate to severe noncompliance or disruptive behavior. These two targets, social behavior and decreased problem behavior, are not necessarily explicit components of NET, though these responses may be valued by AVB practitioners, as suggested by the oft-used phrase "we want them to run to us." Subsequent curriculur publications for AVB might include specific attention to these targets, perhaps with explicit programs for targeting these social skills.

Second, manuals and procedural guidelines exist for some of these procedures (e.g., PRT) written in a manner that is parent friendly, and controlled studies have demonstrated the beneficial effects of PRT at a level meeting the description of an empirically supported intervention. Publication of additional or expanded

procedural guidelines for conducting NET could result in enhanced quality of service delivery on a national level and may increase the chances that parents, siblings, and other natural change agents are incorporated as therapists for other verbal operants besides mands. Many excellent AVB practitioners may not need written manuals and procedural guidelines for simplifying procedures to a level amenable to siblings, but many might. Explicit guidelines might allow greater quality assurance for the growing number of professionals who are only beginning to explore AVB.

Several research questions might prove beneficial to a dialogue between behavior analysts using the verbal behavior model and those who primarily use NTAs. A first study might attempt to empirically test the ideas suggested here about the relevant verbal operants and potential multiple control suggested in this paper. For example, test of "pure" stimulus control (i.e., EO present but no item, item present but no EO) might be conducted throughout NLP intervention to identify variables controlling responding. A direct outcomes comparison for children with autism involved in each intervention model using a randomized group design and outcome indicators relevant for each approach (e.g., MLU, diversity of environments in which language is produced, problem behavior) would allow a data based evaluation of the benefits extolled by each group about their approach (i.e., benefits of training under conditions specific to an operant, benefits of training in natural context regardless of specific operant control) or by both groups (i.e., fun learning is better learning).

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