Referent-Based Verbal Behavior Instruction for Children with Autism

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Abstract Skinner's (1957) analysis of verbal behavior deconstructed language according to stimulus control. Although the functional independence of these verbal operants has been empirically demonstrated, more commonly, a speaker's verbal behavior is induced by a convergence of controlling stimuli. However, circumscribed stimulus control may inhibit the development of complex verbal repertoires for some individuals, including those with autism spectrum disorders. For this reason, in the current paper, we propose a behavior analytic intervention with the overarching goal of establishing multiple control over verbal behavior through the conditioning of referent stimuli.

- Referent-based instruction emphasizes teaching the operant class over specific targets
- Multiple control is established by converging verbal behavior around the referent
- Progress is measured in terms of a stimulus control ratio
- Eliminates arbitrary decision making

Keywords Referent-based instruction · Verbal behavior · Autism spectrum disorder · Stimulus control ratio · Multiple control

Early research on verbal behavior served to demonstrate the functional independence of the verbal operants theorized by Skinner (1957; e.g., Lamarre and Holland 1985). Mands are frequently considered requests, as they specify their reinforcers. Tacts are controlled by the physical presence of the

object in the environment. Similarly, sequels, part of a larger class of intraverbal responses, are replies to other verbal behavior. The success of numerous investigations on verbal behavior ultimately led to educational programming that promotes functional communication training in accordance with the environmental variables specific to each verbal operant. Namely, decontextualized objectives are commonly developed for each of the primary verbal operants. Although behavioral objectives articulate measurable outcomes, they do not readily translate into relevant teaching programs (Engelmann 2005).

Curricula derived from behavioral objectives frequently consist of nothing more than perpetual testing of the target skill that neglects to account for related outcomes, thereby stifling generativity. For example, a treatment plan may simultaneously state that a student will mand for 10 items and tact 10 other items. This arbitrary programming approximates a formulaic treatment plan but neglects to distinguish between that which is most pragmatic for the individual student and that which comes next in the curriculum. Although mands and tacts compose different operant classes, this functional distinction does not imply that such response cannot be integrated within the curriculum.

This manner of teaching poses a problem when the student's verbal repertoire develops at different rates across operant classes. Numerous researchers have reported on participants with disproportionately high levels of some verbal operants over others (e.g., Goldsmith et al. 2007; Kodak and Clements 2009). Similarly, Sundberg (2007) noted that the Verbal Behavior Milestones Assessment and Placement Program (VB-MAPP) profiles for children with autism showed generally higher levels of tacts and echoics than mands and intraverbals, while the VB-MAPP profiles of typically developing children were balanced across each of these four operants. Therefore, it is possible that teaching operants in such a molecular format could promote autistic speech patterns.

For developing complex verbal behavior, multiple control is the rule rather than the exception (Michael et al. 2011). A

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significant body of research is emerging to show that the acquisition of one operant can facilitate the emergence of other verbal operants (cf. Kodak and Clements 2009; Sautter and LeBlanc 2006). Additionally, research has shown that teaching multiple verbal operants simultaneously may increase the rate of acquisition within each individual operant class (Carroll and Hesse 1987). Consequently, here, we propose a curriculum premised upon the use of *referents* to establish a dynamic verbal repertoire. Specifically, the transfer of control across verbal operants is facilitated through high-probability (high-p) command sequences and the convergent control of multiple stimuli over a single response.

Referent-based instruction (RBI) foregrounds acquisition of the generalized operant over individual topographies. Rather than basing behavioral objectives around a specified number of targets, RBI accentuates transfer of control across operant classes as the primary outcome. Progress is measured using a control ratio to balance the relative strength of mands, echoics, tacts, and sequelics (METS), with a long-term goal of balancing these repertoires. Using referents to develop verbal cusps provides an efficacious method of developing functional treatment plans.

A referent is a quickly identified object or event around which verbal behavior training revolves. Referent-based instruction begins with the behavioral technician discriminating the source of stimulation (i.e., time allocation) for a student. This controlling stimulus is then paired with a verbal stimulus, which, through respondent conditioning, assumes some of the reinforcing properties of the original non-arbitrary stimulus. Access to the reinforcing stimulus then becomes contingent on the child's verbal behavior. This continuous schedule of reinforcement is then thinned with the assistance of intermittent generalized reinforcement, which is subsequently used to bring the child's verbal response under the control of the imitative stimulus (i.e., echoic), the exteroceptive stimulus (i.e., tact), and other verbal stimuli (i.e., sequelic).

As with other behavior analytic interventions, RBI relies heavily on established practices within the field, such as multiple exemplar training and errorless teaching. Additionally, RBI expands upon other evidence-based practices, including incidental teaching and pivotal response training. However, the distinguishing feature of RBI is its function: to establish multiple control over verbal behavior. Many verbal behavior analytic interventions emphasize the functional independence of verbal operants without considering the interdependent control of multiple stimuli (Sautter and LeBlanc 2006). As a result, children with autism who receive such training frequently display disproportionately high echoic and tact repertoires in comparison with significantly weaker mand and sequelic repertoires (cf. Goldsmith et al. 2007; Kodak and Clements 2009). The purpose of RBI then is to develop an atomic verbal repertoire balanced across these four primary verbal operants. This procedure prioritizes acquisition of the

generalized operant over individual topographies. Rather than basing behavioral objectives around a specified number of targets, RBI conditions transfer of control across operant classes as the primary outcome. Progress is measured using a control ratio to measure the relative strength of mands, echoics, tacts, and sequelics (METS), with a long-term goal of balancing these repertoires.

Referent-based instructional sessions consist of 10-min activity blocks composed of 9 min of teaching followed by a 1-min probe. The first 9 min are structured as milieu language teaching sessions initiated with an opportune preference assessment to identify referents that serve as a locus of control for METS and may also function as potential reinforcers. For instance, the technician may require the student to tact a toy before providing access. The induction of verbal responses may serve as a measure of the value of that particular stimulus.

The program is designed to be flexible enough to work with novel referent stimuli. Once the referent has been identified, the technician summarily composes various verbal stimuli with grease pencils on laminated index cards to induce subsequent verbal response from the child. For instance, to obtain a tact, the technician may display a toy (or a picture of a toy) and prompt with "Name this," "Tell me what this is," or "What do you see?" To evoke a sequelic response, the technician may describe how the toy is used. For example, "You bounce the ..." or "You roll the ..." both may occasion the student's response "Ball." Echoics, of course, model the desired response and may be prompted with the additional verbal stimulus, "Say..." One verbal stimulus is constructed for each of these three operants. Frequency recording is used to collect data on manding throughout each 9-min trial. Note that across these four antecedent conditions, the student's responses will be topographically identical.

Initially, RBI, like other forms of functional communication training, focuses on mand training. Control is transferred from the student's dominant verbal repertoire—usually either echoics or tacts—to condition manding for the referent using a continuous schedule of reinforcement. Transfer of control is facilitated through the use of a high-p command sequence. For example, if the student's dominant repertoire is echoic, multiple echoic prompts may be used sequentially prior to fading out the prompt and delivering the referent to condition the mand response. Once a consistent mand repertoire has been established, the schedule is thinned through the use of generalized reinforcement (i.e., praise) and the introduction of the other verbal stimuli to condition the same response under other sources of control (e.g., other verbal behavior).

In addition to the high-p command sequence, errorless teaching is employed throughout the 9-min teaching session to address student errors and further condition stimulus control. This process is repeated for as many other referents with which the child engages over the 9-min teaching period. Trials from the first referent are interspersed when thinning the

Table 1 Characteristics of the 13 referent-based instruction participants

Participants	Ethnicity	Age at intake (years)	VB-MAPP (pre)	VB-MAPP (post)	Diagnosis
A	Hispanic	2–11	14.5	41.5	Autism spectrum disorder
B	Caucasian	3–10	17	21.5	Autism spectrum disorder
C	Caucasian	3–5	22	46	Autism spectrum disorder; development delay
D	Hispanic	5–2	24.5	56.5	Autism spectrum disorder; development delay
E	Hispanic	4–2	26	65.5	Autism spectrum disorder
F	Hispanic	2–10	32.5	41.5	Autism spectrum disorder; development delay
G	Hispanic	3–4	32.5	81	Autism spectrum disorder
H	Hispanic	3–10	38	60.5	Autism spectrum disorder
I	Hispanic	4–7	55.5	84.5	Autism spectrum disorder
J	Hispanic	4–5	57	88	Autism spectrum disorder
K	Hispanic	4–7	79	122	Autism spectrum disorder; attention deficit hyperactivity disorder
L	Hispanic	5–1	82.5	103.5	Autism spectrum disorder
M	African American	4–11	99	144.5	Autism spectrum disorder; development delay

reinforcement schedule on the second referent, and this process is repeated for each subsequent referent. The total number of referents addressed within the teaching session will depend on the child.

At the end of the teaching period, a 1-min fluency probe is conducted to assess the pure control of the echoic, tact, and sequelic stimuli across all referents. The probe conditions are designed to mirror the teaching conditions to the greatest extent possible. The index cards upon which the verbal stimuli for each referent were written are then shuffled and the 1-min timing begins. The verbal stimuli are read aloud to the student and the student's responses are differentially recorded by placing the index cards to which the student responds correctly in one pile, and the cards to which the student incorrectly

responds in another. The cards in the incorrect pile then become the basis for teaching over the next 9 min. Further conditioning of the response class is prioritized over teaching the incorrect target. Therefore, if the student responded correctly to the echoic and tact stimuli with the word "ball," but failed to respond appropriately to the sequelic prompt for "ball," the behavioral technician need not worry if the student no longer allocates his time with the ball. Rather, the behavioral technician focuses on strengthening the sequelic control of all referents over the next 9 min. This 10-min instructional activity is repeated throughout the duration of each day's intervention, thus providing a 90:10 ratio of natural environment teaching to discrete trial training. The prior session's mand data may be used to preliminarily identify referents for the following day.

Fig. 1 A comparison of pre- and post-test scores on the VB-MAPP after 13 weeks of RBI **Fig. 2** A comparison of relative levels of stimulus control over student M's verbal behavior at the time of intake (*left*) and discharge (*right*) as measured on the VB-MAPP

To illustrate the promise of referent-based instruction, pre/post verbal behavior measures of 13 children with autism were analyzed. Over the course of 13 weeks, RBI was implemented with 13 children with an ASD diagnosis. These children received RBI at a university-based center replete with a variety of toys and play activities, 4 days each week for 90-min each day. Table 1 provides a summary of participant characteristics. Instruction was provided by graduate students in a 2:1 technician to student ratio, and focused on strengthening four primary verbal operants: mands, echoics, tacts, and sequels.

The Verbal Behavior Milestones Assessment and Placement Program (VB-MAPP; Sundberg 2008) was used as a pre- and post-measure of the effectiveness of RBI (see Fig. 1). Scores on the pre-test were collected using direct assessment. Scores on the post-test were collected from both student records and direct assessment. A Wilcoxon signed-ranks test indicated that after one semester of RBI, participants scored significantly higher on the VB-MAPP post-test ($Mdn=65.5$) than when initially assessed on the VB-MAPP pre-test ($Mdn=32.5$), $Z=-3.18$, $p=.001$, $r=.62$.

Figure 2 provides a comparison of the control ratios for participant M's verbal repertoire at the time of intake (left) and discharge (right), as measured on the VB-MAPP. His initial assessment showed inflated echoics and tacts contrasted with diminutive levels of mands and sequels. At the time of discharge, the relative control of participant M's verbal behavior exhibited greater proportionate strength.

Preliminary data suggests that RBI is effective for developing balanced verbal repertoires. Further empirical research demonstrating experimental control is now warranted. Additionally, the extent to which RBI promotes naturalistic language should be examined through social validity assessments and direct measures of time allocation; i.e., the extent to which the child both interacts with and talks about the referent stimulus.

Methods

General Programming

1. Identify relative strength of control. For example:
 - (a) Echoic—Strongest
 - (b) Tact
 - (c) Mand
 - (d) Sequel—Weakest
2. S^D s vary
3. Prior days' mand data determines initial referents for subsequent session
4. Referents are identified according to time allocation

Nine-Minute Teaching

1. Identify referent 1 based on student's current MOs
2. Allow student to play with the referent while you:
 - (a) Write echoic card
 - (b) Write tact card (differ from other tact S^D s)
3. Condition mand using the referent as S^{R+}
 - (a) Using a high-p command sequence, transfer control from echoic
 - (b) Use errorless teaching as needed
4. Pair with generalized reinforcement
5. Thin schedule of reinforcement
6. Condition tact
 - (a) Using a high-p command sequence, transfer control from echoic
 - (b) Use errorless teaching as needed
7. Write sequel card (tact how student interacts with the referent—differ from other sequel S^D s)
8. Condition sequel
 - (a) Using a high-p command sequence, independently transfer control from both echoic and tact
 - (b) Use errorless teaching as needed
9. Repeat with other referents
10. Intersperse trials from referent 1 when thinning schedule on referent 2, intersperse trials from referent 1 and 2 when thinning schedule on referent 3, and on down

One-Minute Probe

1. Probe conditions mirror teaching
2. Shuffle cards
3. Set timer for 1 min
4. Read S^D s to student
5. Correct errors as needed throughout probe
6. Differentiate correct from incorrect responses
7. Record probe data
8. Incorrect response class(es) drive subsequent 9 min of teaching

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