

The Verbal Behavior Approach to ABA

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The Verbal Behavior Approach (Barbera & Rasmussen, 2007; Carbone, 2001; Carbone, 2004; Kates-McElrath, K. & Axelrod, S., 2006; Schramm, 2006; Sundberg & Michael, 2001; Sundberg & Partington, 1998) is a behavior-analytic intervention for children with autism that is gaining increasing visibility. While the applications of ABA were not specifically designed for teaching children with autism, the clinical success of intensive ABA programming for children with autism was a breakthrough discovery, showing that behavior analytic intervention could result in normative function and clinical improvements that had been previously thought impossible (Anderson, Avery, DiPietro, & Edwards, 1987; Lovaas, 1987; Lovaas, 1993; McEachin, Smith, & Lovaas, 1993; Maurice, Green & Luce, 1996).

The Verbal Behavior Approach to Applied Behavior Analysis (ABA/VB) allows all the applied technologies and procedures of ABA but additionally benefits from the emphasis of including and prioritizing application of Skinner's Analysis of Verbal Behavior (Skinner, 1957) and Motivating Operations (Laraway, Snyckerski, Michael, & Poling, 2003; Michael, 1993). This prioritization allows examination of environmental stimulus control and motivation beyond that when language training is confined to the broad categories of "receptive" (in a listener role of using language) and "expressive" (in a speaker role of using language) (Frost & Bondy, 2006), and as such adds a useful refinement and additional necessary research area to the science of autism intervention (Goldstein, 2002; Sundberg & Michael, 2001; Sundberg, 2006).

The Motivating Operation

Despite implications to language development and language education, motivation is an important antecedent variable that was somewhat neglected in ABA for 20 years because of the focus on consequence contingencies. Dr. Jack Michael (1982a, 1993) revived interest in motivation by his elaboration of the Establishing Operation (EO) (McGill, 1999; Michael, 1993). The most recent terminology is the Motivating Operation (MO) (Laraway, Snyckerski, Michael, & Poling, 2003; Sundberg 2004).

The MO and the discriminative stimulus (S^D) are both parts of the antecedent variable in an operant contingency, however they are not functionally equivalent (Michael, 1982a; Sundberg, 2004).

● An S^D is a stimulus whose presence indicates the availability of reinforcement but is independent of the value of the reinforcing stimulus (S^R).

● An MO temporarily alters the effectiveness, or value of a particular item or event as a reinforcer.

Sitting only becomes reinforcing when one desires relief from a fatigue. A chair (S^D) generally signals the possibility of sitting down and relieving fatigue (S^R). However, one would more likely choose the behavior of sitting when also experiencing fa-

tigue (MO). This important inclusion supports the idea that for any behavior to take place interventionists must consider both an S^D and an MO as well as the S^R . Additionally, in the absence of a chair (S^D), the likelihood of engaging in behavior to locate an S^D may be evoked, such as looking for a chair or asking someone where one might be found. This illustrates the evocative effect of an MO in the absence of an S^D . In the continued unavailability of a chair, one might begin to engage in other fatigue-relieving behavior, such as leaning against a wall, fidgeting, buying a cup of coffee, or locating another relevant stimulus to provide reinforcement, such as sitting on the floor.

An MO has two functions (Laraway, et al., 2003; McGill, 1999; Michael, 1993):

1. A value altering function which establishes or abolishes the current value of a reinforcer, and
2. An evocative or abative function that affects the emission of a behavior based on past history of reinforcement or punishment.

Any ABA program that considers only the availability of reinforcement in relation to a behavior of interest might fail in evoking change in the use of that behavior as the current value of the reinforcement may not have been established or in fact may have been abolished in the antecedent condition.

The addition of the MO as an antecedent variable to the three-term operant contingency of Discriminative Stimulus (S^D)—Response (R)—Reinforcing Stimulus (S^R) results in a more realistic four term contingent relationship, which frames the emission and strength of a response based on momentary current value of reinforcement and past reinforcement history.

MO/S^D-R-S^R

MO might also evoke or abate response in the absence of a reinforcer. (McGill, 1999; Laraway, et.al., 2001).

$MO-R \uparrow$ or \downarrow

The Unconditioned Motivating Operations (UMOs)

The nine unlearned or Unconditioned MOs (UMOs) are: food; drink; sleep; activity; sex; organism response to hot or cold; air; and removal of pain (Michael, 1993). These are related to basic

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necessities of survival. Deprivation of any UMO functions as an unconditioned establishing operation (UEO). Satiation or satisfaction of any UMO functions as an unconditioned abolishing operation (UAO) (Laraway, et al., 2003).

The Conditioned Motivating Operations (CMOs)

The Conditioned MOs (CMOs) are of three types (McGill, 1999; Michael, 1993):

- Surrogate MO (CMO-S): Previously neutral events that, through correlation in time with a UMO or an already-established CMO, acquire similar motivative effects. Current research support for the CMO-S is incomplete or inconclusive.

- Reflexive MO (CMO-R): Alters its own function; a previously neutral event whose termination becomes reinforcing (or punishing) through preceding a systematically ‘worsening’ (or ‘improving’) set of conditions when not terminated.

- Transitive MO (CMO-T): Alters the function of another event; previously neutral stimuli whose occurrence alters the reinforcing or punishing effectiveness of another event and evokes responses that produce or suppress the event.

The two CMOs usually discussed in reference to ABA/VB programming are the CMO-R and the CMO-T.

The CMO-R has relevance in a learning environment when a history of punishing contingencies, reliance on negative reinforcement, or relative removal of positive reinforcement in instruction conditions the teacher and instructional setting as warning stimuli for worsening conditions for the learner (Carbone, Morgenstern, Zecchin-Tirri, & Kolberg, 2007; Sundberg, 1993b). A CMO-R can also be introduced into a learning contingency with the goal of reducing off task behavior or inappropriate behavior through the use of Mini-Consequences that act as a worsening set of conditions (Schramm, 2006).

The CMO-T is an essential aspect of verbal behavior instruction because the environment can be arranged so that many neutral stimuli can be conditioned to function as reinforcement.

For example, a spoon may not have any intrinsic reinforcing value, but if having a spoon becomes a pre-requisite to eating ice cream, the MO for ice cream will transfer to an MO for a spoon, causing the spoon to function as a reinforcer and evoking the mand response of asking for a spoon. Additionally, the ice cream scoop, the bowl for the ice cream, and other chains to the final result of the eating of ice cream can be conditioned as reinforcers that are useful for teaching (e.g., Hall & Sundberg, 1987; Rosales & Rehfeldt, 2007; Sundberg, 1993b; Sundberg, Loeb, Hale, & Eigenheer, 2002). Contriving instruction via the CMO-T opens a wide possibility of teaching targets tied to motivation that would not be possible by reliance on the simple deprivation or other conditions via UMOs (Michael, 1988; Sundberg, 1993b).

B.F. Skinner’s Verbal Behavior and the Ele-

mentary Verbal Operants

In his theoretical volume, *Verbal Behavior* (1957) B.F. Skinner described language in terms of verbal operants, that is, the relationships between antecedent motivation and controlling stimuli, verbal response (which extends beyond the vocal to signing, writing, gesture, typing), and consequence. There is also a speaker-listener relationship, and assumption of language development shaped by a “verbal community.” By looking at language functionally across all of the verbal operants, one is in a position to better explain verbal choices and by extension, improve or amend the choices of those with deficits. The book *Verbal Behavior* is a fundamental and valuable text. For additional information the reader is directed to the articles by Michael (1982b, 1984), Frost & Bondy (2006), and Sundberg (2007). Pages from *Verbal Behavior* are noted for the reader’s convenience.

The Elementary Verbal Operants

Mand (pp. 35-51): from “command,” “demand,” “countermand” Antecedent controlling variable is the MO, the response specifies its own reinforcer/direct reinforcement via another person. Mands are unique in benefiting the speaker, rather than the listener.

Example 1:

Antecedent: Learner knows there is cake in the kitchen and wants to eat some.

Learner behavior: “I want cake.”

Reinforcing Stimulus: Adult gives learner a piece of cake.

Example 2:

Antecedent: CMO-R (Reflexive Conditioned Motivating Operation) Learner is playing with toys, adult presence represents a “warning stimulus” that it is time to put the toys away.

Learner behavior: “Five more minutes?”

S^R: (If) adult leaves for five minutes.

Example 3:

Antecedent: CMO-T (Transitive Conditioned Motivating Operation) for going outside,

Learner behavior: “Where are my shoes?”

S^R: Listener/audience supplies information.

Example 4, multiply controlled (Intraverbal/tact/mand):

Antecedent: Teacher asks, “Which do you want?”, in the presence of a tray of cookies.

Learner behavior: “This one” (pointing to the cookie).

S^R: Teacher gives learner the chosen cookie.

Tact (pp.81-146): from contact with the physical environment.

The response is antecedently controlled by a non-verbal stimulus or condition in the environment, such as an object, action, re-

lation, or property; termed by Skinner as “the whole of the physical environment.” The reinforcer is usually generalized via another person.

Examples 1:

Antecedent: Learner smells smoke.
Learner behavior: Says, “smoke” to teacher.
S^R: Teacher says, “Thanks for telling me.”

Example 2:

Antecedent: Learner sees a tree.
Learner behavior: makes sign language gesture for “tree” in the presence of the teacher.
S^R: Teacher says, “I see it.”

Example 3

Antecedent: Learner sees a cat.
Learner behavior: writes or types, “Cat.”
S^R: May be from prior learning history or immediate if teacher praises writing.

Intraverbal (pp. 71-78)—The response is antecedently controlled by a verbal stimulus, where the response form does not have point-to-point correspondence. The response form can be sign, speech or writing. The reinforcer is generalized via another person.

Example 1:

Antecedent: Teacher says, “two plus two equals.”
Learner behavior: Says, “four.”
S^R: Teacher says, “Correct.”

Example 2:

Antecedent: Teacher sings, “The Wheels on the bus go” (pause).
Learner: Sings, “Round and round.”
S^R: Continues singing the child’s favorite song.

Example 3.

Antecedent: Teacher says, “dog.”
Learner behavior: makes sign language gesture, “dog.”
(This is not a dupic (see below) because the response form does not have point-to-point correspondence to the verbal stimulus; American Sign Language (ASL) for “dog” is a snap and knee slap, which has no formal similarity to the vocal utterance “dog.”)

Michael (1985) also summarized two additional categories that are suggested in Verbal Behavior, Reinforcement in these categories is usually generalized via another person.

Codic

A. Textual (pp.65-69):

Antecedent: Written text or equivalent (such as Braille) is the stimulus
Learner behavior: Speaking or other verbal behavior, e.g., reading aloud.

B. Transcription (pp. 69-70): The verbal behavior of the speaker is the stimulus and the response is writing, typing, finger spelling, or otherwise recording.

Example 1:

Antecedent: Teacher says, “The cat is fat.”
Learner behavior: Writes or types, “The cat is fat.”

Example 2:

Antecedent: Teacher says, “dog.”
Learner behavior: Fingerspells, “d-o-g.”

Duplic—Implies duplication.

A. Echoic (pp. 55-65) The stimulus and response is spoken, and has point-to-point correspondence. Reinforcer is usually generalized via another person (automatic reinforcement to achieve parity hypothesized for language development in infants).

Example:

Antecedent: Teacher says, “House.”
Learner behavior: Learner says, “House.”

B. Mimetic (p.71) Similar to the echoic, the stimulus and response is signed or gestural

Example:

Antecedent: Teacher signs “red.”
Learner behavior: Learner signs “red.”

C. Copying a text (p.70)

Example:

Antecedent: Learner sees the printed telephone number, “56 21 73”.

Learner behavior: Learner writes “56 21 73”.

As it is seen, the mand, tact, intraverbal and echoic are controlled by different antecedents: Mand by the Motivating Operation (MO), tact by a non-verbal stimulus, intraverbal by a verbal stimulus without point-to-point correspondence or formal similarity, and the echoic by a verbal stimulus with point-to-point correspondence and formal similarity and as such are independently controlled. The independence of the verbal operants has been corroborated in research that has also studied methods of teaching each, facilitation of transfer across the operants, and generalization (e.g., Barbera & Kubina, 2005; Braam & Poling, 1983; Braam & Sundberg, 1991; Hall & Sundberg, 1987;

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Lamarre & Holland, 1985; Kelley, Shillingsburg, Castro, Addison, & LaRue, 2007; Luciano, 1986; Miguel, Petursdottir & Carr, 2005; Partington & Bailey, 1993; Partington, Sundberg, Newhouse, & Spengler, 1994; Sigafos, Reichele, & Doss, 1990; Twyman, 1995).

The mand in particular is dependent on presence of an MO and direct reinforcement through another person, and the other operants by generalized reinforcement through another person. The independence of these antecedents highlight that limiting mand instruction to a “requesting” or an “I want” program may not take advantage of all sources of motivational control or to risk teaching a verbal response that has the form of a mand but is under incorrect or multiple control (Michael, 1988).

Common Tactics and Procedures in Programs Using the Verbal Behavior Approach

While ABA/VB has already been described as an individualized application of tactics from the science of ABA and not a strict package of procedures, listed below are some instructional tactics that represent common starting practice in ABA/VB programs. It is worthwhile to restate that best behavior-analytic instructional practice requires that data-driven decision-making inform the use of these procedures and that they be subject to modification to optimize learning trajectories for an individual learner.

These tactics include but are not limited to:

Use of assessment instruments and curriculum guides to develop language goals based on Verbal Behavior

Stimulus-stimulus pairing to condition the learning environment as reinforcing;

Establishing Instructional Control

Fading (In) task demand

Early emphasis on mand training

Including Natural Environment Teaching in programming

Emphasis of augmentative strategies based on topography rather than selection; use of sign language as a bridge to spoken language

Stimulus-stimulus pairing to develop echoic repertoire

Use of transfer trials across operants as well as within operants

Errorless learning rather than trial and error instruction

Use of error correction

Teaching loosely

Use of task interspersal and stimulus variation, commonly known as “mix and vary”

Maintaining a high ratio of easy to difficult tasks

Considering the pace of task presentation

Use of intermittent first trial probe rather than continuous trial-by-trial data taking

Use of variable ratio reinforcement schedules to maintain high rates of responding

Considering fluent (accurate and quick) responding rather

than accuracy alone

More advanced topics, complex operants, multiple control, and joint control

Use of Assessment Instruments and Curriculum Guides to Develop Language Goals Based on the Analysis of Verbal Behavior

The development of individualized language programming for children with autism, including those utilizing the analysis of Verbal Behavior, necessitates assessment instruments to determine baseline performance, develop curricular goals and track skill mastery. Dr. Joseph E. Spradlin was the first to apply a Verbal Behavior framework to language assessment and instruction of the developmentally disabled in Parsons Language Sample (Spradlin, 1963). Another early Verbal Behavior assessment and program was used at the Kalamazoo Valley Multihandicap Center (KVMC) (Sundberg, 1978; Sundberg, Ray, Braam, Stafford, Reuber, & Braam, 1979).

Below are descriptions of current formalized instruments that explicitly consider targeted language goals based on the verbal operants.

The Behavioral Language Assessment

The Behavioral Language Assessment, chapter 2 of the volume Teaching Language to Children with Autism or Other Developmental Disabilities (Sundberg & Partington, 1998), contains 12 sections assessing a variety of basic language-related skills (e.g., cooperation, requests/mands, motor imitation, echoics, matching-to-sample, receptive, tacting, receptive by function, feature, class; conversation/intraverbal, letters and numbers, and social interaction). Each section is divided into five levels. The design reflects the average performance of a typical two- to three-year-old.

Chapter 3 is the interpretation of the assessment, including recommendations to further assessment via the Assessment of Basic Language and Learning Skills (ABLBS) (Partington & Sundberg, 1998).

The Assessment of Basic Language and Learning Skills (ABLBS)

The ABLBS, (Partington & Sundberg, 1998) is an assessment and curriculum development instrument that reflects developmental measures and that explicitly structures and identifies skill targets by their verbal operant categories. The ABLBS lists 25 skill tracks, organized as Basic Learner Skills Assessment, which include the elementary verbal operants, receptive skills, more advanced syntax and grammar skills, visual performance, imitation, assessing reinforcer effectiveness and learner cooperation, spontaneity of vocalization, generalization, social and classroom skills, an Academic Skills Assessment, a Self-Help Skills Assessment and a Motor Skills Assessment. Completion of the ABLBS

represents those skills that are prerequisite to kindergarten entry, with the exception of the academic skills that extend to approximately second grade level.

The ABLLS-R and IEP development guide (Partington, 2006) is a recent revision of the original ABLLS to reflect additional research with subsequent adjustment of target hierarchies, field testing information and added emphasis on fluency of response as a criterion on some skills.

The Verbal Behavior Milestones Assessment and Placement Program: The VB-MAPP

The VB-MAPP (Sundberg, 2008), based on B.F. Skinner's analysis of verbal behavior, consists of five components:

The Skills Assessment of verbal operants and developmental levels (mand, tact, echoic, intraverbal, listener, motor imitation, independent play, social and social play, visual perceptual and matching-to-sample, linguistic structure, group and classroom skills, and early academics; 0-18, 18-30, and 30-48 months);

Barriers Assessment of language and learning barriers (instructional control, behavior problems, defective mands, defective tacts, defective imitation, defective echoic, defective matching-to-sample, defective listener skills, defective intraverbal, prompt dependency, defective generalization, scrolling, defective scanning, defective conditional discriminations, weak motivators, response requirement weakens the motivators, self-stimulation, defective articulation, obsessive compulsive behavior, reinforcer dependency, defective attending, and defective social skills);

VB-MAPP Task Analysis and Skills Tracking, a fine comb curriculum guide of 1000 skills, a Transition Assessment to assess readiness to enter a less-restrictive educational environment; and

VB-MAPP Placement Guide and IEP Goals, provides specific direction for each of the 170 milestones in the Skills Assessment as well as specific suggestions for IEP goals.

The VB-MAPP program is projected for release mid-year 2008.

Stimulus-Stimulus Pairing to Condition the Learning Environment as Reinforcing; Establishing Instructional Control

One of the first goals in ABA/VB is to establish learner cooperation and participation through gaining instructional control, that is "the likelihood that (teacher) instructions will evoke a correct response from (the learner)." When instructional control is not established, the learner may exhibit behavior that is characterized as "noncompliant" or "non-responsive" (Sundberg & Partington, 2001). Two steps to establishing instructional control are by stimulus-stimulus pairing to condition the neutral stimuli associated with instruction (materials, setting, teacher) as reinforcers through association with already existing reinforcers or other reinforcing consequences, rather than warning stimuli for worsening conditions (Carbone, et al, 2007), and to maintain a schedule of positive reinforcement balanced with fading-in of instruction

with the learner to continue the association with delivery of reinforcement, rather than its removal. (Longano & Greer, 2006; Sundberg & Partington, 2001). Simply, an instructor must first be conditioned as a source of reinforcement to the learner and instructional demands must be introduced gradually so that the transition from non-contingent reinforcement to working for contingent reinforcement is indiscriminable to the learner.

Coercing a learner to participate in instruction by relying on physical restraint and working through escape behavior depends on escape extinction and negative reinforcement (contingent removal of an aversive stimuli that is associated with future increase of a response). While the use of extinction procedures are relevant and may be necessary within some behavioral reduction programs, ABA/VB attempts to minimize the need for such use during regular instruction by using instructional practices that keep the learner successful, in frequent contact with positive reinforcement, and that continue to condition the learning environment as a source of reinforcement (Schramm, 2006).

Fading (In) Task Demand

Teaching which systematically increases demand and balances task demand against availability of reinforcement so that introduction of demand is graduated from non-contingent reinforcement conditions to allow the learner to become accustomed to accepting instruction without engaging in maladaptive behavior (Richman, Wacker, & Winborn, 2001; Weld & Evans, 1990).

Early Emphasis on Mand Training

It is also relevant to note that ABA/VB places early emphasis on mand instruction (Partington & Sundberg 1998; Carbone, 2001; Partington, 2006), to condition learner verbal behavior as a reinforcing activity because the mand benefits the speaker and specifies its own reinforcer, to capitalize on natural MO, to teach replacement behavior for maladaptive mands such as tantrums (Carr & Durand, 1985; Horner & Day, 1991), and as a cusp skill with extensions beyond the immediate setting (Bosch & Fuqua, 2001).

Including Natural Environment Teaching (NET) in Programming

Natural Environment Teaching (NET) is a variation of the incidental teaching models (Warren & Kaiser, 1986; Cautilli, 2006); in particular NET resembles the Natural Language Paradigm (NLP) (Koegel, O'Dell & Koegel, 1988) and refers to a framework for verbal language instruction, rather than a setting (although instruction in relevant natural settings is certainly encouraged). NET instructional targets and stimuli are functionally relevant to the interaction, occurring within incidental occurrences and explicitly capitalize on momentary learner interest and motivation. Because of the emphasis on MO, NET represents

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an especially effective strategy for mand training. One critical review of controlled studies comparing naturalistic language teaching models with that of discrete-trial teaching found that naturalized teaching was more effective than discrete-trial teaching and resulted in more positive parent affect (Delprato, 2001).

Emphasis of Augmentative Language Strategies Based on Topography Rather than Selection: Use of Sign Language as a Bridge to Spoken Language

Development of speech and functional communication correlates with learner outcome (Garfin & Lord, 1986; Gillberg, 1991; McEachin, Smith, & Lovaas, 1993), and the development of fluent conversational speech by age five continues to be a prognosticator of good outcomes by adolescence (Venter, Lord & Schopler, 1993), so development of functional communication is a priority skill area. For typical children, communication is primarily vocal, but for many children with autism or other developmental disabilities, speech is a core deficit in diagnosis (American Psychiatric Association, 2000; Siegel, Pliner, Eschler & Elliott, 1988); some may lack an initial echoic repertoire amenable for vocal communication instruction, and others may still have significant difficulties even after prior speech and language programming.

While different Augmentative Alternative Communication (AAC) systems exist for these learners, including such as Picture Exchange Communication System (PECS) (Bondy & Frost, 1994) or electronic voice output communication aids (VOCA), (Mirenda, 2002) many who use ABA/VB prefer to use sign language as a parsimonious starting point in AAC.

Use of sign language does not interfere with speech development, and evidence exists that when modeled in instruction as speech-plus-sign, it can in fact assist in speech development (Barrera, Lobato-Barrera & Sulzer-Azaroff, 1980; Barerra & Sulzer-Azaroff, 1983; Yoder & Layton, 1988). Sign language and speech resemble one another because both are topographic-based systems. Sign has some advantages of portability, immediacy, use as a controlling prompt by the instructor, and the ability to be used as a self-prompting strategy for evoking speech (Sundberg, 1993a).

Errorless Learning Rather Than Trial-and-Error Instruction

Trial-and-error instruction has been shown to be a less efficient method of instruction for severe learners and more prone to development of collateral behaviors or intermittent recurrence of previously emitted errors than teaching that is designed to antecedently prevent errors or incorrect responses (Green, 2001; Heckaman, Alber, Hooper, & Heward, W., 1998; Heflin, 2001; Schilmoeller, Schilmoeller, & Etzel, 1979; Singer & Gaines, 1975).

Typically, prompts (additional stimuli or artificial cues that provide assistance to the learner in evoking or performing the correct or desired response) are antecedently presented so that an

individual engages in a behavior that is being targeted before the learner has an opportunity to make the error, and then systematically removed (faded) so that the correct responding continues with few or no errors. Errorless learning strategies includes many prompting strategies such as physical prompts, modification of stimuli, modelling, verbal prompts, constant and progressive time delays, etc. (Cooper, Heron & Heward, 2007; Wolery, Bailey & Sugai, 1988). The primary consideration is that the prompt supplied effectively control a correct response and is quickly faded to prevent development of prompt dependency.

Use of Error Correction

Although the use of errorless learning attempts to minimize errors, incorrect responding will undoubtedly occur. In ordinary practice, error correction is implemented whenever errors occur. One such procedure is to interrupt the error in progress by immediately intercepting the error without feedback, redelivering the relevant S^D to avoid a chaining of error to correct response, and concurrent with the S^D delivering a controlling prompt for the correct response. The S^D is then again delivered to gauge transfer, and distributed practice and retention probe is made (Kibbe & Richards, 2003).

Rodgers and Iwata (1991) noted that error correction procedures might have mildly aversive properties that lead to avoidance of incorrect responses and exercise stimulus control to connection between the discriminative stimulus and response. (Smith, Mruzek, Wheat & Hughes 2006), noted that error correction might need to be individualized to be most effective.

Use of Transfer Trials Within Operants and Across Operants

While use of transfer within an operant from a prompted response to that of an unprompted independent response is a routine tactic in ABA instruction, transfer can also be accomplished across operants, for example, from a tact response to an intraverbal response, using the tact stimulus as a controlling prompt. Transfers are also common from mimetic responses to listener (receptive) and/or intraverbal responses.

Teacher: "What animal has whiskers?"

Learner: says, "Cat" (mastered as a tact).

Teacher: flips picture over so the cat is hidden, but leaving it in the same place in the field (prompt)

Teacher: "Name an animal that has whiskers"

Learner: uses momentum from previous response and partial prompt of upside down picture to say, "Cat"

Teacher: removes picture from the table (unprompted trial)

Teacher: "Tell me an animal that has whiskers"

Learner: says, "Cat" (transfer trial)

Teacher: reinforces correct response

Teacher: Tests the skill for retention further removing immediacy prompts by inserting distracter trials of mastered skills.

Teacher: (not displaying a picture of a cat) “Tell me an animal with whiskers.”

Learner: says, “Cat”. A correct response indicates that transfer and retention has occurred.

Teacher: reinforces the response if correct. If the learner has a delayed response or begins to respond incorrectly, the Teacher can briefly display the picture to prompt the correct response, and again attempt transfer and retention test.

Teaching loosely to facilitate generalization

One of the determinants of functionality and generalization is the ability to perform a taught skill under functional circumstances of relevant stimuli not restricted to those of the instructional conditions or environment (Stokes & Baer, 1977; White, Liberty, Haring, Billingsley, Boer, Burrage, et al., 1988). One such generalization tactic is Teaching Loosely, to systematically vary non-critical features of instructional materials as part of a conceptual set, so that the learner does not become dependent on specific conditions to respond or develop over-selection on a non-critical feature of stimuli (example, the color of a cup, rather than the form). For example, if the critical feature of instruction is “nose”, the interventionist would teach the learner to respond to different instructions/ SDs to select “nose”, such as “touch”, “point to”, “find”; would also have the learner find a variety of noses, such as on other people or animals, and use varying stimuli such as objects, photos with and without background, and drawings. Other strategies of loose teaching are to teach across environments, people, and times of day. Compared to serial introduction of SDs, loose teaching results in more efficient and reliable generalization (Stokes & Baer, 1977; Charlop-Christy & Carpenter, 2000).

Use of task interspersal and stimulus variation, commonly known as “mix and vary”

There is a body of literature that indicates that practices that maintain a high rate of learner responding with a decreased rate of escape and other aberrant behaviors are that of task interspersal and stimulus variation (Dunlap, 1984; Dunlap & Koegel, 1980). When taken together, this is commonly known as mixing and varying tasks. Mixing and varying includes the mixing of different skills in the same instructional sitting rather than presenting massed trials of the same skill or stimuli, and utilizing a high proportion of easy or previously mastered skills to those in active acquisition. The other clinical advantage of this task interspersal is increasing attention to task and teaching the ability to respond to shifting S^Ds, which is more representative of responding in the natural environment than multiple responding to a single discriminative stimulus.

Maintaining a high ratio of easy to difficult tasks

By maintaining a high proportion of easy or mastered skills in presentation, overall learner demand is relatively low and reinforcement remains relatively high. Research has shown that maladaptive behavior is correlated with high demand in instruction and that increasing the proportion of easy/mastered skills has a positive effect on reducing this behavior (Horner & Day, 1991; Horner, Day, Sprague, O’Brien, & Heathfield, 1991; Weeks & Gaylord-Ross, 1981; Winterling, Dunlap & O’Neill, 1987). Practically, by maintaining mastered items in rotation with new targets, previously mastered targets are given additional opportunity to be practiced and maintained while also positively affecting the value of the teaching environment.

Considering the pace of task presentation

Some research has shown that instructional pacing which is brisk and decreases the inter-trial interval (interval between reinforcement and the next S^D) results in higher quality responding and reduction of off-task or maladaptive behavior. Reduction of inter-trial intervals also allows an increased ratio of instruction to “wait time” in a given teaching session (Carnine, 1976; Dunlap, Dyer & Koegel, 1983; Tincani, Ernsbarger, Harrison & Heward, 2005). This allows the possibility of more learning trials per session and less off-task behavior.

Use of intermittent first trial probe rather than continuous trial-by-trial data taking

Data driven decision-making is a necessity of any behavior analytic program to determine effectiveness and efficiency of the intervention or teaching strategy and whether procedural modification is called for (Cooper, et al., 2007; Wolery, et al., 1988). A common clinical practice in ABA/VB programs is measurement by intermittent probe data, commonly referred to as first cold probe data, rather than continuous trial-by-trial measurements. The procedure is to probe an unprompted teaching trial of an instructional target at the beginning of the day or session to measure transfer of instruction and independent response. In the event of an unprompted correct response, the response is noted as correct and data taking on that target is complete until the next day or probe session, with a series of consecutive correct first-trial probes, for example over 3 days, commonly used to indicate that transfer and retention has occurred with the teaching target now designated as mastered (Carbone, 2001).

Conversely in an instance of an error on the first-trial probe, an incorrect response is noted and error correction procedures and distributed practice is instituted. If skill transfer is not occurring in a timely manner, use of continuous trial-by-trial data-taking may then be implemented to have a finer-comb analysis of instruction (Carbone, 2001).

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Use of Variable Ratio Reinforcement Schedules to Maintain High Rates of Responding

In acquisition the goal is to quickly establish stimulus control over a response so a continuous reinforcement schedule (CRF) is appropriate to establish the contingent relation between response and reinforcement. However, once a skill target or response is under stimulus control, i.e., mastered, it is necessary to systematically thin the reinforcement schedule. Thinning of a reinforcement schedule means that responses previously reinforced “every time” are systematically shifted to “sometimes reinforced,” then “occasionally reinforced” or “seldom reinforced.” The final schedule would preferably reflect that normally available in the natural environment so that a high rate of accurate responding that is resistant to extinction is maintained in the thin schedules generally available in the natural environment.

There is evidence that a variable ratio reinforcement schedule (VR schedule), rather than one that is fixed in number or interval, results in higher rates of consistent responding which is resistant to extinction when systematically thinned (Skinner & Ferster, 1957/1997). For example, a VR-5 schedule indicates that reinforcement occurs on an average of correct responses (sometimes one, sometimes seven, sometimes four, etc. to an average of five) vs. every fifth trial on a fixed ratio reinforcement schedule, such as a FR-5. Simply, a VR schedule keeps the learner from knowing when reinforcement will occur and therefore responding quickly and accurately. A VR schedule is also less liable to some of the issues on fixed schedules, such as reduced responding or lower-quality responding after reinforcement.

Considering Fluent (Accurate and Quick) Responding Rather Than Accuracy Alone

Research from the field of Precision Teaching has presented some evidence that emphasis on fluency, defined as quick and accurate responding (Binder, 1996), results in competent performance that has greater retention, endurance and application than practice of accurate but slow responding (Kubina, Morrison & Lee, 2002; Kubina & Wolfe, 2005).

More Advanced Topics, Complex Operants, Multiple Control, and Self-Editing

While a thorough discussion is beyond the scope of this chapter, it is relevant to mention that there are additional topics discussed in Verbal Behavior (Skinner, 1957) and other references. Below are listed a few of these as introduction, and pages from Verbal Behavior. See also, Sundberg, 2004c, and Frost & Bondy, 2006.

- Extended mands (pp. 46-47),
- Superstitious mands (pp. 47-48),
- Magical mands (pp. 48-49),
- Generic tact extension (pp. 91-92),
- Metaphorical tact extension (pp. 92-99),

- Metonymical tact extension (pp.99-102),
- Nomination (pp. 104-105),
- The Autoclitic (pp. 311-330; 331-343), see also Sundberg, (2004b),
- Multiple Control (pp. 227-252), see also Frost & Bondy (2006),
- Self-editing (pp. 369-383), see also Sundberg, (2006).

In conclusion

The Verbal Behavior Approach is an application of ABA that is consistent with the tactics derived from that science but emphasizes the analysis of language function, relevant antecedents, including motivation, and, therefore, helps to identify language barriers, instructional tactics, and environmental contingencies. The goal of the chapter is to highlight independence of the verbal operants, the role of the MO in instruction, and suggested instructional practice to work to the advantage of learner motivation and language training for individuals with autism spectrum disorders. For practical application of ABA/VB, the reader is especially encouraged to review the references and to work with a qualified behavior analyst with the competencies listed in Consumer Guidelines for Identifying, Selecting, and Evaluating Behavior Analysts Working With Individuals with Autism Spectrum Disorders (Autism Special Interest Group (SIG) of the Association for Behavior Analysis International, 2007).

For Further Reading

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