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A General Outline of the Verbal Behavior Developmental Theory

Um Esboço Geral da Teoria do Desenvolvimento do Comportamento Verbal
Un Esquema General de la Teoría del Desarrollo de la Conducta Verbal

Djenane Brasil da Conceição[1], Robert Douglas Greer[2], Jennifer Lee Moschella[3]

1 Universidade Federal do Recôncavo da Bahia, 2 Columbia University, 3 Gotham Children

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Correspondência

Djenane Brasil da Conceição
djenanebc@ufrb.edu.br

Centro de Ciências da Saúde, Universidade Federal do Recôncavo da Bahia, Avenida Carlos Amaral (R. do Cajueiro), 1015 (Antigo Campo do Governo), Santo Antônio de Jesus, BA, 44574-490

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Abstract

B. F. Skinner's Verbal Behavior is the foundation for understanding language and communication within Behavior Analysis. The Verbal Behavior Developmental Theory (VBDT) is a growing body of empirical research that builds upon and expands this foundation, incorporating the Naming Theory and the Relational Frame Theory (RFT). VBDT identifies and organizes language development milestones into a trajectory of behavioral cusps and cusps that are new learning capabilities to create a comprehensive understanding of how individuals learn language. Specific instructional histories lead to the acquisition of new conditioned reinforcers, thus new cusps and capabilities emerge. Not only does VBDT identify and describe such milestones, but it also includes specific research-based protocols for inducing cusps and capabilities which could solve learning problems. This paper describes each cusp and capability as they have been identified in the research thus far and summarizes the basic principles and concepts from which they were derived.

Keywords: Verbal Behavior Developmental Theory, Bidirectional Naming, BiN, conditioned reinforcers, behavioral cusps and capabilities.

Resumo

O Comportamento Verbal, de B. F. Skinner, é a base para a compreensão da linguagem e da comunicação na Análise do Comportamento. A Teoria do Desenvolvimento do Comportamento Verbal (VBDT) consiste em um corpo crescente de pesquisas empíricas que se fundamenta nesta base e a expande, incorporando a Teoria da Nomeação e a Teoria das Molduras Relacionais (RFT). A VBDT identifica e organiza marcos do desenvolvimento da linguagem em uma trajetória de cúspides comportamentais e cúspides que são novas capacidades de aprendizagem, criando uma compreensão abrangente sobre como os indivíduos aprendem a linguagem. Histórias específicas de ensino levam à aquisição de novos reforçadores condicionados, e assim surgem novas cúspides e capacidades. A VBDT não apenas identifica e descreve esses marcos, como também inclui protocolos específicos, baseados em pesquisa, para induzir cúspides e capacidades de aprendizagem capazes de resolver problemas de aprendizagem. Este artigo descreve cada cúspide e capacidade conforme foram identificadas na pesquisa até agora e resume os princípios e conceitos básicos dos quais foram derivadas.

Palavras-chave: Teoria do Desenvolvimento do Comportamento Verbal, Nomeação Bidirecional, BiN, reforçadores condicionados, cúspides e capacidades comportamentais.

Resumen

El Comportamiento Verbal de B. F. Skinner es la base para comprender el lenguaje y la comunicación en el Análisis de la Conducta. La Teoría del Desarrollo del Comportamiento Verbal (VBDT) es un creciente cuerpo de investigación empírica que se sustenta y expande sobre esta base, incorporando la Teoría del Naming y la Teoría de los Marcos Relacionales (RFT). VBDT identifica y organiza los hitos de desarrollo del lenguaje en una trayectoria de cúspides comportamentales y cúspides como nuevas capacidades de aprendizaje, creando una comprensión integral sobre cómo las personas aprenden el lenguaje. Determinadas historias de enseñanza conducen a la adquisición de nuevos reforzadores condicionados y, por lo tanto, surgen nuevas cúspides y capacidades. VBDT no solo identifica y describe estos hitos, sino que también incluye protocolos específicos, basados en la investigación, para inducir cúspides y capacidades de aprendizaje capaces de resolver problemas de aprendizaje. Este artículo describe cada cúspide y capacidad tal y como han sido identificadas hasta ahora en la investigación y resume los principios y conceptos básicos que los han derivado.

Palabras clave: Teoría del Desarrollo del Comportamiento Verbal, Naming Bidireccional, BiN, reforzadores condicionados, cúspides y capacidades conductuales.

A General Outline of the Verbal Behavior Developmental Theory

Djenane Brasil da Conceição[1], Robert Douglas Greer[2], Jennifer Lee Moschella[3]

1 Universidade Federal do Recôncavo da Bahia
2 Columbia University
3 Gotham Children

B. F. Skinner's Verbal Behavior is the foundation for understanding language and communication within Behavior Analysis. The Verbal Behavior Developmental Theory (VBDT) is a growing body of empirical research that builds upon and expands this foundation, incorporating the Naming Theory and the Relational Frame Theory (RFT). VBDT identifies and organizes language development milestones into a trajectory of behavioral cusps and cusps that are new learning capabilities to create a comprehensive understanding of how individuals learn language. Specific instructional histories lead to the acquisition of new conditioned reinforcers, thus new cusps and capabilities emerge. Not only does VBDT identify and describe such milestones, but it also includes specific research-based protocols for inducing cusps and capabilities which could solve learning problems. This paper describes each cusp and capability as they have been identified in the research thus far and summarizes the basic principles and concepts from which they were derived.

Keywords: Verbal Behavior Developmental Theory, Bidirectional Naming, BiN, conditioned reinforcers, behavioral cusps and capabilities.

In 1957, B. F. Skinner published what he considered his most important book: Verbal Behavior (Greer, 2008; Greer & Ross, 2008, 2013; Skinner, 1957/1992). Using both linguistic sources (Passos, 2004, 2007; Passos & Matos, 2006, 2007) and laboratory data obtained with non-human animals, he presented a behavioral analytical account of one of the most human challenging and complex behaviors – Language and Communication.

In this work, Skinner (1957/1992) defined verbal behavior as operant behavior reinforced through the mediation of a listener who had acquired specific practices of a verbal community. These practices are often called "language" and are not restricted to spoken language, although his analysis more frequently refers to it as a prototype. For example, sign-language and Morse code are other cultural practices that parallel vocal language (Greer, 2008). Skinner first (1957/1992) highlighted that while verbal behavior has no effect on the physical environment, its effects on the social environment (listeners) are great. Later in the book, he highlighted the special listener training in cultural practices that allow one to reinforce a speaker's behaviors in a community of listeners and, in the second part of the book, he discussed the multiple stimulus control, the context in which the listener, or editor, plays a significant role.

In conceptualizing language as verbal behavior, Skinner (1957/1992) developed an analysis that defined how the social environment selects out verbal behavior. This idea continues to have wide-reaching effects in basic, theoretical, and applied issues, for example, how language could be taught to children[1] with language delays. According to Greer (2008), "Given the

[1] The terms children, child and, sometimes, student will be used for simplification. One can confidently substitute it for people, person or others with the same meaning/ context.

mounting evidence, it is possible that no other language theory has, to date, achieved the applied impact made by Skinner's treatment of language function as behavior selected out by social contingencies" (p. 366). Further theoretical and empirical, basic, and applied research expanded this concept, with the discovery of the initial independence of verbal operants, listener and speaker responses, as well as other types of observing and producing responses (Greer, Stolfi, et al., 2005; Lamarre & Holland, 1985; Twyman, 1996). These concepts produced extensions of Skinner's theory, such as: (a) Naming Theory (Horne & Lowe, 1996), (b) Relational Frame Theory (RFT) (Hayes et al, 2001) built on Sidman's findings (1971), and (c) the Verbal Behavior Development Theory (VBDT) (Greer, 2008; Greer & Keohane, 2006; Greer et al., 2017; Greer & Ross, 2008; Greer & Speckman, 2009).

Verbal Behavior Development Theory came about as the result of an empirical program of studies conducted with typically and atypically developing children, mainly within CABAS®[2] schools and classrooms, over the last forty years (Keohane et al., 2009; Greer et al., 2017; Greer & Speckman, 2009; Greer & Ross, 2008). This theory offers an account of how verbal behavior evolves within the individual's lifespan (ontogenesis) in ways that lead to the joining of the listener and speaker functions and, once the cusps/capabilities are demonstrated, seeks to determine how children can best be taught. VBDT organizes the normal development of language into a trajectory of cusps and cusps that are also capabilities. If an individual's development deviates from that path, VBDT allows a teacher or therapist to intervene in ways that language develops. A cusp or capability that is missing is induced through these procedures and makes possible what was not possible before. Children then have opportunities for socially productive interactions that were missed altogether before intervention.

This paper can improve our research and practice with atypically developing children, especially those with language delays. It provides a tool for analyzing and implementing important behavioral changes in therapeutic and school settings. As an example, practice in CABAS® accredited schools and classrooms led to the creation and implementation of a curriculum and assessment called the Early Learner Curriculum and Achievement Record (ELCAR®). The ELCAR® combines the trajectory of VBDT cusps and capabilities with curricular objectives. However, it is not enough to identify and induce cusps and capabilities that are missing through VBDT. The instructor must also change the way the child is taught after each cusp or capability is induced. This has been done with thousands of both neurotypical and language-delayed students in CABAS® schools. Therefore, this paper covers the identification and implementation of cusps

[2] CABAS® refers to the Comprehensive Application of Behavior Analysis to Schooling (Greer, 1998), which is a model of instruction, classroom management, and teacher training. CABAS® schools are behavior-analytic in every component of their functioning, from student instruction to organizational management. www.cabasschools.org

and capabilities, but also how to revise teaching strategies once new cusps and capabilities are obtained.

This paper is an effort to guide practitioners to the most updated research in VBDT, in order to increase teaching efficiency and expand research possibilities. This knowledge has potential to change people's lives by establishing and enhancing pre-verbal and verbal repertoires which justifies its application and research. In recent years, Brazil's behavior analytic community has grown it's interest in some aspects of verbal behavior development, such as the integration of listener and speaker functions - particularly in Bidirectional Naming (Germano & Medeiros, 2020; Guerra & Verdu, 2020; Pereira et al., 2016; Pereira et al., 2018; Rique et al., 2017; Santos & Souza, 2016). VBDT is not yet implemented in a comprehensive way and thus this paper attempts to expand the VBDT audience in Brazil.

The authors aim to provide a deeper look into Verbal Behavior Developmental Theory and its applicability in enhancing individuals' verbal behavior, due to its importance to language acquisition and development. Though not exhaustive, this paper presents an overview of VDBT showing the main concepts, principles, and milestones (i.e. behavioral cusps and cusps that are capabilities), as well as the protocols used to induce them. It was written in close dialogue with Verbal Behavior Analysis (Greer & Ross, 2008) and The Separate Development of Children's Listener and Speaker Behavior and the Intercept as Behavioral Metamorphosis (Greer et al., 2017), although it has many other important sources.

Basic Principles and Concepts

Cusps and Capabilities

Verbal Behavior Development Theory adopts Rosales-Ruiz and Baer's (1996, 1997) concept of a behavioral developmental cusp (Greer, 2008; Greer & Du, 2015; Greer & Ross, 2008; Greer & Speckman, 2009). A cusp is a pragmatic way to talk about development without attaching "stages" or "steps" of development to biological events such as age. According to Rosales-Ruiz and Baer (1997), a cusp is a behavioral change in a response or response class resulting in socially relevant and far-reaching consequences for the organism or its species. VBDT findings resulted in some differences between the initial notion of cusps in that VBD cusps are what appear to be the onset of classes of responses belonging to overarching stimulus control that is necessary for all children to participate in a verbal community more fully. Without these cusps, the child may not move toward more sophisticated behavioral repertoires[3],

[3] The term behavioral repertoire refers to behaviors that a person can perform even if they are not currently performing them (Cooper et al., 2014; Catania, 1998/1999). Cusps and capabilities are kinds of behavioral changes that, when demonstrated for the first time, become considered part of the individual's behavioral repertoire.

or further achievements would be very hard, in the cusp domain and, sometimes in other domains too (Rosales-Ruiz & Baer, 1997). Even given a state-of-the-science instruction, complete with a three-term-contingency to the student (Albers & Greer, 1991), well-designed curricula and behaviorally defined objectives, graphical displays of data, and moment-to-moment decision-making (Greer, 2002), an individual without key cusps and capabilities may learn very slowly or not learn at all. Certain cusps are capabilities, which allow an individual to learn in other ways (Hranchuk et al., 2018).

A capability is a special class of cusp that allows the child to learn not only by contacting new contingencies, but also in new ways in which the child could not do before presenting the behavioral change (Greer, 2008; Greer & Speckman, 2009). "When children acquire the capability (i.e., stimulus control) to learn language or verbal behavior incidentally this is not only a cusp, but also a change in how the child can learn verbal responding" (Greer, 2008, p. 369). Notably, Bidirectional Naming or BiN[4] is one such cusp that is also a capability, which allows an individual to learn jointly as a listener (responding to "Where is the parrot?") and speaker (saying "That is a parrot!") from exposure alone. Recent research indicates that BiN also serves as a prerequisite to critical problem-solving repertoires, is part of the individual becoming more fully verbal and is correlated to derived relation or networks of coordination (Frank, 2018; Ma et al., 2016; Miguel 2016; Morgan et al., 2020).

Initial Independence of Responses Classes, their Integration, and Verbal Behavior Cusps and Capabilities

The joining of the listener and speaker responses, or the joining of verbal operants (e.g., mands and tacts), or the joining of observing and producing responses, seems to occur so naturally and fluently in a skillful speaker, reader or writer that one could expect it has always been in this way, but it has not! There is evidence showing the initial independence of these classes of responses in both children with and without disabilities (Feliciano, 2006; Gilic & Greer, 2011; Greer, 2008; Greer & Speckman, 2009; Kleinert, 2018; Lamarre & Holland, 1985; Morgan, 2018; Twyman, 1996). Emitting a response such as looking at someone making movements (e.g., observing someone raising her hand) is initially independent from copying those movements (e.g., producing response of raising one's own hand after observing someone

[4] The term Naming or Full Naming (Fiorile & Greer, 2007; Horne & Lowe, 1996) was used in many previous VBDT studies. The term Bidirectional Naming (i.e., BiN) as suggested by Miguel (2016) is more commonly used now. Although very recently, Hawkins et al. (2018) suggested several classifications according to the focuses of different laboratories, such as focus on BiN and intraverbal relations, I-BiN (Ma et al., 2016), or focus on Incidental Bidirectional Naming (i.e. Inc-BiN) (Carnerero et al., 2019; Hawkins et al., 2009; Longano & Greer, 2014; Pérez-González et al., 2011). For the purpose of the current analysis, the authors will keep using BiN until the new terms, and correspondent descriptions, are better understood and established in the literature.

doing the same). Getting a box of chocolate cookies when mom says, "get the box of chocolate cookies" (listener response) is initially independent from saying "chocolate cookies" (speaker response) in the presence of these treats (Greer, Yuan, & Gautreaux, 2005). Saying that an object is on the left side of another (tact) is initially independent from asking for that object referring to its left side position in relation to another (mand) (Lamarre & Holland, 1985). Similarly, making an "X" on a multiple-choice exam (selection response) is initially independent from writing a sentence (production response) about exactly the same topic (de Rose, 2004; Greer, 2002). Skinner (1957/1992) referred to these as two modes of responding to the same thing and wondered how this comes about. We now know a great deal about how that happens (Eby et al., 2010; Gilic & Greer, 2011; Greer, Stolfi, et al., 2005). The initial independence of observing and producing responses, as well as other types of responses has important consequences for how one teaches children, especially when they present with language delays or are missing cusps and capabilities. It is crucial to understand how the integration evolves.

Another critical aspect is the role of conditioned reinforcers in the VBDT. These learned reinforcers select out behaviors and antecedents, such as discriminative stimulus and/or motivational conditions, which makes the emergence of new cusps or capabilities possible. These learned reinforcers lead to another step in language acquisition and development, probably the most significant achievement of a human being, the stimulus control to learn how to learn from socially conditioned reinforcement (Greer & Du, 2015; Greer et al. 2017; Greer, 2020).

In a recent theoretical paper, Greer et al. (2017) categorized cusps and capabilities in a manner paralleling biological metamorphosis. That is, a kind of functional and behavioral metamorphosis in humans is akin to the transformation of a caterpillar into a butterfly. Prior to this transformation, we are presented with a child who is totally dependent upon others to survive. Through contact with critical environmental contingencies, either naturally or intensively arranged by instruction, the individual acquires critical stimulus control for new reinforcers. This newly acquired stimulus control allows one to learn faster and in new ways, accelerating learning along the trajectory from egg-caterpillar to chrysalis-butterfly, or from Pre-verbal to Joining of the Listener and Speaker categories. By the end of these metamorphoses, we have a person who interacts with her environment with an integration of the listener and speaker repertoires, which can be expanded by contact with linked to print stimuli cusps. This person can contribute in many ways to the social community (Keohane, et al., 2009). So how, specifically, can one produce the significant behavioral-environmental interactions during a person's life, that allows him or her to enjoy many aspects of a typical verbal behavior community?

About Protocols, Assessment, How to Teach, and the Teacher's Pre-requisites

VBDT can provide the experiences needed to evaluate and induce missing cusps, capabilities, and the joint functions within them through Verbal Behavior Development Protocols (Greer, 2008; Greer & Longano, 2010; Greer et al., 2017; Greer & Ross, 2008; Greer & Speckman, 2009). These protocols provide the rationale for inducing each cusp or capability, it's necessary pre-requisites, a description of pre- and post-intervention probes (and criteria) as well as a description of instructional procedures and criteria. Due to the focus of the present paper, they will not be described here, even briefly. Instead, they will be identified and relevant references will be indicated. Assessing for the presence or absence of a cusp is a first step since it is necessary to identify the cusps that are and are not demonstrated. Further, cusps determine how and what a child can be taught (Greer, Corwin, & Buttieg, 2011; Hranchuk et al., 2018). The presence of certain cusps also determines what new cusps can be induced. Once new cusps are induced, the individual is able to contact their environment in ways they could not before, and should be taught differently. The presence of cusps or the establishment of cusps allow for the best outcomes of using a well-designed curriculum and state-of-the science instruction. Instruction is individualized, even if delivered within group format. Visual displays (i.e., graphs) show students' responses. Moment-to-moment instruction for each instructional objective (e.g., mathematics, writing, reading) guides decision-making[5] (e.g., implementing a tactic [scientific based procedures] or switching programs) (Greer, 2002; Greer & Ross, 2008; Keohane & Greer, 2005).

Instructional programs are delivered through learn units (LU), which are the basic units of teaching (Albers & Greer, 1991). The LU consists of interlocking contingencies between teacher and student in which the teacher, after getting the child's attention, presents the antecedent (i.e., "what sound does [pointing to the letter] d make?"), the student then emits a response, or does not, and receives corresponding consequences: delivery of potential reinforcer or correction[6] and instruction goes on. However, the presence of certain cusps (i.e., BiN) should result in changes to the types of LUs that are used (Greer, Corwin, & Buttieg, 2011; Hranchuk et al., 2018). Presentation of LU ensures delivery of state-of-the science instruction, but a child with missing cusps and capabilities will still require high numbers of LU presentations to master an instructional objective.

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[5] VBDT literature also includes an empirically based CABAS® Decision Protocol (i.e., a Decision Tree) that guide problem solving (Greer, 2002; Greer & Ross, 2008; Keohane & Greer, 2005) (See www.cabasschools.org).

[6] A correction consists of an independent correct response to the antecedent after the teacher's model, that then signals the teacher that the student is ready for the next LU presentation. The independent response should not be reinforced.

Prerequisites for a state-of-the science instruction with LUs include:

(1) The teacher, or any other professional, functioning as a deliverer of reinforcement for the child's behavior,

(2) The teacher having instructional control over the child,

(3) The teacher responding to the child's learning or lack of learning based on the correct LU to teach the child founded on prior learning and on the child's existing cusps,

(4) The teacher presenting a well-established contingency-shaped repertoire of teaching according to behavior analysis and the vocabulary of the same science. In addition, a teacher needs to use his verbally-mediated repertoires as a tool to solve problems and to establish the best course of action (Greer, 2002; Keohane & Greer, 2005).

When these prerequisites are understood and practiced, assessment can begin and teaching takes place.

Verbal Behavior Development Categories and Correspondent Cusps and Capabilities

VBD Cusps and Capabilities, and related cusps, are grouped into key categories that help teachers and interventionists understand and address delays and deficits in a meaningful way. Figure 1 shows a plan of these categories, that will be described below.

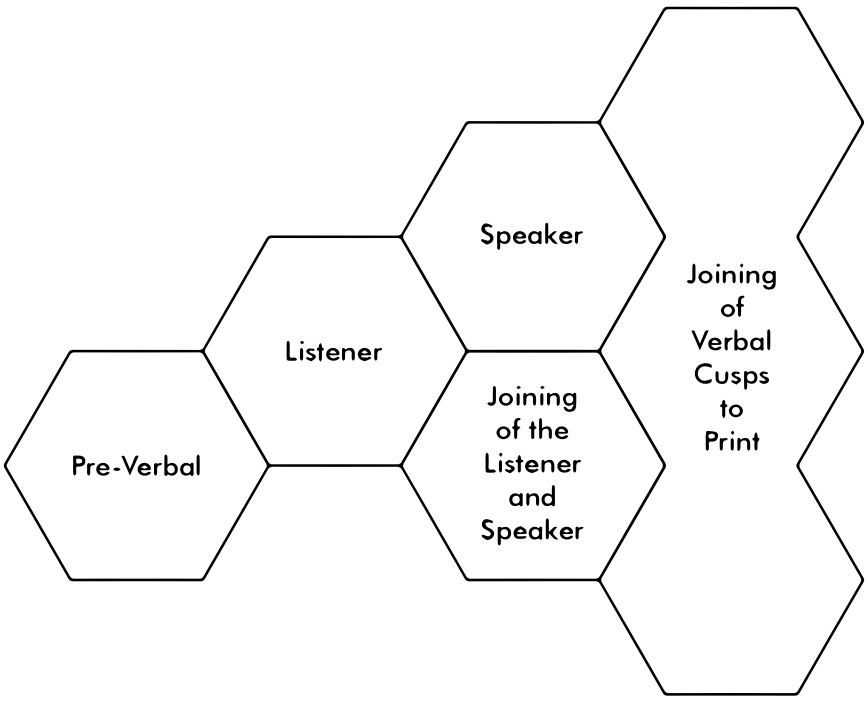

Figure 1. Verbal Behavior Developmental Categories and an Intrinsically Related Category. *Note*. This diagram illustrates the grouping of cusps and capabilities of verbal development in the pre-verbal, listener, speaker, joining of the listener and speaker categories, and an intrinsically related category called joining of verbal cusps to printed stimuli. Experiences play a defining role in verbal behavior complexity growth, which is not necessarily linear.

Pre-verbal Cusps

Pre-verbal repertoires are not themselves verbal, but they establish the foundations from which verbal behavior accrues. At the pre-verbal category, children are totally dependent on others to access necessities; consequently, they do not offer reciprocal social contributions (Greer & Keohane, 2006). At this "level," cusps involve the senses and body movements. A foundational capability may also emerge. The focus is on observing responses and the role exerted by conditioned reinforcers over them in relation to joining the observing and producing responses within the skin. It is argued that for typically developing children, intrauterine and after birth repetitive movements such as swimming motions, and after birth vocalizations are essential experiences that allow see-do correspondence (Donahoe & Palmer, 2004; Greer & Speckman, 2009). Orienting to Others' Voices; Orienting to Others' Faces or to Others' Presence; Generalized Identity Matching and Capacity for Sameness across the Senses are pre--verbal cusps, and Generalized Imitation is a pre-verbal capability (Greer & Ross, 2008; Greer et al., 2017).

Orienting to Others' Voices allows a child to be in contact with new environments where speech sounds are present and affect a child's observing responses. It consists of a child orienting to adult voices when her name is called or when an adult speaks to another person close to her (and other analogous situations). This is tested and identified when a child chooses to listen to adult's voices telling stories in a free play area setting for the most part (90%) of two consecutive five-minute sessions. The demonstration of this cusp is correlated to reduction in stereotypy and increased rate of learning (Greer, Pistoljevic, et al., 2011; Greer & Ross, 2008; Keohane et al., 2009; Maffei et al., 2014). Additionally, it will have effects in achievements such as the child's production of speech sounds (hear-say) as in parroting or echoing. This cusp is a probable pre-requisite for responses such as following directions or being under control of one's spoken language (Greer, Pistoljevic, et al., 2011). When the child does not respond to auditory stimuli in the environment (e.g., does not turn her face in the direction of a speaker) it is harder to make progress on curricular goals, academic or not (Keohane et al., 2009; Maffei et al., 2014), because the teacher cannot affect child's behavior through vocal verbal instructions. In order to induce Orienting to Others' Voices, one needs to make sure that the child's visual and hearing functions are intact. The Voice Conditioning Protocol induces this cusp (Greer, Pistoljevic, et al., 2011; Greer & Ross, 2008).

Orienting to Others' Faces or to the Presence of Others cusp refers to the child's ability to attend to adults' faces, as when looking at the speaker's face when the child's name is called or when praise is given. When this cusp is demonstrated, the child can also visually follow a parent or caregiver entering or leaving a room and ask for assistance by physically guiding an adult to a desired item. If the child is under control of adults' faces as a conditioned reinforcer, the adult's presence selects out her orienting and prolonged observing responses susch that she can learn at accelerated

rates than without this cusp. After this cusp is induced, attentional programs such as "look at me" or "eye contact" are not necessary anymore (Greer et al., 2017; Greer & Ross, 2008). Faces most likely become conditioned reinforcers for observing when a newborn hears their mother's voice and sees their mother's face while being being fed, along with other sensory experiences such as being touched, and smelling (Greer, 2008; Greer & Ross, 2008; Greer, Pistoljevic, et al., 2011; Kuhl, 2003). Later, based on these precursor sensory experiences, the child will be able to see and do, as in reproducing what her mother (caretaker) does.

When a child does not demonstrate the stimulus control for this cusp, she does not orient to others in situations where she needs to do so, such as someone presenting a stimulus to her, or requiring attention in instructional settings (Casarini, 2011). The Faces Conditioning Protocol induces this cusp (Greer et al., 2017; Maffei et al., 2014; Maffei-Lewis, 2011). These key observing responses are the result of newly acquired stimulus control for previously neutral stimuli in the environment and correlated learned reinforcers. That is, a child begins to attend to and learn from observing stimuli in the environment that they were unaware of before. They are now part of her environment when before they were not. Once the child contacts the mother's face as a result of orienting to the face the proximity of the voice with the face conditions the face as a reinforcer for the visual observing operant.

Just as children must begin to orient toward sounds, voices, and faces in their environment, they must also begin to attend to two-dimensional and three-dimensional stimuli. These are the foundations for developmentally appropriate play skills and academic learning. Generalized Identity Matching is a cusp that involves sustained observation of visual two-dimensional (2D, such as stimuli in a page that include numbers, shapes, letters and pictures) and three-dimensional non-preferred stimuli (3D, such as binders, crayons and other objects) in a way that one is able to match novel stimuli first time they appear. An important step is to establish the observing response, of those stimuli, itself. Demonstrating this cusp makes visual discrimination tasks easier and the child can learn from being in contact with visual 2D and 3D stimuli in tasks such as "match" and "point to." Additionally, toys and puzzles can be conditioned as reinforcers for playing, enlarging child's community of reinforcers and increasing independence, because after having toys as conditioned reinforcers the child can play by herself (independently) while teacher delivers instruction to others. A child without this cusp may fail in basic attentional repertoires (e.g., sit still, "look at me", and "do this"), and may require many LUs for matching tasks, and she may depend on prompts to succeed in visual tasks (Du et al., 2015; Greer, 2002; Greer et al., 2017; Greer & Ross, 2008; Keohane et al., 2009). Two different protocols induce this cusp: 2D Conditioning Protocol Using Stimulus-Stimulus Pairing and 3D Conditioning Protocol (Du et al., 2015; Greer et al., 2017; Greer & Han, 2015; Greer & Ross, 2008).

Capacity for Sameness across the Senses is the basis for further discrimination learning. A child that demonstrates the stimulus control for this cusp can match similar pairs of stimuli contacted through different senses. For example, after smelling the scent of coffee, the child can choose the container with the coffee beans when given that and a non-exemplar (i.e. a container with tea). This cusp accelerates learning rates and increased observational responses by making the child more aware of his or her environment. Moreover, echoing and "point to" responses can accrue (Keohane et al., 2009) due to this newfound awareness of sameness. This cusp provides the necessary stimulus control for the abstraction of sameness and, consequently differences, using rotated stimuli presentations across five senses (vision, hearing, taste, smell and touch; Greer & Ross, 2008). This cusp is demonstrated when the child can say, sign, or signal the same name or symbol for the "same" stimuli presented in different modalities (visual, auditory, tactile, and olfactory stimuli). For example, they may say "coffee" when presented with a photo of coffee beans, when they smell a pot of coffee brewing, when they hear someone scooping and pouring the beans into the machine, and when putting their hand in a bag of coffee beans after hearing the name "coffee" while having had an experience with each of these sensations (Frias, 2017). The Sensory Matching Protocol Using Multiple Exemplar Instruction is used to induce this cusp (Frias, 2017; Greer & Ross, 2008).

Generalized Imitation is the capability that implies "point-to-point" correspondence between the behavior of the observer (student) and the behavior of the model (teacher). It requires the see-do correspondence as reinforcer and allows the child to learn from observing others' movements, instead of only having her behaviors directly shaped, as in graduated prompting. If the child could imitate directly taught actions but does not succeed in imitating actions that are presented for the first time, the intervention is recommended. Although it is not verbal, this establishes correspondence or parity as a conditioned reinforcer that becomes important in verbal development (Ross & Greer, 2003; Tsiouri & Greer, 2003). One should consider Generalized Imitation present when a child imitates novel behavior without direct reinforcement of a particular response topography (Keohane et al., 2009); rather the correspondence between observing and then doing becomes the reinforcer (Ross & Greer, 2003; Tsiouri & Greer, 2003, 2007). After acquiring this capability, the child can learn routines faster because she learns from observing a model and prompts will not be necessary as frequently as before presenting the capability (Greer et al., 2017; Moreno, 2011). The Mirror Protocol is used to induce the Generalized Imitation capability (Keohane et al., 2009; Du & Greer, 2014). Once this capability is demonstrated students should be taught such that examples of correct body responses precede response opportunities.

Listener Cusps

Skinner (1957/1992) initially argued that listener behavior was not verbal although in a later paper he implied the importance of the listener. Initially, he regarded communicating as essentially verbal while he regarded responding to communication as not verbal. However he later stated that treatment of the listener was problematic, "there would be little verbal behavior to consider if someone had not already acquired special responses to the patterns of energy generated by the speaker" (Skinner, 1989, p. 2).

As an extension of Skinner's verbal behavior propositions, VBDT scholars realized that missing listener repertoires prevented children from moving forward in terms of verbal development[7]. At this "level," cusps involve hearing and behaving accordingly (Greer & Speckman, 2009), enabling the child to follow instructions or echo spoken words. Although the child is still dependent on others, physical prompts and visual cues become less necessary because verbal stimuli evoke behavior (Greer & Keohane, 2006). Becoming a listener introduces a person into the verbal community and makes him/her able to contribute to the social community in some ways (Greer & Keohane, 2009; Keohane et al., 2009), but the child is not yet fully verbal, as he or she has not yet acquired the stimulus control to rotate listener and speaker roles within the skin.

Auditory Identity Matching and Listener Literacy are key listener cusps within VBDT. Auditory Matching has been correlated with increasing learning rates and the emergence of echoic repertoires. Keohane et al. (2008) affirm it is a listener cusp because it targets the matching of spoken vowel--consonant blends, although it can evoke speaker responses too. A child who demonstrates this cusp can present gross and fine auditory discriminations, such as differentiating sounds from non-sounds and between complex words or sentences made of common elements, for example, "The book is on the cabinet" vs. "The book is over the cabinet" or "The book is on the table" (Choi, 2012); "immunization" vs. "impulsivity," or "occurrence" vs. "occupational" (Nuzzolo, 2014). This cusp can be used to improve or make echoics emerge, to expand pronunciation, and to help children to reach listener literacy (see the next section), when they are otherwise unsucessful. The Auditory Matching Protocol is used to induce this cusp (Chavez-Brown, 2005; Choi, 2012; Greer et al., 2017; Greer & Ross, 2008). The specific sequence of instruction was recently made available through an App in the iTunes® Store called SoundsSame.

Basic Listener Literacy is a cusp that describes the auditory control over a child's listener responses such that the child can follow simple directions (one-step and two-step) and can respond fluently and differentially from actual instructions ("clap hands", "arms up"), versus nonsense ones ("bla-bla-bla"; "touch the sky"). When the child is under control of spoken words, i.e., demonstrates hear-do behavior, even if distractors are employed

[7] The terms verbal development and verbal behavior development are used interchangeably in this paper.

this cusp is established. The Listener Emersion Protocol is used to induce this cusp (Choi, 2012; Greer, 2008; Greer et al., 2017; Greer & Ross, 2008), however it should be noted that listener literacy acquisition does not necessarily imply the acquisition of the correspondent speaker repertoires.

Speaker Cusps

In his book Verbal Behavior, Skinner (1957/1992) described the following verbal operants: mand, tact, echoic, textual, intraverbal, copy, dictation, and the autoclitic. Except for textual, copy, and dictation, these are all speaker cusps. This means that once the correspondent reinforcer and stimulus control is demonstrated for a class of responding, the child can learn the range of responses that constitute each cusp. For example, the tact must be under social reinforcement correlated to responses of objects/events of the world. Once social reinforcement is established (in that conditions) children can learn a range of tacts (Eby & Greer, 2017; Greer et al., 2008). If, however, a token or edibles are used, the wrong speaker verbal operant is learned (i.e., the response is a mand) and other more complex socially-motivated behavior may remain stagnant.

At the speaker status, indirect action on environment through verbal behavior becomes possible. It is a significant step towards controlling the surrounding contingencies. Not only does the individual benefit from this status, but he or she also has an effect on the social community. The social community has gained a member that can be more integrated, independent, and productive (Greer & Keohane, 2006). For example, a child can recruit social attention through tacts (Greer et al., 2017). There are eight cusps related to the speaker category of VBDT: (a) Parroting, (b) Echoic-to-Mand, (c) Echoic-to-Tact, (d) Independent Mands, (e) Independent Tacts, (f) Transformation of Establishing Operations across Mands and Tacts,(g) Intraverbal, and (h) Autoclitic.

Parroting or Canonical Babbling, as described in other literatures, is a child's production response (as differentiated from observing). It consists of producing vocal responses that present point-to-point correspondence to immediately heard vocal sounds, and are controlled by automatic reinforcement, i.e. the sounds heard and the correspondence between the sounds heard and the child's vocalization. In this case, the reinforcer is that correspondence, not the verbal function (social reinforcement). The induction of this cusp aims to establish the vocal sound as reinforcer to vocalize (Yoon & Bennett, 2000). Parroting is a cusp to be induced just in those cases where the child has never presented any echoic or babbling sounds. If the child does not demonstrate vocal sounds as reinforcers to vocalize, the topography of speaking is missing and echoics may not develop. The Stimulus-Stimulus Pairing Protocol and Rapid Motor Imitation Protocol (RMI) are used to induce this cusp (Greer & Keohane, 2006; Greer & Ross, 2008) and the first instances of vocal speech.

The Echoic-to-Mand and Echoic-to-Tact cusps involve echoic production responses, which are prerequisite repertoires that are then emitted

to allow the control of mands or tacts through contact with their correspondent antecedents and consequences. The critical characteristic here is setting the appropriate motivating operations or antecedent stimulus control to evoke the vocal verbal responses that, when correct, lead to natural reinforcement consequences, i.e., the item manded for mands, or social reinforcement for tacts. "While mands are important for the acquisition of early speaker behavior, the tact repertoire is even more critical when building complex verbal responses" (Greer & Ross, 2008, p. 116). The echoic-to-tact unit increases the child's contact with the surrounding environment, allowing the child to contact social praise as a consequence for talking about the world. Greer et al. (2017) differentiate contract social functions related to mands versus contact social functions related tacts. The echoic-to-mand cusp allows the child to learn new mands while echoing, and echoic-to-tact allows to learn new tacts in analogous conditions. At this point the reinforcement for the production is the correspondence between the production and its specific functional effects on the behavior of a speaker. Echoic-to-Mand should be induced if, when given a motivating operation to mand an item or event, the child does not emit mands. The child does not need these protocols if she emits two independent mands in non-instructional settings (Greer & Ross, 2008). Echoic-to-Tact should be induced when given the presence of a stimulus in the environment that the child can contact using her senses (in the same way that somebody else, for example, seeing the stimulus) and the vocal antecedent related to that stimulus presented by another person, the child does not emit tacts (the child does not echo the vocal antecedent related to the observational response in order to gain social contact). The emission of two independent tacts in non-instructional settings is an exclusion criterion. The motivating operation for tacts is brief deprivation of attention and consequence is delivery of social approval or contact (Greer & Ross, 2008) and should be distinguished from the mand, where the interaction is contractual, i.e., a vocal verbal mand in exchange for an item (Greer et al., 2017). Echoic-to-Mand Protocol is used to induce echoic-to-mand cusp while Echoic-to-Tact Protocol is used to induce echoic-to-tact cusp. Rapid Motor Imitation Approach (RMIA) may be used in both cases (Greer et al., 2017; Tsiouri & Greer, 2003; 2007).

The Independent Mand is a verbal cusp and a verbal operant such as classified by Skinner (1957/1992). It is critical to child's independence. The goal in inducing this cusp is to teach mands under natural controlling variables, i.e., deprivation or aversive stimulation, without the need of cues such as previous vocal verbal antecedent from an adult. The consequence is to receive the item (or access to an event) named (Greer & Ross, 2008). The Speaker Immersion Protocol is used to induce this cusp (Greer et al., 2017; Ross et al., 2006). The Independent Tact is also a verbal cusp and a verbal operant such as classified by Skinner (1957/1992). The goal in inducing this cusp is to emit tacts under natural controlling variables, which are the objects and events of child's surrounding world. The child is given an

opportunity to say the name of an item, social praise is used as reinforcer (Greer & Ross, 2008). After presenting some independent tacts, what is called "spontaneous speech" may accrue, under control of the relevant environmental conditions (the stimulus to be tacted and a listener; Greer & Ross, 2008). Also, the child can acquire social attention by using tacts. This is important to more complex verbal development such conversational units, self-talk, say/do correspondence and BiN. The Intensive Tact Protocol is used to induce this cusp (Greer et al., 2017; Pistoljevic & Greer, 2006).

Transformation of Establishing Operations across Mands and Tacts is a cusp that allows a child to learn to emit a spoken word according to one contingency context, e.g., mand, and be able to use it in the other contingency context, e.g., tact. Mands and tacts are originally independent verbal functions, although the same form could be used in both cases (Lamarre & Holland, 1985). After this cusp is demonstrated, the child can emit verbal operants that were not directly taught (e.g., mands) from learning a similar verbal response, after another has been directly taught function (e.g., tacts; Greer & Ross, 2008). Multiple Exemplar Instruction (MEI) across Establishing Operations for Mands and Tacts is the protocol that induces this cusp (Greer et al., 2017; Nirgudkar, 2005).

An Intraverbal is a verbal operant which is also a cusp in the VBDT. When the child demonstrates this cusp, she emits verbal responses that do not have point-to-point or formal correspondence with the antecedent; therefore, the topography of the response is different from the antecedent verbal stimuli presented by others. In the beginning, intraverbals occur as a response to some statement made by another person in a verbal exchange. As language develops, it can occur as a child's dialogue with herself. The child who presents an intraverbal repertoire can answer questions in school settings, for example, or in social interaction circumstances. It is an important pre-requisite for BiN and is part of the conversational units. Two protocols can be used to induce this cusp: Say-do Correspondence (Farrell, 2017) and Self-Talk (Donley & Greer, 1993; Eby & Greer, 2017; Greer et al, 2017; Keohane & Greer, 2009; Schmelzkopf et al., 2017).

Autoclitics are verbal operants that are a cusp within VBDT. Greer and Ross (2008) define the autoclitic as "...verbal behavior that modifies the effects of elementary verbal operants (mands, tacts, echoics, and intraverbals) on a listener" (p. 4). For example, a child specifies a car she sees or "needs" by saying "big car" instead of just saying "car," and receives some source of generalized reinforcement for an autoclitic plus tact response, and gets the big car, not the small one, for an autoclitic plus mand response. When the child demonstrates this cusp, the motivating operation of deprivation shifts the autoclitic function from one to another untaught stimulus or verbal function, which is somehow correlated with the main verbal unit previously learned. Thus the child emits untaught verbal behavior. It means that an entire verbal unit (autoclitic plus tact, for example) works as a tact, and that learning the whole verbal unit makes the child able to emit the analogous speech under new conditions (for example, emitting the

correspondent unit as autoclitic plus mand in a deprivation situation in face of the same stimulus; Greer et al., 2017). The induction of autoclitic "frames" should be done if the child does not demonstrate this class of responding. The occurrence of autoclitics in child's speech illustrates complexity in language acquisition since elements of syntax and grammar are added to basic operants (Speckman et al., 2012). Since autoclitics also act to affect the behavior of the listener, amplifying speaker's control over the social environment expands the speaker's capacity to be part of the social community (Greer & Keohane, 2006).

Joining of the Listener and Speaker Cusps

Joining the Listener and Speaker is the category in which more complex verbal behavior is possible. Here we come to appreciate Skinner's (1957/1992) critical conception of speaker-as-own-listener (Greer & Speckman, 2009; Lodhi & Greer, 1989), where a speaker may respond to his own verbal and non-verbal behavior in many forms. "An important fact about verbal behavior is that speaker and listener may reside within the same skin. The speaker hears himself, and the writer reads what he himself has written" (Skinner, 1957/1992, p. 163).

It has been argued that the interception of listener and speaker turns a person fully verbal (Barnes-Holmes et al., 2000; Horne & Lowe, 1996; Greer & Ross, 2008; Greer, 2020). Paralleling the functional independence of verbal operants, the listener and speaker functions could remain developmentally separate up until this point. The VBDT has, at present, described two cusps that are capabilities (a) Bidirectional Naming (BiN) and Observational Learning; and three cusps (a) Self-talk in Fantasy Play; (b) Conversational Unit between Individuals; and (c) Say-do Correspondence, in the Joining the Listener and Speaker category. BiN is of special interest and will be described in more detail here.

Bidirectional Naming can be understood, simultaneously, as a capability and a bidirectional operant (Ma et al., 2016; Miguel, 2016) that allows a child to learn at least two operants after observing someone say the name of a stimulus jointly observed by the child and the other person (see Fiorile & Greer, 2007; Gilic & Greer, 2011; Greer & Du, 2015). BiN is demonstrated when a child learns the names of objects and events of the world incidentally, that is without direct reinforcement delivered by another with deliberate instruction. Thus the child learns tacts and listener responses by observing others talking about a nonverbal stimulus (one type of naming experience) which then allows him or her to learn combinatorial relations of coordination or equivalence (Kleinert, 2018; Kleinert-Ventresca et al., 2020; Morgan et al., 2020). Also, if taught to emit a listener behavior, a child who demonstrates BiN can respond with the untaught speaker behaviors related to the same stimuli. A child who does not demonstrate BiN must be directly taught or reinforced for both listener and speaker responses. For example, if a child is taught to say the name of a specific type of bird, he or she may not be able to "point to"

(listener) a photo of the same bird. Children who demonstrate the listener component of this capability (i.e., Unidirectional Naming or UniN) will emit a new listener response if taught the listener response, but will not emit a speaker response (Abdool-Ghany, 2020; Abdool-Ghany & Fienup, 2020). BiN is an integration of listener and speaker within the skin such that one experience can lead to learning multiple repertoires (Greer, 2008; Greer & Longano, 2010; Greer & Ross, 2008; Morgan et al., 2020). The goal of inducing this capability is to combine listener and speaker responses leading to joint stimulus control across both repertoires. It should be noted that more recently, instead of a binary type of analysis (BiN's presence or absence), BiN has been considered as a process and measured in degrees (of acquisition), one of them being the former listener component of BiN, currently UniN (Greer, 2020; Morgan et al., 2020; Pohl et al., 2018).

As in the case of Observational Learning, BiN is a capability of particular importance in general educational settings, where complete LUs are rare, if present at all (Greer & Speckman, 2009). It is a key capability necessary to be successful in regular education classrooms. When BiN is demonstrated, the child can learn from instructional demonstration LUs (through observed models), as shown by Hranchuk et al. (2018). The typical procedure used to induce BiN is the Multiple Exemplar Instruction across Listener and Speaker Responses Protocol (Fiorile & Greer, 2007), although other procedures such as the Intensive Tact Procedure (Pistoljevic, 2008), a combination of Producing Echoics and Stimulus-Stimulus Pairing (Longano, 2008), and Repeated Probes (Cao, 2016; Kleinert, 2018; Kleinert-Ventresca et al., 2020; Lo, 2016), have also been used. Kleinert-Ventresca et al., (2020) found that emergent untaught responses for non-familiar stimuli (arbitrary symbols attached to created names) are significantly lower than familiar untaught responses, and further that Repeated Probes serve to condition unfamiliar stimuli as reinforcers, thereby selecting out responses to future presentations of previously neutral stimuli. This appears to explain how we continue to learn without direct instruction. The embedded reinforcers continue to attract still other stimulus control.

Bidirectional Naming is not only valuable for language acquisition, but as the speaker and listener become joined, more complex, higher order “thinking” or relational responding occurs (Greer et al., 2017). As Morgan et al. (2020) found, the demonstration of stronger stimulus control for BiN is highly correlated with more complex derived relations and scores on the Boehm Test of Basic Concepts 3rd Edition – Preschool Version (BTBC3-P) (Boehm, 2001). This was a further extension of work in the stimulus Equivalence (Sidman, 1992) and Relational Frame Theory (Hayes et al., 2001) on emergent language. Horne and Lowe (1996) first used the term Naming to describe a developmental milestone that, once demonstrated, allows individuals to acquire language through observation, namely through the rotation of listener and speaker behavior within the skin. As mentioned previously, recent research on BiN as a verbal capability indicates that conditioned reinforcers provide the stimulus control that

allows the learning of observing responses and speaking responses for learning the names of things (Eby et al., 2010; Greer, 2020; Greer et al., 2005; Kleinert, 2018; Kleinert-Ventresca et al., 2020; Morgan, 2018). This accounts of how seemingly untaught or emergent behaviors are acquired, such as the relations discovered by Sidman (1971).

Observational Learning from Observing Consequences is another learning capability. According to Greer and Ross (2008) it is a type of advanced Observational Learning in which listening and other senses are involved simultaneously. Observational Learning can be distinguished in four ways:1) the ability to emit a known behavior after observing an advantageous consequence from another, 2) learning new behavior through observing another (as described below), 3) the acquisition of a new conditioned reinforcer through observation, and 4) peer attention (Greer et al., 2006). Considering the second type above, this cusp allows the student to learn by observing others receiving consequences, through indirect contact with contingencies, as occurs in group instruction, enriching the universe of events that can be learned (Greer et al., 2017). Additionally, it may provide the basis for students to develop self-management skills (Hawkins et al., 2007). It is a key capability necessary to transition from special education classes to general education. Once the child presents this cusp that is a new learning capability, she can benefit from group instruction (Greer, Pistoljevic, et al., 2011). Observational learning can be applied to children who do not demonstrate BiN to improve listener responses and tacts acquisition (Greer & Ross, 2008). Many interventions have been used to induce this capability such as: Peer-Yoked Contingency, Peer tutoring, Peer monitoring, Response Boards, Choral Responding and Video Presentations (Greer et al., 2017).

Self-talk Conversational Units in Fantasy Play is a cusp that refers to Conversational Units (a single person exchanges the roles of listener and speaker in an intraverbal sequence as a dialogue) taking place when a child talks to herself in a fantasy-play context. Frequently, one observes the child changing her voice tone to indicate different roles of each part of speech (Farrell, 2017; Lodhi & Greer, 1989). Self-talk Conversational Units are the basis to more advanced verbal categories such as “thinking,” self-editing, and problem solving. To check for self-talk, the teacher has to observe the child during free-play, especially solitary play conditions in the presence of anthropomorphic toys (Greer & Ross, 2008). We consider the child demonstrates this cusp if she presents three or more self-talk conversational units (two exchanges between speaker and listener functions) in a ten minutes’ session. This cusp should be induced to expand intraverbal repertoires for children who cannot emit conversational units to themselves. Inducing Self-Talk Using Anthropomorphic Toys (Lodhi & Greer, 1989) is the protocol used to induce this cusp.

Conversational Units between Individuals is a cusp described by an interaction between two people in which both individuals play the role of listener and speaker, alternately, in a single episode (Greer et al., 2017;

Lodhi & Greer, 1989). It requires advanced intraverbal responses within a verbal episode. At this point, reinforcement for listening to others (adults or pairs) involving exchanges of listener and speaker roles is established and the child can ask questions and respond as a listener. Conversational units may not be vocal, but they are always verbal. In this sense, they are important elements of social-verbal interactions (Greer et al., 2017; Lodhi & Greer, 1989). Children without this cusp will probably not initiate conversation and will miss opportunities to respond to others. The focus in inducing this cusp is to set the appropriate motivating conditions (i.e., learned as a result of acquired reinforcers) and the reinforcement for listening to others in different contexts calling for social-verbal interactions (e.g., game situations; Baker, 2014). The Social Listener Reinforcement Protocol is used to induce this cusp (Baker, 2014; Greer et al, 2017).

Say-Do correspondence (in Speaker-as-Own-Listener Function) is a cusp shown when the child can do as she said she would. When a statement is said aloud and an action done overtly, one has evidence of child functioning as listener and speaker within herself. It is also an important repertoire in self-management contexts and a foundation for verbal thinking (Greer & Speckman, 2009). This cusp should be induced if the child misses the repertoire of following her own directions. For example, if the child says "I'm going to the play area" and goes to another place in the classroom, she is not presenting say-do correspondence. After presenting this cusp, the child can control her own future behavior trough verbal antecedents. Additionally, the child can explain what happened in some situations or how she arrived at an answer. The intervention consists of using LUs to teach the child to follow her own directions (Casarini, 2011). The Correspondence between Saying and Doing Protocol is used to induce this cusp (Greer & Ross, 2008; Greer et al., 2017).

Moving forward, a new category of cusps will be discussed: The Joining of Verbal Cusps to Print.

The Joining of Verbal Cusps to Print[8]

VBDT now distinguishes verbal developmental cusps from other learning cusps. Joining of Verbal Cusps to Print is the category in which cups such as reading and writing are categorized. Although learning to read and write are significant learning cusps, they are extensions of the existing stimulus control for verbal development cusps, and as such they are not verbal developmental cusps themselves. Print becomes an extension of a child's existing verbal development when: 1) print evokes listening when one reads and 2) writing functions as effective speaker behavior

[8] We are not making a distinction between printed text stimuli and digital text stimuli, so the reader can substitute print for digital text interchangeably. The difference will be important in some cases such as manual writing reading and when motor skills for writing are the focus of the work, which is not the case here. The reader can see Bucher and Schumacher (2006) and Mangen et al. (2019), for examples.

for a given audience. This means that many of students' difficulties with learning to read or write are traceable to missing or weak cusp stimulus control. The cusps associated with the joining of the listener and speaker category cusps are key. A rough overview of the sequence of steps for learning to join print to verbal cusps includes the following cusps: (a) Conditioned Reinforcement for Observing Books; (b) Textual Response; (c) BiN Accrues from Listening to a Story Read by Others or Reading; (d) Textually Responds at 80 Words per Minute; (e) Responds to Own Textual as a Listener; (f) Print Transcription (see-write); (g) Dictation (hear-write); (h) Transformation of Stimulus Function across Saying and Writing; (i) Read and Do Correspondence; (j) Textual Responding Joins Existing BiN Stimulus Control; (k) Textual Content Function as a Conditioned Reinforcer Raising Reading Comprehension; (l) Technical Writing Precisely Affects Reader's Behavior; (m) Aesthetic Writing Affects Emotions; (n) Writer as Self-editing; (o) Verbally Governed Behavior from Print Stimuli; and (p) Verbally Governing the Behavior of Others by Producing Print.

Conditioned Reinforcement for Observing Books is a cusp built on orienting to others' voices and generalized identity matching cusps. The child demonstrates this cusp when she chooses to look at books during free play time, i.e., observing books is a reinforcer (Buttigieg, 2015; Buttigieg & Greer, 2020; Tsai & Greer, 2006). Time spent looking at books increases when this cusp is established. It also has effects on rate of learning to read and reading comprehension. This cusp contributes to a larger community of reinforcers, to independent play, and to reduction of stereotypy and passivity (Nuzzolo-Gomez et al., 2002). Greer (2002) affirms that staying in a play area independently and playing with toys or looking at books are ways to test for the onset of conditioned reinforcers that are foundational to learning new discriminations. VBD evidence shows that the effective way to teach new operants involves establishing reinforcers prior to teaching the discriminative stimulus control such as see print and read or demonstrate discriminations of antonyms, for example. The induction of this cusp should be done prior to teaching textual responses and as a tactic if the child is struggling in learning textual responses. Conditioned reinforcement for observing books is analogous to what has been called reading readiness, and we now have an empirical definition of this expression (Buttigieg & Greer, 2020). The Stimulus-Stimulus Pairing Protocol (Greer & Ross, 2008; Greer et al., 2017; Nuzzolo-Gomez et al., 2002; Tsai & Greer, 2006) is one of the three interventions used to induce this cusp. The others are Operant Conditioning of Reinforcement or Conditioning Books by Observation (Greer, 2020; Greer, Pistoljevic, et al., 2011; Lo, 2016; Longano & Greer, 2014; Oblak et al., 2015). Different children require different procedures.

The Textual Response is another verbal operant that is also a cusp. The child with this cusp can see print stimuli, in the form of graphemes, and say the correspondent phonemes. It could be also called basic reading. Accompanied by reading as listening, minimal fluency, and conditioned

seeing, it can turn into reading with comprehension. The protocol to induce the textual fluency is in the Joining of Verbal Cusps to Print category. Other protocols, in the same category, are based on textual responses. When textual cusp is demonstrated, the individual's verbal repertoire is enlarged, and begins to be free from time and space restrictions, typical of vocal verbal personal interactions (as prototype; Greer & Ross, 2008). Considering that literacy is so important to everyday life and to academic success in literate societies such as ours, the development of this cusp allows one to be more capable of fully exercise citizenship, to access many cultural assets, and to engage in various opportunities for self-realization, contributing in a variety of forms to the community (Conceição, 2015; Greer, 2002; Greer & Ross, 2008; Lyons, 2014; Mackey, 2017; Weber, 2016). Auditory Matching for Textual Responses Protocol (Lyons, 2014), Read and Do Correspondence (Mackey, 2017) and Conditioned Reinforcement for Books and Acquisition of Textual Responses (Buttigieg, 2015) are protocols used to induce this cusp (see also, Gentilini & Greer, 2020, 2021).

Bidirectional Naming Accrues from Listening to a Story Read by Others or Reading is a cusp that indicates child's indirectly learned listener and speaker responses (pointing to or saying the name of an object, for example) to stimuli as a result of listening a story read by others or reading the story. It increases a child's vocabulary, since she learns, for example, the names of world's objects by hearing people reading to her or through reading herself (Greer et al., 2017). This cusp is useful in acquiring verbal operants (e.g., tacts) incidentally and in reading comprehension. If the child hasn't demonstrated BiN yet, the protocol to induce this cusp is an option (Casarini, 2011). The Word-Picture Matching Discrimination Protocol is used to induce this cusp (Greer et al., 2017).

Textually Responding at 80 Words per Minute is another cusp. Demonstrating Books as Conditioned Reinforcers for Observing Print-related Stimuli, and demonstrating Two-dimensional Stimuli as Conditioned Reinforcers, are important pre-requisites to induce this cusp (Greer & Ross, 2008). When the child demonstrates this cusp, she reads fluently and can achieve comprehension. One should induce this cusp if reading comprehension is missing and the teacher/researcher suspects it is due to child's reading fluency, i.e., textual responding is taking too long to lead to comprehension. To induce this cusp, two components of reading are considered: form and fluency. Reading materials or programs are used for these purposes. Greer and Ross (2008) argue that rate of reading cannot be ignored "since the rate of textual responding is critical to the listener literacy component of reading. Students must read fast enough to "'hear the story,' so to speak" (Greer & Ross, 2008, p. 230). Reading fluency is a critical component of reading comprehension (Greer & Ross, 2008; McGuiness, 2004), the ultimate goal of teaching textual responses. The Fluency Training Protocol is used to induce this cusp (Greer et al., 2017).

Responds to Own Textual Responding as Listener (i.e., textually respond and hear-do, or hear-name) is a cusp that describes child's ability to textually

respond (read) and answer comprehension questions or behave as directed by the text. An individual's responses are under listener control of her own textual responses. Reading with comprehension allows the individual into a whole new world, that which is under control of printed verbal stimuli. For example, printed verbal stimuli may control the use of algorithms to reach verbally governed problem solving (Greer & Speckman, 2009). This cusp may need to be induced if the child demonstrates difficulty in responding to comprehension questions. Multiple Exemplar Instruction across Auditory and Visual Components of Reading Responses is the protocol used to induce this cusp (Greer et al., 2017; Greer & Ross, 2008).

Print Transcription (See-write) is the cusp that corresponds to Skinner's (1957/1992) verbal operant "copy." Typically, there is a word, sentence or text, and the child has to copy, to "reproduce" the printed stimuli in the same (e.g., manuscript to manuscript) or correspondent (e.g., printed to manuscript) form with point-to-point correspondence (accuracy). This cusp establishes the topography of writing. To induce it one should choose a reading program according to child's reading level, selecting out model stimuli, subsequently asking the child to copy them. The teacher should use as many words as she thinks is necessary to demonstrate the cusp. With thi cusp in repertoire, she can copy any verbal printed stimuli with accuracy and hears the words as she writes. The print must be understood otherwise simply copying is calligraphy and it is critical that the teacher is aware of this. At the beginning, it may be necessary to teach pre-requisite skills such as linking dotted lines, covering circles and other shapes; linking dotted letters and numbers as the student speaks the letter sounds. As the child masters "writing over dots," visual prompts are gradually faded, switching to copying letters/numbers, and finally moving to copying words, sentences and paragraphs. This cusp establishes basic skills for writing, which can lead to more complex behavior such as the student having his own behavior governed by writing and the student influencing the behavior of others through writing (Greer & Ross, 2008). This cusp can establish the need to write - that is, the establishing operation for writing to communicate to a reader is a part of the child's verbal community. After the child can copy with accuracy, the teacher can begin working on dictation. The Learn Units to Establish Transcription Protocol is used to induce this cusp (Greer et al., 2017; Greer & Ross, 2008).

Dictation (Hear-write) is a cusp that corresponds to what Skinner (1957/1992) called Dictation. It represents the child's ability to writing after hearing a word initially said by others (Eby et al., 2017; Greer et al., 2005). If the child cannot write a words or phrases said by the teacher or is not able to write notes from teacher's lectures, she does not demonstrate this cusp. When hearing and writing are joined, the child can vocally spell and write something after listening. For example, the teacher says, "cat" and the child writes cat. Subsequently, the child can answer the question "How do we spell cat?" saying \si\ei\ti\. The teacher doesn't need to offer printed instructions anymore (such as writing on the

board to provide a model for copying). This cusp represents great increases in independence and in how one can teach children. For example, if the child demonstrates fluent reading and writing repertoires a Personalized System of Instruction (PSI) can be used to teach new operants (Greer, 2002). Teacher should choose words or sentences from reading programs according to the child's knowledge (instructional history) and present the vocal stimuli to be written in order to evaluate the child's repertoire. Being able to do this with accuracy indicates the presence of this cusp. Intervention, when it is missing, consists of selecting the verbal stimuli to be taught and presenting them in a rotated fashion across both responses copying (printed antecedent) and dictation (vocal antecedent). The goal is to make the child able to write accurately, as spoken words are said to her. Following well-designed and tested reading programs will help in making decisions such as choosing the size of words, sentences, and the types of words (e.g., with different degrees in the grapheme-phoneme correspondence). This cusp may establish the need to write. Instruction to Establish Dictation is used to induce this cusp (Greer et al., 2017).

Transformation of Stimulus Function across Saying and Writing is a cusp described by a verbal vocal topography of responses and correspondent written verbal topography joined in way that learning one leads to the emergence of the other. When saying and writing are joined, a child can emit the vocal topography (vocal spelling) from reading and written topography from vocally spelling. Additionally, she can write the word and read with comprehension as a consequence of sounding it out (Greer & Ross, 2008). For example, you can teach a child to spell "boy" by saying \bi\ou\wai\ and she will be able to write the word boy, although it was not directly taught. To test for presence or absence of this cusp, the teacher should verify if the child can write a new word after having sounded it out. If there is no accuracy, the teacher should choose a set of four words (unknown to that child and according to child's reading level) and teach the child to spell them vocally. Once the child demonstrates this cusp, the teacher can spell the word and the child will write it correctly. In educational settings, it means that teacher does not need to write all the instructions on the board, for example. The Multiple Exemplar Instruction across Saying and Writing Protocol is used to induce this cusp (Greer et al., 2017).

Read and then Do Correspondence is a cusp that refers to reading and doing or that reading governs the child's responses. The child demonstrates this cusp if when given written instructions, e.g., "Your toy is on the red shelf," she can find the toy (Greer & Ross, 2008). It is important to create establishing operations related to instructions, so the child stays motivated to read and do what is written. If the child does not yet read sentences, the teacher can attach tags to containers filled with reinforers (e.g., cookies, cars, candies) and say to child: "Find the cookies." If the child can read the tags and find the correct item, she will receive the reinforcer. After acquiring this cusp, reading affects the behavior of the

reader in a very precise way (the technical function of reading) and more complex behaviors can take place, such as following algorithms (verbally mediated responses) and other kinds of directions that lead to problem solving (Greer & Ross, 2008). Reader Emersion is the protocol to induce this cusp (Greer et al., 2017; Mackey, 2017).

Textual Responding Joins Existing BiN Stimulus Control. When the child demonstrates this cusp, she can read a word for the first time and immediately present comprehension as a result of joining previous BiN experiences with textual responding. For example, suppose that the child is textually responding with accuracy and fluency to the word pineapple for the first time and is able to listen to herself reading the word (overt or covertly). In listening to herself, the child evokes previous experiences with pineapples, as in BiN experiences (hearing the word and seeing/observing the correspondent object/event) and respondent conditioning (e.g., emotions related to the pineapple), which helps her to comprehend the word she read. Conditioned seeing (Skinner, 1957/1992), or beneath--the-skin visualization of the word read, can then accrue from reading. One should induce this cusp if the child demonstrates BiN but is not able to use it in the reader function and/or the child is having difficulties in reading comprehension but fluency is not an issue (Greer & Ross, 2008). After acquiring this cusp, the child's learning rate may increase because sounding out a novel textual response can result in comprehension (if the child demonstrates the correspondent tacts or intraverbals in repertoire). Additionally, if the child presents joint stimulus control across saying and writing, sounding out the word may result not only in reading comprehension but also, in being able to write it (Greer & Ross, 2008). Word-Picture Matching Discrimination Protocol is used to induce this cusp (Greer et al., 2017).

Textual Content Function as a Conditioned Reinforcer Raising Reading Comprehension cusp is described by listening to story read to oneself and being reinforced by one's own textual responding. It is an extension of having Voices as Conditioned Reinforcers for hearing such that the listener hears himself as a speaker. Listening to what is read is the reinforcer for reading (Greer & Ross, 2008). Motivational issues here are not taken in terms of practical results of reading (related to the technical function of reading) as in following written instructions, but in terms of the "pleasure of reading." To assess this reading content cusp, one should observe the child while she reads and check if she presents emotional reactions evoked by the story (Gentilini & Greer, 2020, 2021), if she keeps reading word by word, phrase by phrase, paragraph by paragraph, page by page, and if she makes comments or tries to guess what is going to happen in the sequence. If the child does not emit those responses frequently, the cusp may need to be induced. When listening to oneself reading is established, the child will enjoy reading and can be in contact with both technical and aesthetic functions of reading. Much new information can be taught through written words. This cusp allows the child to have her senses extended by being in

contact with written words, consequently having experiences (emotional, for example) without being in direct contact with contingencies. Multiple Exemplar Instruction across Auditory and Visual Components of Reading is the protocol used to induce this cusp (Greer et al., 2017).

Technical Writing Precisely Affects Reader's Behavior is a cusp that refers to a child's writing accurately influencing the behavior of others in both the form and function of his writing. "The technical function requires that the writer affects the behavior of a reader in a very precise way" (Greer & Ross, 2008, p. 218). To check if the child demonstrates or does not demonsrate this cusp in repertoire, the teacher should probe for functional and technical aspects of writing. This is done by assessing the percentage of correct responses to grammar, punctuation, and other structural components in a short essay. Total accuracy is required (Reilly-Lawson & Greer, 2006). Additionally, functional components are assessed. Function is measured by recording the effect of the child's writing on a reader not directly involved in the same task. Precision of the reader's performance indicates adequate functional writing. For example, the reader should draw exactly what is described, and the reader's production response should have exact correspondence with the original sample the writer described. The intervention consists of making all communication, between teacher and students, and among students, be done in a written form. The protocol produces increases in both structural and functional aspects of writing in children who already demonstrate the ability to write but need to improve proficiency. Once acquired, this cusp allows the student to control the behavior of others without the constrictions of space and time, which constrain vocal language. After the child acquires this cusp, the teacher can work on the aesthetic function of writing and can evaluate textually responding for problem solving, and additionally can assesses if writing governs complex operations (Casarini, 2011). The Writer Immersion Protocol is used to induce this cusp (Greer et al., 2017).

Aesthetic Writing Affects Emotions is a cusp that refers to writing responses that are technically correct but also work to evoke a reader's emotions. Metaphors (one type of extended tact; Skinner, 1957/1992) are particularly useful for this purpose (Greer & Ross, 2008). This cusp should be induced to improve child's aesthetic writing, when technical writing is present but aesthetic writing is not. Aesthetic writing, including metaphorical writing, is related to creativity and new usages of language. When the child demonstrates this cusp, she can write personal journals, create stories, and talk about new observed (or felt) things across metaphors, transferring emotional functions from certain stimuli to other ones, related to the written experience. It is an important step relative to the social world, as we see in the products of writers' behaviors in literature and poetry. The Writer Immersion Protocol is used to induce this cusp (Greer et al., 2017).

Writer as Self-editor is a cusp that refers to self-editing, that is, making a child re-write a text in order to be more precise, when it is necessary to

affect the behavior of the reader. Consequently, “Experiences that result in the writer learning to affect the behavior of a reader need to occur as the controlling consequence for the writer before the editing repertoire can be developed” (Reilly-Lawson & Greer, 2006, p. 156). After acquiring this cusp, the student is able to edit his own writing. In self-editing, the writer needs to respond as a reader to his own writing, and in doing so he evaluates the precision of his writing as it affects the behavior of the reader, especially relative to specific audiences (Greer et al., 2017; Weber, 2016). Generative and precise writing can be developed in different domains after self-editing is present. “As writers can read their own writing from the perspective of an eventual audience, they grow increasingly independent from reliance on education audiences (e.g., teachers, supervisors, and colleagues)” (Greer & Ross, 2008, p. 19). The protocol typically used here is the Writing Protocol (Broto & Greer, 2014; Pellegren, 2015).

Verbally Governed Behavior from Print Stimuli refers to the use of verbally-mediated behavior to control one’s own behavior. In other words, it is the use of algorithms to solve problems or deal with complex operations (Keohane & Greer, 2005).

After acquiring verbally-mediated behavior, the student is able to work more independently on assignments, managing his own behavior and the surrounding environment. Reading allows him to engage in new complex tasks to manage the world and turn control to new contingencies. The Need to Read Using Learn Units in Writing Protocol is used to induce this cusp (Greer et al., 2017).

Verbally Governing the Behavior of Others by Producing Print is the last learning cusp we will describe here. If this cusp is demonstrated, the student's writing (or a text message from a mobile app) will affect the behavior of a naïve reader in relation to complex tasks (such as problem solving). The way to assessing for it is to give the student a complex task from which he has to write a detailed description that someone is to follow. After the student concludes writing, the teacher gives the written instructions to another person and asks the person to follow the written instructions. If the naïve reader succeeds in following the writer’s directions, he was effective in affecting the complex behavior of others through writing (Reilly-Lawson & Greer, 2006). After acquiring this cusp, the student can produce written verbal behavior (instructions and algorithms) to guide his own behavior or the behavior of others (verbal or non-verbal). Written words may produce the kind of problem-solving present in scientific knowledge. Writer Immersion is the protocol used to induce this cusp (Greer et al., 2017).

Here concludes this summary of cusps and capabilities and the protocols used to produce the changes in language development and acquisition that natural contingencies have not. All the categories, and cusps and capabilities within them, whether they are pre-verbal, verbal, or extensions of verbal cusps to print “affect whether and how a child can access the social community” (Buttigieg, 2015, p. 25),

Conclusions

Implications of Verbal Behavior Developmental Theory

The Verbal Behavior Development Theory presented in this paper is an empirically based, comprehensive, and dynamic conception of how verbal behavior evolves within the individual lifespan considering verbal behavior's role in culture. This theory was derived from an empirically--based set of cusps and capabilities, grouped into metamorphosis statuses, or VBDT categories, that show how incidental, emergent, and complex verbal behavior becomes possible through key experiences. It also includes extensions of verbal cusps to print stimuli, a complementary category. For example, the person that reaches high level categories may solve problems applying the methods of authority, tenacity and science (Greer, 2002), and may combine technical and esthetical functions of writing (Greer & Ross, 2008) in new ways while writing a didactical book or a novel. It is experience that allows one to reach more complex functional levels of verbal behavior. What happens so naturally for many children, needs to be planned in order to improve the repertoires of those who lack environmental experiences or who demonstrate developmental delays (Greer & Ross, 2008; Hart & Risley, 1995). Moreover, 15 years of the CABAS® AIL (Accelerated Independent Learner) Model for general education suggests this sequence is the solution for many literacy issues for all children, not just children with disabilities. Second language learners and children from impoverished backgrounds may demonstrate deficits in cusps that if not rectified, affect learning how to read, write, compute, and think. It is likely that true literacy is based on the demonstration and strength of these verbal behavior developmental cusps.

In terms of social relevance, one of the challenges of applied sciences related to language is to provide tools or procedures to teach people that lack appropriate language function. The VBDT addresses such issues in a body of empirical studies showing that specific experiences lead to listener and speaker functions being isolated and then joined in increasing complexity. Increases in rate of learning, improvements in verbal repertoires, and correlations between BiN and derived relational responding (arbitrary and non-arbitrary, mutual and combinatorial entailment) were found in many empirical studies, supporting VBDT (see Greer, 2008; Greer & Longano, 2010; Greer & Ross, 2008; Greer et al., 2017 to check for more empirical references; Morgan et al., 2020). The results found in that empirical research should speak for themselves in advocating for VBDT social relevance.

The role of conditioned reinforcers in the verbal behavior development, including social and socially conditioned reinforcers, is one of the most interesting findings of the theory. These learned or acquired reinforcers select out behaviors and antecedents, such as a discriminative stimulus or establishing operation, which are related to learning from socially established reinforcers (Greer, 2020; Greer & Du, 2015). "It appears that the beginnings

of control by social stimuli, the antecedent responses of others as stimuli as well as reinforcement responses of others as stimuli, are the key to the ontogenic development of many language functions" (Greer & Du, 2015, p. 22).

Although it might be possible to find correlation between cusps and capabilities and age, the critical aspect is that they are mainly a result of learning experiences. If the child does not demonstrate certain cusps and capabilities, the protocols cited here should be used. In many cases, the sequence of categories presented in this paper is particularly relevant, especially when some pre-requisite cusps and capabilities should be considered. The practitioner or researcher needs to be careful in taking pieces of the theory without understanding its articulation within the whole process. An egg doesn't change directly to a butterfly; there are steps in between. This theory is helpful not only in teaching new repertoires but also in teaching children how to learn from a limited number of experiences and how to learn without direct instruction, consequently becoming more independent. The theory also allows a person to know how to overcome the barriers of time and space through reading and writing, how to govern one's own behavior and the behavior of others through verbal written behavior, how to have one's own behavior governed by vocal or written stimuli, and from this, even more complex verbal behavior possible. Considering that it is not possible to directly teach children everything they need to know to engage in a variety of forms in social community, it is critical to teach them how to learn, to learn from specific experiences, and to learn to teach themselves. These cusps and capabilities constitute foundational steps to achieve learning independence and complex verbal behavior. Thus, this theory shows how to increase one's role in verbal communities as both consumer and contributor (Greer & Ross, 2008).

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