The Relation Between Components of Naming and Conditioned Seeing

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In two experiments, I tested for the presence of conditioned seeing as a measurable behavior, which was measured by participants' accuracy in drawing a stimulus, and how this behavior was related to the demonstration of the naming capability. In Experiment 1, participants demonstrated a correlation between drawing responses and speaker responses in a test for naming (i.e., incidental learning of language) \(r(10) = .702, p < .02\). In Experiment 2, I tested for the effects of using a delayed phonemic response teaching intervention on the acquisition of the drawing responses. There were twelve participants in Experiment 1, six of whom then continued on to Experiment 2. In Experiment 2, I used a non-concurrent multiple probe across participants to test the effects of the phonemic response intervention on the numbers of correct listener, speaker, and drawing responses. The independent variable was the delayed phonemic response intervention to control for the presence of the names of the stimuli, which would be necessary for the demonstration of the speaker component of naming. Four of the six participants in Experiment 2 demonstrated both the acquisition of the speaker component of naming as well as the drawing responses as a function of the delayed phonemic response teaching intervention. All participants responded in one of three ways: 1) demonstrated both drawing responses and the speaker component of naming, 2) neither drawing responses nor the speaker component of naming or 3) drawing responses but not the speaker component of naming. There were no instances of the speaker component of naming without drawing responses.
Results from Experiment 2 further supported the relation between these two variables suggesting the possibility that the drawing responses were a measure of conditioned seeing, and that the conditioned seeing behavior is related to the development of the naming repertoire as it pertains to visual object-name relations. Implications, limitations, and future avenues for research are discussed.
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Chapter 1

INTRODUCTION AND REVIEW OF THE LITERATURE

Introduction

Evidence has shown that children who experience academic success have a spoken vocabulary of close to 2000 words by the age of three (Hart & Risley, 1995). The vast majority of these words are not acquired through direct instruction (Crystal, 2007; Hart & Risley, 1995; Kenneally, 2007; Pinker, 1994). It is critical that a child develop the ability to learn language indirectly, or incidentally. During the early developmental years, the parents of these children who succeed have spoken over 50,000,000 words to them while those children who are struggling have heard five times fewer words (Hart & Risley, 1995). During this time period, the parents of successful children are providing numerous opportunities for children to make the associations between their caregiver’s utterances and the object’s referent. Over time, children learn that when a caregiver names an item, there is a relationship between the name and the item itself, and the child may learn that he or she can respond to the name of that item as a listener (pointing to, selecting, or retrieving the item) or as a speaker (naming the item) without being directly instructed on either of these behaviors (Greer & Longano, 2010; Greer & Speckman-Collins, 2009). The ability to respond to these names and items without being directly instructed on their relation is called naming.

Naming, used herein, is distinguished from the commonplace definition of naming meaning to simply learn the names of things. Naming, in the behavioral sense, is a verbal behavior developmental capability first theorized by Horne and Lowe (1996). A
capability is a behavioral cusp that allows children to learn in ways they could not learn before, to be distinguished from a cusp that is not a capability, which exposes an individual’s repertoire to new environments or contingencies (Greer & Speckman-Collins, 2009; Rosales-Ruiz & Baer, 1997). In short, a cusp allows individuals to contact reinforcers they could not before while a cusp that is a capability additionally allows individuals to learn in ways that they could not before. Naming is a new learning capability in that prior to having the naming capability, a child must be taught the names of objects directly, and thus is limited to naming objects that have been directly taught. Children must contact reinforcement for either selecting or pointing to an item and may need to contact reinforcement separately in order to provide the name for the item. After naming is present, the child may learn to say the name of the item and learn to select the item simply by hearing one provide the name in the presence of the object.

Horne and Lowe (1996) defined naming as “a higher order bidirectional behavioral relation that (a) combines conventional speaker and listener behavior within the individual and (b) does not require reinforcement of both the speaker and listener behavior for each new name to be established, and (c) relates to classes of objects and events.” (1996, p. 207). Horne and Lowe suggested that naming is a, or the, source for acquisition of language incidentally. As described above, without the naming capability, Horne and Lowe state that all language must be taught directly.

Naming is a speaker-as-own-listener behavior. This type of behavior was noted by Skinner (1957) but not thoroughly developed in his theory on verbal behavior. Skinner stated, “The speaker and listener within the same skin engage in activities which are traditionally described as ‘thinking’.” However, Skinner focused on this type of
behavior in the adult individual, one who has a fully developed speaker-as-own-listener repertoire. Lodhi and Greer (1989) conducted an experimental analysis of Skinner’s notion of speaking and listening to oneself. The authors found that children do indeed emit “conversational units” within their own skin, thereby demonstrating that one can listen to, and respond to oneself as well as function as both a speaker and a listener in a verbal manner without another human of the same verbal community present. Naming theory identifies these first instances of speaker-as-own-listener behaviors as an echoic repertoire, which is initially reinforced by caregivers, and identifies how the joining of the speaker and listener within one’s skin as self-echoics is necessary for the initial reinforcement of naming.

Longano and Greer (2013) identified observing responses for visual and auditory stimuli as the source or reinforcement for the naming capability. They found that when visual and auditory stimuli selected out observing responses, participants may contact reinforcement for attending to visual and auditory stimuli presented simultaneously (perhaps what would initially be given by a caregiver in an early naming experience). Longano and Greer measured the number of echoics emitted as participants began to contact reinforcement for observing auditory stimuli, but had no measure of the behavior emitted while contacting visual stimuli. It would seem to be necessary that the participant would contact reinforcement for observing both stimuli in order to demonstrate the naming capability.

Previous works relating to naming focus on the role of the listener and speaker within one’s skin and the acquisition of the verbal stimulus, but none of these studies have focused on the properties and reinforcement contingencies of the physical stimulus,
or visual referent itself (Gilic & Greer, 2011; Greer, Stolfi, Chavez-Brown, & Rivera-Valdes, 2005; Greer, Stolfi, & Pistoljevic, 2007; Horne, Hughes, & Lowe, 2006; Horne & Lowe, 1996; Horne, Lowe, & Harris, 2007; Horne, Lowe, & Randle, 2004; Lowe, Horne, Harris, & Randle, 2002; Lowe, Horne, & Hughes, 2005). If echoics, or self-echoics, were the sole source of reinforcement for naming, then simply memorizing a list of words would function to produce listener and speaker behavior for a person with naming. However, there is another behavior that occurs beneath the skin that may potentially function as a secondary source of reinforcement for the naming capability. That is the behavior of conditioned seeing.

Conditioned seeing was a term first used by Skinner in *Science and Human Behavior* (1953) and expanded upon in *Verbal Behavior* (1957). Conditioned seeing is the behavior of seeing an image within one’s skin, in the absence of the physical stimulus that the image represents. This image is capable of evoking a response, which may have a verbal function mediated either by another or by oneself as speaker-as-own-listener. In other words, the behavior evoked by the conditioned seeing may affect either another person or one’s own behavior. As an example, Skinner spoke of seeing an image of a snake upon hearing “snake”, however there was no physical snake present. It was not the sounds S/N/A/K/E themselves that led to the ultimate behavior (possibly a mand, “don’t say that!”) but rather that the sounds S/N/A/K/E had become an antecedent for the conditioned seeing of a snake, which then led to the mand (or other) vocal verbal behavior. The listener then mediated the response by no longer saying, “snake” in the presence of the individual. Skinner theorized that the conditioned seeing behavior itself was emitted as a respondent upon hearing the name of the stimulus. Previous
experimental analysis of this theory has proven difficult due to the nature of a measure for such covert behavior.

In the current study, I tested for the presence of conditioned seeing as it is related to the demonstration of the naming capability. I propose that conditioned seeing is a measurable behavior, which may be defined and measured by a participant’s ability to draw a representation of a stimulus in the absence of the visual stimulus as well as the absence of an experimenter provided vocal name for the stimulus. I propose that this measure of conditioned seeing of a stimulus as an operant is acquired in tandem with the acquisition of the tact response as one demonstrates the naming capability. I tested the role the acquisition of speaker-as-own-listener behavior plays in the demonstration of conditioned seeing as related to naming and, what role, if any, conditioned seeing plays in the demonstration of naming in and of itself. Before an analysis of the role of conditioned seeing is conducted, a review of the literature on language acquisition from the behavioral perspective is presented. For a definition of terms used throughout the literature review, see Appendix A.

Review of the Literature

Verbal Behavior and the Functional Approach to Language

In 1957, Skinner published his theory on verbal behavior. He stated that, “Behavior which is effective only through the mediation of other persons has so many distinguishing dynamic and topographical properties that a special treatment is justified, and indeed, demanded.” (Skinner, 1957, p. 2). In this way, Skinner set verbal behavior apart from other human behavior or the behavior of other organisms. Skinner felt that a
behavioral explanation of the contingencies that controlled language was necessary for the behavioral approach to human behavior to advance (Vargas, 1992).

In his theory, Skinner identified basic operants, or learned behaviors, that define human verbal behavior. These operants were as follows; the mand, the tact, the intraverbal, the echoic, the textual response, and the sequelic. Skinner defined each of these operants in terms of the antecedents, observable behaviors, and consequences, which when emitted by the listener, determined the immediate function of the behavior as well as controlled the future frequency of each behavior. In somewhat less detail, Skinner also discussed the control of a few non-observable behaviors such as listening to oneself as a speaker, thinking, and conditioned seeing.

While Skinner discussed the role of a listener for each operant, that being to “…provide the conditions we have assumed in explaining the behavior of the speaker” (Skinner, 1957, p. 34), the focus of Verbal Behavior was specifically on the behavior of the speaker. It was not until 1989 that Skinner discussed the truly important role of the listener stating, “…if listeners are responsible for the behavior of speakers, we need to look more closely at what they do.” (Skinner & Hayes, 1989, p. 86). As Skinner theorized here, and as research continued, it became more apparent that the role of the listener would be a critical component of the verbal behavior model, particularly when studying language development and the role of the listener and speaker within one’s own skin (D. Barnes-Holmes, Barnes-Holmes, & Cullinan, 2000; Horne & Lowe, 1996; Lodhi & Greer, 1989).
Criticisms of both Verbal Behavior and a Nativist Approach to Language

Almost immediately after the publication of Verbal Behavior, the linguist, Noam Chomsky (1959), rebuked the notion that language development and vocal behavior were controlled by environmental stimuli and consequences. Chomsky (1959) argued that language is an innate behavior and that “a refusal to study the contribution of the child to language learning permits only a superficial account of language acquisition…” (p. 58).

This critique of verbal behavior added support to the then current nativist theory, arguing that language development might be looked at in the same way as physical development. In other words, all humans are genetically predisposed to the same basic linguistic characteristics, specifically that language ability was innate and that there was a “universal grammar.” This approach focused on the innate nature of language, posing that humans’ ability over other animals to produce grammatical rules across different languages demonstrated that humans must have an innate language instinct (Pinker, 2004).

However, not all within Chomsky’s own field accepted his critique, despite the overall influence of Chomsky’s arguments (Pinker, 2004). Further reviews of Chomsky’s work put together a counter-argument to Chomsky’s critique, identifying that Chomsky misinterpreted or wholly ignored many of Skinner’s arguments and rationales (Chomsky & Place, 2000; MacCorquodale, 1970; Palmer, 2000a, 2000b; Schoneberger, 2000; Tomasello, 2008). However as behavioral psychologists continued to study Skinner’s theory of verbal behavior, data, based on research with humans, began to show that environmental stimuli and reinforcement could indeed develop and control language. These studies led to many robust theories of language development from the behavioral
perspective that continues to be advanced today. Further, modern linguists have begun to doubt the Chomskian argument of language being an innate behavior, with some presenting arguments that much more closely resemble the theories of post-Skinnerian verbal behavior than the nativist approach to language (Tomasello, 2008).

Emergence of the Study of Relational Responding

Stimulus equivalence. Despite the immediate shift towards a nativist approach to language in the years directly after Chomsky’s critique of Verbal Behavior, many linguists, cognitive psychologists, developmental psychologists, and behavioral analysts continued to study and pursue additional accounts of language. While a few behavioral studies had begun to demonstrate the role reinforcement contingencies played on verbal behavior, a major shift occurred with an analysis of stimulus equivalence (Greenspoon, 1955; Salzinger, Feldman, & Portnoy, 1964; Salzinger & Pisoni, 1958, 1960, 1961; Sidman, 1971). Unlike the studies before, stimulus equivalence did not focus on the operants of Verbal Behavior, but rather analyzed reinforcement control of the process of emitting novel, or untaught, verbal behavior. The first demonstration of stimulus equivalence took place with a participant who could not “comprehend” written words, or the Skinnerian “see-say” behavior. In this first experiment, the participant could match spoken words to visual pictures. However, this participant could not match visual pictures to “visual words,” or textual stimuli, and could not match spoken words to textual stimuli. After the participant had been taught the equivalence relation between spoken words and textual responses, the participant was able to match visual pictures and
visual words, which was an untaught relation. This phenomenon was a demonstration of the stimulus equivalence tenant defined as transitivity.

The stimulus equivalence tenants, which are analogous to the mathematical properties of reflexivity (A=A), symmetry (A=B, therefore B=A), and transitivity (if A=B and B=C, then A=C), demonstrate that when stimulus equivalence is present, a trained relation, or relations, would yield additional untrained relations. So if a child was taught to select the textual stimulus “shoe” (B) in the presence of hearing the spoken word “shoe” (A), training would not be needed for the child to speak the word “shoe” (A) in the presence of the textual stimulus “shoe” (B) (A=B so B=A). This untrained, or emergent behavior, was a demonstration that a child may respond in untaught ways based on his or her history of stimulus control and reinforcement in the related response. According to Sidman, these relational responses were a given, in that if A=B there is no such natural way that B could not equal A.

The potential impact of stimulus equivalence on verbal behavior was apparent from the beginning simply by virtue of the fact that the stimuli used in that first experiment were verbal stimuli (tacts and textual responses). Despite this fact, Sidman’s immediate focus was not on the relation between stimulus equivalence and verbal behavior, but rather on continuing to establish the research base of the stimulus equivalence relations, often with pictures, symbols, or other non-verbal stimuli (Sidman, 1994).

Relational frame theory. In the years after Sidman, behavior analysts began to study verbal behavior in more detail, focusing on what stimulus and reinforcement control would be necessary to support the verbal behavior approach to language, as it
specifically related to the operants that Skinner put forth. Early research focused on the mand and tact operants (Hall & Sundberg, 1987; Lamarre & Holland, 1985; Michael, 1988; Stafford, Sundberg, & Braam, 1988; Williams & Greer, 1993). This slowly began to expand to autoclitics, intraverbals, and further functional accounts of speaker-as-own-listener behaviors (Braam & Poling, 1983; Howard & Rice, 1988; Lodhi & Greer, 1989; Watkins, Pack-Teixeira, & Howard, 1989). As the research base expanded on the basic operants, new lines of research began to emerge based on the emergent relations of stimulus equivalence as they directly related to the notion of verbal behavior.

First to come was the Relational Frame Theory of Barnes-Holmes, Hayes and colleagues (D. Barnes-Holmes et al., 2000; S. C. Hayes, Barnes-Holmes, & Roche, 2001). Relational frame theory (RFT) states that responses are related to each other through the same basic properties identified by Sidman (1971), but that instead of solely analyzing equivalent relations, other relations could be analyzed as well through various behavioral “frames” (Berens & Hayes, 2007; S. C. Hayes et al., 2001). The relations proposed by relational frame theory are mutual entailment (if A is related to B, then B is related to A), combinatorial entailment (if A is related to B, and B is related to C, then A is related to C), and transformation of stimulus function (D. Barnes-Holmes & Keenan, 1993; Y. Barnes-Holmes, Barnes-Holmes, & Smeets, 2004; Y. Barnes-Holmes, Barnes-Holmes, Smeets, Strand, & Friman, 2004; S. C. Hayes, Devany, Kohlenberg, Brownstein, & Shelby, 1987; S. C. Hayes, Kohlenberg, & Hayes, 1991; Healy, Barnes-Holmes, & Smeets, 2000; Lipkens, Hayes, & Hayes, 1993).

Transformation of stimulus function refers to the notion that the function of a stimulus could be transferred to another stimulus through any one of the relational frames.
In this way, the function of a positively reinforcing stimulus may transfer to a neutral stimulus through mutual entailment. In other words if A is related to B, then the function of A can be transferred to serve as the function of B.

Lipkens et al. (1993) conducted a longitudinal study with a typically developing child over the course of an 8-month period. The experiments tested the participant for the establishment of mutual and combinatorial entailment multiple times over the 9-month period. In brief, the experimenters found that at the initial onset of the study (age 16 months) the participant demonstrated responding across lines of mutual entailment but did not reliably demonstrate responding through combinatorial entailment. By the end of the study, (age 27 months), the participant demonstrated both mutual and combinatorial entailment.

Healy et al. (2000) demonstrated that derived relational responding, specifically in the form of mutual and combinatorial entailment, might be established as generalized operant classes. In four experiments, the authors demonstrated that mutual and combinatorial entailment could be established as patterns of responding contingent upon accurate and inaccurate feedback patterns. The experimenters tested 13 college-level participants on the establishment of stimulus classes along the lines of mutual and combinatorial entailment. In Experiments 1-3, the experimenters established that combinatorial entailment, defined as B1-C1, B2-C2, B3-C3 responses after the establishment of A1-C1, A1-B1, A2-C2, A2-B2, A3-C3, A3-B3 equivalences, was possible. In Experiment 4, the authors demonstrated that the establishment of mutual entailment, defined as training B-A and C-B relations and testing for A-B and B-C relations, was demonstrated at a faster rate than combinatorial entailment. The authors
identified this evidence in adults as support of evidence presented in the Lipkens et al. (1993) study.

S. C. Hayes et al. (1991) provided an example of transformation of stimulus function. The experimenters tested for the establishment of transfer of stimulus function across consequential functions for nine college-level participants. In this experiment, the experimenters first conditioned two stimuli, the first as a conditioned reinforcer, and the second as a conditioned punisher. This was established by presenting each stimulus (B1 and B3) for correct and incorrect responses to a sorting task. Once the function of B1 and B3 were established, the experimenters continued by establishing equivalence between arbitrary stimuli and the trained B1 and B3 stimuli in accordance with mutual and combinatorial entailment through a frame of coordination. Once the derived (untaught) equivalence relations were established, the experimenters tested for the transfer of consequential function of the B1 and B3 stimuli to the C1 and C3 stimuli (the equivalence of which was a derived response through combinatorial entailment). The results demonstrated that the C1 and C3 stimuli functioned as the appropriate consequence as defined by transformation of stimulus function of eight of the nine participants.

Where relational frame theory differed from stimulus equivalence was in the notion that “equality” was the only way in which stimuli could be related. Relational frame theory argued that stimuli could be related in multiple ways beyond equality. Examples of relational frames include the frame of coordination, which could relate stimuli equally, the frame of opposition could relate stimuli oppositely, frames of distinction, frames of comparison, hierarchical frames, and deictic frames. When applied
to language, verbal stimuli could acquire numerous functions through various relations to other stimuli, responses, and histories. S. C. Hayes et al. (2001) proposed that relational frame theory serve as a new way in which to look at verbal behavior.

Relational frame theorists argued that relational frames were overarching operants and could be acquired through a history of reinforcement (S. C. Hayes, Gifford, & Wilson, 1996). This was later demonstrated by Healy et al. (2000). This history was arbitrarily applicable in that the stimuli and responses that were present during the reinforcement history of the organism were inconsequential. It was the type of responding itself that would be reinforced. This reinforced type of responding could then be applied to new stimuli and new responses through a derived relation. In this way, it was not that A was related to B, but rather that any A could be related to some B along some relational lines. D. Barnes-Holmes et al. (2000) stated that being able to respond to stimuli in such a way constituted a possible definition of the verbal being. Skinner (1957) presented the speaker operants that defined verbal behavior, while Hayes and colleagues were presenting one possible way in which one may come to be defined as verbal.

**Naming theory.** Horne and Lowe (1996) first proposed naming as a higher order bidirectional behavioral relation that (a) combines conventional speaker and listener behavior within the individual and (b) does not require reinforcement of both the speaker and listener behavior for each new name to be established, and (c) relates to classes of objects and events.” (1996, p. 207). Horne and Lowe proposed naming as the basic unit of verbal behavior, as naming involves the joining of speaker and listener behavior within one’s skin, proposed to be necessary “…in the development of stimulus classes,
and…symbolic behavior” (1996, p. 185). The theory on naming identified how a history of reinforcement between listener behavior and echoic behavior subsequently joins the two responses, such that accurate responses in the first topography (listener) will produce accurate responses in the second (speaker). Further, by joining the listener and speaker behaviors within one’s own skin, a child may respond as both a speaker and a listener in the absence of a caregiver, and thus acquire novel names through only indirect instruction. That is, the caregiver names the object, the child then orients toward the object (listener), responds as a speaker within his skin (overt or covert echoic, or speaker), and responds as a listener to his own speaker response. In this way, the child acquires the name of the object without directly contacting reinforcement for selecting, pointing, naming, or otherwise producing its name.

Through a series of papers, Horne et al. (2006) and Lowe et al. (2002; 2005) identified the role that naming plays in stimulus categorization, the initial independence of listener and speaker repertoires, as well the insufficiency of solely responding as a listener in the development of stimulus categories (Horne et al., 2006; 2004). Finally, Horne et al. (2007) identified manual signs as sufficient to establish stimulus categorization in the same way that speaker responses did.

To identify the role that naming plays in categorization, Lowe et al. (2002, 2005) taught a total of 19 participants, all typically developing children between 1.7 and 3.7 years of age, to identify non-identical arbitrary shapes using arbitrary names. In the first study, four participants were able to categorize by matching to sample after tact training for each of the arbitrary stimuli (Lowe et al., 2002). For the five participants who did not initially categorize, all five were able to categorize after a requirement of tacting the...
sample stimulus prior to categorization was added. This finding was replicated and added to by Lowe et al. (2005). In this study, the experimenters taught 10 participants to tact non-identical arbitrary stimuli with arbitrary names, similar to the previous study. After tact training, all participants were able to select sample stimuli (listener response), categorize stimuli (match-to-sample response), as well as acquire a novel function (clap or wave) along “name-consistent” categories. These studies identified tact responses, as the end behavior of the naming relation, as sufficient to establish stimulus categories.

In two subsequent studies 23 participants across the two studies were trained to respond to arbitrary stimuli and arbitrary names as a listener (selection response) (Horne et al., 2004; Lowe et al., 2005). All participants were of similar age and development to the previous studies. In the first study, none of the nine participants were able to categorize after only listener training, and only two of the participants were able to tact the responses after listener training. After subsequent tact training, five of the seven remaining participants were able to pass the category match-to-sample test. This provided evidence that listener and speaker behaviors were initially independent as well as provided evidence that listener responding was not sufficient to establish stimulus categories. Horne et al. (2006) replicated this finding with a similar function (wave or clap) across name-consistent lines being added, meaning the participants would add the function to the set of stimuli that had been given a common name. In this study 10 of the 14 participants were able to respond to the stimuli as a speaker after being trained as a listener. These 10 participants were able to pass subsequent category match-to-sample tests (stimulus categorization) as well as the category transfer across functions. The 4 participants who did not demonstrate speaker responding after listener training also did
not show categorization or function transfer. These results further provided evidence for a) the independence of listener and speaker repertoires and b) the necessity of the tact repertoire in order for categorization to emerge.

In totality, these studies create an argument that the naming relation is primary to stimulus categorization, and thus a necessary higher order operant that must be acquired before children may respond through other relations involving stimulus categorization. Horne and Lowe (1996, 1997) discussed naming as it related to both Sidman's (1971) stimulus equivalence and Hayes’ relational frame theory (S. C. Hayes, 1991, 1994). Horne and Lowe (1996) took issue with the notion of the word-object relation as symmetry. They identified that while “x” may refer to an object, an object does not necessarily refer to “x.” Further, Horne and Lowe stated that while stimulus equivalence and RFT may account for how stimuli are related, there is no account for the development of an acquisition of language through the behavioral processes of both the listener, speaker, and speaker-as-own-listener. In other words, the central component of language acquisition from a behavioral perspective, the echoic, had no place in the relational frame account of language development. However, Horne and Lowe also recognized that the differences between the theories were currently theoretical, lacking an empirical base with which to make an informed decision over the primacy of each of the three theories. They accepted that at present, there were no data to support whether or not naming would give rise to relational frames or stimulus equivalence, or if RFT would give rise to stimulus equivalence and naming, or whether stimulus equivalence may give rise to both.
Verbal behavior development theory (VBDT). Unlike the theories that came before, each of which focused on specific types of responding believed to define “verbal,” Greer and colleagues proposed a theory of verbal development that outlined the various verbal behavior development cusps and capabilities that were acquired as one became verbal (Greer & Ross, 2008; Greer & Speckman-Collins, 2009). This theory drew on the work of Sidman, Hayes and colleagues, as well as Horne, Lowe, and colleagues, but focused on the instructional histories and experiences that were needed for each of these cusps and capabilities to be induced, as opposed to identification of the specific cusps or capabilities that would define one as “verbal.” The definition of a developmental cusp was based on the work of Rosales-Ruiz and Baer (1997), who defined a developmental cusp as “…any behavior change that brings the organism’s behavior into contact with new contingencies that have even more far-reaching consequences” (Rosales-Ruiz & Baer, 1997, p. 533). The notion that each of these cusps may be induced when absent built on the further statements of Rosalez-Ruiz and Baer: “Of all the environmental contingencies that change or maintain behavior, those that accomplish cusps are developmental” (Rosales-Ruiz & Baer, 1997, p. 533). If environmental contingencies led to the development of particular cusps, then providing those contingencies could induce those cusps when absent. The verbal behavior development theory then focused its analysis on the cusp specifically as it pertained to verbal behavior development.

Greer and Speckman-Collins (2009) added the concept of a verbal behavior development capability to the Rosalez-Ruiz and Baer concept of a cusp. Greer and Speckman-Collins defined a verbal behavior development capability as a type of cusp that, when induced, “…results in a child’s being able to learn in a way that he or she
could not before…” (Greer & Speckman-Collins, 2009, p. 462). Each of these cusps and capabilities identified by Greer and others would be necessary for a child to fully develop as a functional listener, speaker, reader, writer, and self-editor.

Research on the verbal behavior development theory sought to identify the protocols that would induce the various cusps and capabilities when missing. These experimental data led to the necessary cusps and capabilities that defined each stage of verbal development, but the theory also led to experimentally tested protocols that were subsequently shown to induce these cusps and capabilities when missing (Greer & Ross, 2008). Instead of testing for the contingencies that controlled each of these cusps and capabilities, the number and type of operants emitted due to the presence of each cusp and capability became dependent variables, with the protocols used to establish the reinforcement control being treated as the independent variables. For the first time, this line of research allowed for a possible comprehensive sequence of language development from a verbal behavior perspective.

Much of the research that arose from the VBDT focused on the induction of listener and speaker behavior, culminating in the joining of listener and speaker behaviors within one’s skin and the induction of the naming capability. The naming capability came to be one of the central components of VBDT, with Greer and colleagues arguing that the joining of speaker and listener behaviors, through relational responding, was the necessary capability for children to further develop verbally.

**Research on the Naming Theory**

*Multiple exemplar instruction and naming as a dependent variable.*

Relational Frame theorists and naming theorists disagree on the major point of what the
Minimal repertoires are for one to be considered verbal: naming in and of itself as a form of relational responding, or relational responding in more general terms, which would include the naming phenomenon. Further, Horne and Lowe (1996) have argued that relational frame theory does not concretely demonstrate the type of relational responding that would induce such a relation, however the Horne and Lowe account of how “multimodal development of the name relation” (p. 204) occurs, would fall in line with the RFT account of arbitrarily applicable relational responding. Horne and Lowe further state “…all three accounts [naming, RFT, stimulus equivalence] share common ground…In view of these central similarities, might not the differing accounts be reconciled in order to advance a common research agenda for the future?” (Horne & Lowe, 1996, p. 239).

To this point, the naming and RFT theorists treated this class of phenomena in a similar light. That is, they tested what behaviors could, or could not, be emitted prior to this type of responding and what could be emitted with it, such as stimulus categorization and later, rates of learning (Corwin and Greer, 2013; Greer, Corwin, & Buttigieg, 2010; Horne & Lowe, 1996; Horne et al., 2007; Horne et al., 2004; Lowe et al., 2002; Lowe et al., 2005; Miguel, Petursdottir, Carr, & Michael, 2008). For both camps, the presence or absence of naming or relational responding was treated as the independent variable and the effects of responding in such a way were measured. However, it was not until Greer, Stolfi, et al. (2005) began testing for the induction of naming as a dependent variable that the reconciliation spoken of by Horne and Lowe (1996) began, and the field began exploring the environmental conditions and behavioral processes needed for a child to develop such a repertoire.
Greer, Stolfi, et al. (2005) tested a multiple exemplar instruction procedure across listener and speaker responses on the joining of the listener and speaker behavior for three participants. This procedure was built on the notion of relational responding as set forth by D. Barnes-Holmes et al. (2000). For these participants, listener and speaker behavior were not previously under joint stimulus control; that is, they could not respond as a speaker to stimuli that they could respond to as a listener. The presence of naming was tested for using a procedure first outlined by Horne and Lowe (1996). They stated, “Teaching subjects particular name relations for the stimuli used in match-to-sample procedures may be a powerful determinant of subsequent performance on equivalence tests” (Horne & Lowe, 1996, p. 224). In the Greer, Stolfi, et al. (2005) procedure, participants were “exposed,” through a type of “Naming Experience,” to the names of stimuli through a match-to-sample procedure. This “Naming Experience” would simulate a situation in the early verbal development of a child in which the caregiver would name a stimulus in the presence of multiple stimuli. The match procedure simulated the child accurately discriminating the stimulus to which the caregiver was referring.

In this procedure, the participants heard the name of a stimulus for the first time as they were asked to match the stimulus to a non-identical exemplar of the stimulus. The purpose of using non-identical exemplars was to ensure that the relevant characteristics of the stimulus were selecting out the correct responses as opposed to conditions of identity matching. Hearing the name of the stimulus during this procedure mimicked the incidental language “instruction” that most children are exposed to. Participants’ responses were reinforced when they correctly emitted the match-to-sample
response, which simultaneously ensured joint attention between the experimenter and the participant, and ensured that the potential for an equivalence to be established between name and object was present for those participants who had the naming capability. After the match-to-sample instruction was complete, the experimenters tested whether or not the participants could respond as a listener (selection response) or a speaker (tact response) for each of the stimuli. To do this, the experimenter presented the participants with multiple stimuli, including the target stimulus as well as non-exemplars. The experimenter told the participant to, “point to ____.” This was done so that the participants had the opportunity to point to each exemplar of the stimuli. Then, the experimenter presented the participant with a tact opportunity for each stimulus. The data showed that while two of three participants could respond to the stimuli as a listener, none of the participants could then respond as a speaker to these same stimuli.

Multiple exemplar instruction (MEI) across listener and speaker responses provided a history of rapidly rotated responses across match-to-sample, listener, and speaker (tact and intraverbal tact) responses. This rapid rotation was used to establish the equivalence between both listener and speaker responding, as well as between these two responses and the match-to-sample responding that would precede it. Further, this rotation simulated the reinforcement history that a typical child would contact in order to establish the naming capability (Horne & Lowe, 1996). The procedure itself was based on the suggestions of Hayes and colleagues, in which a history of relational responding established an arbitrarily applicable relation between visual match-to-sample, listener, and speaker responses. One of the key components of this MEI was the arbitrary application of such an equivalence. The MEI was conducted with novel sets of stimuli.
and the results would be tested with the original set. The MEI was not used to train the responses for any one specific set of stimuli, but rather an overall relation that would allow the participants to contact reinforcement such that they could respond in this way to ANY set after hearing the name of the stimuli during any “naming experience.”

After the use of multiple exemplar instruction across listener and speaker responses, the participants who could not previously respond as a speaker in the pre-intervention probes were once again presented with the opportunity to respond as a listener and a speaker following intervention. No additional match-to-sample or “naming experience” history was provided. Rather, the relation between responding as a listener and responding as a speaker was identified as the potential cause for any increases in speaker responses to the original set, and the MEI procedure was identified as what potentially allowed for this new relation to develop.

For all participants, the data showed that speaker responding significantly increased for the set used in pre-intervention probes as well as for a novel set, for which a new naming experience was provided. This experiment demonstrated that listener and speaker responses that are initially independent, as identified by Horne et al. (2006; 2007; 2002; 2005), could be joined following a history of framing, or relational responding, as identified by D. Barnes-Holmes et al. and Hayes et al. (D. Barnes-Holmes, et al., 2000; S. C. Hayes et al., 2001). Additionally this experiment demonstrated that multiple exemplar instruction across listener and speaker responses may be sufficient to establish the relationship between responding as a listener and as a speaker after an incidental language, or naming experience.
A critical component in the test for the presence of absence of naming is the match-to-sample procedure that was conducted prior to participants having the opportunity to respond as either a listener or a speaker. The match-to-sample procedure used by Greer, Stolfi, et al. (2005) was based on the simulation of a naming experience that a child might contact during the early verbal developmental years. A caregiver may show a picture of a stimulus to a child and ask the child to find a “like stimulus” in the environment (i.e. 2-D to 3-D) while the caregiver says the name of the object, or the caregiver may hold an object and say the name (tact presentation), or the caregiver may simply point to the object and say the name. In all of these cases, the caregiver orients the child to the stimulus and emits the name of the object. In the match-to-sample procedure used by Greer, Stolfi, et al. (2005) the experimenter ensured joint attention through the match procedure while the experimenter emitted the name of the stimulus. This would be the first opportunity for the participants to acquire the name-object relation.

A key component in the Greer et al. study, as well as subsequent studies on the naming phenomenon, is that this match-to-sample opportunity was the only opportunity for the participants to acquire the object-name relation (Corwin & Greer, 2013; Gilic & Greer, 2011; Greer et al., 2010; Greer, Stolfi, et al., 2005; Greer et al., 2007; Longano & Greer, 2013). The match procedure was not conducted again after multiple exemplar instruction, nor were the names heard again until the listener probe after MEI. By doing this, the experimenters isolated the listener response as the behavior that speaker responding was joining with, as opposed to a subsequent word-object pairing through an additional naming experience of any kind.
Gilic and Greer (2011) further tested the naming theory from a developmental perspective, as well as the role multiple exemplar instruction may play in the induction of naming, by testing the effects of a match instruction procedure and a multiple exemplar instruction procedure across listener and speaker responses on the emission of listener and speaker responses to a previously taught set of stimuli with typically developing two-year-olds. Horne and Lowe (1996) theorized that naming naturally developed somewhere between 2 and 3 years of age. Prior to selecting participants, Gilic and Greer screened 19 children, nine of whom were 3 years old, and ten of whom were 2 years old. Of the participants who were screened, all nine 3-year olds demonstrated the naming capability, while only two of the 2-year olds did. This was evidence supporting the natural development of the naming capability in typically developing children between the ages of 2 and 3 years.

For the 2-year old participants who did not demonstrate the naming capability, the experimenters first taught visual match-to-sample (MTS) responding to criterion level as children at this age did not necessarily have a fluent match-to-sample repertoire. After MTS had been established, the experimenters tested the effects of training stimuli using match-to-sample while emitting the name of the stimulus (establishing the word-object relation) on the emission of listener and speaker responses. Match-to-sample while hearing the names of the stimulus training was not sufficient for any of the eight participants to emit listener and speaker responses and it was thus said that these participants did not have naming.

Gilic and Greer (2011) found that the match-to-sample naming experience was not sufficient to establish naming for any of the eight participants. The same multiple
exemplar instruction procedure used in Greer, Stolfi, et al. (2005) was then used to induce naming for these eight participants. For seven of the eight participants, a multiple exemplar instruction procedure that rotated responses across match, point, and tact topographies for target stimuli, successfully established the relationship between the name heard in the match topography, listener responding, and speaker responding to criterion responding of 80% correct responses. This experiment added further data to the possibility that an experiential history of pairing name and object (match) rotated with responding as a listener and a speaker may establish the equivalence relationship of listener and speaker responding to the spoken name and the object. This equivalence may allow a child to respond as both a listener and speaker after only hearing the name of an object in an incidental way, such as a match-to-sample naming experience.

While Greer, Stolfi, et al. (2005) and Gilic and Greer (2011) demonstrated the potential effects of such an MEI procedure, neither study isolated the rotated instruction of MEI as the basis for the induction of the naming capability. Greer et al. (2007) tested the effects of this multiple exemplar instruction as compared with single exemplar instruction (SEI) on the induction of the naming capability. The SEI involved delivering the same number of learn units to the participant for each response topography (match, point, tact, intraverbal) as MEI, however, all match learn units were presented first, then all point-to learn units, then all tact learn units, then all intraverbal learn units, as opposed to all learn units across the four topographies being rotated and presented together.

The experimenters matched four sets of participants into dyads. For each dyad, one participant was randomly assigned to receive multiple exemplar instruction across listener and speaker responses. The learn units of the matched participant in the SEI
group were yoked to the number of learn units received by his or her partner in the MEI group. All participants in the MEI grouped showed increased number of listener and speaker responses following intervention, and two of the four participants met criterion level responding after two sets of MEI instruction. For the two participants who did not emit criterion level responding after two sets, they were able to emit criterion level responding after a third set. None of the participant’s responses in the matched single exemplar instruction group increased significantly for either of these topographies during the post-intervention probe. The two participants who were matched with the participants in the MEI group who needed an additional MEI set also received an additional round of SEI instruction in order to control for the number of intervention experiences. These participants still did not demonstrate increases to criterion level responding for listener and speaker responses.

Continuing this study, the experimenters used the same MEI procedure with the participants who were in the SEI group. All four of the original SEI participants emitted criterion level responding for both listener and speaker responses after either one or two MEI sets. This experiment isolated an instructional history of rotated listener and speaker responses as an intervention that was not only sufficient, but also necessary, to induce the naming capability when absent.

**Additional interventions used to induce the naming capability.** While multiple exemplar instruction across listener and speaker responses has been the most common, and effective intervention used in the induction of the naming capability, additional interventions have been experimentally shown to induce naming. These interventions include the intensive tact protocol (Choi & Greer, 2013; Greer & Ross,
2008; Greer, Stolfi, et al., 2005; Pistoljevic & Greer, 2006; Schauffler & Greer, 2006), and the auditory matching protocol. In all of these interventions, participants contact reinforcement for observing visual stimuli (pictures in intensive tact and echoic-to-tact, and visual discriminatory stimuli in auditory matching, which the child must observe and “remember” in order to contact reinforcement) and auditory stimuli (tacts in intensive tact and echoic-to-tact, and speech sounds in auditory matching) simultaneously. Both of these observing responses have been shown to be instrumental in the development of the naming capability, as will be discussed later.

**Naming as a Higher Order Operant**

Catania (2007) defined a higher order operant as “…an operant class that includes within it other classes that can themselves function as operants” (pg. 392). Naming is a higher order operant in that listener and speaker responses each function as individual operants. One may emit listener behavior and contact reinforcement for emitting that listener behavior and one may emit speaker behavior and contact reinforcement for emitting speaker behavior. However, this is not the way in which naming is classified as a higher order operant; rather, naming is a higher order operant in that when one demonstrates the ability to learn names through naming, it applies to all names, not simply a subset of names. This must be explored further and compared with other higher order operants.

Another higher order operant is generalized imitation. Generalized imitation is a cusp that is a capability by which one may learn by imitating the behaviors of another. Generalized imitation is a capability because prior to the presence of generalized imitation, one must be taught to emit behaviors using physical prompts (Greer 


Once generalized imitation is present, one may simply watch another emit a behavior and then he/she may emit the behavior himself (Baer & Sherman, 1964). This imitation is not limited solely to a subset of behaviors such as gross motor, or fine motor behaviors, but rather to a wide range of behaviors that lie within the physical capabilities of the observer. Baer and Sherman state that once generalized imitation is present “…the child is responsive to the stimulus of similarity between responses, apparently independent of the particular physical stimuli involved in specific responses...” (Baer & Sherman, 1964, p. 47).

However, simply having the physical capability to emit the behavior, or even necessarily emitting the behavior in the presence of another emitting the same behavior is enough to define the reinforcement contingencies surrounding generalized imitation. One who swims for the first time (in a pool, with others present) does not necessarily learn to swim through imitation of the other swimmers. Or the child who picks up a pencil in the presence of others who are writing did not necessarily observe others picking up the pencil. There must be a source of reinforcement for emitting behavior that has point-to-point correspondence with another. The source of reinforcement for generalized imitation may be the observation of another emitting the behavior, while individuals contact reinforcement for emitting the behavior with point-to-point correspondence themselves.

An example of generalized imitation may be in learning to jump. When learning to jump prior to generalized imitation being present, one must be physically prompted to stand up, then bend at the knees, then “push” up, which may be simulated for the learner by lifting him or her up. Each behavior is differentially reinforced until the full chain of
behaviors is emitted. If one has generalized imitation, one may observe another stand up, bend at the knees, then push up. The reinforcer contacted is not simply the effect of jumping, but rather emitting point-to-point correspondence with the standing, bending, pushing off and finally jumping behaviors.

So what of the individual imitating an upward jump, who, instead of jumping upward, jumps outward, or worse off, falls down? This individual would not have contacted reinforcement for emitting the point-to-point correspondence with the original jumper, and must emit the behavior again. One may expect this individual to ask the original jumper to jump again so that he may observe again to see what went wrong. Again, the observation of the original jumper may be the source of reinforcement for generalized imitation, but it is not until the imitator contacts reinforcement by emitting point-to-point correspondence with the behavior of the original jumper that the operant is acquired. If naming is a higher order operant in the same sense as generalized imitation, then it seems to follow that there would be a similar source of reinforcement (observing responses) and behaviors that must be emitted to contact reinforcement in order for learning to occur via the naming capability.

**Sources of Reinforcement for Naming**

In the seminal paper on the naming theory, Horne and Lowe (1996) identified the role of echoic behavior as a speaker-as-own-listener behavior that would be a minimal necessary repertoire in order for the naming capability to be present. The necessity of speaker-as-own-listener behavior seems to logically follow the definition of the naming capability, that being the joining of speaker and listener behaviors. In the Horne and Lowe account of naming, echoic behavior, a behavior that has been previously reinforced
along traditional Skinnerian (1957) lines (point-to-point correspondence between the vocal behavior of another and oneself), is emitted after the caregiver’s tact. The caregiver reinforces this echoic behavior, which begins to establish the tact function of the object-name relation. However, Skinner states that there may be other indirect ways in which echoic behavior is reinforced. Skinner says, “Within certain temporal limits, the required behavior may be echoic but weak because the stimulus is remote. A familiar case is the self-echoic behavior of recalling what you were on the point of saying” (Skinner, 1957, p. 404). In this account it is not simply that one emits echoic behavior following his or her own vocal behavior, but one also listens to, and reinforces the echoic behavior in place of another human as listener.

Horne and Lowe (1996) agree with this account of the echoic in that one may reinforce individual echoic behavior as a listener, not necessarily requiring the behavior of the caregiver to contact reinforcement. This is differentiated from the vocal behavior of parroting, vocal behavior that is automatically reinforcing (which is not verbal), based on the individual’s prior history of reinforcement with a listener reinforcing echoic behavior. Upon hearing oneself emit the response (which functions in the same way as the original caregiver), the name is echoed again, which is then again “listened to” by one’s own listener behavior. In this way a speaker-as-own-listener “loop” is created by which one may emit speaker and listener behavior in response to one’s own listener and speaker behavior. In the absence of a caregiver, the child may see a shoe and say “shoe” (reinforced by hearing oneself say shoe) or say “shoe” and pick the shoe up. In this way, the original speaker behavior of the caregiver became the source of reinforcement for the child to emit the original vocal stimulus, “shoe,” but it was the self-echoic behavior of the
child emitting the vocal stimulus “shoe” that allowed the child to contact reinforcement for the vocal operant “shoe” and thus maintain the tact until another listener was present to reinforce the vocal behavior.

Longano and Greer (2013) sought to identify observing responses for visual and auditory stimuli as the source of reinforcement for the naming capability. In this experiment, Longano and Greer demonstrated that once both visual and auditory stimuli selected out observing responses, participants demonstrated the naming capability. Three participants, including two 7-year old males with developmental delays and a 5-year old typically developing female, did not demonstrate the naming capability. Participant T, while typically developing, did not demonstrate academic levels typical of a 5-year old, and was identified as academically “at-risk.” All participants demonstrated a fluent listener repertoire and echoic repertoire, which were identified as prerequisite skills to demonstrate the naming capability. The presence of these capabilities meant that reinforcement for some other verbal behavior developmental cusp was missing.

Participants were tested for the naming capability in two settings, one in which joint antecedent control was firmly established (match-to-sample instruction to establish the word-object relation) and one in which the target stimulus was tacted in the natural environment by the experimenter in the presence of the participant. In pre-experimental probes, the three participants emitted low levels of speaker responses (tact and intraverbal) during naming probes, despite high or criterion levels of responding for listener responses.

A non-concurrent multiple probe design was used to then test the effects of conditioning observing responses for auditory and visual stimuli as reinforcers on the
emergence of naming. Prior to the onset of intervention, the experimenters tested if auditory and visual stimuli selected out observing responses. The three participants demonstrated varying levels of conditioned reinforcement for observing responses for both visual and auditory stimuli; however, none of the three participants emitted criterion level responding for both auditory and visual stimuli. At this point, the experimenters implemented a stimulus-stimulus pairing procedure to condition observing responses for auditory and visual stimuli following the non-concurrent multiple probe design. Each of the participants required multiple sets of the stimulus-stimulus pairing procedure ranging from 2-4 sets with none of the intervention sets requiring more than a 10-second duration of pairing procedure. All three participants demonstrated conditioned reinforcement for observing responses for auditory and visual stimuli post-intervention.

All three participants emitted increased or criterion levels of intraverbal and tact responses during post-intervention probes in both joint-attention and natural conditions for both the first set of stimuli and a novel set. These results demonstrated that the acquisition of stimuli as conditioned reinforcers for observing responses might be a source of reinforcement for naming in that once participants’ observing responses were selected out by auditory and visual stimuli, then the bi-directional relationship between listener and speaker responses could be established as well as the ability to acquire language incidentally. Further, the increased levels of responding during the novel probes in both the joint-attention and natural conditions provide additional support for this notion.

During this experiment, the experimenters measured the number of echoics emitted by the participants during intervention sessions. This measurement demonstrated
the reinforcing effects of the auditory stimuli for maintaining observing responses. When the participants emitted echoics, they contacted additional reinforcement for emitting speech sounds with point-to-point correspondence with the experimenter’s vocal behavior. The experimenters did not reinforce these specific behaviors, yet the behaviors were maintained. The increased correct responses, as opposed to correct echoics to incorrect stimuli, may support that these echoics were not simply functioning as echoic responses, but also as tact responses, reinforced by the participants’ own speaker-as-own-listener behavior as discussed previously. At the same time, each speech sound was also being paired with a visual stimulus for which participants were now contacting reinforcement for observing as a function of the stimulus-stimulus pairing procedure. Unlike the overt echoic behavior that functioned as a measure of reinforcement of observing the auditory stimulus, there was no overt measure of reinforcement for observing the visual stimulus. Again, the results did show that naming was induced for all participants, for both the original and novel set, and it can be said that these participants contacted reinforcement for observing both visual and auditory stimuli. However, there was only an accurate measure of the auditory stimulus as both a source of reinforcement and the resulting contact with the reinforcing stimulus.

**Conditioned Sensory Responses and Conditioned Seeing**

**Skinner and conditioned seeing as a respondent.** As early as 1953 in *Science and Human Behavior* and then again in *Verbal Behavior* (1957), Skinner recognized conditioned seeing as a behavior that occurs beneath the skin. Skinner (1953) defined conditioned seeing as a behavior that is a conditioned reflex, emitted in the absence of the actual stimulus, to a stimulus that has been previously paired with the presence of the
stimulus. This may be the name of the stimulus, the sound or smell of the stimulus, or as in a Pavlovian sense, any stimulus that has been paired (such as a dinner bell). Skinner postulated that when one emits a response based on a first-order classically conditioned pairing, it is not the conditioned stimulus that one is responding to, but rather the conditioned sensory response behavior that the pairing elicits. In other words, the dog does not salivate because the stimulus of the bell causes salivation, but rather because the bell causes the dog to “sense” food, potentially as conditioned seeing (or smelling), which causes salivation.

Further, Skinner both spoke of, and alluded to, conditioned seeing in *Verbal Behavior* (1957). In addition to a reiteration of the conditioned seeing account given in *Science and Human Behavior* (1953) in *Verbal Behavior*, Skinner speaks of responses to stimuli that are not present, but have been present at some time in the past. One may respond to events that happened a few minutes before, a few hours before, or days or years before. In these examples, the visual stimuli are not present but the response may be as strong as if the stimuli were still in the visual field of the speaker. Further, this behavior may be evoked by stimuli that take on a completely different topography than the original stimulus. That is, a physical shark, which evoked a fearful response in the past, may evoke the same fearful response when another says “shark.” The sounds SH/A/R/K by themselves should not evoke a response of fear. However the conditioned image that the speech sounds evoke lead to a fearful response.

Staats, Staats, and Heard (1961) demonstrated that word meaning could be conditioned through pairing with known words that elicit a sensory response. In this study, college students were presented with four different unconditioned stimuli that were
nonsense words. Each word was paired with a set of words that were related through specific characteristic. The target characteristics were “angular” and “round” with control characteristics being “transportation” and “building material.” Each unconditioned word was paired with a word from the pre-determined set 12 times (one time for each conditioned word in each set). After the intervention was complete, the experimenters asked the participants to rate each word on four different levels. These levels were the experimental level of “angular” or “round”, and three distractor levels of “active-passive”, “weak-strong”, and “pleasant-unpleasant.” The results demonstrated that the difference between subjects’ rating of each word along its conditioned response was significant. In this study, it was the conditioned seeing response to each of the paired words that “created” meaning for the unconditioned words. In this way, the conditioned sensory response, elicited by previously conditioned words, gave “meaning” to these novel words as concluded by the fact that the experimental level that elicited a direct conditioned seeing response in regards to the specific stimuli led to a significant result (an angle may be perceived as strong, however this is a more abstract relation).

Skinner separated conditioned seeing from a different term; operant seeing. Operant seeing is similar to conditioned seeing in that a stimulus directly relating to the conditioned image must not be present for the operant seeing behavior to occur. Operant seeing, as the name suggests is under reinforcement and deprivation control, as is all operant behavior. This is juxtaposed to the respondent notion of conditioned seeing. When one is under conditions of deprivation for sushi, and the eating of sushi has abated those conditions, the image of sushi may then become a conditioned reinforcer for having
abative properties relative to the deprivation condition of “wanting” sushi. No stimulus related to sushi need be present for one to “see” sushi.

**Conditioned sensory responses in naming.** In many of the previous studies on the naming phenomenon, the echoic is discussed in detail as a measure of reinforcement for auditory observing responses to a stimulus (Choi & Greer, 2013; Horne & Lowe, 1996; Longano & Greer, 2013; Speckman-Collins, Park, & Greer, 2007). However, it is pointed out at each stage that the child visually observes the stimulus as well. In the Horne and Lowe (1996) theory on naming, there is some discussion of the role that visually observing the stimulus plays as strengthening the object-name relation. Observing the visual stimulus (or observing the stimulus through other modes) is joined with the object-name relation, and it may allow for the child to emit the name based on other sensory antecedents. In this account, it does seem apparent that the observation of the stimulus must occur in the same manner as echoic behavior in response to the stimulus in order to name and select out the stimulus in the future.

Horne and Lowe (1996) referred to Skinner’s analysis of conditioned seeing as respondent behavior as part of the reinforcement contingencies that maintain the naming relation. They stated “…a child who emits the name ‘mama’ in her mother’s absence may ‘see’ her, ‘hear’ her, ‘smell’ her….,” (Horne & Lowe, 1996, p. 203). Horne and Lowe discussed this behavior, though, as behavior that maintained the naming relation, not necessarily behavior that precluded it. They state, “Eventually the shoe may either be “seen” or visualized when the shoe is not present (i.e. conditioned seeing), and this conditioned stimulus may also give rise to the utterance, ‘shoe’.” (Horne & Lowe, 1996,
For Horne and Lowe, conditioned seeing was one of many given behaviors that further strengthened the object-name relation.

**A measure of conditioned sensory responses.** Hefferline and Perera (1963) demonstrated that a covert conditioned hearing response could maintain subsequent responses, much the way that Horne and Lowe (1996) indicated a conditioned seeing response could maintain an object-name relation. In this study, participants were told to press a key every time that a tone was heard. The tone was presented contingent upon observation of a subtle thumb twitch by the experimenter, the tone then functioning to reinforce the twitch. After tones reliably produced key presses, the tone was delayed, and presented contingent upon the thumb twitch and the initial movement toward a key press, called a sub key press. At this point, the tone was faded out over a series of sessions until it was completely absent, yet the participant continued to press the key. At the conclusion of the session, the participant maintained that he continued to hear the tone despite the tone’s actual absence. This experiment provided evidence that a conditioned sensory response could have a verbal effect on a listener (report that the tone was present) as suggested by Skinner (1957) or as a speaker-as-own-listener and the maintenance of a conditioned stimulus-response relation (hear the tone-press key) as suggested by Horne and Lowe (1996) (“see” shoe, say “shoe”).

**Joint control and rehearsal as a measure of conditioned sensory responses.** Lowenkron identified joint-control of echoic, self-echoic, and non-verbal stimuli as necessary for speaker-as-own-listener behaviors to result in the acquisition of a “name” through naming. In a series of papers, Lowenkron discussed the importance of a self-echoic as a match-to-sample response for listener behavior to occur and hinted at the
importance of a conditioned seeing response as a similar match-to-sample process for visual stimuli in order for tacts to occur (Lowenkron, 1988, 1989, 1991, 1997; Lowenkron and Colvin, 1992). Lowenkron discussed this “rehearsal” of a vocal stimulus, echoing one’s own vocal verbal behavior until a visual stimulus, which had been previously reinforced for having an identity relation with the vocal stimulus, appears in the presence of the one who is echoing. At this point, the vocal verbal behavior that is emitted is not that of an echoic, but that of a tact, which is reinforced by affirmation (or consequated with negation if incorrect) by a listener. But what of the person emitting the self-echoic in the presence of stimuli not as a tact, with neither reinforcement nor punishment from a listener? Or the person saying, “No, not this one, but this one!”? If there is reinforcement for emitting the self-echoic as a tact in the presence of the visual stimulus, then there must also be reinforcement for tacting the correct visual stimulus (Lowenkron & Colvin, 1992). There are many occurrences in which the relation has been directly reinforced (tact training, direct learning opportunities such as “This is a shoe, say ‘shoe’”), but as discussed previously, this is not always the case. In the case of naming, there is no direct training, and as such there must be a source of reinforcement for the correct visual stimulus similar to the reinforcement provided for the vocal behavior of a tact in the self-echoic.

In a study by Lowenkron (1988), the experimenters tested the effects of teaching an arbitrary sign as measure of a conditioned response on the correct responding of tacting using sign language (an overt, measurable behavior) for four teenage participants who were developmentally delayed, defined as an IQ below 40. In this study, Lowenkron likened the sign to that of an echoic being used to maintain an object-name
relation, however, the visual nature of the sign functionally differentiates the sign from echoic behavior. A possible interpretation is that the sign used was more closely akin to a representation of a conditioned seeing response. Lowenkron found that when participants repeated the sign in the absence of the stimulus, they were more likely to select the correct equivalent sign as a tact at a later point in time. A major limitation to this method as a measure of conditioned seeing is that the behavior that was taught (signing) was an overt behavior, and therefore not equivalent to the conditioned seeing response defined by Skinner. However, the notion of rehearsing an image, overt or not, further supports the Horne and Lowe (1996) notion of conditioned seeing maintaining the object-name, or tact, relation in the absence of the visual stimulus.

**Visual Imagining and Memory**

There is some behavioral literature related to “seeing” images in the absence of the stimulus. The literature discusses these behaviors under various names such as visual imagery, and visual imagining (Catania, 2007; Kisamore, Carr, & LeBlanc, 2011). This literature focuses more on Skinner’s (1953) “operant seeing” as discussed above, leaving a study of conditioned seeing in the Skinnerian sense untouched. Both Catania (2007) and Kisamore et al. (2011) focus on this behavior in the way that Skinner spoke of operant seeing in problem solving as well as tasks such as word-object associations. Each of these cases refer to conditions and operants with which the organism is already familiar, as opposed to the role of conditioned seeing in the Horne and Lowe (1996) account of naming as well as the role of rehearsal for Lowenkron (1988).
Rationale and Educational Significance

The number of words children acquire by the time they enter school is upwards of 55,000 (McGuinness, 2004). Once in school, thousands more are acquired annually. Students do not receive direct instruction on each of these words, and as vocabulary increases, the amount of direct instruction for the acquisition of new words continues to decrease (Greer et al., 2010). The process by which children may acquire language in such a way is naming. However, naming does not naturally develop for all children. Developmentally delayed children and educationally disenfranchised children may not have the experiential history necessary for educational success (Hart & Risley, 1995). These experiences are the experiences that lead to what has been defined by the research under the verbal behavior development theory as the verbal behavior cusps and capabilities (Greer & Ross, 2008; Greer & Speckman-Collins, 2009). These experiences have been shown to lead to the joining of the listener and speaker behaviors, and the subsequent development of the naming capability. Theoretically, a lack of these experiences prevents the development of such a capability. Research has shown that providing such a history may allow for the induction of the naming capability, and the increased educational outcomes that come with the presence of this capability (Choi & Greer, 2013; Corwin & Greer, 2013; Gilic & Greer, 2011; Greer et al., 2010; Greer & Longano, 2010; Greer & Ross, 2008; Greer & Speckman-Collins, 2009; Greer, Stolfi, et al., 2005; Greer et al., 2007; Longano & Greer, 2013).

If the naming capability is to be induced for children where it is not present, then a complete understanding of what allows a child to “name” is necessary. Some research suggests that the source of reinforcement for the naming capability may be observing
responses for visual and auditory stimuli (Choi & Greer, 2013; Greer & Han, 2013; Longano & Greer, 2013). In these experiments, echoic responses served as one measure of the acquisition of conditioned reinforcement for observing auditory stimuli, but no measure was present for the acquisition of conditioned reinforcement for observing visual stimuli. Additional research has shown increased listener responding and increased rates of learning for acquisition of conditioned reinforcement for observing voices and increased match-to-sample responding following the acquisition of conditioned reinforcement for observing visual stimuli (Greer & Han, 2013; Greer, Pistoljevic, Cahill, & Du, 2011; Keohane, Delgado, & Greer, 2009; Speckman-Collins et al., 2007).

However, the current research has yet to identify an observable behavior that is emitted in the absence of the visual stimulus that is due to the acquisition of conditioned reinforcement for observing the visual stimulus itself.

The Horne and Lowe (1996) diagrams that account for the development and maintenance of the naming relation both speak of the role that conditioned seeing may play. In the first, Horne and Lowe state “The shoe may in addition be visualized (CRs) when it is not present (such conditioned seeing being evoked by a reliably accompanying object…)…may also occasion the utterance “shoe” (Horne & Lowe, 1996, p. 200). In the second, they state “the auditory stimulus comes to occasion conditioned seeing, feeling, smelling, and hearing of dogs, which may, in turn, evoke saying “dog” and so on” (Horne & Lowe, 1996, p. 203). Figure 1 is a reproduction of the potential source of reinforcement contingencies as set forth by Longano (2008). There is a gap between these two diagrams regarding the initial role of the visual stimulus as a conditioned reinforcer, a gap that is left untouched in the current research, as it does not follow that
any child who has an echoic repertoire and observes will demonstrate the naming capability. Longano and Greer (2013) do identify this discrepancy, but do not present a measure for the behavior. To this point, a measure of conditioned reinforcement for observing visual stimuli is needed. Figure 2 is a proposed bridge between the source of reinforcement diagram identified in Longano and Greer, and the reinforcement contacted in the Horne and Lowe theory, with a measure of conditioned seeing being the missing behavior. Figure 3 is a potential demonstration of how conditioned seeing responses join with self-echoic responses during the naming experience. The figure demonstrates how the joining of the responses is conditional on both the source of reinforcement (observing responses for auditory and visual stimuli) as well as contacting reinforcement by emitting both self-echoic and conditioned seeing behaviors simultaneously.

Additionally, the definition of naming necessitates a joining of speaker and listener behaviors with visual stimuli. Presumably, if one has conditioned reinforcement for observing visual and auditory responses, and if the measures for these observing responses are echoic and conditioned seeing behaviors, but one does not emit both of these behaviors in the presence of the visual stimuli, then the acquisition of a name, through naming, will not occur. Horne and Lowe (1996) did indeed speak of the behaviors that may maintain the naming relation as “embodied within the name relation itself” (p. 203), and that these behaviors, either “operant or Pavlovian” (as Skinner suggested) may be produced as “[seeing…hearing…smelling…or feeling].”

If conditioned seeing is a measure of conditioned reinforcement for observing responses of visual stimuli, then it is necessary to identify if this behavior is emitted in typical children with and without the naming capability. If it is indeed an accurate
Figure 1. Echoic Behavior as Source of Reinforcement for Naming. Adapted from "The Effects of Echoic Behavior and a Second Order Classical Conditioning Procedure as a History of Reinforcement for Emergent Naming" by J.M. Longano, 2008, Doctoral dissertation, pg. 53. Copyright, 2013, by J.M.
measure, then it is necessary to understand if naming can emerge independent of conditioned seeing responses. To test this, participants in the following study were probed for the naming capability with a measure of echoic responses during a tact presentation naming experience and a measure of conditioned reinforcement for
observing visual stimuli (conditioned seeing) after the opportunity to respond as a speaker. The measure of conditioned seeing is defined as the participant’s ability to draw a likeness of the stimuli in the absence of the visual stimulus or an experimenter-provided vocal stimulus (the experimenter did not say, “draw ____”). If participants can
demonstrate both the listener and speaker component of naming without a demonstration of conditioned seeing, then this would provide evidence that conditioned seeing is not a behavior that must necessarily be emitted in order for children to acquire language through naming. However, if participants who demonstrate both echoics and conditioned seeing also demonstrate naming, and participants who only demonstrate one or the other do not demonstrate naming, then this may provide evidence that both behaviors must be emitted in order for naming to be present.

If it is true that both speaker-as-own-listener and conditioned seeing behaviors must be emitted simultaneously in the presence of the stimulus, then fully understanding both the echoic and conditioned seeing behaviors is important. In the prior studies on inducing the naming capability discussed previously, many participants needed several sets of multiple exemplar instruction prior to demonstrating the naming capability. In these studies there may have been additional unmeasured behaviors, such as conditioned seeing, that were delayed in joining with the speaker and listener responses. An understanding of the importance of the role of conditioned seeing may influence further research on behaviors that could be included in multiple exemplar instruction to induce naming such that the naming capability may be acquired at a faster rate and have more of an impact on the incidental acquisition of language.

**Research Questions**

This study attempts to expand the research base on the source of reinforcement for naming (language acquisition) from the echoic repertoire that has previously been tested to include conditioned seeing (Greer & Longano, 2010; Longano & Greer, 2013).
I also argue that while the reinforcement derived from conditioned seeing is a further source of reinforcement for language acquisition and naming, it is not the only additional source of reinforcement for language acquisition. While echoics may be a necessary source of reinforcement, I believe that conditioned seeing may be one of many sensory responses that can provide a source of reinforcement for object-name acquisition. Others may be any additional sensory response such as tactile, taste, or smell. The Horne and Lowe (1996) account of naming states a similar position, saying, “Thus a child who emits the name ‘mama’ in her mother’s absence may ‘see’ her, ‘hear’ her, ‘smell’ her….” (p. 203), as do equivalence and relational studies (L. J. Hayes, Tilley, & Hayes, 1988; Sidman, 1994). However, the importance of emitting the conditioned response itself has not been discussed.

To isolate the role of conditioned seeing in naming, a delayed phonemic response intervention was used to provide the names of the objects, typically acquired through speaker-as-own-listener behavior, necessary for the acquisition of names through naming. For participants who do not demonstrate naming prior to the intervention, if controlling for the speaker-as-own-listener behaviors in the absence of the visual stimuli allows for the demonstration of naming but not conditioned seeing, then it can again be concluded that the speaker-as-own-listener and conditioned seeing behaviors do not need to be emitted in tandem. However if providing for the speaker-as-own-listener behaviors does not allow for the demonstration of naming or conditioned seeing, then it can be said that an echoic history with the auditory stimuli is not sufficient to acquire language through the naming capability. Finally, if the phonemic response training allows for both naming and previously absent conditioned seeing behaviors to be demonstrated, then further
research will need to be conducted to isolate the source of the demonstration of the conditioned seeing behaviors.

The research questions addressed in this study are as follows: 1) Does conditioned seeing, as measured by a participant’s ability to draw a stimulus in the absence of the stimulus, occur following a naming experience? 2) Is conditioned seeing related to the demonstration of the naming capability? 3) Is conditioned seeing a behavior that is necessarily demonstrated as names are acquired through naming? 4) Is the presence of conditioned seeing sufficient to establish the name-object relation?
Chapter II

EXPERIMENT 1

Method

Participants

There were 12 participants in Experiment 1. There were four females and eight males, all between seven and eight years old. All participants were typically developing, general education students, whose level of academic responding ranged from slightly below grade level (mid first-grade reading) to multiple years above grade level (fourth grade math and fifth grade reading).

All participants were selected from a 2nd grade inclusion classroom in a public elementary school. Participants were currently students in the inclusion classroom, which utilized the CABAS®/AIL (Comprehensive Application of Behavior Analysis to Schooling/Accelerated Independent Learner) model of Teaching as Applied Behavior Analysis. Participants had been in this educational model for 1 or 2 years and were accustomed to working individually with one or more teachers, as well as receiving learn units (Albers & Greer, 1991), which involved teacher praise as a consequence for correct responses and correction procedures for incorrect responses. These participants were also accustomed to participating in non-traditional educational activities such as probe procedures, as well as traditional educational probes, such as tests, in which responses, either correct or incorrect, went without consequence.
Table 1

*Demographic and Verbal Development Information for Experiment 1 Participants*

| Participant | Age | Level of VB* | Observational Learning | Transformation of Stimulus Function Across Saying and Writing | Grade Level Equivalence by Participant in Math and Reading

<p>| | | | | | |</p>
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<tbody>
<tr>
<td>P1</td>
<td>7</td>
<td>L,S,R,W, SE</td>
<td>Y</td>
<td>Y</td>
<td>M-3/R-3</td>
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<td>P3</td>
<td>8</td>
<td>L,S,R,W,SE</td>
<td>Y</td>
<td>Y</td>
<td>M-4/R-3</td>
</tr>
<tr>
<td>P6</td>
<td>7</td>
<td>L,S,R,W</td>
<td>Y</td>
<td>Y</td>
<td>M-3/R-3</td>
</tr>
<tr>
<td>P8</td>
<td>8</td>
<td>L,S,R,W</td>
<td>Y**</td>
<td>Y</td>
<td>M-2/R-2</td>
</tr>
<tr>
<td>P9</td>
<td>7</td>
<td>L,S,R,W</td>
<td>Y</td>
<td>Y</td>
<td>M-2/R-2</td>
</tr>
<tr>
<td>P10</td>
<td>8</td>
<td>L,S,R,W</td>
<td>Y</td>
<td>Y</td>
<td>M-2/R-2</td>
</tr>
<tr>
<td>P11</td>
<td>7</td>
<td>L,S,R,W</td>
<td>Y**</td>
<td>Y</td>
<td>M-2/R-2</td>
</tr>
</tbody>
</table>

*a As determined by formative assessments administered by the participants' school district

* L - Listener, S - Speaker, R - Reader, W - Writer, SE - Self Editor

** Observational Learning was induced using a yoked contingency game board

*** Observational Learning was not initially found to be present; however classroom contingencies led to the emergence of the capability
Pre-experimental screening tests had previously been conducted on all participants for an array of verbal developmental cusps and capabilities including observational learning (OL) of new operants (Greer & Ross, 2008), and transformation of stimulus function across saying and writing (Greer, Yaun, & Gautreaux, 2005). All participants had demonstrated both of these verbal behavior development capabilities as well as a number of verbal behavior development cusps. For two participants, an observational learning intervention was used to induce the capability. Both participants successfully completed the intervention and demonstrated the OL capability. One additional participant did not initially demonstrate observational learning, but the capability emerged without intervention. For a complete list of academic and verbal behavior development levels, see Table 1.

Setting and Materials

All sessions took place either in the participants’ regular classroom, another classroom that the participants were familiar with, or in the hallway outside the participants’ regular classroom. Regardless of the location where the sessions took place, other students and participants were not present. This was to ensure that the only exposure that potential participants had to either the visual or vocal stimuli took place during experimenter-controlled opportunities. Controlling for instructional history with both vocal and visual stimuli was critical and as a result it was necessary to ensure that others were not present.

Visual stimuli. All visual stimuli were created in Microsoft Powerpoint® and printed in black ink on 7.6 cm x 12.7 cm index cards. Stimuli were approximately 3.5 cm x 3.5 cm and printed in various fonts. All stimuli were contained within a 5 cm x 5 cm
square outline. This was to provide a consistent reference point for participants and
independent observers scoring drawing response forms (Appendix B). Visual stimuli
were arbitrary symbols that participants had no previous instructional history with.
During pre-experimental probes (prior to the onset of the probe sequence), participants
were asked if they had seen the symbols before. If participants told the experimenter that
they had seen the symbol before, it was removed from the set and replaced with a
different stimulus that was also verified as novel. If participants said the symbol looked
like something but they had never seen the stimulus before, it remained in the set. Sets of
five stimuli were created from a pool of twenty stimuli in all (Table 2).

Table 2

*Visual Stimuli Used in Experiment 1 and Experiment 2*

| ⨭ | † | ≠ | ∫ |
| Ξ | ≈ | Φ | ≈ |
| ρ | ψ | Τ | ⊗ |
| € | Ω | δ | ⊑ |
| δ | ≡ | Γ | Ω |

*Note.* Sets were matched with different auditory stimulus sets to
create multiple novel sets.

**Vocal Stimuli.** Vocal stimuli were selected using a random number generator in
Microsoft Excel®. A range of numbers (1-21, and 1-5) was assigned to all letters. The
first set of numbers was assigned to consonants and the second set of numbers was
assigned to vowels, so the number "1" in consonants was assigned to the letter "B", the
number "2" to "C" etc. with vowels being skipped. The same process was completed
with vowels, where the number "1" was assigned to "A", 2 to "E" etc.

The number generator was set up so that randomly constructed sets of words
would be created in consonant-vowel-consonant (CVC) patterns. Four sets of auditory
stimuli were created. The number generator was set up to constantly create potential 1-
syllable CVC words. In other words, three columns were programmed to create potential
CVC words (e.g. kip, mof, dep). However, when the first letter was typed into Microsoft
Excel®, all numbers were again randomly generated, creating a continuous change in the
combinations. The experimenters checked all speech sound combinations for phonemic
fidelity and transparency (i.e. didn’t contain multiple identical letters, didn’t contain
patterns that created irregular sounds, did not make a real word). Consonant-vowel-
consonant combinations were not assigned solely to one set of visual stimuli. All sets
could be rotated creating new sets. For a complete list of visual stimuli and CVC
combinations, see Table 2 and Table 3 respectively.

Visual and CVC sets were assigned to participants randomly. The numbers “1”
through “4” were written on square pieces of paper and put into a bag. Each number was
written twice so that eight total numbers were in the bag. Participants drew one number,
which was then recorded, then another number, which was then recorded. The first
number was assigned to the visual stimulus set, and the second number was assigned to
the CVC set. This ensured that there was no bias in the assigning of the sets either to
each other or to participants.
**Drawing Responses.** A drawing response form was created for participants to draw their responses to demonstrate conditioned seeing. This form contained five boxes, each 5-cm x 5-cm, stacked two on the top, two in the middle and one on the bottom (Appendix B).

**Other Materials.** Other materials of import included a naming data form, presented in Appendix C. This data form allowed experimenters to keep track of the visual stimuli, phonemic combinations, the rotated presentation of stimuli, and various antecedent/response topographies that were presented, as well as coding for specific types of participant responses during the naming experience. The same form was used for interobserver agreement as well as within session data tracking. Only one form was used per stimulus set. New forms were used for the novel sets of stimuli.

<table>
<thead>
<tr>
<th>Set 1</th>
<th>Set 2</th>
<th>Set 3</th>
<th>Set 4</th>
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<tbody>
<tr>
<td>Kaj</td>
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<td>Jev</td>
<td>Dez</td>
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<td>Fap</td>
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<tr>
<td>Pid</td>
<td>Dem</td>
<td>Hod</td>
<td>Mef</td>
</tr>
</tbody>
</table>

Table 3

*Auditory Stimuli Used for Experiments 1 and Experiment 2*
Variables

The responses between which a relation was compared in this study were drawing responses, the listener component of naming, and the speaker component of naming. An analysis of the relation between the drawing responses and each of the components of naming was conducted individually.

Drawing responses. The drawing responses as a measure of conditioned seeing were defined as the participants' ability to draw a functional likeness of each of the five target stimuli, after responding to the stimuli as a listener and a speaker. This was done a minimum of two hours after the initial naming experience (defined in the procedure). The experimenter presented the participant with a drawing response form, then asked the participant to draw as many of the pictures as possible, in any order. At no point did the experimenter tell the participant which stimulus to draw. Criterion level responding was defined as four out of five correct responses (80%). A correct response was defined as eight out of ten independent observers (discussed below) scoring the response as correct.

Listener component of naming. The listener component of naming was defined as responding to a spoken word by looking at and pointing to the stimulus after hearing the tact. In this study, the experimenter presented three stimuli on a surface such that all three stimuli were visible, and said, “Point to ____.” The participant was then given 5 s to point to the target stimulus, at which point the response was recorded and the stimulus was no longer used as a target response. Target stimuli were rotated such that the participant was asked to point to each stimulus once, and only once. As such, participants responded as a listener 20 times. Criterion level responding was defined as 16/20 (80%) correct responses.
Speaker component of naming. The speaker component of naming was defined as presenting the participant with a total of 20 opportunities to tact four exemplars of the five stimuli with the opportunity to tact each exemplar of the stimulus once. The speaker component of naming was defined as correctly responding as a speaker (tact) to 16/20 stimuli (80%) after responding as a listener.

Data Collection

Data were collected during all naming sessions using the naming data form. Plus (correct) and minus data (incorrect) were collected for all speaker and listener response opportunities during probes for the components of the naming capability. Data were also recorded on the behaviors emitted by the participants during the naming experience using a designated coding system (Table 4).

Speaker responses must have had point-to-point correspondence with the vocal stimulus in order to be recorded as a plus. Any phonemic variation in the speaker response resulted in recording the response as incorrect. Listener responses were recorded as plus if the participant pointed to the correct response within 5 s of the experimenter completing the antecedent, “point to ______.” A minus was recorded if the participant made no response, or selected an incorrect stimulus. For both speaker and listener responses, if the participant emitted a response and then changed his or her response prior to the presentation of the next antecedent, the previous antecedent was presented once more and the participant was allowed to clarify his or her response. If the participant changed their response, the new response was recorded. This could result in changing an incorrect response to a correct response or a correct response to an incorrect response. Data were also collected on responses that were emitted during an incorrect
response to point and tact opportunities. This was done to see if there was consistency in
the names participants were emitting if the participants were naming the stimuli
incorrectly, however these data were only used anecdotally, not experimentally.

For drawing responses, responses needed to demonstrate some majority of
correspondence with the target stimulus as noted by eight out of ten independent, naïve
adult observers. Observers were not present at any point during the study and were not
familiar with the procedure, or participants. When scoring the drawing responses, the
experimenter explained that point-to-point correspondence was not required.
Independent observers were instructed to record if the drawing was correct or incorrect
(again using plus and minus) based on the definition of “Looking like the stimulus, but it
does not need to be exact.” In other words, if the drawing of the stimulus was laid over
the exact stimulus, it did not need to match precisely; it simply needed to demonstrate
enough similar characteristics that an observer would identify the stimulus. Observers
were specifically not calibrated, as the only method of calibrating would be to calibrate to
the experimenters’ expectation of a correct and incorrect response. Instead, if the
independent observer believed that the response was functionally correct, the
experimenter recorded it as correct. A plus was recorded for a response if eight out of ten
observers agreed that it was correct. If three or more observers scored a response as an
incorrect response, it was recorded as incorrect.

Finally, data were collected on multiple behaviors that the participants emitted
during naming experience sessions. These target behaviors were behaviors that either
were vocal verbal operants, such as echoics or tacts, or behaviors that might signify that
self-echoic behavior was occurring beneath the skin, such as nodding or mouthing
### Table 4

**Codes and Definitions of Codes Used on the Naming Data Form**

<table>
<thead>
<tr>
<th>Code</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NE</strong></td>
<td>Naming Experience - The Naming Experience was defined as the experimenter showing the participant the visual stimulus and while the experimenter emitted the tact for the stimulus</td>
</tr>
<tr>
<td><strong>E+</strong></td>
<td>Correct Echoic - A correct echoic was defined as the participant emitting an echoic with point-to-point correspondence to the experimenter tact that was easily audible by the experimenter(s)</td>
</tr>
<tr>
<td><strong>E-</strong></td>
<td>Incorrect Echoic - An incorrect echoic was defined as the participant emitting an echoic without point-to-point correspondence to the experimenter tact that was easily audible by the experimenter(s)</td>
</tr>
<tr>
<td><strong>N</strong></td>
<td>Nod - A nod was defined as a non-vocal response emitted by the participant after the presentation of the tact. A nod was not combined with any other code</td>
</tr>
<tr>
<td><strong>M</strong></td>
<td>Mouthing - Mouthing was defined as the participant shaping the sounds of the vocal stimulus without emitting a vocal response</td>
</tr>
<tr>
<td><strong>Wh</strong></td>
<td>Whisper - A whisper was defined as the participant emitting a vocal response with or without point-to-point correspondence with the experimenter tact at a low volume</td>
</tr>
<tr>
<td><strong>T+/T-</strong></td>
<td>Correct/Incorrect Tact - Or correct or incorrect tact was defined as the participant emitting the vocal stimulus prior to the experimenter emitting the tact. If a tact was emitted, the experimenter still emitted the tact and did not otherwise respond to the participants vocal verbal behavior</td>
</tr>
<tr>
<td><strong>L/L2:</strong></td>
<td>Listener - Listener was the participants responses to the listener half of Naming probe. Listener 2 was used for those participants that required a second pre-intervention listener probe</td>
</tr>
<tr>
<td><strong>S/S2:</strong></td>
<td>Speaker - Speaker was the participants responses to the speaker half of Naming probe. Speaker 2 was used for those participants that required a second pre-intervention speaker probe</td>
</tr>
<tr>
<td><strong>PoL:</strong></td>
<td>Post-Probe Listener - This was the participants listener probe post intervention</td>
</tr>
<tr>
<td><strong>PoS:</strong></td>
<td>Post-Probe Speaker - This was the participants speaker probe post intervention</td>
</tr>
<tr>
<td><strong>E:</strong></td>
<td>Echoic Training - This was the echoic training procedure. A plus or minus denoted correct or incorrect echoics</td>
</tr>
<tr>
<td><strong>P:</strong></td>
<td>Echoic Probe - The echoic probe was the unconsequated opportunity for the participant to emit the names of the five stimuli</td>
</tr>
<tr>
<td><strong>DEP:</strong></td>
<td>Delayed Echoic Probe - The delayed echoic probe was the opportunity for the participant to emit the names of stimuli prior to the echoic intervention. Criterion must have been achieved on the delayed echoic probe in order for the intervention to be concluded</td>
</tr>
</tbody>
</table>
the name. A lack of echoic responses did not signify that self-echoic behavior was absent, but rather that there were no measurable behaviors being emitted by the participant that could be analyzed. These data were recorded by coding the behaviors on the data form. A full list of codes and definitions of responses recorded by the experimenters are provided in Table 4.

**Design**

A non-intervention demonstrational design was used to test if conditioned seeing, as measured by drawing responses, occurred after a naming experience, and if this occurrence was related to a demonstration of naming. Two naming probes were conducted for each participant, with the second probe using novel stimuli. A drawing response probe was conducted after each naming probe. A visual analysis was used to analyze the relation between each of the components of naming and the measure of the drawing response for each probe. A Pearson correlation coefficient was then used to identify the relation between these variables.

**Interobserver and Interscorer Agreement**

Interobserver agreement (IOA) for the naming experience, listener, and speaker components of the naming capability were calculated using trial-by-trial IOA (Cooper, Heron, & Heward, 2007) in which two independent observers recorded behaviors emitted during naming experiences and responses emitted during probe opportunities. After each session was finished, the two experimenters counted the number of agreements and disagreements across all trials. The number of agreements was divided by the total number of agreements plus disagreements and multiplied by 100 to calculate a percent
agreement. So if each experimenter recorded 19 out of 20 correct responses, but the one incorrect was different for each experimenter, there would be 18 agreements out of a possible 20 agreements for a total agreement of 90%. Across all participants, IOA was collected on 62.5% of naming experience sessions as well as 42% of listener probe and speaker probe sessions. The mean agreement for naming experience responses was 98.13% (range = 91-100%), mean agreement for listener responses was 99.38% (range = 95-100%), and mean agreement for speaker responses was 98.75% (range = 95-100%).

Table 5 displays percent agreement across drawing responses as recorded by the independent scorers for each set by participant. Interscorer agreement (ISA) for drawing the stimuli was calculated by counting the number of combinations of agreements across the ten individual observers for each response and dividing by the number of possible agreements. In each case, there were 10 observers that could possibly agree with 9 other observers, so there were always 90 possible agreements (10x9). If eight observers agreed that a response was correct, and two agreed that it was incorrect, then the agreement would be eight observers who agreed with seven other observers (8x7) plus two observers who agreed with one other observer (2x1) divided by 90 possible agreements. This would result in the formula of \(\frac{(8 \times 7) + (2 \times 1)}{90} = 0.644\), or 64.4% agreement for a particular drawing response. The percent agreement for each response was then added together and divided by five (number of stimuli per set) providing a percent agreement for the entire set for each participant. Across all sets, for all participants, mean agreement was 93% (range = 79% – 100%). Across the 24 drawing responses, there were seven sets where agreement was less than 90%. Considering the subjectivity of the scoring of the drawing responses, this mean agreement overall was very high.


Table 5

*Interscorer Agreement for Drawing Responses Within Experiment 1 Participants*

<table>
<thead>
<tr>
<th>Participant</th>
<th>Set 1</th>
<th>Novel Set</th>
<th>Mean Agreement Across Sets</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>2</td>
<td>93%</td>
<td>89%</td>
<td>91%</td>
</tr>
<tr>
<td>3</td>
<td>96%</td>
<td>96%</td>
<td>96%</td>
</tr>
<tr>
<td>4</td>
<td>91%</td>
<td>100%</td>
<td>96%</td>
</tr>
<tr>
<td>5</td>
<td>88%</td>
<td>92%</td>
<td>90%</td>
</tr>
<tr>
<td>6</td>
<td>100%</td>
<td>93%</td>
<td>97%</td>
</tr>
<tr>
<td>7</td>
<td>90%</td>
<td>100%</td>
<td>95%</td>
</tr>
<tr>
<td>8</td>
<td>89%</td>
<td>82%</td>
<td>86%</td>
</tr>
<tr>
<td>9</td>
<td>93%</td>
<td>79%</td>
<td>86%</td>
</tr>
<tr>
<td>10</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>11</td>
<td>92%</td>
<td>83%</td>
<td>88%</td>
</tr>
<tr>
<td>12</td>
<td>86%</td>
<td>100%</td>
<td>93%</td>
</tr>
</tbody>
</table>

**Procedure**

**Naming Experience.** Prior to beginning any probe procedures, a pre-experimental probe was conducted to identify if the participant had an instructional history with any of the visual stimuli that had been targeted for the set. No pre-screening probe was conducted for vocal stimuli, as it was believed that any prior exposure to the vocal stimuli might confound the acquisition of a symbol-name relation. If none of the stimuli were identified, then the naming experience began. If any of the visual stimuli were identified as a stimulus in the participants’ instructional history (e.g. “that was in a
game I played”), it was removed from the set and replaced with another stimulus from the overall set. If the participant related the stimulus to a known stimulus, but had never contacted the target stimulus, the stimulus was left in the set (e.g. “That one looks like two snakes”).

Once a set of five stimuli was identified, the naming experience was conducted. The naming experience, which was only presented one time, consisted of four presentations of each of the five stimuli (20 total presentations). Prior to the onset of the naming experience, the experimenter said, "I am going to show you some pictures and tell you the names of them." The experimenter then held the stimulus at the participant’s eye level, approximately 1 m from the participant, for 3 s. While holding the stimulus, the experimenter provided a tact for the stimulus. At no point did the experimenter tell the participant to look at the stimuli, listen to the names, or echo the behavior of the experimenter. If the participant emitted any echoic behavior or other vocal behavior, that behavior was neither reinforced nor punished. Vocal behavior, and other observable non-vocal behavior, was recorded and coded on the naming data form (Appendix C). Vocal behavior included echoics (saying it out loud or whispering), and tacts of the stimuli prior to the experimenter tact. Observable non-vocal behavior included nodding or mouthing. All behavior was coded according to the codes listed on the data form. Once all 20 stimuli were presented and data recorded, the participant was dismissed.

**Probe for components of naming.** *Listener component of naming.* Following a 2 hr period in which the participant had no access to the target visual or vocal stimuli, probe sessions were conducted for the listener component of naming, the speaker component of naming, and the drawing responses. During the probe session for the
listener component of naming, the participant was presented with three stimuli, consisting of one target stimulus and two non-exemplars from the set of 20 stimuli. The stimuli were placed on the table in front of the participant. The instructor then gave the vocal verbal antecedent “point to ___." The participant was given 5 s to respond by pointing to the visual stimulus. Once the participant responded, the three stimuli were immediately removed from the participants’ field of view, and the target stimulus was removed from the set to ensure it was no longer used, as the experimenter recorded the response as either correct or incorrect. The participant was given 20 opportunities to respond as a listener (four opportunities for each stimulus). Again, responses were not consequated.

**Speaker component of naming.** A probe for the speaker component of naming was conducted immediately following the probe for the listener component of naming. During the probe session for the speaker component of naming, the participant was presented with the same 20 stimuli in the same manner as during the naming experience, however no echoic was provided. The participant was required to respond to the stimulus as a speaker and was instructed to say the names of the stimuli as the visual stimulus was presented. Each stimulus was presented to the participant for approximately 5 s. As soon as the participant emitted the tact for the stimulus, the stimulus was removed from the participants' field of vision, the experimenter then recorded the response, and the next stimulus was presented. If the participant did not respond after 5 s, the stimulus was removed from the participants’ field of vision, the response was recorded as incorrect, and the next stimulus was presented.

**Probe for drawing responses.** The probe session for drawing responses was conducted by giving the participant the drawing response form and asking the participant
to draw as many of the stimuli as possible. Participants were given ample time to think about and draw the stimuli. The probe session was ended when either the participant had drawn all five stimuli or he or she told the experimenters that he or she could not remember the stimuli three times. The time needed ranged from approximately 1 to 5 mins. During that time, if the participant could not remember any of the remaining pictures, the experimenter encouraged the participant to take their time and think about the pictures. Participants were encouraged to do this twice and, on the third time, the experimenter removed the form and the probe session was concluded. After the experimenters had conducted one probe for all participants, a second probe sequence was conducted using a novel set of stimuli (Novel Set).

**Results**

The results for all participants on listener, speaker, and drawing responses across both probes are presented in Table 6, as well as the mean correct responses across each of the two probes by response. The correlation between the listener component means and drawing response means as well as the correlation between the speaker component means and drawing response means are also presented in Table 6.

Figure 4 presents the percentage of probes in which each of the four possible patterns between the components of naming and the drawing responses occurred. The four possible patterns were: 1) naming (L - Listener/S - Speaker) absent – drawing responses (DR) absent, 2) naming present – DR absent, 3) naming absent – DR present, and 4) naming present – DR present).
Ten of the 24 probes across the 12 participants resulted in criterion level responding on the drawing responses, but less than criterion level responding on the

<table>
<thead>
<tr>
<th>Participant</th>
<th>Listener</th>
<th>Mean</th>
<th>Speaker</th>
<th>Mean</th>
<th>Drawing Responses</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>Set 1</td>
<td>20/20</td>
<td>20/20</td>
<td>16/20</td>
<td>5/5</td>
<td>5/5</td>
</tr>
<tr>
<td></td>
<td>Novel Set</td>
<td>20/20</td>
<td>12/20</td>
<td>5/5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2</td>
<td>Set 1</td>
<td>18/20</td>
<td>15/20</td>
<td>11.5/20</td>
<td>4/5</td>
<td>4/5</td>
</tr>
<tr>
<td></td>
<td>Novel Set</td>
<td>20/20</td>
<td>8/20</td>
<td>4/5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P3</td>
<td>Set 1</td>
<td>20/20</td>
<td>20/20</td>
<td>19.5/20</td>
<td>5/5</td>
<td>4.5/5</td>
</tr>
<tr>
<td></td>
<td>Novel Set</td>
<td>20/20</td>
<td>19/20</td>
<td>4/5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P4</td>
<td>Set 1</td>
<td>18/20</td>
<td>11/20</td>
<td>11/20</td>
<td>5/5</td>
<td>5/5</td>
</tr>
<tr>
<td></td>
<td>Novel Set</td>
<td>14/20</td>
<td>11/20</td>
<td>5/5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P5</td>
<td>Set 1</td>
<td>19/20</td>
<td>16/20</td>
<td>18/20</td>
<td>4/5</td>
<td>4/5</td>
</tr>
<tr>
<td></td>
<td>Novel Set</td>
<td>18/20</td>
<td>20/20</td>
<td>4/5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P6</td>
<td>Set 1</td>
<td>19/20</td>
<td>14/20</td>
<td>13/20</td>
<td>5/5</td>
<td>5/5</td>
</tr>
<tr>
<td></td>
<td>Novel Set</td>
<td>17/20</td>
<td>12/20</td>
<td>5/5</td>
<td></td>
<td></td>
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<tr>
<td>P7</td>
<td>Set 1</td>
<td>20/20</td>
<td>20/20</td>
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<td>4/5</td>
<td>4.5/5</td>
</tr>
<tr>
<td></td>
<td>Novel Set</td>
<td>19/20</td>
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<td>5/5</td>
<td></td>
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<td>P8</td>
<td>Set 1</td>
<td>14/20</td>
<td>5/20</td>
<td>7/20</td>
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<td>2.5/5</td>
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<tr>
<td></td>
<td>Novel Set</td>
<td>20/20</td>
<td>9/20</td>
<td>4/5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P9</td>
<td>Set 1</td>
<td>20/20</td>
<td>7/20</td>
<td>7.5/20</td>
<td>2/5</td>
<td>1/5</td>
</tr>
<tr>
<td></td>
<td>Novel Set</td>
<td>20/20</td>
<td>8/20</td>
<td>0/5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P10</td>
<td>Set 1</td>
<td>20/20</td>
<td>12/20</td>
<td>14/20</td>
<td>5/5</td>
<td>4.5/5</td>
</tr>
<tr>
<td></td>
<td>Novel Set</td>
<td>17/20</td>
<td>16/20</td>
<td>4/5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P11</td>
<td>Set 1</td>
<td>20/20</td>
<td>6/20</td>
<td>4.5/20</td>
<td>1/5</td>
<td>.5/5</td>
</tr>
<tr>
<td></td>
<td>Novel Set</td>
<td>10/20</td>
<td>3/20</td>
<td>0/5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P12</td>
<td>Set 1</td>
<td>9/20</td>
<td>8/20</td>
<td>5.5/20</td>
<td>3/5</td>
<td>3.5/5</td>
</tr>
<tr>
<td></td>
<td>Novel Set</td>
<td>9/20</td>
<td>3/20</td>
<td>4/5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Listener-DR correlation $r = .200$, NS
Speaker-DR correlation $r = .702, p < .02$

Note. Correlation is between each of the listener and speaker responses and the drawing responses

Ten of the 24 probes across the 12 participants resulted in criterion level responding on the drawing responses, but less than criterion level responding on the
speaker component of naming. The remaining 14 probes that were conducted presented with either criterion level responding on both drawing responses and the speaker component of naming (8/24 probes), or less than criterion level responding for both responses (6/24 probes). There were no instances of the speaker component of naming being present while the drawing responses were absent.

Only two of the 24 probes across the 12 participants resulted in criterion level responding on the drawing responses but less than criterion level responding on the listener component of naming. Sixteen of 24 probes resulted in criterion level on both drawing responses and listener responses, and three probes resulted in less than criterion responding on both responses. However, unlike the speaker component of naming, there were three instances of criterion level on the listener component of naming and less than criterion level responding on the drawing responses.

Figures 5 through 8 present the results for both probe sets for each participant used for the visual analysis of the relation between drawing responses and components of naming. Participants 1, 3, 5 and 7 emitted criterion level responding during the naming probes for Set 1 stimuli for listener, speaker, and drawing responses. Participants 3, 5, 7, and 10 emitted criterion level responding for these responses during the probes for the Novel Set. The remaining participants did not respond at criterion level on the speaker component of naming, but varied in their listener and drawing response levels. Results are presented by participant for both Set 1 and the Novel Set.

Figure 5 presents the results for both probes for Participants 1-3. During the naming probe for Set 1, Participant 1 emitted 100% correct responses on listener, speaker and drawing responses. On the Novel Set, Participant 1 emitted 100% correct responses
for listener and drawing responses, however only emitted 12/20 (60%) correct speaker responses. For Set 1, Participant 2 emitted 19/20 correct listener responses, 15/20 correct speaker responses and 4/5 correct drawing responses on the first probe after the naming
experience. During the Novel Set, he emitted 20/20 correct listener responses, 8/20 speaker responses and 4/5 correct drawing responses. Participant 3 emitted 100% correct responses to listener and speaker probes and 5/5 correct drawing responses for Set 1. For the Novel Set he emitted 20/20 correct listener responses, 19/20 correct speaker responses, and 4/5 correct drawing responses.

Figure 6 presents the results for Participants 4-6. For Set 1, Participant 4 emitted 18/20 listener responses, 14/20 speaker responses and 4/5 correct drawing responses. On the Novel Set, she emitted 14/20 listener responses, 4/20 speaker responses, and 5/5 drawing responses. Participant 5 emitted a mean of 18.5/20 correct listener responses (range = 18-19), 18/20 speaker responses (range = 16-20) and 4/5 correct drawing responses on both Set 1 and the Novel Set probes. All responses for Participant 5 were at criterion level. Participant 6 emitted a mean of 18/20 correct listener responses across the two probe sets (range = 17-19), 13/20 correct speaker responses (range = 12-14), and 5/5 correct drawing responses for both probes.

Figure 7 presents the results for Participants 7-9. Participant 7 emitted a mean of 19.5/20 correct listener responses (range = 19-20), 20/20 correct speaker responses for both Set 1 and the Novel Set and 4/5 drawing responses for Set 1 and 5/5 correct responses for the Novel Set. For Set 1, Participant 8 emitted 14/20 correct listener responses, 5/20 correct speaker responses and 4/20 correct drawing responses. On the Novel Set, Participant 5 emitted 20/20 listener responses, 9/20 speaker responses, and 3/5 correct drawing responses. Participant 9 emitted, 19/20 listener responses, 7/20 speaker responses, and 2/5 drawing responses. On the probe for the Novel Set, she emitted
similar levels of responding, emitting 20/20 correct listener responses, 8/20 correct speaker responses, and 0/5 correct drawing responses.

*Figure 5.* Demonstration Probes for Set 1 and Novel Set for Participants 1-3. Criterion level responding was 80% for all responses.
Figure 8 presents the results for Participants 10-12. Participant 10 did not emit echoics during the first naming experience, however he did emit echoics during the second naming experience. During Set 1 probes, he emitted 20/20 correct listener
responses, 12/20 speaker responses, and 5/5 drawing responses. The results from his second probe demonstrated variable responses, correctly responding to 16/20 listener responses and 14/20 speaker responses, while maintaining 5/5 correct drawing responses.

Figure 7. Demonstration Probes for Set 1 and Novel Set for Participants 7-9. Criterion level responding was 80% for all responses.
For the Novel Set, Participant 10 emitted 17/20 correct listener responses followed by 16/20 correct speaker responses and 4/5 drawing responses, demonstrating criterion level responding on all three. Participants 11 and 12 again emitted highly variable responding across both probes for both sets of stimuli. Participant 11 emitted echoics during both naming experiences, and Participant 12 emitted echoics during the second naming experience, however neither participant emitted criterion level responding on either listener or speaker responses for either set. Participant 11 emitted 20/20 correct listener responses on the initial probe after the naming experience. However, he emitted only 6/20 speaker responses and no accurate drawing responses. On his second probe, listener responding decreased to 14/20 correct responses, while speaker and drawing responses increased to 10/20 and 2/5 respectively. On the Novel Set, Participant 11 again emitted echoics, however only emitted 10/20 listener responses, 3/20 speaker responses, and 0/5 drawing responses. These numbers increased slightly on the second probe after the naming experience to 16/20 on the listener (criterion level), 6/20 on the speaker, and 2/5 drawing responses. Across the two probes for Set 1, Participant 12 emitted 9/20 and 16/20 listener responses, 8/20 and 9/20 speaker responses, and 2/5 and 3/5 correct drawing responses. On the Novel Set probes, he again emitted relatively low and variable responses, emitting 9/20 and 8/20 listener response, 3/20 and 0/20 speaker responses, and 4/5 decreasing to 3/5 correct drawing responses.

Figure 9 presents the scatterplots for each of the speaker-drawing response relations and the listener-drawing response relations across all probes conducted in Experiment 1. This is presented in addition to the correlation calculated and presented in
Table 6. A significant positive correlation between the speaker component of naming and the drawing responses ($r(10)=.702, p <.02$) was found. The relation between listener
responses and drawing responses was not significant. Visual analysis of Figures 5-8 as well as Figure 9 further support this analysis. In Figure 9 the dotted lines represent criterion level responding for each response. Consistent with the visual analysis of Figures 5-8, a positive linear trend is observed between the speaker-drawing relation
responses. This represents low drawing responses presenting with low speaker responses, and high drawing responses presenting with high speaker responses. In addition, it can be seen that there are multiple instances of the listener component of naming being demonstrated in the absence of the drawing response (top left quadrant of the bottom scatterplot), while there were no instances of the speaker component of naming being present while the drawing responses were not present (upper left quadrant of the top scatterplot). These quadrants represent the Pattern 2 response (naming present-drawing responses absent) defined in Figure 4.

**Discussion**

The results from Experiment 1 demonstrated a concomitant relation between correct responses to the speaker component of naming and correct drawing responses. This was supported by both a visual and statistical analysis of the data. Of the 24 initial probes that were conducted, none resulted in an instance of naming being present while conditioned seeing was not present. A visual analysis of the bar graphs presented in Figures 5-8 as well as the scatterplot presented in Figure 9 support this analysis. In the scatterplot there are zero data points in the upper left quadrant of the graph, which would be the quadrant related to criterion level responding for conditioned seeing and a lack of criterion level responding for the components of naming. It should be noted that this only held true for an analysis of the speaker component of naming, as there were multiple instances of the listener component of naming being present in the absence of conditioned seeing. The visual analyses of these probes were further supported by the statistical analysis, presented in Table 6, with a significant finding for the relation
between the speaker component of naming and the drawing responses as a measure of conditioned seeing. While the number of participants in this study was quite small, decreasing the reliability of a statistical analysis, it is significant to note that a visual analysis of the scatterplots (Figure 9) shows that speaker responses and drawing responses increased proportionally. With so few participants this is important as it shows that the significant correlation may not be due solely to a few participants at the high end of the spectrum bringing up the overall significance of the group. Regardless, more participants are needed to ensure the reliability of this significant correlation.

First and foremost is that all participants who demonstrated naming emitted overt echoics during the naming experience. While two participants did emit echoics and not naming (Participant 11 both sets and Participant 12 on the Novel Set), the naming theory states that echoic behavior is necessary in establishing the naming relation, however it does not follow that this behavior is sufficient to establish the naming relation. The pattern of responding displayed by Participant 12 is also particularly interesting in that he is one of only two participants who emitted both echoics and conditioned seeing responses but did not demonstrate naming. Participant 2 was the other participant who displayed this pattern, but Participant 2’s listener and speaker responses were significantly higher. The response pattern emitted by Participant 12 begins to provide evidence in support of the importance of emitting both conditioned seeing and echoic behavior simultaneously. It is possible that while he was emitting both behaviors, the echoic behavior did not function as a tact of his conditioned seeing behavior, and that the two were emitted independently. As a result, these behaviors did not maintain the object-name relation.
While Experiment 1 established a strong positive relation between the demonstration of naming and conditioned seeing, there were only very limited data regarding the acquisition of conditioned seeing responses as they related to the acquisition of naming (Participant 8). In each of the other cases, either both conditioned seeing and naming were present, conditioned seeing was present prior to the demonstration of naming, or neither were present throughout. In Experiment 2, those participants who did not demonstrate naming were given a delayed phonemic response teaching intervention in order to a) control for the presence of accurate speaker-as-own-listener responding necessary to establish the object-name relation, and b) test if the acquisition of the speaker responses after the intervention, and potentially naming, would also lead to criterion level increases in conditioned seeing responses. This intervention was used to ensure that the reason participants did not demonstrate naming was not because they simply did not acquire the names of the objects. The intervention was then used to teach the names of the stimuli in the absence of the objects so that there were no further opportunities for the object-name relation to be formed other than through the naming capability.
Chapter III

EXPERIMENT 2

Method

Participants

Participants for Experiment 2 were those participants from Experiment 1 who did not demonstrate the speaker component of the naming capability. The six participants for Experiment 2 were selected after a second screening probe was given to all participants who did not demonstrate the speaker component of naming in Experiment 1. This probe was conducted with the same stimulus set as the initial probe, but with no additional naming experience. For both Set 1 and the Novel Set, there were eight participants who did not meet criterion level responding on the Experiment 1 naming probe and were subsequently given the screening probe. For each of these sets, three additional participants responded at criterion level on the speaker component of naming during the second probe, while five participants did not.

Four participants (Participants 1-4) did not respond at criterion level for either Set 1 or the Novel Set, however there were two participants who only participated in Experiment 2 for one set. Participant 5 did not respond at criterion level on the second probe for Set 1, but did respond at criterion level on the first probe for the Novel Set. Participant 6 responded at criterion level during the second Set 1 probe, but did not respond at criterion level on the second probe for the Novel Set and was thus included in
Table 7

Demographic and Verbal Development Information for Experiment 2 Participants

<table>
<thead>
<tr>
<th>Participant</th>
<th>Exp. 1 Participant Number</th>
<th>Age</th>
<th>Level of VB*</th>
<th>Echoes emitted during pre-intervention probes for Set 1/Novel Set</th>
<th>Exp. 1 Probe and pre-screening probe results for Set 1 - L/S/DR</th>
<th>Exp. 1 Probe and pre-screening probe results for Novel Set - L/S/DR</th>
</tr>
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<tbody>
<tr>
<td>P1</td>
<td>P4</td>
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<td>L,S,R,W,SE</td>
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<td>14/11/5</td>
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</tr>
<tr>
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<td>P9</td>
<td>7</td>
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</tr>
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<td>9/3/4</td>
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<td></td>
<td></td>
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</tr>
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<td>P4</td>
<td>P11</td>
<td>7</td>
<td>L,S,R,W</td>
<td>Y/Y</td>
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<td>10/3/0</td>
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<td>P10</td>
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<td>20/12/5</td>
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</tr>
<tr>
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<td>P2</td>
<td>8</td>
<td>L,S,R,W,SE</td>
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<td>20/8/4</td>
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<td></td>
<td>20/20/4</td>
<td>20/12/5</td>
</tr>
</tbody>
</table>

Note. Listener and speaker probe scores are out of 20 while drawing response scores are out of 5

* L - Listener, S - Speaker, R - Reader, W - Writer, SE - Self Editor

Experiment 2. Table 7 displays the demographic information from Table 1 for these participants.

Setting and Materials

All settings and materials were identical to those used in Experiment 1.
**Dependent Variable**

The dependent variable was a pre- and post-intervention probe for the listener and speaker components of naming as well as the drawing responses. All responses were defined in the same way as Experiment 1. The pre-intervention probe measures were the data collected for these participants during Experiment 1. An additional probe sequence was conducted prior to the onset of the intervention, following the non-concurrent multiple probe design of the study, however the naming experience was never provided again. The post-intervention measure was conducted in the same was as the second pre-intervention measure, again, with no naming experience being provided.

**Independent Variable**

**Delayed phonemic response teaching procedure.** The independent variable was the implementation of a delayed phonemic response teaching procedure in which the participant received learn units on the phonemic responses for the target stimuli using echoic responses and a delayed echoic probe. This was not a procedure to induce echoing as a verbal operant, but rather to specifically teach the phonemic responses through echoing the experimenter. This intervention controlled for the presence of the names of the stimuli, which would be necessary in order to demonstrate the speaker component of naming. Theoretically, those participants who acquire names incidentally through the naming relation would have acquired these names through speaker-as-own-listener behavior emitted during the naming experience. However acquisition of names incidentally is only one part of the naming theory, and does not necessarily speak to the bi-directional relation between listener and speaker responses. This intervention
provided the speaker prerequisites in order to determine if the bi-directional relation was present.

**Data Collection**

Data for naming probes and drawing responses were collected in the same way as Experiment 1. Data were also collected for the delayed phonemic response teaching intervention, which included echoic responses, within-session echoic probes, and delayed echoic probes.

**Design**

A non-concurrent multiple-probe design across participants was used to test the effects of the delayed phonemic response teaching intervention. The non-concurrent probe design began with the probes in Experiment 1 and continued based on the pre-screening probe used to select participants for Experiment 2. An initial pre-intervention probe was conducted for all participants (Experiment 1). The following day, the delay of the non-concurrent multiple probe design began. A second pre-intervention probe was conducted for the first participant who did not demonstrate naming on the initial pre-intervention probe. If this participant demonstrated naming on the second pre-intervention probe, the participant was not used in Experiment 2. If the participant did not demonstrate naming on the second pre-intervention probe, the intervention began and the participant participated in Experiment 2.

After the intervention was finished and the post-intervention probe was administered for this participant (Participant 1 in Experiment 2), the second pre-intervention probe was conducted for the next participant until an additional participant
did not demonstrate naming, at which point the intervention began. This participant then became Participant 2. This procedure was followed for all participants for both Set 1 and the Novel Set.

**Interobserver and Interscorer Agreement**

All interobserver and interscorer agreement was calculated using the same methods as in Experiment 1. In addition to the behaviors observed during Experiment 1, agreement was calculated for delayed phonemic response teaching intervention sessions, as well as the within-session echoic probes, and the delayed echoic probes for the intervention sessions. Agreement the pre-intervention probe for Set 1 and the Novel Set were presented in Experiment 1, as these probes constituted the first pre-intervention probe for Experiment 2. Interobserver agreement was calculated for both intervention sessions, as well as naming and drawing response probes after the intervention for Experiment 2.

Interobserver agreement was calculated for 36% of intervention sessions with 100% agreement on all sessions. Interobserver agreement was also calculated on 40% of delayed echoic probe sessions with 100% agreement. IOA was calculated on 90% of post-intervention probe sessions with 100% agreement. Interscorer agreement was calculated on 100% of post-intervention probe drawing responses with mean agreement across the drawing responses of 96.5% (range = 91-100%).

**Procedure**

Pre-intervention probe for the components of naming and drawing responses. Pre-intervention probe procedures were identical to those in Experiment 1.
**Intervention: Delayed phonemic response teaching.** Participants sat across from the experimenter and were told, "We are not going to look at the pictures, but I am going to tell you the names. Each time I say the name, I want you to repeat it. After we have said all five, you are going to tell me as many as you can remember." At this point the experimenter emitted the first vocal stimulus and the participant echoed the vocal stimulus. If the participant emitted the stimulus with point-to-point correspondence with the experimenter stimulus (correct echo), the experimenter recorded a plus and provided vocal reinforcement (reinforcement did not include a repetition of the phonemic response). If the participant emitted a vocal response that did not have point-to-point correspondence with the experimenter stimulus, a correction was provided until the participant did emit point-to-point correspondence. If the participant emitted no response, a prompt was provided to say the response out loud. In this case, if the response was correct after the prompt was provided to say it out loud, reinforcement was provided and the experimenter recorded a plus. The rational for recording a plus if a prompt to echo was given was that the purpose of the intervention was not to teach how to echo, but rather to teach the responses through echoic behavior. It was impossible to know if the participant was emitting a covert echoic or no behavior pertaining to the phonemic response, so the prompt was used to ensure that point-to-point correspondence with the experimenter's vocal behavior was present.

After the experimenter delivered five learn units (one for each vocal stimulus), the experimenter asked the participant to "say as many of the names as you can." Again, a plus was recorded for any responses that were emitted with point-to-point correspondence with the original stimulus and a minus was recorded for incorrect
responses or no response (the participant couldn't "remember" the stimulus). The
"remembering" of the words was called a within-session echoic probe. An example
intervention sequence was as follows:

Experimenter (E): "I’m going to say each of the words and I want you to repeat
them exactly as I do. When we have said each word, I’m going to ask you to tell me all
the words. Jup.”

Participant (P): “Jup.”

E: “Excellent. Kaj.”

P: “Kaj.”

E: “Perfect (Continue for all five responses)

E: “Now that we have said all of them, how many can you tell me [within-session
echoic probe]?”

P: “Kaj, jup, nog,…..that’s all I remember.”

E: “Ok, let’s say them again. Ser.”

P: “Ser.”


P: “Nog.” [continued until sequence was finished].

The intervention session ended when the participant emitted 5/5 correct responses
on three consecutive within-session echoic probes after emitting correct echoic learn
units. At the beginning of the next session (minimum 2 hours later, with no more than
two interventions in one day), the participant was asked to say all five stimuli without the
experimenter emitting the stimulus first. This was called a delayed echoic probe. If the participant could not name all five stimuli, a second intervention session began. This process was repeated until the participant could say all five stimuli during the delayed echoic probe. If the participant said all five names, the experimenters told the participant to repeat the set of names two more times. This was criterion level responding for the intervention overall. If criterion level responding was not reached, an additional training session was conducted. This procedure continued until the participant emitted 100% correct responses prior to the onset of a teaching session, at which point the post-intervention probe began.

**Post-Intervention Probes.** Post-intervention probes for listener, speaker, and drawing responses, were identical to the second pre-intervention probes, with no naming experience being provided (i.e. no repetition of the names of the stimuli by the experimenter in the presence of the visual stimuli). If participants drew four or more of the visual stimuli correctly and emitted 16 or more correct responses on listener and speaker responses, they were said to have conditioned seeing, and full naming after phonemic response teaching. If criterion was not met on drawing responses, but was met on the listener and speaker components of naming, participants were said to have naming after phonemic response teaching, but not conditioned seeing or vice versa (conditioned seeing, but not Naming). If criterion was not met on either, it was determined that participants did not have naming or conditioned seeing.
Results

A pre-screening probe conducted after the Experiment 1 probes for those participants that had not demonstrated naming during Experiment 1 selected out participants for Experiment 2. This resulted in six participants being selected for Experiment 2, with five participants needing intervention for Set 1 and one additional participant needing intervention for the Novel Set (Participant 6). Participant 5 only required intervention for Set 1. Five of the six participants demonstrated this bi-directional relation on at least one set, while one participant did not demonstrate the relation on either set. However these patterns of responding were only consistent between the two sets for four of the six participants. Of the two participants who did not demonstrate consistent responding, Participant 3 demonstrated naming after the intervention for Set 1 but not the Novel Set, while Participant 5 did not demonstrate naming after Set 1, but needed no intervention to demonstrate naming for the Novel Set. Participant 6 did not require intervention for Set 1, but did require intervention prior to demonstrating naming for the Novel Set. Naming was however demonstrated for both sets, so the final result was the same for both sets.

Table 8 displays the results for both pre-intervention and post-intervention probes for all six participants. It should be noted that the first pre-intervention probe for each set are the data that were used for Experiment 1. Figure 10 displays the presence or absence of listener, speaker, and drawing responses (as defined by the experimental criterion level of 80% correct responses) across all pre-probes and post probes for both Set 1 and the Novel Set. The results demonstrated a relation between the demonstration of naming and the demonstration of the drawing responses as all participants who demonstrated naming
### Table 8

*Experiment 2 Participant Results on Listener, Speaker and Drawing Response Probes*

<table>
<thead>
<tr>
<th>Participant</th>
<th>Listener Responses</th>
<th>Speaker Responses</th>
<th>Drawing Response</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Pre-Intervention</td>
<td>Pre-Intervention</td>
<td>Pre-Intervention</td>
</tr>
<tr>
<td></td>
<td>Probe 1</td>
<td>Probe 2</td>
<td>Probe 1</td>
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<tr>
<td></td>
<td>18/20</td>
<td>16/20</td>
<td>11/20</td>
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<td></td>
<td>14/20</td>
<td>17/20</td>
<td>4/20</td>
</tr>
<tr>
<td>P1</td>
<td>Set 1</td>
<td>20/20</td>
<td>6/20</td>
</tr>
<tr>
<td>Novel Set</td>
<td>5/5</td>
<td>8/20</td>
<td>5/5</td>
</tr>
<tr>
<td></td>
<td>19/20</td>
<td>18/20</td>
<td>7/20</td>
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<td>8/20</td>
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<tr>
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<td>Set 1</td>
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<td>11/20</td>
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<tr>
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<td>20/20</td>
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</tbody>
</table>

**Note.** Participant 5 only needed intervention on Set 1 and Participant 6 only needed intervention on the Novel Set.
also demonstrated the drawing responses, and one of the three participants who did not demonstrate naming did not demonstrate the drawing responses. The two remaining participants did demonstrate the drawing responses but did not demonstrate naming.

The results, which are presented as they occurred within the non-concurrent multiple probe design, are presented in absolute terms of the components of naming being present or absent, with a shaded section of the pie graph representing criterion level responding (80% correct) for each of the three responses, listener, speaker, and drawing response. Figures 11, 12, 13, and 14 display the intervention graphs for each participant during Set 1 and Novel Set interventions. The line represents responding on the within session probe, while the bar represents responding on the delayed echoic probes. Echoic training is not displayed as all participants emitted 100% correct responses. Figures 11 and 12 display the results for participants’ intervention for Set 1, while Figures 13 and 14 display the intervention results for the Novel Set.

Participant 1 emitted high and stable listener responses during Set 1, with low and stable speaker responses. She emitted a mean of 17/20 correct listener responses (range = 16-18) and a mean of 8.5 correct speaker responses (range = 6-11). Participant 1 also emitted 100% correct drawing responses. After the intervention, she emitted 100% correct responses on listener, speaker, and drawing responses. During intervention, Participant 1 did not need significant intervention before meeting criterion level responding on the delayed echoic probe for Set 1 (1 intervention set, 4 within session probes, mean – 4.75 correct within-session echoic probe responses, range=4-5).

Similar to Participant 1, Participant 2 emitted high and steady listener responses (mean, 18.5, range = 18-19) across the two pre-intervention probes, and low and steady
Figure 10. Results Across All Probe Sessions Including Experiment 1 Probes (initial probe for Set 1 and Novel Set). Clockwise within pie from upper left: Listener, speaker, and drawing responses for each participant. Empty slices indicate less than 80% correct responses for each topography. Participant 5 only required intervention for Set 1, while Participant 6 only required intervention for the Novel Set. However, results for both sets are displayed for both of these participants.
speaker responses across the two probes (mean – 9, range 7-11), however she did not emit criterion level on the drawing responses (mean – 2.5, range = 2-3). Participant 2 also did not need a significant number of intervention sets prior to meeting criterion on the delayed echoic probe for Set 1 (1 intervention, 7 within session probes, mean – 4.5 correct responses, range=3-5). Further, similar to Participant 1, she did emit criterion level on all responses (19/20 listener responses, 20/20 speaker responses, and 4/5 drawing responses).

Participant 3 emitted highly variable listener responding, but steady speaker and drawing response responding. He emitted a mean of 12.5 correct listener responses (range = 9-16) with a mean of 8.5 speaker responses (range = 8-9) and 2.5 drawing responses (range = 2-3). Participant 3 needed three intervention sets (mean – 10.67 within session probes, range = 5-21, mean 4.03 correct echoic probe responses, range = 2-5) prior to meeting criterion on the delayed echoic probe (3 probes, mean – 3 correct responses, range = 1-5). After the intervention, he, similar to Participant 1 and 2, demonstrated criterion level responding across all three responses (19/20 listener responses, 20/20 speaker responses, and 4/5 drawing responses).

Participant 4 did not demonstrate either naming or drawing responses in pre-intervention or post intervention probes. He demonstrated high levels of responding on the listener half of naming pre-intervention (mean – 17.5 correct responses, range = 15-20), but low speaker and drawing responses (mean 8.5 speaker responses, range = 8-9; mean 1.5 drawing responses, range = 1-2). Participant 4 needed two intervention sets prior to meeting criterion on the intervention for Set 1 (mean – 3.5 within session probes, range = 3-4, mean – 4.87 correct responses, range = 4-5; 2 probes, mean 4.5 correct
responses, range = 4-5). After the intervention, Participant 4 still did not demonstrate naming or drawing responses, emitting 13/20 correct listener responses, 12/20 speaker responses and 3/5 drawing responses.

Figure 11. Intervention Data for Participants 1-3 for Set 1. Line represents number of correct responses during echoic probe sessions, while the bar represents the number of correct responses during the delayed echoic probe. Three delayed echoic probes denotes criterion responding for the intervention.
Participant 5 responded in a similar way to Participant 4, however he demonstrated criterion level on the drawing responses from the initial pre-intervention probe. He emitted a mean of 18.5 correct listener responses (range = 17-20), 13 correct speaker responses (range = 12-14) and 4.5 correct drawing responses (range = 4-5).

*Figure 12.* Intervention data for Participant 4 and 5 for Set 1. Line represents number of correct responses during echoic probe sessions, while the bar represents the number of correct responses during the delayed echoic probe. Three delayed echoic probes denotes criterion responding for the intervention.
Participant 5 only needed one intervention set prior to reaching criterion for Set 1 (mean – 4.75 correct echoic responses, range = 4-5). After the intervention, his level of responding remained somewhat constant with a dip in listener responding to below

Figure 13. Intervention data for Participant 1-3 for Novel Set. Line represents number of correct responses during echoic probe sessions, while the bar represents the number of correct responses during the delayed echoic probe. Three delayed echoic probes denotes criterion responding for the intervention.
criterion level. He emitted 15/20 listener responses, 12/20 speaker responses and 5/5
drawing responses.

During the Novel Set, Participants 1, 2, and 4 responded in similar patterns.

Participant 3 did not demonstrate naming in the Novel Set, where he did in Set 1,
Participant 5 demonstrated naming without needing intervention, and Participant 6 needed intervention prior to demonstrating naming, where no intervention was needed for Set 1. Participant 2 emitted variable responses across both pre-intervention probe sets for both listener and speaker responses (listener mean – 15.5, range = 14-17, speaker mean – 6, range = 4-8). Similar to Set 1, she emitted 100% correct drawing responses. She did however need significant intervention to acquire the names for the stimuli in the Novel Set (6 intervention sets, mean – 5.16 within session probes, range=3-16 probes, mean – 4.64 correct echoic probe responses, range=3-5) before emitting criterion level responding on the delayed echoic probe (6 probes, mean – 3.83, range=3-5). Following intervention, Participant 1 again met criterion level responding for listener, speaker, and drawing responses (listener – 19/20, speaker – 20/20, drawing – 5/5).

Participant 2’s results were very similar to her results for Set 1. She emitted a mean of 19.5 listener responses (range = 19-20), 9 speaker responses (range = 8-10) and 1 drawing responses (range = 0-2). During intervention for the Novel Set, Participant 2 needed three intervention sets (mean 6.33 within session probes, range = 3-11, mean – 4.57 correct responses, range = 3-5) before she met criterion on the delayed echoic probe (3 probes, mean – 4 correct responses, range = 3-5). On the post-intervention probe she emitted 18/20 listener responses, 19/20 speaker responses and 4/5 drawing responses.

Participant 3 did not demonstrate similar results on the Novel Set to those in Set 1. He did not meet criterion responding on either listener or speaker responses at any point during the set, but did meet criterion on the drawing responses throughout. He emitted a mean of 8.5 listener responses (range = 8-9), 2 speaker responses (range = 0-4) and 4/5 drawing responses on both probes. Similar to Set 1, Participant 3 did need a lengthy
intervention prior to demonstrating criterion level responding. He required 6 intervention sets (mean 4.16 within session probes, range = 3-7, mean correct responses – 4.68, range = 3-5) before emitting criterion on the delayed echoic probe (6 probes, mean 4.5 correct responses, range = 2-5). During post-intervention probes he maintained criterion level responding for the drawing responses (4/5), however only emitted 9/20 listener responses and 7/20 speaker responses.

Participant 4 again did not demonstrate naming during the Novel Set. He again emitted variable responding across all responses, with drawing responses remaining low. Participant 4 emitted a mean of 13.5 listener responses (range = 11-16), 4.5 speaker responses (range = 3-6) and 1 drawing response (range = 0-2). Participant 4 needed more intervention sets than for Set 1 (4 sets, mean 5.5 within session probes, range = 3-13, mean correct responses – 4.63 correct responses, range = 2-5). On the four delayed echoic probes, Participant 4 emitted a mean of 3.75 correct responses (range = 2-5). After the intervention he emitted 13/20 correct listener responses, 11/20 correct speaker responses, and 2/5 correct drawing responses, all of which were below criterion level.

Participant 5 did not need intervention during the Novel Set, while Participant 6 only needed intervention during the Novel Set. His responses were high and stable for both listener and drawing responses throughout. He emitted 100% correct listener responses, and a mean of 4.5/5 correct drawing responses (range = 4-5). He only needed 1 intervention set (4 within session probes, mean correct responses 4.75, range = 4-5) and one delayed echoic probe with 100% correct responding. After the intervention, Participant 6 emitted 100% correct listener and speaker responses and 4/5 correct drawing responses.
Discussion

The results from Experiment 2 further support the relation between the speaker component of naming and drawing responses. However, Experiment 2 also presents evidence that the drawing responses are not sufficient to establish the object-name relation. The delayed phonemic response teaching intervention successfully taught the names of the stimuli to all participants, but did not result in the demonstration of naming or the drawing responses for all participants. As a result, a functional relation was not established between the delayed phonemic response teaching intervention and the establishment of the bi-directional relation between the listener and speaker component of naming. This result was expected, as the intervention was not designed to induce the naming capability, but rather to control for the presence of the names of the stimuli for the demonstration of the naming capability. All participants were successful in acquiring the names of the stimuli using the delayed phonemic response intervention. Further, the intervention did establish the listener-to-speaker relation for four of the six participants, and three of these participants were identified as having the naming capability. In each case, the drawing responses as a measure of conditioned seeing were demonstrated either prior to the onset of the intervention or with the speaker component of naming during the post-intervention probe.

The results for Participant 3, and Participant 5 are of particular interest as their results were somewhat unexpected. These two participants displayed different patterns of responding during Set 1 and the Novel Set. The results for Participant 5 seem to be relatively easily explained given the current explanations of the naming capability. Very simply, Participant 5 did not emit echoics during the naming experience for Set 1, and as
a result the name relation was never firmly established. As his results show, his listener responses in fact decreased through the probe sequence further supporting the notion of this weak equivalence. During the Novel Set, he did emit echoics during the naming experience, and as a result the object-name relation was established, resulting in a demonstration of the naming capability.

The results for Participant 3 are somewhat more curious. During the Set 1 naming experience, he did not emit any echoics, however, the speaker component of naming was established after the intervention. During the Novel Set, he did emit echoics during the naming experience, and further, he also emitted the drawing responses but did not demonstrate the speaker component of naming during either the pre- or post-intervention probe. What was missing throughout was the third component of the naming capability. He did not demonstrate the listener component of naming during any of the probes. So, while Participant 3 did emit the behaviors that were theoretically necessary for the object-name relation to be established during the naming experience, neither component of the naming relation was established.

One possible explanation for this is that the phonemic response teaching intervention did seem to have an effect on the participant that was more akin to a verbal behavior development protocol (Greer and Ross, 2008) as opposed to a demonstrational intervention. In other words there was anecdotal evidence that the intervention was inducing speaker-as-own-listener behavior during the Set 1 intervention, as the participant told the experimenter that he was “practicing” the words overnight between intervention sessions. As a result, during the Novel Set, Participant 3 emitted a new behavior (echoics) but had not contacted the necessary reinforcement contingencies for
observing both visual and auditory stimuli simultaneously and as a result the object-name relation was never established. The result was not only not demonstrating the speaker component of naming, but also never demonstrating the listener component of naming.

Analyzing the data from Participant 3, he in fact emitted zero correct listener responses during the pre-intervention probe for the Novel Set, a result that should be near impossible.
In two experiments I tested for evidence that conditioned seeing is a behavior that occurs and can be measured by drawing responses, and what relation this behavior may have to the naming capability. In Experiment 1, I tested if conditioned seeing occurred following a naming experience and responding to the stimuli as a listener and a speaker, and how the presence of this drawing response was related to demonstrating either the listener or speaker component of naming. In Experiment 2, I further tested if conditioned seeing occurred as the object-name relation was established for those participants who did not demonstrate the speaker component of naming in Experiment 1 through the use of a delayed phonemic response teaching intervention. This intervention was used to teach the names of the stimuli, but not the object-name relations individually or to induce naming as a capability. In this way the presence of the names of the stimuli were controlled for.

Results from Experiment 1 provide evidence that conditioned seeing occurs after a naming experience. In this study, participants were never given an opportunity to emit drawing responses in the presence of the stimuli, and were not given the opportunity to draw the stimuli prior to the drawing response opportunity after the naming probe. Further, participants contacted neither reinforcement nor corrections for emitting the drawing responses in the presence or absence of the stimuli at any point during the experiment. As such, the drawing responses were not operant responses. Rather, participants emitted the drawing responses as if they were copying from an image that
was in fact present. This image, correct or incorrect, may have been the conditioned response that had been “experienced” when the original image was presented during the naming experience. It is possible that the more accurate the drawing response, the more closely the conditioned seeing response resembled the original stimulus, which, as I will discuss later, may imply a measure of the strength of observing responses selecting out visual stimuli as a reinforcer.

Experiment 1 also provided evidence that there may be a relation between conditioned seeing and the demonstration of the speaker component of naming. However, this relation does not seem to necessarily be present between the listener component of naming and conditioned seeing. This result is supported primarily by the Pattern 2 response (naming present-drawing responses absent) presented in Figure 4 for each component of naming. As is displayed, there were no instances of the speaker component of naming being present while conditioned seeing was absent. However, there were three instances of the listener component of naming being present while the drawing responses were absent. Evidence from Experiment 2 further supports this interpretation as well. The probe sessions presented in Experiment 2 resulted in no instances of the speaker component of naming being present in the absence of the drawing responses, but three additional occurrences of the listener component of naming being present in the absence of the drawing responses (Figure 10). In fact, across the total of 50 probes that were conducted (including the pre-screening probes for Experiment 2, which are not presented) there was only one instance of the speaker component of naming being present without criterion level responding on the drawing responses. This occurred in the Set 1 pre-screening probe prior to Experiment 2, where
Participant 8 (from Experiment 1) emitted 80% correct speaker responses yet only drew 1 correct drawing response. The remaining 98% of probes however held true for the speaker-conditioned seeing relation.

The results from Experiment 2 also suggest the notion that while there is a relation between conditioned seeing and the acquisition of the object-name relation with visual stimuli, the presence of the drawing responses is not necessarily sufficient to establish the object-name relation. Across the six participants in Experiment 2 (10 post-intervention probes) there were six instances of the speaker component of naming emerging after the intervention and in each case conditioned seeing was present. However, of the four instances where the speaker component of naming was not acquired, two of the participants did present with criterion level responding on the drawing responses, therefore demonstrating conditioned seeing (Participant 3, Novel Set and Participant 5, Set 1). If conditioned seeing had been sufficient to establish the object-name relation, it would follow that these participants would have demonstrated naming after the names of the stimuli had been taught.

**Implications**

This study provides support for the Horne and Lowe (1996) account of naming in that conditioned sensory responses may join with the object-name relation and function to further strengthen the relation. However, the evidence presented in this study seems to suggest that the conditioned sensory response, in this case conditioned seeing, may play a more primary role in the acquisition of the relation itself, as opposed to the secondary role of strengthening the relation that Horne and Lowe suggest. As quoted earlier, Horne and Lowe state, “the auditory stimulus comes to occasion conditioned seeing, feeling,
smelling, and hearing” (pg. 200), however participants were able to demonstrate the conditioned response (conditioned seeing) in the absence of the auditory response (speaker component of naming), and more importantly did not demonstrate the auditory response-object relation in the absence of the conditioned response.

The evidence of the role of the conditioned response presented in this study may be closer to the account given by Lowenkron (1988). The consistency of the presence of the conditioned response lends to some support of the notion that this conditioned response does not simply join with the object-name relation, but rather maintains it in the absence of either the auditory or visual stimulus itself. In the Lowenkron study, this response was equivocated with echoic behavior, however it may have functioned more as a measure of conditioned seeing given the physical those participants who were taught a hand signal to maintain a visual image of the stimulus were able to name a stimulus at a later time. While the physical nature of the hand signal prevents identifying the signal as a covert conditioned sensory response, it is easy to see how it is similar to that of a conditioned seeing response, the difference being that the signal is indeed “seen” overtly.

In the current study, there is no evidence to support the notion that participants were regularly emitting the conditioned seeing response in the way that Lowenkrons’ participants were emitting the hand signal to maintain the relation. However, the relation between the speaker component of naming and the drawing responses implies that some maintaining effect may have been present. Again, more data are needed before this specific an interpretation can be advanced.

While the current study does not specifically address the questions posed by Longano and Greer (2013) regarding conditioned reinforcement for observing responses,
the presence of conditioned seeing as a measurable behavior does provide evidence for a possible measure of the observing responses that were found to be necessary prior to the acquisition of naming. Drawing responses as a measure of conditioned reinforcement for observing visual stimuli still may not be as ideal a measure as echoics are for acquisition of conditioned reinforcement for observing auditory stimuli, but drawing responses are a measure that may be emitted independent of the experimenter-controlled contingencies of the intervention. Further, the stimulus-stimulus pairing procedure used by Longano and Greer provides a potential explanation for the acquisition of conditioned seeing as an operant behavior.

A major implication of this study goes beyond conditioned seeing itself, but rather is in the significance of any conditioned sensory response as related to naming. The research on naming has focused on visual object-name relations but that is not to say that object-name relations are limited to visual stimuli. If the conditioned sensory response of conditioned seeing occurs with visual stimuli, it is possible that the same conditioned sensory responses may occur for smell-name, audio-name, taste-name, or feel-name relations. Both naming theorists as well as relational frame theorists have postulated that any one of these senses may join the object-name relation through a frame of coordination. Conditioned seeing was selected in this experiment due to the relative ease of measurement, as any of the other conditioned sensory responses would most likely have to be measured using measurement of blood flow techniques, however that does not mean that the behavior does not occur. In fact, it would seem to be more likely that all conditioned sensory responses would be related in the same way to the object-name relation as conditioned seeing appears to be.
Limitations

The drawing responses as a measure of conditioned seeing presented the most apparent limitation in this study. While the drawing responses did appear to be a somewhat accurate measure of a participants’ ability to “see” the stimulus, as was confirmed by the high percent of agreement between the independent observers, the drawing response was a not a true measure of the conditioned seeing behavior. A true measure of behavior measures the impact of the behavior itself on the environment. Conditioned seeing is a behavior that occurs beneath the skin, and, without the use of equipment that measures blood flow in the brain, a true measure of such covert behavior is not possible. As such, drawing responses are only a representation of this behavior and may not represent the true way in which participants experienced the covert response. The limitations of this mediated response are apparent. In much the way that one may not be able to sing a song in the same way it can be “heard” covertly, one may not be able to produce a drawing response in exactly the same way that it is “seen” covertly.

Further, teasing out the limitations in the response based on the phylogenetic makeup of an individual versus a measure of the reinforcing properties of the observing response is beyond the scope of this paper. In other words, it may not be that the strength of the conditioned image for one is weaker than for another, or that conditioned reinforcement for observing visual stimuli is stronger for one than it is for another, but it may simply be that the phylogenetic makeup of one individual allows for more precise drawing responses than for another. An attempt to ensure that this was controlled for was made by the selection of visual stimuli that consisted of nothing more than simple shapes, lines, and curves, however prerequisite drawing skills were not measured prior to the
selection of the stimuli. Anecdotally, there was only one instance of a participant saying that she knew the stimulus but did not know how to draw it. There were many possible instances where this inability to emit the form of the drawing response may have been the cause of incorrect responses or the reason for emitting no response, but she was the only participant who voiced this concern.

Another limitation regarding the inexact measure of conditioned seeing was in the scoring of the response itself. There were any number of possible response definitions that could have been given to the independent observers, from the response needing to be exact to simply having the response be identified when given the specific set of stimuli that the participant had been presented with. The ultimate settlement on the definition of the response criteria led to relative uniformity across the observers, but there is still a chance that the response definition led to either a more lenient or a more strict interpretation of the drawings themselves. The inexact nature of the response compounded with the inexact nature of the response definition leaves all results open to further scrutiny.

Procedurally, there was a limitation in ensuring that there was equivalence between the drawing responses emitted by each participant and the participants’ naming of the stimuli that they drew. It was assumed that if the participant named the stimuli during the probe for the speaker component of naming and they were able to draw the response, then the name given for the original stimulus and the drawing response would be equivalent. However, this may not have held true, particularly if not all stimuli were drawn, or if not all stimuli were named during the naming probe. This limitation would be easily corrected in a replication of the current study in any number of ways. The
participants could be required to write or say the names of the stimuli they drew after they drew them. Another possibility is that instead of having participants draw the stimuli once, the experimenter could provide the name of the stimulus as if it were being presented, and have the participant draw the stimuli 20 times. This would control for the number of times the stimuli were presented, similar to the naming experience, listener probe, and speaker probe, but it would also possibly change the function of the conditioned seeing response as the name would now be being provided to the participant. Allowing multiple opportunities to draw the response may allow for participants to “remember” the stimulus, which is very possible, particularly if conditioned seeing responses are as related, as they seem to be, to drawing responses. There were multiple instances of participants not naming a stimulus on the initial presentation but acquiring the response as the speaker probes progressed, or in some cases, misnaming responses as the probe progressed. So to, participants may acquire conditioned seeing responses as the probe progresses. Regardless, altering the current procedure in one of these ways may serve as a more accurate measure of the equivalence between object and name via conditioned seeing.

The use of the Pearson-r product moment correlation as an analytical tool in this study is another limitation. The use of the correlation with such a small sample size leads to bias in the result in that a few participants who demonstrate close agreement for both drawing responses and speaker component of naming responses may artificially skew the result towards a significant correlation. Likewise a few participants who demonstrated widely varying responses for the listener-drawing response correlation may artificially skew the results towards a non-significant correlation. Taking this into consideration, the
correlation was not used as the primary measure of the relation between drawing responses and the components of naming, rather the correlation was used to support the visual analysis of the results.

There are also limitations in the scope of this study regarding the relation between the acquisition of naming and the acquisition of conditioned seeing. Across both sets for the 12 participants, there was only one participant (Participant 2 in Experiment 2) for whom the demonstration of naming and the demonstration of conditioned seeing arose simultaneously (see Figure 10). This participant demonstrated neither the speaker component of naming nor the drawing responses during either pre-intervention probe for both Set 1 and the Novel Set, however demonstrated both during the post-intervention probe. This result provides evidence that as the object-name relation strengthens, so does the conditioned seeing response, however this evidence is very limited. Future research (discussed below) should be able to test for such a relation.

**Future Research**

The current study lends itself to multiple potential avenues of research regarding many of the topics discussed above. First and foremost, questions must be asked regarding conditioned seeing and the induction of the naming capability. The naming research conducted under the verbal behavior development theory has focused on the induction of the naming capability using multiple exemplar instruction. The evidence presented in this study suggests that conditioned seeing should either be present or induced as naming is induced using multiple exemplar instruction. In the previous studies using multiple exemplar instruction to induce naming, many participants required multiple sets of MEI prior to a demonstration of the induction of naming. It is possible
that the reason for the number of sets being required to induce naming does not necessarily have to do with the establishment of the listener to speaker equivalence relation, but rather the strengthening of the conditioned seeing response. Measuring conditioned seeing prior to and after each intervention set may provide more information regarding this relation.

Regarding the induction of naming and conditioned seeing, another potential line of research may possibly add a conditioned seeing (or other conditioned sensory) response into the multiple exemplar rotation. This could involve the experimenter emitting the name of the stimulus, and the participant drawing the response. In addition to measuring the acquisition of the drawing response, the participant would be contacting reinforcement for emitting an additional equivalent response to the naming experience response (echoic, or, in the case of the previous research, the match-to-sample response), listener response, or speaker response.

If it can be shown that conditioned seeing is indeed a necessity in the induction of the naming capability, the question then becomes what role does conditioned seeing play in the acquisition of object-name relations? One possible theory is that when a conditioned seeing response is emitted simultaneously with self-echoics while the visual stimulus and name are being provided, one may subsequently be able to “see” possible stimuli that are to be named, in the absence of the visual stimulus, while listing the names of items, essentially providing a covert selection response. The process of naming would then involve an identity relation between the echoic and the conditioned seeing response combined with a match-to-sample response between the conditioned seeing behavior and the stimuli in one’s field of vision (presented in Figure 3). A study of this nature would
be similar to the Lowenkron (1988) study discussed above, however the conditioned seeing response would take the place of the hand signal used to maintain the object-name relation.

Still other potential research may attempt to test conditioned seeing from a more functional perspective such as, is it possible for operants be selected out based upon a conditioned seeing response, contingent on the presence or absence of naming? In other words, if object-name relations are presented through a naming experience, can participants emit the name in the absence of the stimulus itself, but rather based on descriptions of the stimuli such as size, shape, color, or location presented in the original stimulus. Conversely, given a name and an appropriate audience (one that has a common vocabulary), can participants provide a description of the object such that another may identify it? This would require participants to emit conditioned seeing behaviors as well as demonstrate acquisition of name of the stimulus through naming as either a speaker or a listener.

**Conclusion**

The current study provides evidence that conditioned seeing does occur and the drawing responses used are one possible measure of the conditioned seeing response. Further, the study provides evidence that the conditioned seeing response is related to the presence of the speaker component of naming. If the development of the naming capability is as significant to the acquisition of names as the current research suggests, then it is imperative to know what behaviors or repertoires may play important roles in the development of this capability. This study suggests that conditioned seeing may be a response that is important in the both the acquisition of object-name relations, as well as
the development of the naming capability. That being said, the significance of these
findings are not limited to the conditioned seeing response. The results from this study
only begin to identify the importance of measuring other conditioned sensory responses,
as they may be related to the naming capability, and as such, language acquisition, in
similar ways.
REFERENCES


Appendix A

Definition of Terms

Bi-Directional relationship between Listener and Speaker repertoires – The bi-directional relationship between listener and speaker repertoires speaks to one’s ability to respond as both a speaker and a listener to the same stimulus. Children who may select objects when given the name, but may not produce the name of the object itself do not demonstrate this bi-directional relation. In rare cases, the lack of a relation may go the opposite direction, with a child who may emit the name of a stimulus, but may not be able to select the stimulus. The bi-directional relationship between speaker and listener repertoires is one of the key components in the naming theory.

Capability – A capability is defined by Greer and Speckman-Collins (2009) as a cusp that allows children to learn in ways that they could not before. There are three verbal behavior developmental capabilities that have been identified in the literature, 1) generalized imitation, observational learning, and naming. In each case, once the capability is present, a child may learn in a way that they could not before. In generalized imitation, a child may imitate the behavior of another instead of having to have individual behaviors that make up an operant reinforced individually. In observational learning, a child may learn by watching another contact reinforcement or corrections as long as the antecedent has been observed as well, instead of contacting these contingencies directly. In the case of naming, a child may learn to respond to a
stimulus as both a listener and a speaker while only contacting the name of a stimulus incidentally.

**Conditioned Seeing** – Conditioned seeing is defined as emitting visual point-to-point correspondence with a stimulus in the absence of the stimulus itself. Conditioned seeing, like self-echoic behavior, is a covert behavior, which there are difficulties in precisely measuring. However, unlike echoic behavior, conditioned seeing does not have a researched overt form that demonstrates point-to-point correspondence with its covert form in the way echoic behavior has been defined as a measure of covert self-echoic behavior. In this study a measure of conditioned seeing was defined as a participant’s ability to draw a representation of the stimulus. This drawing response, as a measure of conditioned seeing, varies on some characteristics from the original conditioned response, much the way that echoic behavior will have different, pitch, timbre, and tempo from a self-echoic.

**Cusp** – A cusp is defined by Rosalez-Ruiz and Baer (1997) as a verbal developmental stage that allows children to learn things that they could not before. That is, children can contact reinforcement from stimuli that they could not before acquisition of the cusp. A cusp could be amounted to the difference in what a child could learn before and after learning to walk. While a child is crawling, it can only contact stimuli that are at a specific height level, however after learning to walk, the child may contact stimuli that are higher up. So to, before a child acquires a verbal developmental cusp, the child may only contact reinforcement in one way (say as a listener), however after a cusp is induced (independent mands and tacts) the child can contact reinforcement for emitting speaker behavior and thus can learn things that he could not before.
**Echoic** – Echoic behavior is verbal behavior defined by Skinner (1957) as behavior verbal that has point-to-point correspondence with the verbal behavior of another. The reinforcement of echoic behavior is the point-to-point correspondence. Echoic behavior purely as an echoic (as opposed to a tact) may be reinforced by the behavior of a listener, discriminating behavior that does and does not have point-to-point correspondence with the original behavior. Skinner defines the function of echoics in young children as being primarily educational. He states, “[echoics] make possible a short-circuiting of the process of successive approximation, since it can be used to evoke new units of response upon which other types of reinforcement may then be made contingent” (Skinner, 1957, p. 56). These responses may include mands or tacts as the case may be in naming.

**Learn Unit** – The learn unit is defined as multiple interlocking three-term contingencies in which the behavior of the teacher and student act as antecedents, behaviors, and consequences for the other (Albers & Greer, 1991). The teacher gaining instructional control over the student is the antecedent for the teacher to deliver an antecedent to the student. The teacher’s response (delivering the antecedent), is the antecedent for the student to respond. The student’s response is the consequence for the teacher’s learn unit (correct is a reinforce for the teacher’s previous behavior, an incorrect response is a consequence). The student’s behavior also functions as an antecedent for the teacher’s next behavior, which is to deliver the consequence (correction or reinforce) for the student. This continues until both teacher and student operants are acquired.

**Listener component of naming** – The listener component of naming is defined as selecting, orienting to, or otherwise identifying a stimulus without emitting a vocal verbal
name for the stimulus without having received direct instruction in responding to the stimulus as a listener.

Multiple Exemplar Instruction – Multiple Exemplar Instruction, or MEI, has two general definitions. In either definition, MEI is an instructional tactic by which there is a rotation of either stimuli or responses. Multiple exemplar instruction to establish general case responding requires one to respond to different exemplars of a single stimulus, where each exemplar varies across specific characteristics and remains steady across others such that the responder may establish the necessary stimulus control in order to learn the essential stimulus control.

Multiple exemplar instruction may also be used to join control of multiple responses to a single stimulus. This can be done across establishing operations (mand and tact), vocal and written topographies for production responses, and listener and speaker responses (such as naming). In this case, MEI establishes the equivalence between listener and speaker responses such that a participant may respond to a single stimulus in multiple ways.

Naming - Horne and Lowe (1996) defined naming as “a higher order bidirectional behavioral relation that (a) combines conventional speaker and listener behavior within the individual and (b) does not require reinforcement of both the speaker and listener behavior for each new name to be established, and (c) relates to classes of objects and events.” (Horne & Lowe, 1996, p. 207). Horne and Lowe suggested that naming is a, or the, source for acquisition of language incidentally.

Operant – An operant is a behavior or response that is learned under specific antecedent and reinforcement conditions. Operant behaviors are behaviors that are not
naturally emitted in the presence of environmental stimuli, but rather are differentially reinforced and paired with the antecedent stimuli that will signal the presence of reinforcement in the future. This is contrasted with respondent behavior that is not learned, but rather is naturally emitted based on the phylogeny of the species.

**Probe** – A probe is defined as an unconsequated instructional trial in which an experimenter presents an antecedent to a child, the child emits a response, but the experimenter does not provide feedback (either reinforcement or corrections) based on the response. The purpose of a probe is to test for the presence or absence of an operant, cusp, or capability, as opposed to teaching or inducing an operant, cusp, or capability.

**Speaker as own listener** – Speaker as own listener is a behavior by which one may listen to him or herself speaking, and respond as a listener, or as an additional speaker. In this way, verbal behavior, previously defined as behavior mediated by a listener, may be mediated by one’s own behavior. If a person says, “I’m thirsty” and then goes to get a drink, the person mediated their verbal behavior in exactly the same way a listener would mediate this verbal behavior (providing a drink). Further, if the person responded to, “I’m thirsty” by asking, “What would you like?”, to which the same person responded, “I think I would like a glass of water” the person would be emitting conversational units within their own skin.

**Speaker component of naming** – The speaker component of naming is defined as emitting a correct vocal verbal response to a stimulus without having received direct instruction on how to respond to a stimulus in such a way. In this case, a child may emit a vocal verbal name for a stimulus after hearing a caregiver previously name the stimulus.
**Tact** – A tact is one of Skinner’s (1957) six verbal operants. The tact was defined as a vocal operant under control of non-verbal stimuli, which was reinforced through generalized social stimuli such as praise. The tact was identified as the most important of the six verbal operants. A tact is distinguished from an intraverbal response in that a tact is under control of purely non-vocal stimuli while an intraverbal is under control of both verbal and non-verbal stimuli. It is therefore the tact operant that defines a “name” and when one speaks of naming, it is the tact, or speaker response, that truly allows one to demonstrate the naming capability.

**Verbal Behavior** – Verbal behavior is the study of language from a behavioral perspective. B.F. Skinner first introduced verbal behavior in 1957 in the book of same name. This book is a theory of language based on the control of environmental stimuli and reinforcement contingencies. Verbal behavior itself is defined as the behavior of any speaker that is mediated by the behavior of a listener. The presence of a listener is a stimulus discriminative for the emission of verbal behavior, and verbal behavior itself is reinforced by the behavior of the listener. Skinner identified six individual operants that are the basic units of verbal behavior, these being the mand (command), tact (contact), echoic, intraverbal, textual response, and autoclitic.
Appendix B

Drawing Response Form

Participant Code: __________________ Date: __________________ Set: __________________

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Appendix C

Naming Data Form

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Header Codes: NE - Naming Experience Ethics
S1 - Speaker 1st
S2 - Speaker 2nd
E - Echolalic
T - Total
NR - No Response