A COMPARISON OF TRANSFER OF STIMULUS CONTROL OR MULTIPLE CONTROL ON THE ACQUISITION OF VERBAL OPERANTS IN YOUNG CHILDREN

DISSERTATION

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ABSTRACT

Verbal repertoires are often taught using transfer of stimulus control. Basic research suggests that stimulus blocking may occur during transfer of stimulus control. Stimulus blocking may impede the acquisition of new verbal operants by blocking a new stimulus from acquiring stimulus control. An alternative strategy is to teach verbal operants under multiple sources of control and then fade out additional sources of control. Teaching with multiple sources of control could prevent the occurrence of stimulus blocking. This study assessed the efficiency of teaching mand, tact, and echoic operants using transfer of stimulus control via Simultaneous Presentation and using multiple control.

Five children with developmental disabilities participated. The results suggest that three participants acquired the target operants with fewer teaching trials using multiple control and two participants acquired the target operants with fewer teaching trials using transfer of stimulus control. These data provide preliminary support for the occurrence of stimulus blocking during transfer of stimulus control across verbal operants and may suggest benefits to using multiple control to establish verbal repertoires.

In memory of Guy Bedient

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FIELDS OF STUDY

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CHAPTER 1

INTRODUCTION

Cooper, Heron, and Heward (2007) state that a behavior is under stimulus control when it is, "emitted more often in the presence of the discriminative stimulus than during its absence" (p. 299). Behavior comes under stimulus control when a response is emitted and reinforced in the presence of one stimulus (i.e., discriminative stimulus or SD) but is not reinforced when emitted in the presence of another stimulus (i.e., s-delta or SΔ). The stimulus present when reinforcement occurs comes to signal the availability of reinforcement and the behavior is more likely to occur in the presence of this stimulus. For example, ordering Italian food is more likely to be reinforced in an Italian restaurant. Given a history of ordering a specific type of food in restaurants, ordering food types comes under the stimulus control of the restaurant type. Emitting behavior under stimulus control allows for more frequent access to reinforcement.

Behavior can be taught to occur under new sources of stimulus control or new discriminations through a process called transfer of stimulus control. During transfer, "one set of discriminative stimuli [are substituted] for another" (Catania, 1998, p. 415). In other words, the original controlling stimulus (discriminative stimulus) is gradually attenuated in the presence of the new stimulus. Transfer of stimulus control, then, involves fading stimulus and response prompts to transfer stimulus control from the prompt or supplementary stimulus to the target discriminative stimuli (Cooper et al., 2007). Transfer of stimulus control is used commonly in educational settings to teach individuals to use behaviors under new or different stimulus conditions. Teaching a child to answer an addition problem is one example. Many children can repeat what someone else says (if a teacher says, “five”, the student can say, “five” in response). Saying, “five” is under the stimulus control of the teacher’s vocal behavior, “five.” Therefore, the teacher can present an oral or written stimulus “2 + 3 =” and say, “five,” immediately after, prompting the student to emit the correct response. The student will be more likely to emit the correct response “five” in the presence of “2 + 3 =” (or when shown, 2 + 3 =) given the additional stimulus of the teacher saying, “five.” The presentation of the two stimuli (“two plus three” and “five”) creates what is called a compound stimulus. After a series of successful trials in which the compound stimulus is presented, the teacher can start to increase the delay between the instruction, “2 + 3 =?”, and the prompt, “five,” until the student is saying, “five”, after the teacher says “2 + 3 =”. Essentially, transfer of stimulus control enables the learner to respond to new discriminative stimuli, which allows the learner to use behavior in a variety of environments.

Skinner (1957) emphasized the importance of stimulus control throughout his account of verbal behavior. In Verbal Behavior, Skinner provided a functional account of the behavior of a speaker. He categorized several classes of verbal behavior (see Table 1 for a list of verbal operants and definitions and Table 2 for the controlling variables for common verbal operants). He called these classes of verbal behavior verbal operants and distinguished them from other accounts of language by using definitions that suggest each operant is controlled by the environment. Skinner (1957, 1968) also described stimulus control and its role in learning to communicate and used transfer of stimulus control as an explanation for how individuals learn new verbal behavior such as memorizing poems and learning from illustrated dictionaries. To memorize a poem, stimulus control is transferred from a nonauditory verbal stimulus (print or text) to covert vocal verbal stimulus without point-to-point correspondence with the response (repeating the poem to oneself), thereby taking responding from textual control to intraverbal control. Skinner illustrated tact acquisition through transfer of stimulus control from the text to the picture (e.g., transfer from textual to tact). Although these examples provide a conceptual explanation for how transfer of stimulus control may occur during acquisition and learning, neither Skinner nor other researchers have provided empirical support.

Transfer of stimulus control is commonly applied in language training programs that incorporate Skinner's (1957) analysis of verbal behavior (e.g., Barbera & Kubina, 2005; Braam & Poling, 1983; Finkel & Williams, 2001; LeBlanc, Esch, Sidener, & Firth, 2006; Luciano, 1986; Miguel, Petursdottir, Carr, 2005; Watkins, Pack-Teixeira, & Howard, 1989). However, stimulus blocking may impede language acquisition by prohibiting transfer of stimulus control across verbal operants (Glat, Gould, Stoddard, &

Term	Definition
Verbal behavior	“behavior reinforced through the mediation of other persons” (Skinner, 1957, p. 14).
Mand	“…a verbal operant in which the response is reinforced by a characteristic consequence and is therefore under the functional control of relevant conditions of deprivation or aversive stimulation” (Skinner, 1957, p. 35-36).
Tact	“…a verbal operant in which a response of given form is evoked (or at least strengthened) by a particular object or event or propriety of an object or event” that is maintained by generalized conditioned reinforcement (Skinner, 1957, p. 81-82).
Echoic	“vocal response under the control of a vocal stimulus that has “a point to point correspondence between the sound of the stimulus and the sound of the response” that is maintained by generalized conditioned reinforcement (Skinner, 1957, p. 55).
Intraverbal	verbal responses to verbal stimuli that have no point-to-point correspondence or formal similarity with the verbal stimuli that evoke the response that is maintained by generalized conditioned reinforcers
Textual	”a vocal response is under the control of a nonauditory verbal stimulus.” (Skinner, 1957, p. 66)

Table 1. Verbal behavior – terms and definitions.

Operant	Antecedent	Consequence
Echoic	Vocal verbal stimulus	Generalized conditioned reinforcer
Tact	Nonverbal stimulus	Generalized conditioned reinforcer
Mand	Deprivation or satiation	Item characteristic of the response form
Textual	Written stimulus	Generalized conditioned reinforcer
Intraverbal	Verbal stimulus	Generalized conditioned reinforcer

Table 2. Verbal operants and controlling variables.

Sidman, 1994; Partington, Sundberg, Newhouse, & Spengler, 1994; Sundberg, Endicott, & Eigenheer, 2000). During transfer of stimulus control the original controlling stimulus (e.g., teacher says, “five”) may block the acquisition of control by the new stimulus (e.g., “2 + 3 =”) for the first few transfer trials. For example, when a response is first taught as an echoic or imitation response, (e.g., the teacher says, “cookie” and the student says, “cookie”), the teacher can then use this response to help the child ask for a cookie given a state of deprivation of cookies (i.e., a mand). Transfer of stimulus control can be arranged. After a time period without access to cookies, the teacher says, “cookie”, the student will repeat the word and learn to say “cookie” when in a state of deprivation for cookies. Stimulus blocking may preclude the emission of responses under new stimulus control. If stimulus blocking occurs, the new stimulus (period of time without access to cookies) may not acquire control over the response because of the previous history of the teacher's prompt (teacher says, "cookie"). This may prevent the child from accessing cookies, particularly when the teacher is not present. Another example is illustrated by Didden, Pinsen, and Sigafoos (2000) who noted that, "previous conditioning of a verbal response to a picture [tact/label] may block conditioning of the verbal response to its written equivalent [textual/decoding] when the picture and word are presented as a compound stimulus" (p. 317). The delay in language acquisition that occurs as a function of stimulus blocking poses a serious problem in the development of language, particularly for individuals who are non-speakers or who have limited verbal skills. In these cases, language acquisition can make significant changes in one's quality of life.

However, it is possible that responses taught under compound stimulus control might minimize the effects of stimulus blocking. For example, if the child is taught to say, "cookie" when the teacher says "cookie" after the child has not had access to cookies, it is more likely that the response will be emitted under either stimulus condition alone. This outcome is supported by Fields (1979), Singh and Solman (1990), and Didden and colleagues (2000) who suggested that variations in the original controlling stimuli can foster more rapid acquisition of stimulus control by minimizing stimulus blocking. However, few studies provide empirical support for stimulus blocking in verbal behavior (Didden et al.; Singh & Solman). Rather, references to stimulus blocking in verbal behavior have been made post hoc (Glat et al., 1994; Partington et al., 1994; Sundberg et al., 2000). In addition, research that has explicitly examined stimulus blocking has occurred with only a few subjects and a few response classes and not in the context of verbal behavior (Singh & Solman; Didden et al.). Finally, applied studies on stimulus blocking do not link their findings to the basic research on transfer of stimulus control and stimulus blocking.

Stimulus blocking may impede the efficiency of transfer of stimulus control to new stimuli. For example, it may be more difficult to transfer control from echoic control to mand or tact control. If the same response topography is initially taught under multiple control (mand and echoic control) and then the original controlling stimuli are attenuated bringing responding under a single source of control, language training may be expedited. Control by a compound stimulus is trained initially. Fading additional sources of control is all that is required to produce similar outcomes to those obtained during transfer. In essence, attempts to train operants under a single source of control or to transfer stimulus control to establish new verbal operants under a single source of control include three steps. Researchers must establish a response under stimulus control, establish a compound stimulus, and then fade the initial stimulus. Establishing verbal operants under multiple control then subsequently attaining responses under a single source of control requires only two steps: initial training under multiple control and fading of some of the original controlling stimuli.

Researchers generally focus on establishing one response topography under the control of a single verbal operant (e.g., a vocal stimulus, when the student repeats what the teacher says) and using a transfer of stimulus control procedure to establish that response topography under different controlling variables (e.g., a nonverbal stimulus, when the student labels the item shown in a picture) (Barbera & Kubina, 2005; Braam & Poling, 1983; Finkel & Williams, 2001; LeBlanc et al., 2006; Luciano, 1986; Miguel et al., 2005; Watkins et al., 1989). Practitioners, often begin by teaching a response under multiple stimulus control (e.g., under the control of the nonverbal stimulus and the vocal stimulus) without regard to teaching the response under pure control (Bondy, Tincani, & Frost, 2004). There is a general agreement in the literature that mand training is the most effective and efficient first step for establishing a verbal repertoire in non-speakers (Skinner, 1957; Sundberg & Michael, 2001). The mand differs from other verbal operants due to its defining consequence; it specifies its reinforcement (e.g., an individual says, "cookie" given a state of deprivation for cookies and receives a cookie that maintains that form of response under similar conditions in the future). The mand makes verbal behavior functional for the speaker rather than the listener (Bondy et al.; Sundberg & Michael) because the speaker gets something for emitting the response. However, mands trained in clinical settings may actually be a combination of mand (i.e., control by characteristic state of deprivation), tact (i.e., control by nonverbal stimuli), and intraverbal (i.e., control by verbal stimulus of trainer) responses. Both approaches suggest difficulty arranging the controlling variables to produce verbal repertoires.

Researchers who have examined procedures that teach multiple verbal operants concurrently have suggested that there may be benefits to establishing verbal operants under more than one source of control (multiple control) (Braam & Poling, 1983; Carrol & Hesse, 1987). Multiple control procedures may decrease the number of teaching steps required to establish responding under the control for a single verbal operant by eliminating the potential for stimulus blocking to occur. Research that measures rate of acquisition for each verbal operant can help to address the benefits and limitations related to each approach. Furthermore, research in this area could provide guidelines to determine the best sequence for teaching the verbal operants.

Additional research regarding the effects of stimulus blocking on the transfer of stimulus control across verbal operants is needed. Training responses under multiple control and subsequently fading some of the controlling stimuli should be compared with training under single source of control and subsequently transferring stimulus control. The results of this comparison may point to a more efficient technology for teaching verbal behavior. Individuals with autism who demonstrate a predisposition to stimulus overselectivity (e.g., Allen & Fuqua, 1985) may be even more prone to stimulus blocking. In essence, the effects of stimulus blocking may be more salient with some populations, particularly persons with limited verbal repertoires who may benefit most from a more skilled approach for teaching verbal behavior.

One direction for this research is teaching verbal responses under multiple control, which may influence the efficiency of transfer by both decreasing the steps required to achieve responding under particular discriminative stimuli and by minimizing the potential blocking effects. Furthermore, this research could curtail debates surrounding the chronology of teaching particular verbal operants. If verbal responses are trained under the controlling stimuli for all verbal operants simultaneously (e.g., for a mand, tact, and echoic responses, the controlling stimuli would include a state of deprivation, a nonverbal representation of the item, and a vocal cue), there would be no question as to which verbal operant should be acquired first. Furthermore, much verbal behavior occurs with supplementary stimulation (Skinner, 1957) or multiple sources of control (Bondy et al., 2004; Skinner) such as when ordering food in a restaurant occurs under the control of the type of restaurant and the textual prompt from the menu. As a result, it may be unnecessary to fade additional sources of control to acquire a functional verbal repertoire.

The purpose of the current study was to address questions related to the efficiency of procedures used to teach verbal behavior and the possible influence of stimulus blocking. The specific research questions addressed were: (a) Does teaching a response topography under the multiple control of operants (i.e., as an echoic, mand, and tact) and then fading sources of control require fewer teaching trials than teaching a response topography under the control of one verbal operant (i.e., echoic), using this to establish control under a compound stimulus, and fading to transfer of stimulus control to establish additional verbal operants (i.e., mand and tact)? (b) How does each procedure affect the emergence of untrained operants? (c) Do outcomes vary based on the order in which operants are targeted for transfer? (d) Is there evidence of stimulus blocking when echoic repertoires are used to transfer control to tact and mand repertoires?

CHAPTER 2

LITERATURE REVIEW

A behavior is under stimulus control when it is "emitted more often in the presence of the discriminative stimulus than during its absence" (Cooper et al, 2007, p. 299). Transfer is a process in which, "one set of discriminative stimuli [are substituted] for another" (Catania, 1998, p. 415). Transfer of stimulus control involves fading stimulus and response prompts to transfer stimulus control from the prompt to the target discriminative stimuli (Cooper et al.). The transfer of stimulus control is rooted in basic research and was implemented to minimize the use of extinction (EXT) during discrimination training (Skinner, 1968). This basic research provided the foundation for establishing a technology of teaching (Skinner).

For example, Terrace (1963a, 1963b) demonstrated that errors could be eliminated if the S-delta (EXT stimulus) was gradually introduced into the selection field and a response to the target stimulus was reinforced. Terrace went on to demonstrate errorless transfer of stimulus control. He superimposed a new stimulus on the original controlling stimulus and subsequently faded the intensity of the original controlling stimulus until the new target stimulus acquired discriminative control. Terrace's findings provided one of the first experimental demonstrations of transfer of stimulus control. Sidman and Stoddard (1967) later applied stimulus shaping, a form of transfer of stimulus control, to teaching individuals with severe disabilities. Participants were taught to respond to successively changing discriminative stimuli via transfer of stimulus control. This further demonstrated that responses emitted in the presence of one stimulus could be trained to occur in the presence of a new controlling stimulus. This study highlighted the extension of a new teaching technique, the transfer of stimulus control, with human participants. Sidman and Stoddard's study set the stage for applied researchers to examine transfer of stimulus control as a teaching technology. Additional research focusing on the transfer of stimulus control to enhance human behavior followed (e.g., Barbera & Kubina, 2005; Braam & Poling, 1983; Finkel & Williams, 2001; LeBlanc et al., 2006; Luciano, 1986; Miguel et al., 2005; Watkins et al., 1989).

Skinner (1957) emphasized the importance of stimulus control throughout his account of verbal behavior. He described stimulus control and its role in language acquisition and used transfer of stimulus control as an explanation for how individuals memorize poems and how individuals learn from illustrated dictionaries (Skinner, 1957, 1968). To memorize a poem, stimulus control is transferred from a nonauditory verbal stimulus to a covert vocal verbal stimulus without point-to-point correspondence with the response, thereby shifting stimulus control from textual to intraverbal control. Skinner illustrated tact acquisition through transfer of stimulus control from the text to the picture (e.g., transfer from textual to tact). Although these examples provide an explanation for how transfer of stimulus control may occur during learning, empirical support was not provided in either text.

It has been suggested that a behavior-analytic account of verbal behavior has been problematic due to the conceptual nature of its advent (Michael, 1984). In general, behaviorally based concepts begin in basic research paradigms where support for behavior change strategies or principles are first formulated and examined. Basic research findings are then systematically extended to issues of applied significance and subsequent interpretations or conceptualizations are derived logically from the subsequent findings (McIlvane, 1992). In the case of verbal behavior, the conceptual analysis was written first and data were collected later. As a result, there is a significant gap between what the research indicates and what Skinner (1957) conceptualized. Since Michael's critique, several reviews and citation analyses have been conducted to identify the continuity of research based on Skinner's Verbal Behavior and to identify gaps in the research (Dymond, O'Hora, Whelan, & O'Donovan, 2006; McPherson, Bonem, Green, & Osborne, 1984; Oah & Dickenson, 1989). Michael contended that verbal behavior research was still in its early stages, but an excellent foundation had been established and research was progressing.

Oah and Dickenson (1989) suggested three major conclusions from their review. First, the few studies they found focused primarily on mand and tact relations. Second, Oah and Dickenson noted that the empirical base provided a solid groundwork for additional research. Finally, they suggested that the findings offered a direction for language training for individuals with limited verbal repertoires, particularly with respect to training individual verbal operants and developing speaker and listener repertoires. In summary, Oah and Dickenson concurred with Michael (1984) in terms of the existing research and empirical base. The authors, however, were less optimistic regarding the growth rate of verbal behavior research. More recently, Dymond et al. (2006) conducted a citation analysis of Skinner's (1957) *Verbal Behavior*. They reported that the number of citations from 1984 to 2005 have remained stable at an average of 52 per year with the majority of citations occurring in nonempirical works. Furthermore, the authors noted that the empirical work stemmed conceptually from Verbal Behavior. Some research centered on techniques for understanding and teaching language from a functional perspective, specifically, establishing verbal responses under the controlling variables outlined in *Verbal Behavior*.

Sundberg and Michael (2001) summarized the advantages of adding Skinner's (1957) analysis of verbal behavior to language training programs for children with autism. They suggested that each verbal operant is a separate functional unit and an extensive repertoire of each type of verbal operant is required to form the "basis for more advanced verbal behavior" (Sundberg & Michael, p. 705). They go on to suggest that, "more advanced verbal relations involve multiple sources of control and interacting repertoires that cannot be established before the relevant components are firmly established" (p. 716). Skinner's description of pure verbal operants (i.e., those under one source of stimulus control) and impure verbal operants (i.e., those under multiple sources of stimulus control) focuses on the variables governing the emission of a response (Bondy et al., 2004). Selection- and topography-based language training programs further illustrate the differences between pure and impure operants. In short, selection based language systems teach a single response topography (e.g., pointing, selecting, etc.) that is used to select the stimulus that corresponds to the response. Topography based systems consist of varied response topographies that occur in the absence of stimulus selection (Michael, 1984). The basic discourse involves the number of conditional discriminations required in selection based language systems that are not required for topography-based systems. Advocates for topography based systems suggest that the emphasis on pure verbal operants requires fewer skills to master the communication system (Sundberg & Partington, 1998). In contrast, proponents of selection- based systems contend that individuals are less reliant on others' verbal behavior to emit a response (e.g., "what do you want" preceding a mand) (Bondy, et al.). Furthermore, selection- based systems facilitate impure verbal operants, however, little verbal behavior occurs in its pure form and topography-based language training programs rarely succeed in establishing pure verbal repertories (Bondy et al.). Regardless of the training system, the literature suggests a general agreement that mand training is the first step to establishing a verbal repertoire. The mand's characteristic consequence, for example, makes verbal behavior functional for the speaker rather than the listener (Bondy et al.; Sundberg & Michael). However, the mand training sequence has minimal empirical support. Rather, it is based on an interpretation of language development extrapolated from an understanding of reinforcement contingencies.

Recently, the lack of empirical support for language training programs grounded in an analysis of verbal behavior has been the subject of much debate (Green, 2005). Particular attention has been focused on the sequence of training. Some have emphasized an early focus on mand training and others have suggested that multiple verbal operants should be taught concurrently (Green). Sundberg and Michael (2001) suggest that discrete trial (DTT) training programs focus on enhancing tact and receptive repertoires and that natural environment training (NET) programs emphasize mand training. They go on to suggest that, "from a verbal behavior perspective, a more complete language repertoire would be acquired from a combination of DTT and NET programs" (Sundberg and Michael, p. 719). LeBlanc et al. (2006) further support this contention. However, researchers generally focus on establishing one response topography under the control of a single verbal operant and use transfer of stimulus control to establish that response topography under the controlling variables for a different verbal operant (Barbera & Kubina, 2005; Braam & Poling, 1983; Finkel & Williams, 2001; LeBlanc, et al.; Luciano, 1986; Miguel et al., 2005; Watkins et al., 1989). Clinicians practice the alternative teaching responses under multiple sources of control. Few studies directly assess the impact of initial mand training on the subsequent acquisition of more advanced verbal repertoires. In fact, there are few studies that illustrate the acquisition of advanced verbal repertoires. Moreover, there are no studies that have examined the outcomes of teaching multiple verbal operants concurrently (Green). Clearly there is a significant gap between Skinner's (1957) analysis of verbal behavior, empirical support for best practices, and clinical applications of a teaching technology extrapolated from *Verbal Behavior*.

Skinner (1957) conceptualized verbal behavior as behavior. As such, the same principles that govern nonverbal behavior govern verbal behavior. Accordingly, researchers have adopted the procedures for nonverbal behavior change and extended them to the practice of teaching verbal behavior. An illustration of this process can be found in Sidman and

Stoddard (1967) and Terrace's (1963a, 1963b) demonstrations of the transfer of stimulus control. These studies extend directly from Skinner's (1957, 1968) discussions of transfer of stimulus control across verbal operants. However, if verbal behavior is subject to the same controlling variables as nonverbal behavior then it is also subject to the limitations of the existing empirical base for these principles.

For example, stimulus blocking can occur during transfer of stimulus control. During transfer of stimulus control, responding is first brought under the control of a specific stimulus. This stimulus subsequently blocks the acquisition of control by the new stimulus for the first few transfer trials until control is acquired by the compound stimulus. Therefore, stimulus blocking may impede language acquisition when transfer of stimulus control is applied with verbal operants if transfer is prohibited. Stimulus blocking is an educational problem that may be further compounded when time delay procedures are used (Charlop, Schreibman, & Thibodeau, 1985; Glat et al., 1994; Singh & Solman, 1990). Moreover, stimulus blocking has also been observed during transfer of stimulus control across verbal operants (Glat et al.; Partington et al., 1994; Sundberg et al., 2000). Limited research on teaching multiple verbal operants concurrently, establishing impure or pure verbal operants, and stimulus blocking poses a challenge when attempting to develop an effective teaching technology to establish verbal behavior. Few studies, replications, and extensions prevent a complete analysis of language development, particularly with respect to the most efficient teaching procedures. Didden et al. (2000) illustrated some of these unanswered questions when they suggested that, "previous conditioning of a verbal response to a picture [tact] may block conditioning of the verbal response to its written equivalent [textual] when the picture and word are presented as a compound stimulus" (p. 317). If this is true, this phenomenon may be related to tact to intraverbal transfer procedures and possibly transfer applied to other verbal operants. As a result, stimulus blocking may explain examples of unsuccessful transfer found in research conducted with individuals who have limited verbal repertoires because these participants are often predisposed to stimulus overselectivity (Allen & Fuqua, 1985; McIlvane, 1992). Further analysis of how stimulus blocking may interfere with the acquisition of verbal behavior may lead to advances in determining the most efficient way to establish verbal repertoires with individuals who exhibit minimal repertoires. Specifically, it would be possible to determine if transfer of stimulus control is more or less efficient than teaching verbal behavior under multiple control.

This review begins by summarizing the basic research on transfer of stimulus control to identify the basic processes that occur during transfer and variables that might increase the efficacy of transfer. A review of the application of transfer of stimulus control to applied questions and its relation to the acquisition of verbal behavior follows. Information from these two literature bases is extended to demonstrations of stimulus blocking in an effort to hypothesize how stimulus blocking may impact the acquisition of verbal behavior. This analysis permits a discussion of the role of stimulus blocking in transfer of stimulus control and how future research may be designed to answer questions related to the most efficient procedures for increasing verbal repertoires.

Basic Research on Transfer of Stimulus Control

This section reviews the basic research on transfer of stimulus control especially findings that increase the efficiency of transfer of stimulus control. One type of transfer of stimulus control involves using stimulus manipulations. There are two forms: (a) stimulus shaping and (b) stimulus fading. Stimulus shaping involves changing the topography of the stimulus whereas stimulus fading involves strengthening some feature of the stimulus in order to increase the likelihood of a response occurring (Cooper et al., 2007). In general, the focus in the basic research has been on the acquisition of control by new stimuli (i.e., transfer of stimulus control) through stimulus fading, which incorporates a combination of fading and superimposition. Touchette (1971) measured the moment of transfer of stimulus control using superimposition with individuals with mental retardation. Specifically, he transferred stimulus control from color to form through superimposition of the forms on the colored stimuli. The time before the onset of the original controlling stimulus was gradually increased. Dependent variables included the number of correct and incorrect responses as well as the response latency and the time of onset of the first discriminative stimulus. Results indicated the moment of transfer differed both within and across subjects. Touchette's study highlighted the use of transfer of stimulus control as a mechanism to establish responding under new discriminative stimuli.

One of the major themes in basic research focused on the variables that increase the efficacy of transfer of stimulus control. Fields, Bruno, and Keller (1976) used superimposition and fading to transfer stimulus control from red and black stimuli to lines with different angular orientations. They assessed the rate of responding in the presence of the discriminative stimulus, the S-delta, the discriminative stimulus during line probes, and the discriminative stimulus during red probes. Responding was also assessed during probes at each fading level during the attenuation of the initial controlling stimulus. Fields et al. found that two stages of acquisition occurred during transfer of stimulus control. First, responding came under the control of the compound stimulus (i.e., color and line). Then, responding came under the control of the new discriminative stimulus (i.e., line).

Fields (1978) measured the moment of transfer during superimposition and fading. Stimulus control was transferred from color to lines of different angular orientations. Fields analyzed when transfer occurred when the discriminative stimulus was faded alone or in conjunction with the S-delta. He measured response rates in the presence of each compound discriminative stimulus during the attenuation of the original controlling stimulus and response rates in the presence of discriminative stimulus and S-delta during probes at each fading level. The results suggested that different components of new stimuli acquired control during different fading conditions. For example, when the discriminative stimulus was attenuated with the S-delta, only one dimension of the line acquired control; however, if the discriminative stimulus was attenuated alone, more than one dimension of the line acquired control. Fields indicated that transfer occurred without errors when the discriminative stimulus was attenuated alone or in conjunction with the S-delta, but errors were emitted when the S-delta was attenuated alone.

Probes were incorporated in studies on transfer of stimulus control to assess when transfer occurred (Fields, 1978; Fields et al., 1976; Touchette, 1971). Fields (1979) explored the effects of using initial stimuli with lower intensities and the effects of the inclusion or the exclusion of probe trials on the number of trials to the moment of transfer. Fields used transfer of stimulus control from color to line orientation and measured response rates to the discriminative stimulus and the S-delta at each level of stimulus fading. Data indicated support for the inclusion of probe trials; however, results were confounded by the varied intensities of the initial stimuli. Fields (1981) sought to replicate and extend Fields (1979) by manipulating the onset of probe trials during fading and assessing the influence on the moment of transfer. He did not manipulate intensity in order to better assess the influence of probe trials. The number of probes occasioning correct responding at each fading level and the number of fading levels needed to reach criterion during early and late probe introduction were measured. Fields (1981) included two groups of college students: one group experienced early onset probes and one group experienced late onset probes. He also included differential reinforcement for probe responding. Stimuli involved in the transfer procedures included initial control by English capital letters and transfer of stimulus control to the Braille equivalents. The results indicated that the inclusion of probe trials during fading procedures enhanced both measurement and acquisition.

Fields (1985) assessed the effects of reinforcement during probes on the acquisition of stimulus control during fading procedures. He measured the number of corrected fading levels necessary to complete acquisition of discriminations during reinforced and unreinforced trials. The results of the comparison supported the use of reinforcement during probes to increase the efficacy of transfer. The use of reinforcement during probes both decreased the number of fading levels needed and minimized the total number of trials needed to transfer stimulus control.

A second theme in the basic research involves the effects of the history of training discriminations on the efficiency of the transfer of stimulus control (Doran & Holland, 1979; Fields, 1980). Doran and Holland studied the effects of discrimination difficulty on fading. Level of difficulty was defined in terms of the size of the stimulus (i.e., discriminative stimulus was 14 mm in diameter, the easy discrimination was 5 mm in diameter, etc.). Doran and Holland assessed transfer of stimulus control across three conditions. Participants received training sessions from the least difficult to the most difficult discriminations in the gradual progression condition. Training on the most difficult discrimination and subsequent training sessions using a gradual progression of difficulty made up the difficult/gradual progression condition. Finally, in the difficult condition, participants received training sessions on the most difficult discrimination. Transfer was measured in terms of responding controlled by luminance, size, both, or neither during probe trials across each condition. The number of trials with errors was also recorded. Results indicated that participants who showed dual control or control by the compound stimulus responded without errors on target discriminations. Differences in the controlling stimuli were noted between groups. This in turn influenced the number of errors on target discriminations. In general, the most favorable results were obtained from the participants in the gradual progression group.

Fields (1980) examined the impact of a history of errorless learning on subsequent contact with discrimination trials. Eleven college students acquired a set of discriminations through traditional discrimination training procedures using reinforcement and extinction. Then, participants were split into two groups, one learning a second set of discriminations through traditional discrimination training and the other learning the second set of discriminations through stimulus fading. All participants then learned a third set of discriminations through traditional discrimination training. Data were analyzed in terms of the number of trials required to learn the discrimination as well as the number of errors made within each condition. Results indicated that a history of errorless learning enhanced subsequent discrimination training. Specifically, individuals who received discrimination training via stimulus fading required fewer trials to learn subsequent discriminations. In addition, these participants learned subsequent discriminations with fewer errors.

A synthesis of the basic research indicates the most effective procedural variations for transfer of stimulus control with stimulus manipulations and provides insight into the mechanisms governing the transfer of stimulus control. Fields et al. (1976) suggest that two stages of acquisition occur when transferring stimulus control: (a) control by the compound stimulus, and (b) control by the new discriminative stimulus. Fields (1978) suggests that fewer errors occur during discrimination training when the discriminative stimulus is attenuated alone or in conjunction with the S-delta, but not when the S-delta is attenuated alone. Fields (1979, 1981) provides support for the inclusion of probe trials during stimulus fading. In addition, Fields (1985) suggests benefits of using reinforcement during probe trials and Fields (1979) supports the use of initial stimuli of lesser intensities or lessening the difficulty of the discrimination. Furthermore, Doran and Holland (1979) suggest training sessions be conducted in the order of least to most difficulty. Finally, Fields (1980) confirms that a history of errorless discrimination training enhances subsequent contact with discrimination trials. In general, transfer of stimulus control is most efficient when discriminations are less difficult, probes are incorporated, and responding during probes is reinforced.

Applied Research on Transfer of Stimulus Control

Applied research on transfer of stimulus control employs different transfer procedures than those used in basic research paradigms. Basic research incorporates superimposition and fading of stimuli and applied research emphasizes the use of additional stimuli that function as prompts and researchers manipulate the onset of these stimuli. It is difficult to draw strong conclusions regarding the most effective mechanisms in the use of time delay, potentially due to within and across individual differences. However, script fading procedures provide additional information, as they more closely resemble the transfer procedures used in basic research. In script fading, the original controlling stimulus is faded rather than the delay to the response prompt.

Applied research on transfer of stimulus control focuses on response prompts such as graduated guidance, least to most prompting, most to least prompting (e.g., script fading), and time delay (Cooper et al, 2007). Time delay may involve fixed intervals (Halle, Baer, & Spradlin, 1981) or progressive intervals (Charlop et al., 1985). For example, Halle et al. evaluated the effects of a fixed time delay to transfer stimulus control from a delay to an environmental stimulus. The dependent variables were the percentage of delay opportunities used by teachers as well as the percentage of child vocal initiations. Results suggested that immediately following the onset of treatment, children increased the number of vocal responses in correspondence to the number of teacher provided opportunities. Halle et al. noted that control was shifted from the delay to the environmental stimuli suggesting that time delay results in successful transfer. Results of the second experiment replicated the results.

Charlop et al. (1985) examined progressive time delay in the transfer of control from a vocal stimulus to a nonverbal stimulus. They measured the percentage of correct responding during training and probe trials. Results indicated that all but one participant responded vocally to the nonverbal stimuli. Generalization and maintenance were obtained across settings, across settings and people, and across stimuli. In addition, progressive time delay produced errorless responding and fixed time delay did not. Delayed prompting procedures emerged from Touchette (1971) in an effort to assess the advantages of delayed prompting over stimulus fading (Handen & Zane, 1987). Delayed prompting was suggested as a mechanism to decrease attention to irrelevant stimuli, to limit the necessary modifications to training stimuli required for stimulus shaping, and to allocate more time for teaching due to the precision with which transfer of stimulus control could be assessed (Handen & Zane). Most empirical applications of time delay have reported successful transfer (Handen & Zane; Halle et al., 1981; Charlop et al., 1985). Furthermore, results seem to be favorable regardless of the use of fixed or progressive time delay. However, Wolery et al. (1992) noted that in all studies, individuals received training until criterion was met. This would produce successful outcomes because training was not terminated until the target repertoire was established, thereby ensuring successful transfer. Additional disadvantages of time delay may result if responses cannot be prompted such as vocal-verbal behavior or if control is exerted by the delay (Handen & Zane).

Most to least prompting procedures are used with script fading when stimulus control is transferred from written or vocal stimuli to vocal or nonverbal stimuli (Charlop-Christy & Kelso, 2003; Krantz & McClannahan, 1998; Sarakoff, Taylor, & Poulson, 2001; Stevenson, Krantz, & McClannahan, 2000). These studies generally report production of the desired vocal verbal repertoires. Written (Krantz & McClannahan; Sarokoff et al.) or vocal (Stevenson et al.) scripts were used to facilitate responses to vocal or nonverbal controlling stimuli. Initially, participants were taught to read or echo scripted responses. The scripts were systematically faded until responses were maintained solely by the target stimuli. The procedures were most often applied with individuals with textual repertoires (Krantz & McClannahan; Sarokoff et al.) and generated intraverbal repertoires.

Script fading procedures are effective and efficient in increasing verbal responding. Researchers have suggested that scripts are easily faded independent of the script topography. In addition, results have indicated generalization and maintenance of skills (Krantz & McClannahan, 1998; Sarokoff et al., 2001; Stevenson et al., 2000), and limited response variation. Responses were typically emitted only under contrived stimulus conditions and generalization was limited to environments similar to those used in training. Script fading can be conceptualized as another form of transfer of stimulus control (e.g., textual or echoic to tact or intraverbal), although researchers generally have not described dependent variables in terms of their functional definition. Furthermore, independent variables have rarely been described as transfer of stimulus control. Nevertheless, research in verbal behavior has described transfer of stimulus control as the independent variable applied to teaching verbal operants as the dependent variable.

Verbal Behavior

Skinner (1957) defined verbal behavior as "behavior reinforced through the mediation of other persons" (p. 14). He characterized several verbal operants defined in terms of the controlling stimuli and the reinforcement contingencies. Transfer of stimulus control has been explored as a technique to transfer control from stimuli that control one verbal operant to the stimuli that control another verbal operant. Thereafter, the same topography of response is emitted under controlling variables for two functionally independent verbal operants.

One example has been to develop intraverbal repertoires through already developed tact repertoires. Braam and Poling (1983) explored transfer from a nonverbal stimulus to a manual sign with a seventeen year old with mental retardation and a hearing impairment. They used transfer of stimulus control by presenting a picture cue following incorrect intraverbal responses. Tokens were delivered following prompted and correct responses. Researchers measured the percentage of correct unprompted thematic intraverbal responses and the number of intraverbal variations emitted in response to target categories. The results indicated an increase in the percentage of correct responses as well as an increase in the number of response forms emitted during and following training. These results suggest that stimulus control may be transferred from nonverbal stimuli to verbal stimuli.

In their second experiment, Braam and Poling (1983) applied delayed prompting procedures to establish an intraverbal repertoire by transferring control from a nonverbal stimulus (i.e., a color card) to a compound verbal stimulus (i.e., manual sign plus a vocal question). They extended their first study by attempting to produce transfer without errors. A seventeen year old with mental retardation and speech and language impairment participated. Researchers used a gradual delay to transfer stimulus control from a color card to a compound verbal stimulus. The delay gradually increased to 2 s and probes to assess transfer occurred after 15 consecutive correct responses. The dependent variables were the same as in Experiment 1. Results suggested transfer of stimulus control occurred without errors for the three stimuli at the 2 s delay.

Luciano (1986) replicated and extended Braam and Poling's (1983) study measuring different response topographies (i.e., vocal rather than sign). He compared the effects of different transfer strategies (i.e., a nonverbal cue presented with gradual delay vs. no immediate prompt) on the percentage of correct unprompted thematic intraverbal responses and variations in responding. After training for each class of stimuli, the researcher administered a probe session. Participants included three individuals with mental retardation. Two participants were taught three categories and one participant learned two categories. Follow-up data indicated some decline in performance. Two participants generalized responding across all three categories and one participant generalized responding for one category. In summary, the results replicate Braam and Poling's findings.

Watkins et al. (1989) examined transfer of stimulus control to generate an intraverbal repertoire from an existing echoic repertoire with individuals with severe mental retardation. They examined simple and compound intraverbal responses (e.g., adjective and noun combination) in addition to stimulus generalization. They were also interested in assessing the functional independence of intraverbal and tact repertoires. Training occurred in three phases: (a) intraverbal training with adjectives, (b) intraverbal training with nouns, and (c) compound response training (adjective plus noun). Watkins et al. also included training to transfer of control from a vocal to a nonverbal stimulus. They recorded the number of trials to criterion and the percentage of correct intraverbal responses. They also recorded the cumulative number of compound responses and the percentage of correct unprompted responses for simple and multiple tacts. Trials to criterion decreased as training progressed. Compound responses occurred without direct training for different noun classes after training. In addition, few untrained compound intraverbal responses and few untrained tacts were emitted during probe sessions.
In Experiment 2, Watkins, et al. (1989) assessed whether compound responding could be established without the simple response procedures used in their first experiment. They implemented response training for 15 nouns using transfer of stimulus control with a delay prompt and measured the effects on intraverbal behavior. Results indicated a decrease in the number of training trials to criterion and fewer prompts to obtain the target repertoire as training progressed. Both participants emitted several untrained

responses during training trials with an increasing trend as training progressed. Participants emitted few untrained responses during probes and limited generalization of the compound response forms to the nonverbal stimuli occurred. These studies provide support for the transfer of control from echoic to tact and intraverbal operants and some evidence of the functional independence of tacts and intraverbals.

Sundberg, San Juan, Dawdy, and Arguelles (1990) trained tacts, mands, and intraverbals and assessed the rates of acquisition. They assessed the emergence of tacts and intraverbals for response topographies established under mand conditions, the emergence of mands or intraverbals for response topographies established under tact conditions, and the emergence of mands or tacts for response topographies established under intraverbal conditions. Tacts were established via transfer of stimulus control from echoics to tacts with a 5 s delay and echoic stimuli were faded from full word to initial sound. Mands were established with a chaining procedure that established a conditioned establishing operation prior to transfer of stimulus control. Prompts were faded as in the tact training condition. Intraverbals were trained using echoic prompts. Researchers recorded tact, mand, and intraverbal responses. The percentage of correct echoic, tact, mand, intraverbal, and textual responses during baseline and object selection conditions; the percentage of correct tact, mand, and intraverbal responses during probes; and the percentage of correct within-session responding and number of trials to criterion during tact, mand, and intraverbal training were recorded.

Results of tact training and transfer suggested that participants acquired tacts, which were easily transferred to mand and intraverbal conditions. Mand training and transfer was the least effective for producing mands. Following mand training, some transfer was observed, but much less than what was observed with tact training. In general, there was a decrease in the number of trials to criterion across all conditions for both participants. Furthermore, the strongest retention followed tact and intraverbal training. These conditions were also the most efficient procedures for establishing the target repertoires. Direct mand training was the least efficient. These findings are contradictory to other research in developmental disabilities that support initial mand training (Sundberg & Michael, 2001; Sundberg, et al., 1990). Rather, these findings support initial training of tact or intraverbal repertoires.

Partington and Bailey (1993) conducted a series of experiments that examined the functional independence of verbal operants. They sought to determine whether tact and intraverbal repertoires were functionally independent in typically developing preschool children and, if so, if transfer of stimulus control procedures would be effective in transferring control from tacts to intraverbals. They also examined a slight modification to the transfer procedures to assess its effectiveness in developing generalized intraverbal repertoires. Independent variables included tact training or transfer from echoic control to tact control and intraverbal training or transfer from tact control to intraverbal control. Pre- and post- training scores on the Verbal Performance section of the McCarthy scales and correct intraverbal responses during probe, baseline, and training sessions were recorded. Results indicated that there was not a substantial increase in intraverbal repertoires following tact training except with one participant. Nevertheless, transfer of stimulus control was effective in establishing intraverbal responding. These results indicated that tacts and intraverbals were functionally independent repertoires in typically developing children.

Finkel and Williams (2001) assessed the effectiveness of prompts on the acquisition of intraverbal behavior with a six-year-old boy with autism. They transferred stimulus control from preexisting textual or echoic repertoires to intraverbal control for three sets of questions. Stimuli were faded one word or phrase at a time. They measured the number of correct full sentence answers, the number of correct partial answers, and the number of nonsensical responses. The results indicated that transfer from textual control was more effective than transfer from echoic control in establishing full sentence intraverbals. Barbera and Kubina (2005) used an echoic repertoire to establish a tact repertoire for a child with autism. They combined echoic transfer and receptive to echoic to tact transfer procedures. The results indicated that the combined transfer procedures resulted in the acquisition of 30 new tacts.

Finally Miguel et al. (2005) compared the effectiveness of several procedures in order to determine the utility of transfer procedures. They evaluated the effects of multiple tact training and receptive discrimination training on the acquisition of intraverbal behavior. When neither of these procedures produced the desired repertoires, they evaluated the effects transfer of stimulus control on the acquisition of the target repertoire. The independent variables included receptive discrimination training, multiple tact training, and transfer of stimulus control procedures (i.e., tact and/or echoic to intraverbal). The dependent variables were the number of correct thematic intraverbal responses (e.g., category), the number of new and novel intraverbal responses, and the cumulative number of intraverbal responses. Results indicated that transfer of stimulus control procedures were required to achieve the desired increase in intraverbal behavior. These results suggested transfer procedures were most effective in establishing verbal responses under new forms of stimulus control.

The results of these studies using transfer of stimulus control with verbal behavior indicate its effectiveness when existing verbal repertoires are used to establish new verbal repertories. Specifically, existing tact, echoic, and textual repertoires have been used to generate responding under intraverbal or tact control (Barbera & Kubina, 2005; Braam & Poling, 1983; Finkel & Williams, 2001; Luciano, 1986; Miguel et al., 2005; Partington & Bailey, 1993; Sundberg et al., 1990; Watkins et al., 1989). Transfer of stimulus control was more effective than receptive discrimination training or multiple tact training when the three were directly compared (Miguel et al.; Partington & Bailey). Furthermore, when transfer from echoic or textual to intraverbal was compared, transfer from textual repertoires was more effective (Finkel & Williams, 2001). Partington and Bailey and Sundberg et al. suggest that tact and intraverbal training was the most efficient and mand training was the least efficient in generating target verbal repertories. Errorless transfer occurred if the delay between the discriminative stimulus and the prompt was gradually increased (Braam & Poling; Luciano). In addition, Watkins et al. suggested that compound response training may have increased the effectiveness of transfer of stimulus control. However, each experiment examined transfer of stimulus control to transfer control to one other verbal operant. Little attention was focused on establishing responding under multiple sources of control or using transfer of stimulus control with impure verbal operants. If impure verbal operants were established (e.g., Sundberg et al.) they were not referred to as such. In addition, none of these studies investigated the possible influence of stimulus blocking during transfer procedures. Transfer of stimulus control yielded favorable results when applied to verbal behavior; however, less successful outcomes related to transfer have also been described.

Stimulus Blocking

Before transfer of stimulus control can be used, a response must be under discriminative control (McIlvane, 1992). The original controlling stimulus may block control by the new stimulus. This resistance to transfer is referred to as stimulus blocking. It is only after superimposition of the two stimuli and subsequent fading of the initial stimulus that the blocked stimulus dimension acquires control over responding. Often, the gradual elimination of the original blocking stimulus allows transfer of stimulus control to occur without errors (Doran & Holland, 1979; Fields, 1978, 1979, 1980, 1981, 1985; Fields et al., 1976; Terrace, 1963a, 1963b; Touchette, 1971). However, blocking may impede the efficiency of transfer of stimulus control to produce effective verbal repertoires. Stimulus blocking has been studied both as an effect observed after unsuccessful teaching as well as an independent variable applied in research on transfer of stimulus control.

In verbal behavior, stimulus blocking has been observed following failed attempts to transfer stimulus control. Partington et al. (1994) examined different procedures to transfer stimulus control from verbal to nonverbal stimuli for a child with autism who engaged in stimulus overselectivity. Researchers used an imitative model of the correct response, a signed intraverbal prompt, and pointing, while simultaneously saying the participant's name to minimize overselectivity. They measured the percentage of correct tacts and the total number of prompts required to reach criterion. Results indicated that transfer of control was expedited when the blocking stimulus (i.e., "What is this?") was removed. Enhancement of the nonverbal stimulus (i.e., placing it in a box), and differential reinforcement for unprompted responses also facilitated successful transfer. Partington et al. concluded that transferring control from intraverbal control to tact control was restricted as a function of stimulus blocking. Specifically, the vocal stimulus, "What is this?" blocked the acquisition of control by the nonverbal stimulus. Essentially, the stimulus that had originally controlled the response prevented transfer of control to the new target stimulus. Once this stimulus was removed and the participant acquired tacts, the blocking stimulus could be reintroduced without affecting rates of acquisition. Glat et al. (1994) used a delayed cue procedure that resulted in a series of unsuccessful transfers with a twenty-five year old male with hydrocephaly and moderate mental retardation. One condition, the no repeating condition, involved dictating the word name and presenting the printed word. Prompts were faded to just the printed word. The second condition, repeating dictated word name, involved repeating the word and showing the printed word and repeating the word name. The dependent measure was the correct auditory/textual matching responses for the percentage of anticipations and the percentage of correct and incorrect responses in successive trial blocks. Results indicated that the participant did not acquire the target response in the no repeating condition. The participant waited until presentation of the supplementary cue before responding. The inclusion of the vocal prompt seemed to function as a discriminative stimulus to attend to the textual stimulus and thus emit a response. Consequently, repeating the dictated word was effective in teaching the desired repertoire. Glat et al. discussed their results in terms of blocking, noting that the delay functioned as a blocking stimulus. Therefore, acquisition of control by the new stimulus (i.e., textual) was blocked by the control exerted by the original stimulus (i.e., delay).

Sundberg et al. (2000) used intraverbal prompts to establish tacts for children who were reliant on imitative prompts. Two children with autism participated in the standard condition, which included a vocal stimulus, "What is that?" presented in combination with a nonverbal stimulus and the intraverbal condition in which the instruction, "sign (name of the item)" was presented in conjunction with the nonverbal stimulus. The dependent variables were the percentage of correct tacts and the cumulative number of tacts acquired during pure tact probes. Results suggested that the intraverbal prompt procedure was more effective in teaching the tact repertoire. These results provide support for Partington et al. (1994) and the potential blocking effects of the "What is that?" vocal cue for establishing tact repertoires. In addition, support for establishing verbal operants under some forms of multiple control was also demonstrated.

It has been suggested that, "parameters that reduce blocking effects of stimuli, when applied to the original stimuli in fading should enhance rate of acquisition of control by the new stimuli in fading" (Fields et al., 1976, p. 299). For example, Fields (1979) found that, "the point in fading at which the new stimuli acquired control of responding is directly related to the starting intensity of the original controlling stimuli" (p. 126). In other words, stimulus control may be transferred more efficiently when the original blocking stimulus is initially presented at a lesser intensity, thereby lessening the difficulty of the discrimination. Studies that examine stimulus blocking as an independent variable illustrate how blocking effects may be enhanced or minimized.

Singh and Solman (1990) provided an empirical demonstration of applied issues as related to stimulus blocking. They measured the rate of acquisition for vocal responses to written stimuli across a variety of conditions that minimized or maximized blocking effects. Eight students with mental retardation participated in a comparison of four conditions. During condition A, participants were presented with a picture stimulus followed by a compound word/picture stimulus in which the picture was enhanced in size. Condition B served as the control for Condition A. In Condition B, the word was presented in isolation. In condition C, hypothesized to reduce the blocking effect of the picture, the word was presented in isolation and was followed by the compound word/picture stimulus in which the word was enhanced in terms of size and position. Condition D, with a single presentation of an enhanced word, served as a control for Condition C. Correction trials included transfer of stimulus control from a vocal stimulus to a textual stimulus.

The results indicated that stimulus blocking effects could be manipulated. Response rates were slowest during the maximum blocking condition (A) and 6 of the participants had the fastest response rate during the minimized blocking condition (C). Singh and Solman (1990) suggest that, "conditioning to one member of a compound stimulus can be blocked by the presence of a second member to which the response was previously conditioned” (p. 525). In sum, stimulus blocking impacted the rate of acquisition.

Didden et al. (2000) directly tested the blocking effect by using extra stimulus prompts (i.e., picture prompts) in the acquisition of sight words across five conditions for 6 children with moderate mental retardation. In the word/enhanced picture condition, the picture was presented alone and then as a compound stimulus including the picture plus the word. In both the word-only and the enhanced word conditions, the word was presented alone, but in the enhanced word condition, the word was emphasized. In the enhanced-word/picture condition, the word was presented alone followed by the presentation of the word and the picture. Finally, in the word-only/picture-feedback condition, the word was presented alone and then the picture was presented for 2 s contingent upon a correct response. The dependent variable was the number of correct textual responses. Results indicated that acquisition was faster during word only conditions; however, picture feedback was effective for one participant. Didden et al. suggested that the results might have been due to blocking or overshadowing because of previous tact history.

In summary, transfer of stimulus control procedures originated in the basic research and focused on stimulus fading techniques, specifically superimposition and fading to transfer stimulus control. These investigations produced several procedural modifications that increased the efficiency of transfer procedures. However, specific investigations related to the attenuation of the original controlling stimulus and fading in the new stimulus indicated some instances of stimulus blocking. Procedural variations led to research examining the errorless transfer of stimulus control in an effort to minimize blocking effects and decrease stimulus overselectivity.

Transfer of stimulus control procedures in the applied literature have been found in research on script fading, time delay, and transfer of stimulus control across verbal operants. This body of research has provided support for the effective use of transfer of stimulus control procedures for establishing responding under new controlling stimuli. Some researchers have focused simply on demonstrating the effectiveness of transfer of stimulus control from the stimuli controlling one verbal operant to stimuli controlling another verbal operant. Others have investigated the functional independence of different verbal operants when stimulus control is explicitly trained for one verbal operant and how this impacts the acquisition of stimulus control for other verbal operants. Still others have investigated transfer of stimulus control when responding is under multiple control or conditional discriminations. The failure of some participants' responding to occur under new stimulus control has developed into hypotheses regarding how stimulus blocking impacts the successful transfer of stimulus control. Much of this discussion has occurred in research investigating the transfer of stimulus control across verbal operants.

Multiple Control

The effects of training responses under multiple control or simultaneously training two or more verbal operants on acquisition of untrained operants emerged in an effort to enhance the acquisition of verbal behavior. This approach minimizes the use of transfer of stimulus control, thereby eliminating the possibility of stimulus blocking, because control by multiple stimuli is programmed initially. Fading is the only component of transfer required for responses taught under multiple control to be emitted under individual stimuli. Supplementary stimuli or response prompts are unnecessary. Braam and Poling (1983) illustrated this in their third experiment. They used transfer of stimulus control to establish more complex intraverbal behavior that involved conditional discriminations. They also transferred stimulus control from complex control to new controlling variables. Two individuals with mental retardation and hearing impairments participated. The independent variable was the same as in Experiment 1; however, verbal stimuli were compound, consisting of two manual signs and word cards (i.e., nonauditory verbal stimuli to evoke textual behavior), which were used as prompts. The dependent variable was the number of correct, unprompted intraverbal responses to the target category. Results indicated that one participant acquired the target repertoire for six compound stimuli and another participant acquired the target repertoire for four compound stimuli. These results suggested successful transfer of control from a manual sign plus a nonauditory verbal stimulus to manual sign only.

Carroll and Hesse (1987) investigated the role of establishing operations and reinforcement in language training by alternating mand and tact training. Independent variables included tact training and simultaneous mand and tact training. The dependent variables were the number of trials to criterion for tact responses during tact only and mand and tact training conditions as well as the tacts retained from each condition. The results indicated that fewer trials were needed to establish tacts when mand and tact training occurred simultaneously. In addition, participants demonstrated better retention for tacts learned under mand and tact training as opposed to only tact training. These results provide support for training verbal behavior under multiple control or teaching the same topography of response under impure control rather than under pure control. Partington and Bailey (1993) assessed the effects of teaching item labels as tacts as well as category labels as tacts on the acquisition of intraverbal repertoires in their second experiment. The effects of multiple tact training for the label and class of the item, tact training (transfer of stimulus control from echoic to tact), and intraverbal training (transfer of stimulus control from tact to intraverbal) on pre- and post- training scores on the Verbal Performance section of the McCarthy scales and correct intraverbal responses during probe, baseline, and training sessions were assessed. Two participants showed an increase in intraverbal responding following multiple tact training and all participants learned intraverbal responses when intraverbal training followed multiple tact training. Partington and Bailey noted some generalization to untrained stimuli.

In summary, training multiple response forms may lead to the emergence of untrained response topographies within the trained verbal operant (Partington & Bailey, 1993; Watkins et al., 1989). In addition, fewer trials were needed to establish tacts when mand and tact training procedures were combined, and resulted in more retention (Carroll & Hesse, 1987). Moreover, intraverbals did not emerge following tact training; yet, multiple tact training slightly increased intraverbal responding (Partington & Bailey). The strongest retention was observed following multiple control conditions (Carroll & Hesse). Transfer from verbal operants under complex control to new controlling variables resulted in acquisition of target intraverbal repertoires (Braam & Poling, 1983). Finally, having verbal operants under multiple control facilitated generalization possibly because more stimuli were present to acquire control over the response (Charlop et al., 1985).

Implications

Partington et al. (1994) and Sundberg et al. (2000) found the vocal stimulus, "What is this?" functioned as a blocking stimulus when transferring control to a nonverbal stimulus to teach a tact repertoire. Training multiple response forms led to the emergence of untrained responses within the operant class (Watkins et al., 1989; Partington & Bailey, 1993). Furthermore, it took fewer trials to acquire tacts when mand and tact training procedures were concurrently implemented. This also resulted in better retention for tacts (Carroll & Hesse, 1987). Teaching verbal operants under multiple control may facilitate generalization because more stimuli are present to acquire control over responding which may enhance generalization (Charlop et al., 1985). Moreover, Braam and Poling (1983) suggested that transfer of stimulus control can be used with verbal operants under complex control to establish responding under new controlling variables.

It is possible that responses taught under compound stimulus control could minimize the effects of stimulus blocking encountered during transfer. This is supported by the work of Fields (1979) and Singh and Solman (1990) who suggest that variations in the original controlling stimuli can foster more rapid acquisition of stimulus control by breaking down stimulus blocking effects. However, these conclusions, as applied to verbal behavior, must be drawn with caution. First, very few researchers have designed their research to provide empirical support for stimulus blocking in verbal behavior.

References to stimulus blocking in verbal behavior have been made post hoc. Second, the research that has explicitly examined stimulus blocking has occurred only with a few subjects and a few response classes. Third, few link stimulus blocking in the applied research to stimulus blocking in the basic research. Fourth, transfer of stimulus control in the basic research focuses on one operant class while transfer of stimulus control as applied to verbal behavior represents transferring control across different operant classes. Research with individuals with limited verbal repertoires often begin with the training of one verbal operant (e.g., mand) followed by attempts to transfer stimulus control to another verbal operant (e.g., tact). Stimulus blocking may impede the efficiency with which transfer of stimulus control to new stimuli occurs. Previous research suggests that it may require more teaching trials to transfer control if the response form was initially taught under a single source of control. For example, it may be more difficult to transfer control from mand or tact control to intraverbal control. However, if the response topography is initially taught under multiple control and then the original controlling stimuli are faded to bring responding under a single controlling stimulus, language training may be expedited. Control by the compound stimulus would be established initially, thereby preventing stimulus blocking as an outcome. Fading would be the only necessary component to produce responding under a single source of control. In essence, an attempt to teach pure verbal operants or to transfer stimulus control to establish other pure verbal operants includes three steps. Researchers must include initial discrimination or imitation training, superimposition or simultaneous presentation of two or more stimuli, and then fading. Control by a compound stimulus must be established before control can be transferred to the new stimulus. The number of teaching trials during transfer of stimulus control may drastically outnumber those needed when using transfer of stimulus control to establish pure verbal repertoires. Furthermore, if most naturally occurring verbal behavior is impure, establishing verbal operants under a single source of control may limit further development of advanced verbal repertoires in two ways. First, more teaching would be necessary to establish responding under single sources of control. Second, more trials may be necessary to establish responding under multiple control or the stimulus conditions that naturally control verbal behavior. These implications may be especially detrimental for individuals with limited verbal repertoires who are predisposed to stimulus overselectivity.

Additional research regarding the effects of stimulus blocking on the transfer of stimulus control across verbal operants needs to be conducted in order to determine how detrimental the effects of stimulus blocking are on the acquisition of verbal behavior. Comparisons of training responses under multiple control and subsequently fading the additional controlling stimuli and using transfer of stimulus control could provide the answer. These findings may lead researchers and clinicians to a more efficient technology for teaching verbal behavior. Such comparisons should be conducted across various populations to determine if some individuals are more or less affected by stimulus blocking. Specifically, studies should investigate the effects of stimulus blocking with individuals with autism who demonstrate a predisposition to stimulus overselectivity. Children with autism may be more affected by stimulus blocking thereby making it more difficult to teach verbal behavior.

Teaching verbal responses under multiple control may influence the efficiency of transfer by both decreasing the steps required to achieve responding under particular discriminative stimuli and by minimizing the potential blocking effects. Furthermore, research examining these variables could curtail debates surrounding the chronology of teaching particular verbal operants. If verbal responses are trained under the controlling stimuli for all verbal operants simultaneously, there would be no question as to which verbal operant should be acquired first. Furthermore, since much verbal behavior occurs as a result of supplementary stimulation (Skinner, 1957) and is under multiple control (Bondy et al., 2004), it may be unnecessary to go through the additional steps required for transfer of stimulus control.

This review presents at least two possibilities for further research efforts. First, researchers need to address whether or not transfer of stimulus control is limited in terms of efficiency due to stimulus blocking, particularly with respect to a technology for teaching verbal operants. However, researchers must first acquire information regarding stimulus blocking for each verbal operant. Currently, research provides evidence for stimulus blocking in textual and tact relations (Didden et al., 2000; Singh & Solman, 1990). Application of similar research methodology should be applied to training procedures for other verbal operants. Moreover, this research demonstrates that stimulus blocking can either be enhanced or lessened by manipulating stimulus presentation. The findings indicate that training verbal operants under multiple control may impede acquisition of the target repertories.

Conversely, researchers examining procedures that teach multiple verbal operants concurrently suggest that there may be benefits to establishing verbal operants under multiple control (Braam & Poling, 1983; Carrol & Hesse, 1987). These procedures may decrease the steps required to establish responding under the control for a single verbal operant. Specifically, training under multiple control and then fading each source of control requires only a one step approach whereas transfer of stimulus control requires two steps: simultaneous presentation of the compound stimulus and fading. Research that measures rate of acquisition for either procedure across populations and verbal operants can help to address the benefits and limitations related to each approach. Furthermore, research in this area could provide guidelines to determine the sequence of teaching the verbal operants.

This study seeks to initiate investigations of this type. Specifically, the purpose was to address questions related to the efficiency of procedures used to teach verbal behavior and the possible influence of stimulus blocking. The specific research questions addressed were: (a) Does teaching a response topography under the multiple control of operants (i.e., as an echoic, mand, and tact) simultaneously and then fading sources of control require fewer teaching trials than teaching a response topography under the control of one verbal operant (i.e., echoic) and establishing a compound stimulus and fading to transfer of stimulus control to establish additional verbal operants (i.e., mand and tact)? (b) How does each procedure affect the emergence of untrained operants? (c) Do outcomes vary based on the order in which operants are targeted for transfer? (d) Is there evidence of stimulus blocking when echoic repertoires are used to transfer control to tact and mand repertoires?

CHAPTER 3

METHOD

Participants and Setting

Five individuals between 2 and 7 years old participated in the study. Criteria for participation included: (a) a verbal repertoire consisting of fewer than 20 echoic responses, (b) a record of good attendance, as documented by the participant's teacher, (c) a recommendation from the classroom teacher that participation would be likely to benefit the child, and (d) parental or guardian consent for participation.

Teige was a 4-year-old male with a cleft palate. During the course of the study, he was being evaluated for a diagnosis of autism. Sessions were conducted three to five times a week in a small supply room near Teige's classroom. Herb was a 4-year-old male with a diagnosis of autism. Sessions were conducted three to six times per week in a room free of distractions in Herb's home. Al was a 7-year-old male with a diagnosis of autism. Sessions were conducted five to ten times per week in a small room at his school. Bea was a 2-year-old female with a diagnosis of autism. Sessions were conducted four to seven times per week in a room free of distractions in Bea's home. Javier was a 7-year-old boy with a diagnosis of autism. Sessions were conducted five to ten times per week in a small room Javier's school.

Overall language skills were evaluated using the Behavioral Language Assessment Form (Sundberg & Partington, 1998). The Behavioral Language Assessment Form was chosen because it tests skills within a variety of functional language domains (e.g., mand, tact, echoic, etc.), it provides a direct measure of the target behaviors of interest, and is relatively easy to administer. This assessment was administered to determine participants' verbal repertoires prior to the onset of intervention. Specifically, the assessment provided a direct assessment of the verbal operants of interest (i.e., mands, tacts, and echoics).

Figures 1 and 2 depict the language assessment results for Teige and Herb. The data indicate that both participants entered the study with minimal verbal repertoires. Specifically, Teige was unable to ask for reinforcers outside of engaging in problem behavior. Herb indicated his wants and needs by pulling someone toward the item. Both participants echoed a few specific sounds or words and neither participant was able to identify any items or actions. Figure 3 shows the results of the language assessment for Al. He requested reinforcers by pulling someone toward the item and pointing or standing near the item, repeated or closely approximated several words and sounds, and was able to identify 1 to 5 items or actions. Results of the language assessment for Bea are presented in Figure 4. The data suggest that Bea identified 1 to 5 items or actions, repeated or approximated several words and sounds, and requested reinforcers by pulling someone toward the item and pointing or standing near the item. Figure 5 shows the language assessment data for Javier who entered the study with a strong tact repertoire; he demonstrated the ability to identify between 16 and 50 items. He was also able to repeat or closely approximate several words and sounds, but was unable to request reinforcers outside of engaging in problem behavior. In general, the participants had acquired weak verbal repertoires prior to beginning the study, demonstrating varying degrees of echoic and tact repertoires and minimal mand repertoires.

The purpose and all procedures for this study were described to parents and teachers (see Appendix A) and parents provided written consent for their child to participate before beginning the study (see Appendix B). The purpose and all procedures were also described to building administrators from whom consent to conduct the study in the school setting was obtained (see Appendix C). Approval to conduct the study was obtained from the Institutional Review Board of The Ohio State University prior to beginning the study.

Dependent Measures and Data Analysis

The verbal operants examined included mands, tacts, and echoics. A mand was defined as, "…a verbal operant in which the response is reinforced by a characteristic consequence and is therefore under the functional control of relevant conditions of deprivation or aversive stimulation" (Skinner, 1957, p. 35–36). A tact was defined as, "…a verbal operant in which a response of given form is evoked (or at least strengthened) by a particular object or event or propriety of an object or event that is maintained by generalized conditioned reinforcement" (Skinner, 1957, p. 81–82). An echoic was defined as a vocal response under the control of a vocal stimulus that has "a point to point correspondence between the sound of the stimulus and the sound of the

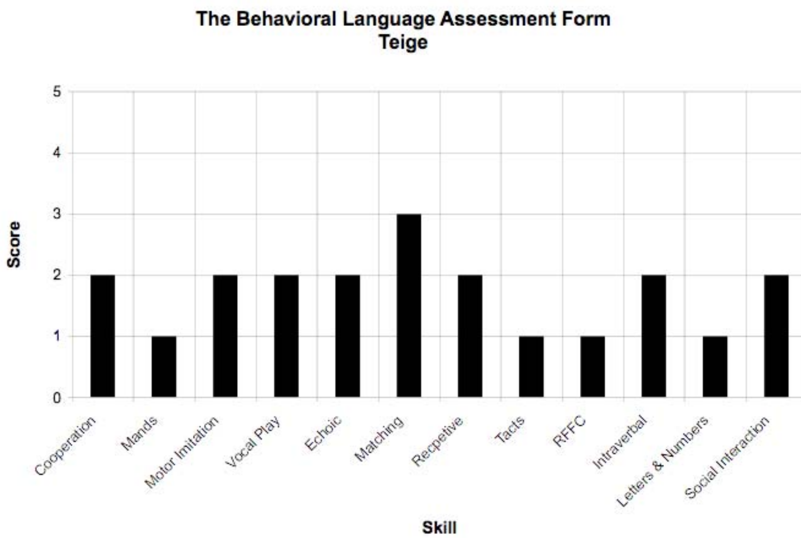

Figure 1. Language assessment results for Teige.

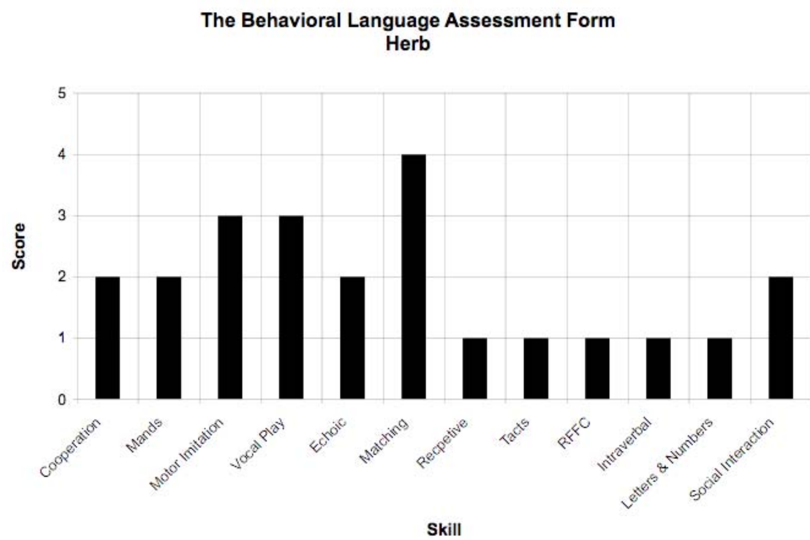

Figure 2. Language assessment results for Herb.

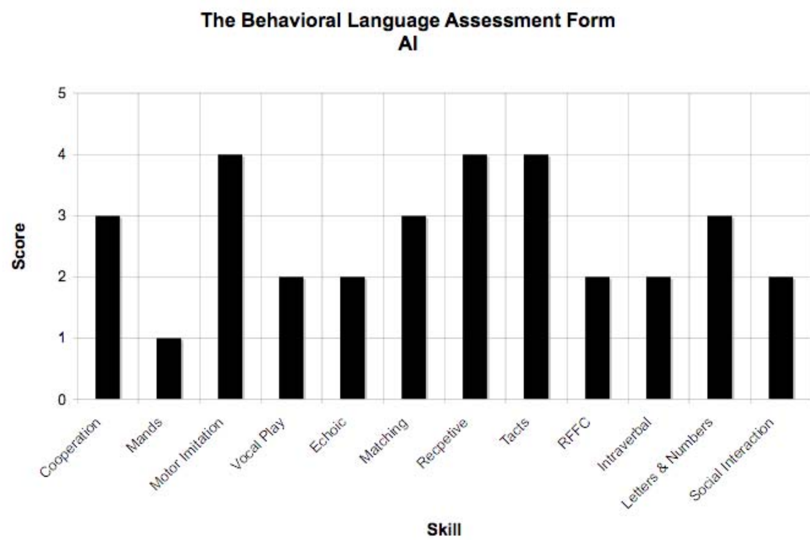

Figure 3. Language assessment results for Al.

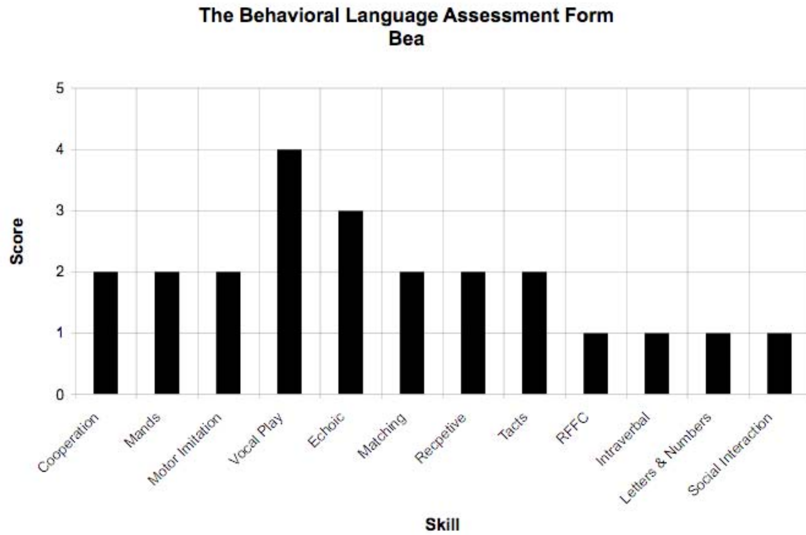

Figure 4. Language assessment results for Bea.

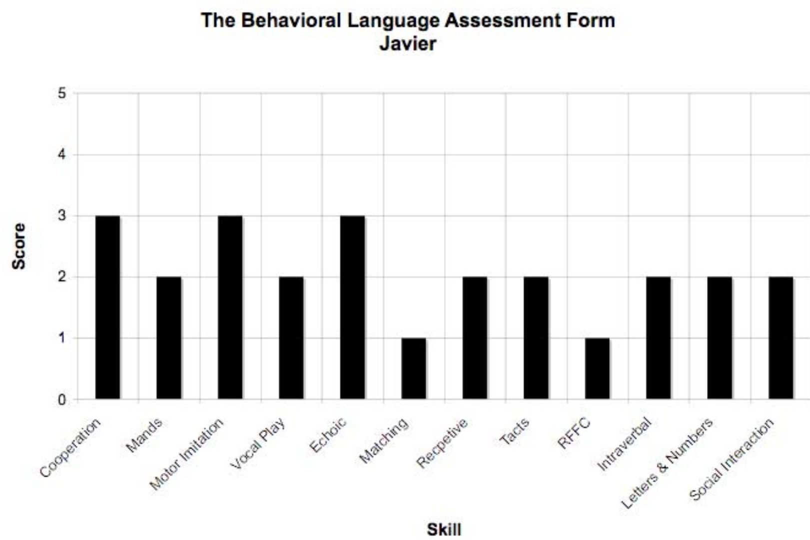

Figure 5. Language assessment results for Javier.

response” (Skinner, 1957, p. 55) that is maintained by generalized conditioned reinforcement.

During teaching and probe trials, data were collected on the number of correct and incorrect responses emitted (see Appendixes D, E, and F for sample data sheets). Correct responses were defined in terms of the definition for the targeted verbal operant during each condition. Partial or incorrect responses were scored for any responses that did not meet the definitional criterion with the exception of Herb whose correct responses consisted of approximations to the target vocal verbal stimulus (e.g., /guh-ee/ for gummies). Data were analyzed in terms of the number of consecutive correct responses emitted and the number of trials and probe sessions necessary to establish each verbal operant under pure or single sources of control.

Preference Assessment

Parents or classroom teachers and/or aides were given a structured interview (Reinforcer Assessment for Individuals with Severe Disabilities, Fisher, Piazza, Bowman, & Amari, 1996, see Appendix G) that was used to develop a list of preferred items and activities. A multiple stimulus without replacement (MSWO) preference assessment (DeLeon & Iwata, 1996) was conducted prior to initial teaching sessions. Each participant was presented with an array of five to seven stimuli and asked to choose one. The participant was permitted to interact with the chosen stimulus for 10 s. The remaining stimuli were presented and the participant was asked to choose. This procedure was repeated until only one stimulus remained (see Appendix H). The results of the preference assessment were calculated by dividing the number of trials an item was selected by the number of trials the item was presented and multiplying by 100. Highest ranked items were used as target response topographies. For example, if the participant chose bubbles first and juice second each time they were presented in the array; the participant was taught to imitate the words bubbles and juice, to ask for bubbles and juice, and to label bubbles and juice. First and second preferred items alternated between conditions. For example, if bubbles was ranked first and was used in the multiple control condition, then the item that was ranked first in the second preference assessment was used in the transfer of stimulus control condition.

Teaching Procedures

The differential effects of two teaching procedures were examined on the emergence of three pure verbal operants: mands, tacts, and echoics. One procedure, transfer of stimulus control, involved first teaching a response to occur under echoic control and then using the echoic response to establish a response under mand and tact control, respectively. The second procedure, multiple control, involved teaching a response under tact, mand, and echoic control simultaneously and then using fading to establish the response under pure mand, tact, and echoic control. Different response topographies were trained under each independent variable. Teaching sessions for all conditions consisted of no more than 10 trials focusing on the target verbal response. If multiple teaching sessions occurred in one day, there were at least 30 min between teaching sessions that targeted the same response topography if mand conditions were in effect. A probe, assessing each pure verbal operant, was conducted before fading sessions and after a response topography was taught using either approach. Probe sessions consisted of five trials for mands, tacts, and echoics.

Transfer of stimulus control. Transfer of stimulus control consisted of three phases: imitation training, simultaneous presentation, and fading (see Figure 6) for each verbal operant targeted. During imitation training, the participant was taught first to emit an echoic response. The experimenter presented a vocal verbal stimulus. When the participant emitted the target response (i.e., echoic) within 3 s of the vocal verbal stimulus, the experimenter delivered generalized conditioned reinforcement in the form of social praise (e.g., "That's right, you said water") immediately following the response. Participants also received tangible reinforcement not specific to the response form after approximately three responses. An incorrect, partial, or no response within 3 s of the vocal verbal stimulus resulted in termination of the teaching trial and a new teaching trial began. Imitation training for echoic responses continued until the participant emitted five consecutive correct responses in a teaching session. Once the participant reached criterion for imitation training, simultaneous presentation for the remaining verbal operants began. Participants completed simultaneous presentation and fading for one verbal operant (e.g., mand) before simultaneous presentation and fading for the next verbal operant (e.g., tact) began.

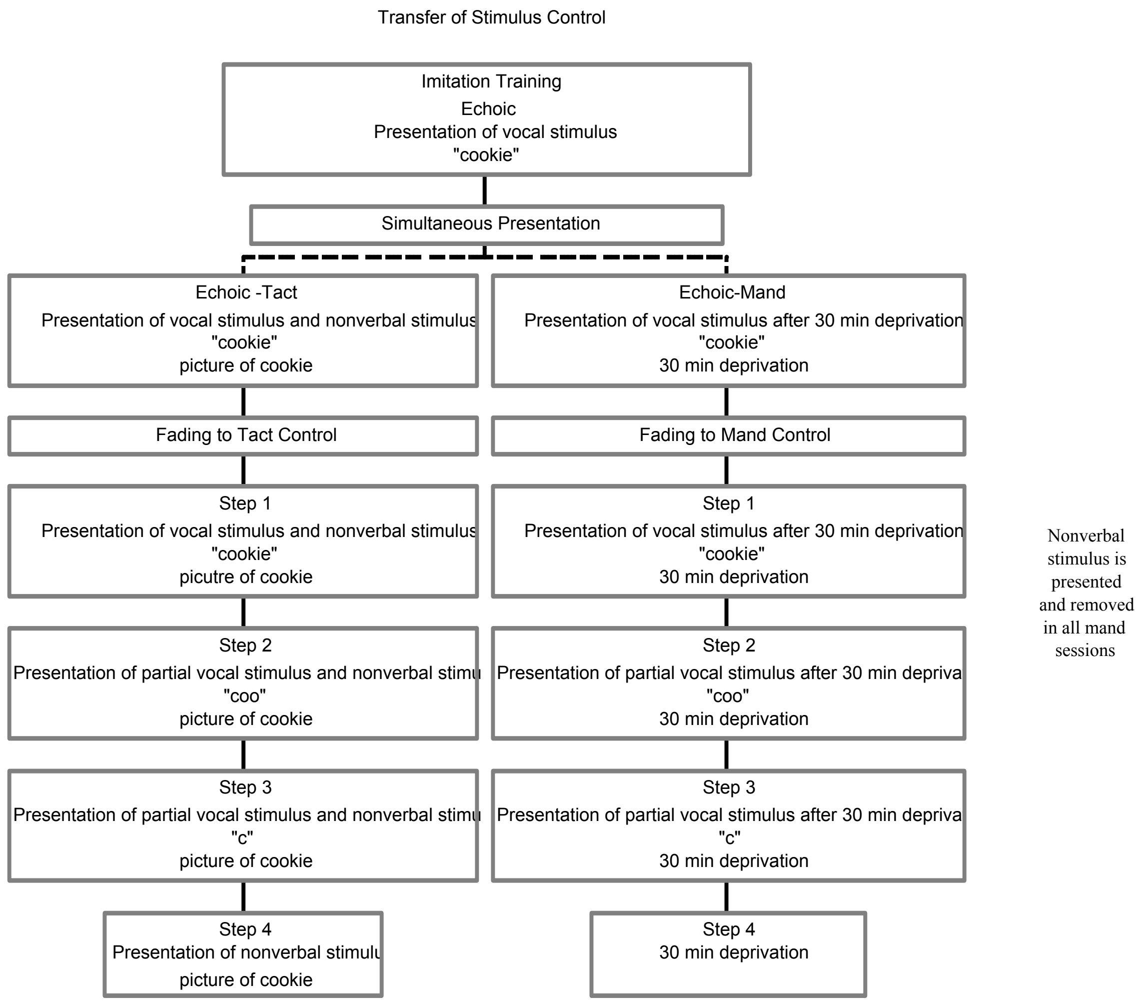

Figure 6. Diagram of transfer of stimulus control.

During simultaneous presentation, the experimenter simultaneously presented two antecedent stimuli to establish a compound stimulus. To transfer to mand control, simultaneous presentation consisted of the presentation of an establishing operation (contrived by ensuring 30 min of deprivation from the target stimulus), a vocal verbal stimulus (teacher says, "water"), and a brief presentation and quick removal of the nonverbal stimulus (to signal availability). When the participant emitted the target response (i.e., mand-echoic) within 3 s of the antecedent presentation, the experimenter immediately delivered reinforcement specific to the response form (e.g., a drink of water when the participant says "water") and delivered generalized conditioned reinforcement in the form of social praise. An incorrect, partial, or no response within 3 s resulted in termination of the teaching trial and a new teaching trial began immediately (i.e., no programmed consequence occurred and the experimenter moved to the next trial). Simultaneous presentation continued until the participant emitted the target response correctly across five consecutive trials within a teaching session.

To transfer to tact control, a nonverbal stimulus and a vocal verbal stimulus were simultaneously presented. For example, the experimenter showed the participant a picture of the target item or the target item in conjunction with the spoken name of the target item. When the participant emitted the target response (i.e., tact-echoic) within 3 s of the antecedent stimulus presentation, the experimenter immediately delivered generalized conditioned reinforcement in the form of social praise (e.g., that's right, it is water). An incorrect, partial, or no response within 3 s of the antecedent stimulus presentation resulted in termination of the teaching trial and a new teaching trial began. Simultaneous presentation continued until the participant emitted the target response correctly across five consecutive trials within a teaching session. The order of mand or tact plus echoic simultaneous presentation alternated across conditions and across participants. Once the participant reached criterion during simultaneous presentation, fading sessions began.

The original controlling stimulus was gradually attenuated to transfer stimulus control to the establishing operation or the nonverbal stimulus. The echoic stimulus was faded from full word to partial word to initial sound to no presentation. Five consecutive correct responses within a teaching session prompted the next level of fading. Fewer than two correct responses within a teaching session prompted a return to the previous fading level. Fading continued until the participant emitted the target response correctly under the control of the establishing operation or the nonverbal stimulus in five consecutive teaching trials. See Appendix I for a detailed description of the experimenter and participant behaviors in each step of the transfer of stimulus control conditions.

Multiple control. Multiple control consisted of two phases: simultaneous presentation and fading (see Figure 7). During simultaneous presentation, the participant was taught to emit the target response under mand, tact, and echoic control. Essentially, the experimenter contrived an establishing operation (as described previously) and simultaneously presented the nonverbal and vocal verbal stimulus. For example, if the target response was "cookie," the participant did not have access to cookies for 30 min prior to the teaching session, and the experimenter said "cookie" in the presence of a picture of or a cookie. Correct responses emitted within 3 s of the antecedent stimulus presentation resulted in immediate reinforcement specific to the response form (mand)

and generalized conditioned reinforcement in the form of social praise (tact, echoic). A partial, incorrect, or no response resulted in termination of the teaching trial and a new teaching trial began. Simultaneous presentation of multiple control continued until the participant emitted five consecutive correct responses during one teaching session. Participants completed fading for one verbal operant (e.g., mand, echoic) before fading for the next verbal operant (e.g., tact, mand) began. Prior to fading for the second operant, a return to multiple control training was conducted to ensure maintenance of mand, tact, and echoic compound control.

Fading was achieved through the gradual attenuation of the unnecessary stimuli (e.g., to establish pure tact control, mand and echoic controlling stimuli were faded). Additional stimuli were faded concurrently. Five consecutive correct responses during one teaching session prompted the next level of fading. Fewer than two consecutive correct responses in a teaching session prompted a return to the previous fading level. Fading for each operant continued until the target response was correctly emitted under the control for the target verbal operant across five consecutive teaching trials.

Fading echoic stimuli followed the same procedures outlined previously. Time of deprivation prior to teaching sessions decreased in 10 min intervals until no state of deprivation occurred. During fading, the nonverbal stimulus was cut by thirds until it was simply presented and removed quickly (to signal availability). Correct echoic and tact

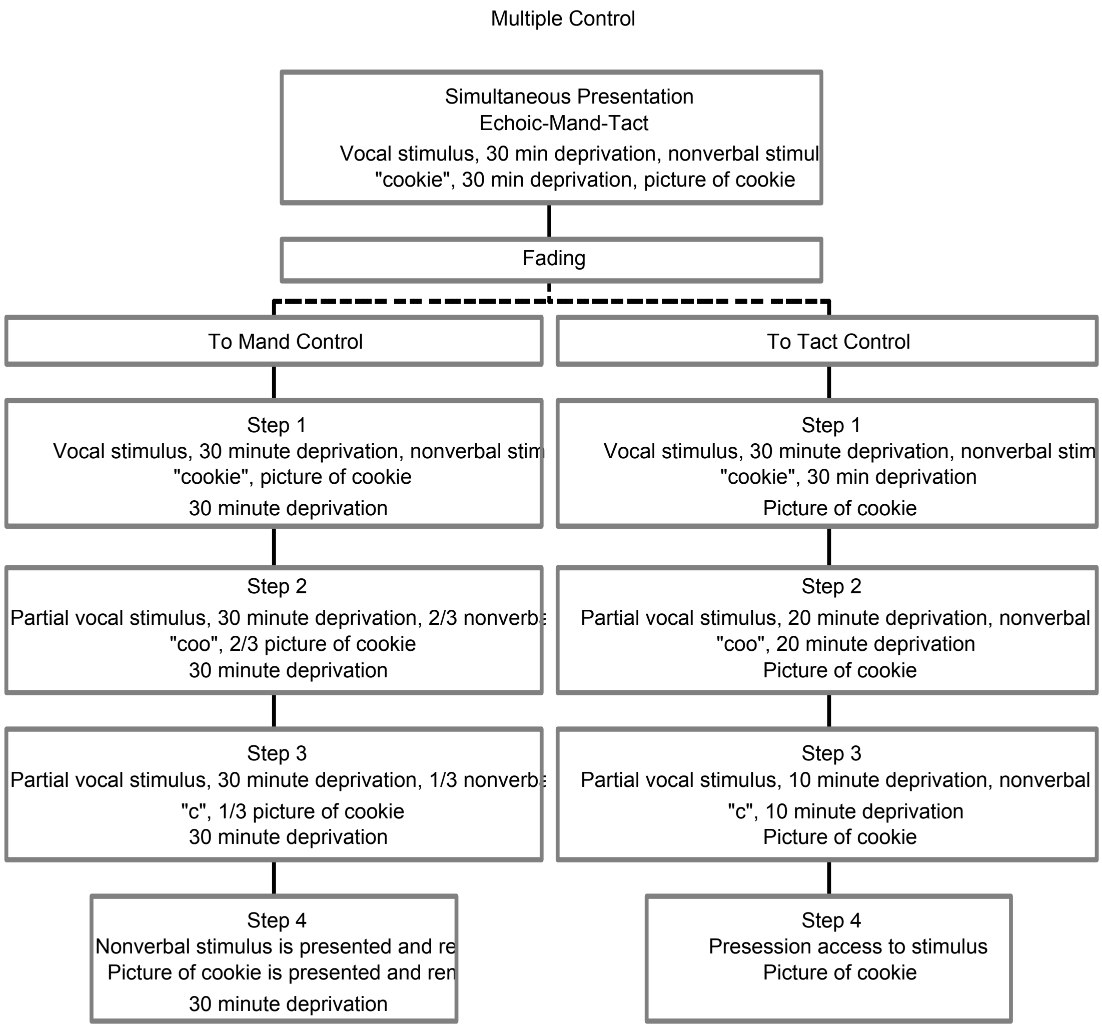

Figure 7. Diagram of multiple control condition.

responses emitted within 3 s of the antecedent stimulus presentation received immediate generalized conditioned reinforcement in the form of social praise and non-specific tangible items on or about every three responses. Correct mand responses emitted within 3 s of the antecedent stimulus presentation received the stimulus specific to the response form. A partial, incorrect, or no response within 3 s of the antecedent stimulus presentation resulted in termination of the teaching trial and a new teaching trial began. See Appendix J for a detailed description of the experimenter and participant behaviors in each step of the multiple control conditions.

Probes

Probes assessing each verbal operant were conducted before response topographies were taught using transfer of stimulus control or multiple control, prior to fading in each experimental condition, and after training of the response topography using either procedure. Probes conducted before teaching continued until data indicated an even or decreasing trend. Each probe consisted of five opportunities to respond to the controlling stimulus for each pure verbal operant (see Appendix I).

To assess echoic responding, the experimenter presented a vocal verbal stimulus to the participant. To assess tact responding, the experimenter presented a nonverbal stimulus to the participant. To assess mand responding, the experimenter contrived an establishing operation for the target stimulus (30 min deprivation) and quickly presented and removed the nonverbal stimulus (to signal availability). Reinforcement that corresponded to the defining characteristics of the verbal operant probed was delivered immediately following the correct response if it was emitted within 3 s of the antecedent stimulus presentation (i.e., for mands, the stimulus was delivered, for tacts and echoics, generalized conditioned reinforcers were delivered). A partial, incorrect, or no response within 3 s of the antecedent stimulus presentation resulted in termination of the probe trial and when appropriate the next probe session began. See Appendix K for a detailed description of the experimenter and participant behaviors in probe sessions.

Experimental Design

An alternating treatments design was used to evaluate the effects of the two teaching procedures on developing pure mand, tact, and echoic responses. Each participant received both interventions targeting different response topographies for a total of 2 to 8 responses (1 to 4 in each experimental condition). The order of the interventions was counterbalanced across participants. Additional support was obtained by conducting replications across participants.

Interobserver Agreement

Graduate students were trained to score the dependent variables with at least 90% accuracy. Interobserver agreement (IOA) was scored for at least 20% of all sessions. IOA was calculated by dividing the total number of agreements by the total number of agreements plus disagreements and multiplying by 100. Observers used the same data sheets that were used for recording teaching and probe data. IOA for probe conditions was 98%. IOA was 99% for both transfer of stimulus control conditions and multiple control conditions.

Treatment Integrity

Treatment integrity was scored by a number of graduate students trained to at least 90% criterion on sample experimental conditions. Data were collected on how the experimenter arranged the appropriate controlling variables such as presenting or withholding particular stimuli before, during, and after each training trial (see Appendixes L to JJ for sample treatment integrity checklists). Treatment integrity was scored for at least 20% of all probe and experimental sessions. Treatment integrity data were calculated by dividing the number of steps performed accurately by the total steps and multiplying by 100. The average treatment integrity for probe conditions was 99% (range, 90% to 100%). Treatment integrity for transfer of stimulus control and multiple control conditions averaged 99% (range, 96% to 100%) and 99% (range, 96% to 100%), respectively.

CHAPTER 4

RESULTS

Preference Assessments

Preference assessments were conducted prior to introducing new response topographies into each condition. For example, in the first preference assessment, Teige selected gummy candy (100%) and movie (39%) most frequently. In the second preference assessment, the most preferred items were goldfish (56%) and potato chips (50%). Preferences and rankings by participant for each preference assessment are represented in Table 3.

Participant	MSWO Number	First Ranked	Second Ranked
Teige	1	Gummies (100%)	Movie (39%)
	2	Goldfish (36%)	Potato Chips (50%)
Herb	1	Chair (63%)	Gummies (42%)
	2	Marshmallows (83%)	Veggie Sticks (50%)
	3	Pez candy (100%)	Bumble Ball (42%)
Al	1	Top (71%)	Beads (50%)
Bea	1	M&Ms (100%)	Goldfish (50%)
	2	Slime (50%)	Toy bug (31%) Noisestick (30%)
	3	Pudding (100%)	Letters (36%)
	4	Bumble Ball (83%)	Dora puzzle (31%)
	5	Dora Mirror (50%)	Marshmallows (50%)
Javier	1	M&Ms (56%)	Movie (42%)
	2	Nerds candy (63%)	Koosh ball (38%)

Table 3. Results for each participant's preference assessments.

Probe Data Results

Results of the preference assessments were used to determine response topographies targeted in each condition. Reponses were counterbalanced across response topographies for each participant and across conditions for each participant based on preference. The order of the counterbalancing is depicted in Table 4.

Participant	Item	Preference	Condition	Operant
Teige	Gummies	1st	Transfer	Mand
	Movie	2nd	Multiple Control	Mand
	Goldfish	1st	Multiple Control	Tact*
	Potato Chip	2nd	Transfer	Tact*
Herb	Chair	1st	Transfer	Tact
	Gummies	2nd	Multiple Control	Tact
	Marshmallows	1st	Multiple Control	Mand
	Veggie Sticks	2nd	Transfer	Mand
	Pez Candy	1st	Transfer	Tact*
	Bumble Ball	2nd	Multiple Control	Tact
Al	Top	1st	Transfer	Mand
	Beads	2nd	Multiple Control	Mand
Bea	M&Ms	1st	Multiple Control	Mand
	Goldfish	2nd	Transfer	Mand
	Slime	1st	Transfer	Tact
	Noisestick	2nd	Multiple Control	Mand*
	Pudding	1st	Multiple Control	Tact
	Letters	2nd	Transfer	Mand*
	Bumble Ball	1st	Transfer	Mand
	Dora Puzzle	2nd	Multiple Control	Mand*
	Dora Mirror	1st	Multiple Control	Tact*
	Marshmallows	2nd	Transfer	Tact*
Javier	M&Ms	1st	Multiple Control	Tact
	Movie	2nd	Transfer	Tact
	Nerds	1st	Transfer	Mand
	Koosh	2nd	Multiple Control	Mand

Table 4. Stimulus topography, stimulus preference, corresponding conditions, and first operant targeted. Asterisks represent operants faded out of sequence due to acquisition during baseline probes.

Teige. Figure 8 depicts Teige's data for baseline, pre-fading, and post-fading sessions for responses taught via transfer of stimulus control. Baseline data for the first response (R1) targeted with transfer of stimulus control was variable with few echoic responses occurring and no mand or tact responses. Prior to fading the vocal-verbal stimulus to attain responding under mand control, there was a slight increase in echoic responses. After fading the vocal-verbal stimulus, there was an increase in echoic, tact, and mand responding with mands emitted on all possible opportunities. Following fading to control by the nonverbal stimulus (i.e., tact control), Teige emitted mands, tacts, and echoics under the relevant stimulus conditions for all possible opportunities.

Figure 9 shows Teige's responding during multiple control probes. R1 occurred at a steady rate under echoic controls but did not occur under mand and tact controlling variables during baseline. Prior to fading to control by the establishing operation, Teige demonstrated a slight increase in tact responding and echoic and mand responses remained stable. After transferring control to the establishing operation, Teige demonstrated an increase in all targeted operants with mand responses occurring on all possible opportunities. After responding was brought under tact control, Teige emitted all operants on all possible opportunities.

Teige's responding during probe sessions indicates that he acquired mands, tacts, and echoics through both transfer of stimulus control and multiple control procedures. Echoics emerged after fading to mand and tact control, but without explicit fading to echoic control. Furthermore, when R2 was introduced in multiple control, Teige acquired the target operants during baseline conditions.

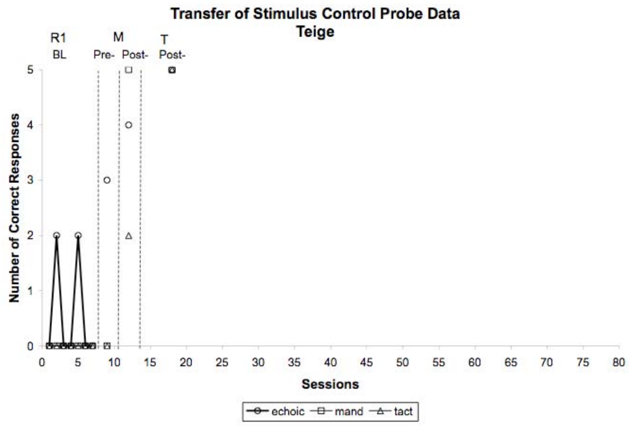

Figure 8. Echoic, mand, and tact responding during transfer of stimulus control probes for Teige.

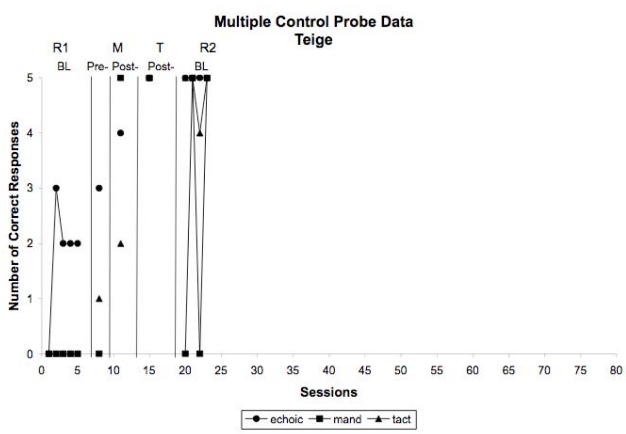

Figure 9. Echoic, mand, and tact responding during multiple control probes for Teige.

Herb. The results for Herb's baseline, pre-fading, and post-fading probe conditions are represented in Figures 10 and 11. It is important to note that the initial sound of the target word was an acceptable response for Herb. For example, when targeting chair, /ch/ constituted a correct response. Figure 10 illustrates probe responding during transfer of stimulus control conditions. Baseline data for R1 indicate that Surer did not emit any mands, tacts, or echoics. Prior to fading the vocal-verbal stimulus to establish control by a nonverbal stimulus, echoic responding occurred on all possible opportunities and mands and tacts remained at zero rates. Following fading to control by the nonverbal stimulus, there was a slight drop in echoic responding, a slight increase in mand responding, and tacts were emitted on all possible opportunities. After superimposing the vocal-verbal stimulus with a state of deprivation, there was a slight drop in responding under all sources of control. After fading to complete control by the establishing operation, Herb emitted all operants at all possible opportunities. The second response (R2) taught under transfer of stimulus control conditions occurred once under echoic control and did not occur under tact or mand control in baseline. Prior to fading to mand control, there was an increase in echoic responding; however, mand and tact responses were not emitted.

Figure 11 illustrates probe responding during multiple control conditions. Baseline data for responses one and two indicate that Herb did not emit any mands, tacts, or echoics. For R1, there was a slight increase in echoic responding while mands and tacts were not emitted prior to fading additional sources of control. After fading to tact control, Herb emitted mands and tacts on four out of five opportunities and echoics on all possible opportunities. Pre-fading data for R2 indicate echoics occurring on all opportunities and no responding under mand and tact control. After fading to mand control, echoic responding remained high, mands occurred on all opportunities, and there was a slight increase in tact responding. Following a return to simultaneous presentation, Herb emitted all operants on all opportunities during probes. The third response (R3) targeted in multiple control conditions occurred at variable and then decreasing rates under echoic control and again, no mands or tacts were emitted. Prior to fading to tact control, there was an increase in echoic responding, a slight increase in responding under tact control, and mands were not emitted.

Herb's responding during probe conditions suggests that he acquired mands, tacts, and echoics for two response topographies through multiple control teaching procedures and had begun to acquire a third response topography. During transfer of stimulus control, Herb only acquired one response topography as a mand, tact, and echoic and had just begun to acquire a second response topography. Acquisition of the target operants for R1 required all fading levels for both transfer to mand and tact control. Echoic responses emerged via multiple control without systematically fading the supplementary sources of control. In addition, mands emerged following fading to tact control for R1 and tacts emerged following fading to mand control and the second simultaneous presentation session for R2 in multiple control.

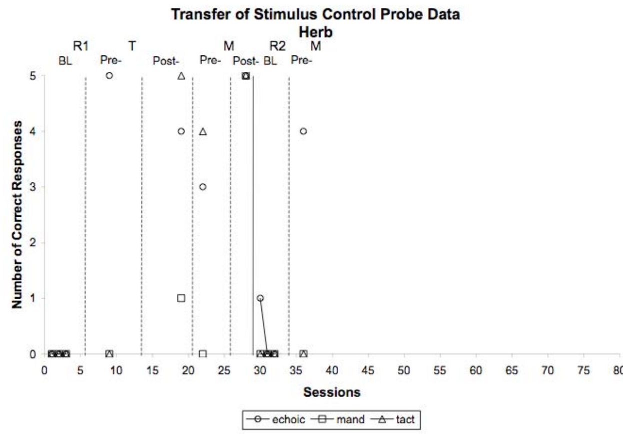

Figure 10. Echoic, mand, and tact responding during transfer of stimulus control probes for Herb.

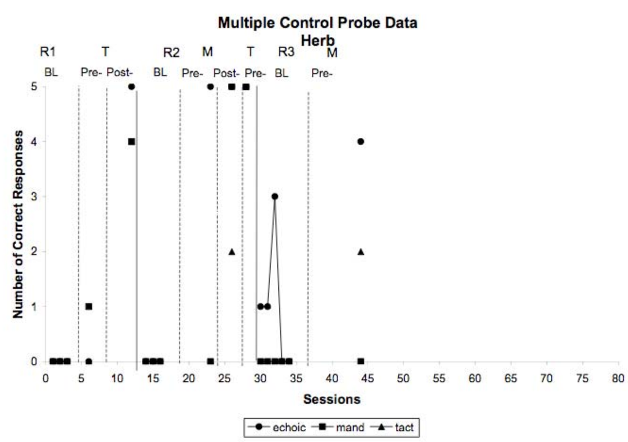

Figure 11. Echoic, mand, and tact responding during multiple control probes for Herb.

Al. Baseline, pre-fading, and post-fading probe data for Al are displayed in Figures 12 and 13. Figure 12 shows probe responding during transfer of stimulus control teaching conditions. Baseline data for R1 indicate a decrease in responding under echoic control and no responding under mand and tact control. Prior to fading to tact control, echoics occurred on all possible opportunities and mand and tacts were not emitted. Following fading to mand control, there was a slight decrease in echoic responding and mand and tact responses remained steady at zero. Prior to fading to tact control, echoics increased, there was a slight increase in mand responding, and tacts did not occur. Following the completion of fading to tact control, probe data indicate that Al emitted all operants on all possible opportunities. Figure 13 shows probe responding during multiple control teaching conditions. Baseline data for R1 indicate the absence of mand and tacts but an increasing trend in echoic responding until the response was emitted under all opportunities to emit an echoic. Before and after fading to mand control, Al performed similarly to baseline for all operants. Al's probe data suggest that he acquired a mand, tact, and echoic response for R1 through transfer of stimulus control but did not acquire the target operants for R1 in multiple control.

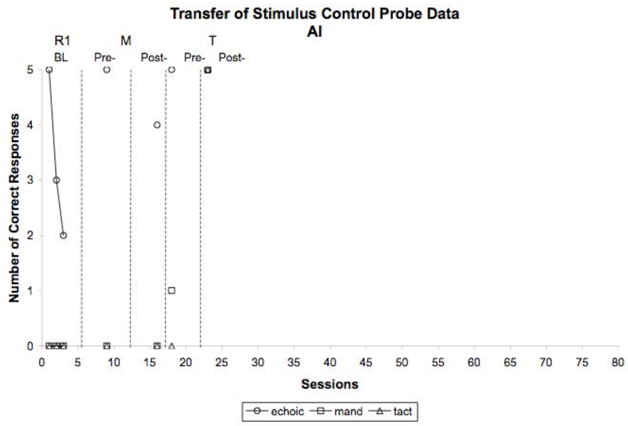

Figure 12. Echoic, mand, and tact responding during transfer of stimulus control probes for Al.

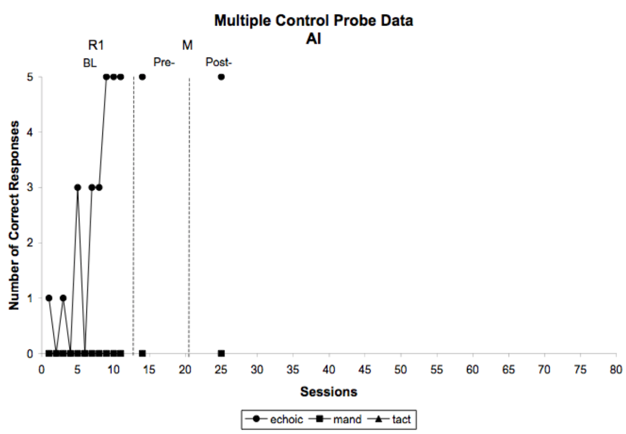

Figure 13. Echoic, mand, and tact responding during multiple control probes for Al.

Bea. Figures 14 and 15 indicate the baseline, pre-fading, and post-fading probe data for Bea for each experimental condition. Figure 14 represents probe data for stimuli taught using transfer of stimulus control. Baseline data for R1 was initially variable but eventually decreased prior to intervention. After fading to mand control, Bea emitted all operants on all opportunities. Baseline data for R2 indicated moderate but steady echoic responding and no mands and tacts were emitted. Prior to fading to tact control, echoic responding increased and mands and tacts remained stable. After fading to tact control, Bea emitted all possible echoics and tacts but did not emit any mands. Responding for all operants remained steady prior to fading to mand control. After fading, Bea emitted all operants on all possible opportunities. During baseline for R3, Bea acquired the response as a mand, tact, and echoic. Baseline for R4 showed echoics occurring on all possible opportunities, no responding under tact control, and a decrease in mand responses after a slight increase. Prior to fading to mand control, Bea did not emit any mands or tacts, but emitted echoics on all possible opportunities. After fading to mand control, Bea emitted all operants on all possible opportunities. Baseline data for R5 indicate that Bea emitted echoics on all possible opportunities, but did not emit mands or tacts. After simultaneous presentation of echoic and tact stimuli, Bea emitted all operants on all possible opportunities.

Figure 15 shows probe data for response topographies taught via multiple control. Bea emitted echoics at a low steady rate but did not emit any mands or tacts during baseline for R1. Prior to fading to mand control, Bea showed a slight increase in echoic responding with mand and tacts remaining at zero rates. After fading to mand control, Bea emitted mands on all possible opportunities while tact and echoic responding remained stable. Bea emitted all operants on all opportunities after fading to tact control. Bea acquired mands, tacts, and echoics for R2 during baseline. Baseline data for R3 indicate a decreasing trend in responding under echoic control and no tact or mand responses. Following simultaneous presentation of mand, tact, and echoic stimuli, Bea emitted both echoics and tacts on four out of five opportunities. Following fading to mand control, mands were emitted on four out of five opportunities and echoics and tacts were emitted on all opportunities. Baseline data for R4 indicate that echoics occurred on all opportunities and mands and tacts were not emitted. Prior to fading, Bea emitted echoics and tacts on all opportunities but did not emit any mands. Following fading to mand control, Bea emitted mands, tacts, and echoics for R4. Baseline data for R5 indicate variable then increasing responding under echoic and tact control. Responding under mand control decreased. Following simultaneous presentation of mand, tact, and echoic controlling stimuli, Bea demonstrated all operants on all opportunities for R5. Baseline probe data for R6 indicate echoics occurred on all possible opportunities and mand and tact responses decreased prior to intervention. Following simultaneous presentation, Bea emitted all operants on all possible opportunities.

Bea's performance during probe sessions indicate that she acquired target operants for five response topographies taught via transfer of stimulus control and six response topographies taught via multiple control. Several operants across response topographies emerged without explicit fading. In transfer of stimulus control, tacts emerged without training for the R1 and R5 following fading to mand control and the initial simultaneous presentation session, respectively. Mands emerged following the fade to tact control for R4. In multiple control, mands emerged following the fade to tact control for R4 and the initial simultaneous presentation session for R5 and R6. Tacts emerged without explicit fading to tact control for the R3 and again after the initial simultaneous presentation session for R5 and R6. Echoics emerged without fading to echoic control for R1 and R2 and were then emitted consistently throughout baseline for subsequent response topographies.

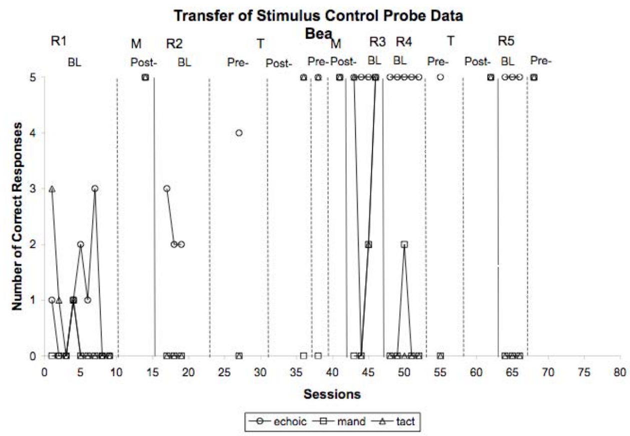

Figure 14. Echoic, mand, and tact responding during transfer of stimulus control probes for Bea.

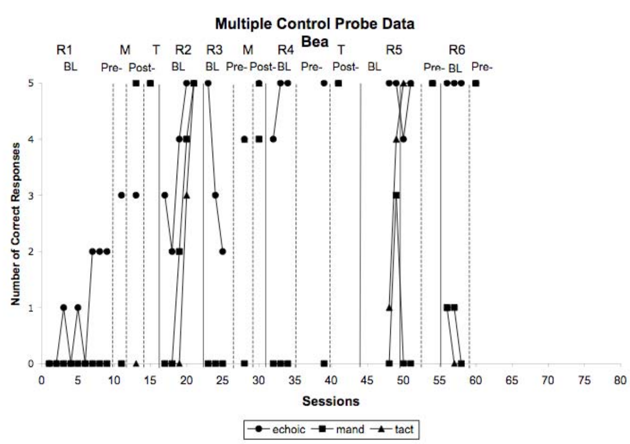

Figure 15. Echoic, mand, and tact responding during multiple control probes for Bea.

Javier. Baseline, pre-fading, and post-fading probe results for Javier are in Figures 16 and 17. Figure 16 represents probe responding during transfer of stimulus control teaching conditions. In baseline probes for R1, Javier emitted echoics on a decreasing trend and did not emit mands or tacts. After fading to tact control, Javier emitted all operants on all possible opportunities. Javier did not emit any mands, tacts, or echoics during baseline probes for R2. Following fading to mand control, all operants were emitted on all possible opportunities. Figure 17 represents probe responding during multiple control teaching conditions. Baseline data for R1 indicate mands, tacts, and echoics were emitted at low, variable rates before decreasing to zero rates. Prior to fading to tact control, Javier showed a slight increase in echoic responses while mands and tacts were not emitted. After fading was completed, all operants were emitted on all opportunities. Baseline responding for R2 showed a low steady rate of echoic responding and mands and tacts were not emitted. Responding remained stable prior to fading to mand control.

Javier acquired target operants for two response topographies via transfer of stimulus control, for one response topography via multiple control and had recently begun instruction on a second response topography. Responding during transfer of stimulus control probes suggest that mands emerged following transfer to tact control for R1 and tacts emerged following transfer to mand control for R2. During multiple control probes, Javier acquired mands and echoics following the fade to tact control for R1 but did not demonstrate an increase in operants following the fade to mand control for R2.

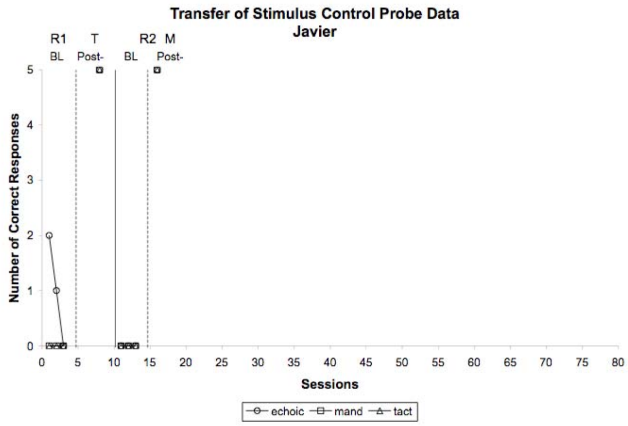

Figure 16. Echoic, mand, and tact responding during transfer of stimulus control probes for Javier.

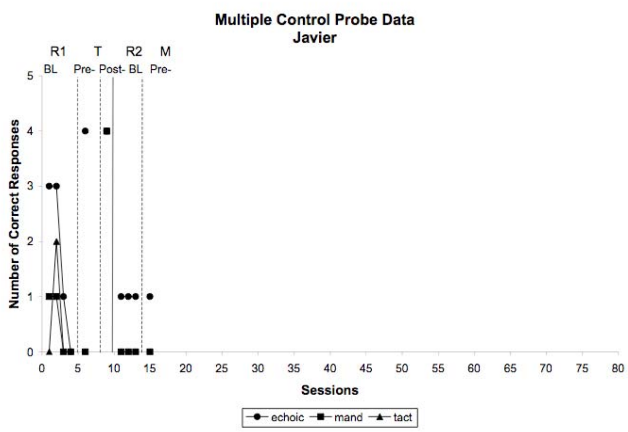

Figure 17. Echoic, mand, and tact responding during multiple control probes for Javier.

Teaching Data Results

Teige. Figures 18 and 19 show Teige's responding during teaching. Figure 18 shows responding during transfer of stimulus control teaching sessions. In transfer of stimulus control to mand conditions for R1, Teige required a return to fading level 3 twice before acquiring the response under echoic, mand, and tact control. Figure 19 indicates teaching data under multiple control conditions. During multiple control teaching sessions for R1, Teige progressed through all fading levels, returning to fading level 2 once before acquiring all operants. The number of teaching trials to criterion is shown in Figures 20 and 21. Both figures show that fewer teaching trials were required to teach mands, tacts, and echoics under multiple control (117) than under transfer of stimulus control (139). Figure 21 also shows the number of trials to criterion for each operant. Data indicate that during transfer of stimulus control, Teige acquired responding under echoic control in five trials, under mand control in 93 trials, and under tact control in 117 trials. Teige acquired the mand for R1 in 61 trials, the tact in 117 trials, and the echoic emerged without teaching.

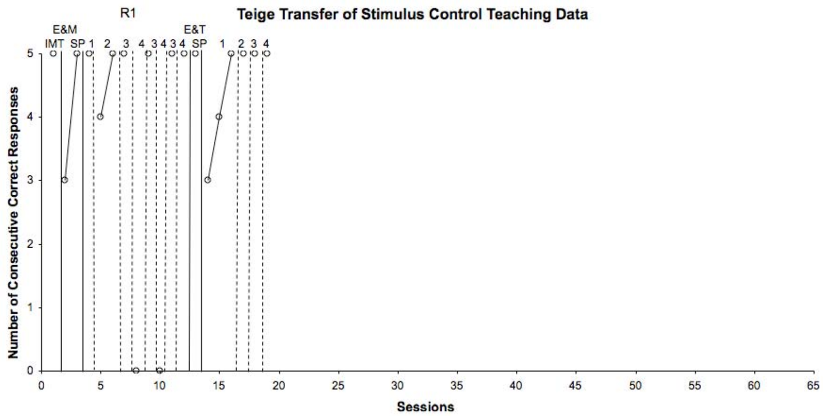

Figure 18. Transfer of stimulus control teaching data for Teige.

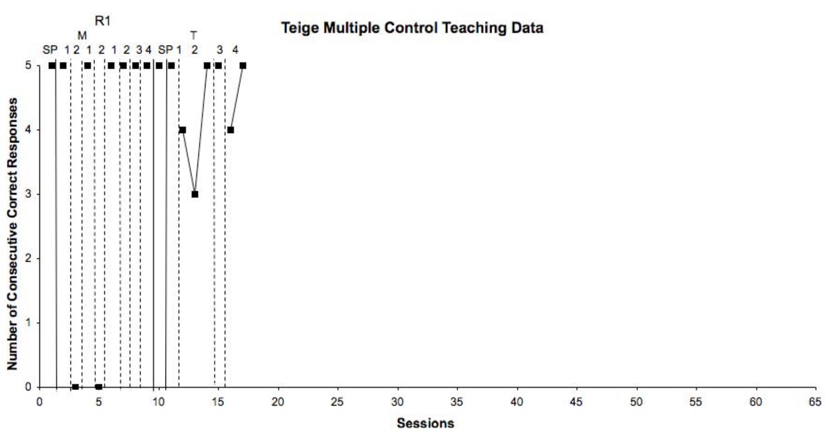

Figure 19. Multiple control teaching data for Teige.

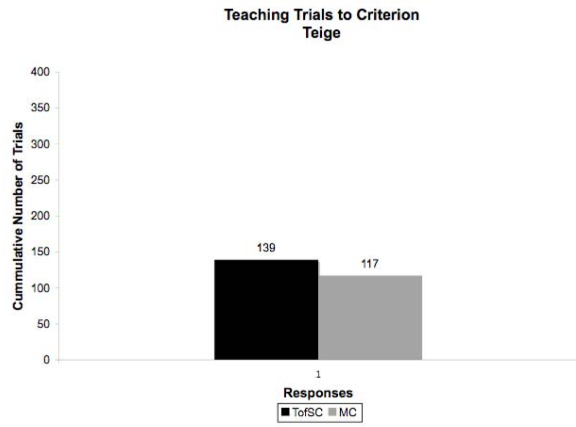

Figure 20. Number of teaching trails to criterion by condition for Teige.

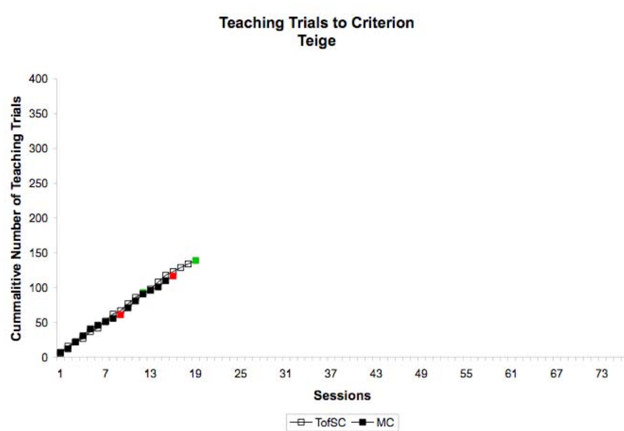

Figure 21. Number of teaching trials to criterion for each operant by condition for Teige. Colored squares represent when each operant was acquired.

Herb. Figures 22 and 23 show the results for teaching sessions. Figure 22 represents the results of transfer of stimulus control teaching sessions. Herb acquired the first response topography with one return to both fading levels 1 and 3 during fading to tact control and one return to fading level 3 on the transfer to mand control. R2 did not progress through all teaching levels but required a return to fading level 3 twice during fading to mand control. Figure 23 indicates the results of multiple control teaching sessions. R1 necessitated a return to fading level 1 during fading to tact control. R2 was acquired without any returns to previous fading levels. Herb did not progress through all teaching sessions for R3, but required a return to fading level 3 three times during fading to tact control.

Figures 24 and 25 show the number of teaching trials to criterion for response topographies targeted in transfer of stimulus control and multiple control conditions. These data indicate that fewer trials were required to teach two response topographies under mand, tact, and echoic control using multiple control procedures than transfer of stimulus control procedures. Initial response topographies were acquired in 194 teaching trials with multiple control and 348 teaching trials with transfer of stimulus control. The second response topographies replicated this pattern as R2 was acquired using multiple control in 105 trials and R2 was not acquired using transfer of stimulus control after 126 trials. The data also indicate a decrease in the number of teaching trials necessary to acquire the second response topographies in each condition.

Figure 25 also shows the number of teaching trials to acquire each target verbal operant. During transfer of stimulus control, Herb acquired the echoic in 106 trials for R1 and in 15 trials for R2. He acquired the tact and mand for R1 in 273 and 348 trials, respectively. Transfer for mand and tact responses was not completed for R2, but transfer to mand control had taken 126 trials at termination of the study. R1 mands, tacts, and echoics were acquired in 194 trials during multiple control. Programmed fading was not required for mand and echoic responses to emerge. For R2, 105 trials were necessary for Herb to learn the mand, tact, and echoic operants. Fading was not required for mand and echoics to be learned. Fading for R3 was not completed, but 154 trials had been conducted prior to termination of the study.

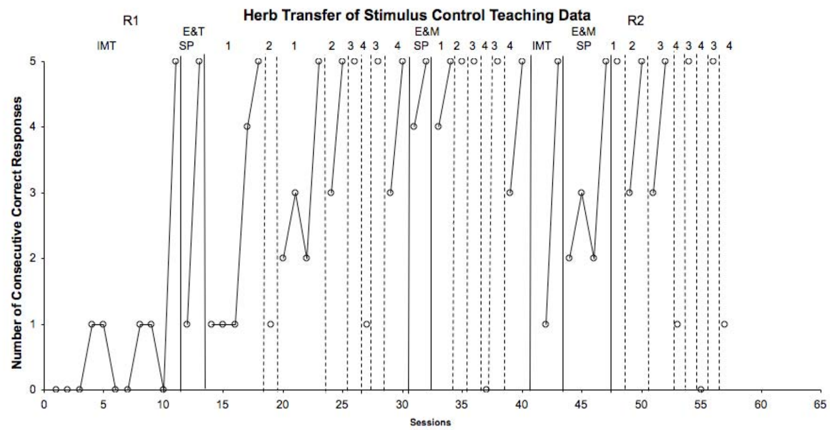

Figure 22. Transfer of stimulus control teaching data for Herb.

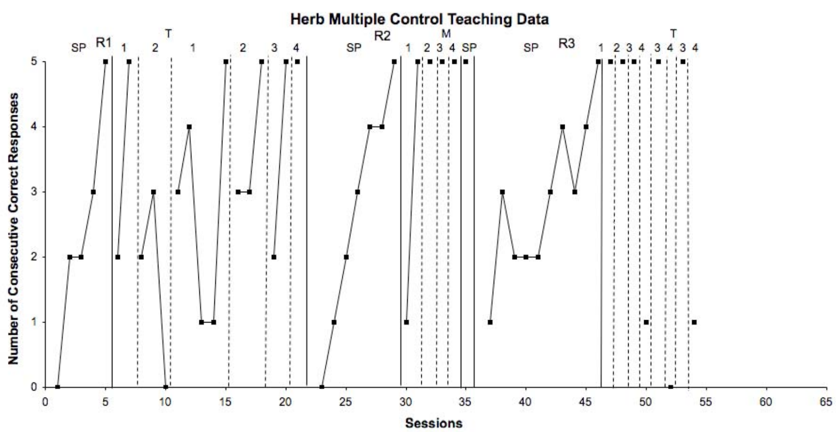

Figure 23. Multiple control teaching data for Herb.

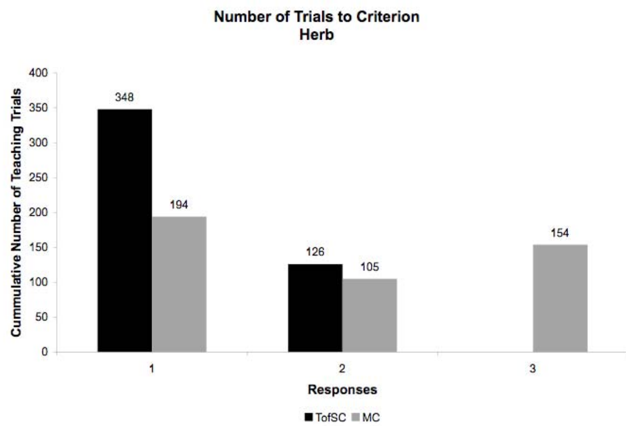

Figure 24. Number of teaching trials to criterion for Herb.

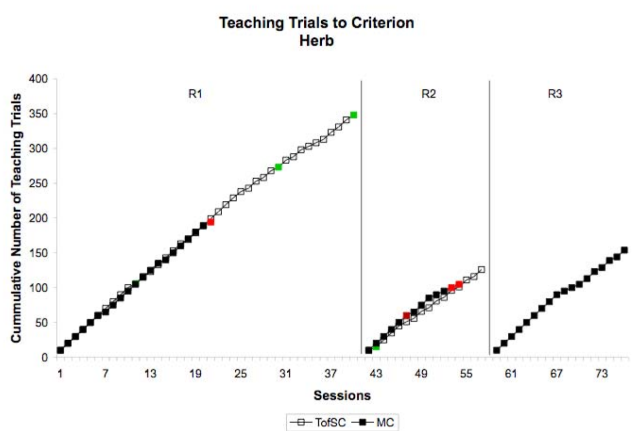

Figure 25. Number of teaching trials to criterion for each operant by condition for Herb. Colored squares represent when each operant was acquired.

Al. Teaching session data for Al are pictured in Figures 26 and 27. Figure 26 shows data for transfer of stimulus control teaching sessions. The data indicate that Al returned to fading level 3 three times during transfer of stimulus control to mand control. No returns were required when control was transferred to tact control. Figure 27 shows data for multiple control teaching sessions. During multiple control teaching sessions, control was faded to mand control. A total of six returns to previous fading levels were required, twice to fading level 2, once back to fading level one which precipitated one return to fading level 2 and three returns to fading level three. Figures 28 and 29 indicate the cumulative number of teaching trials required to learn mand, tact, and echoic responses during each experimental condition. The data indicate that Al required fewer trials to acquire target operants with transfer of stimulus control (250) than with multiple control (303, and still not acquired). Figure 29 also indicates the number of teaching trials required to acquire each operant. Al learned to emit the echoic response in 7 teaching trials, the mand response in 216 trials, and the tact in 250 trials using transfer of stimulus control. Multiple control teaching sessions were not completed, but 303 trials were required to teach the mand response.

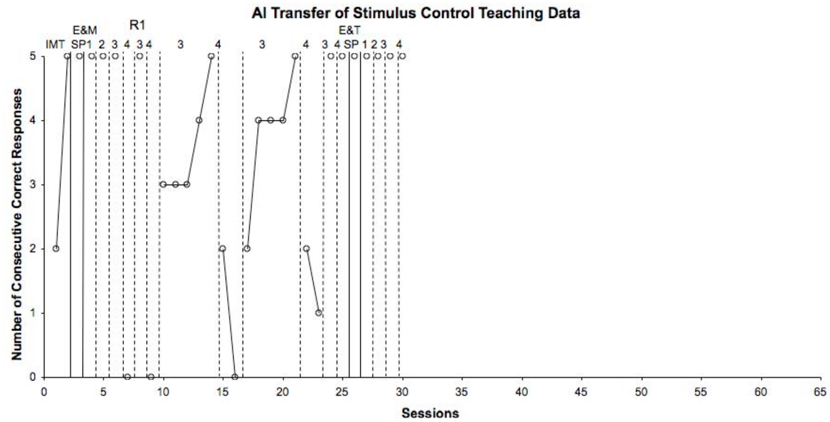

Figure 26. Transfer of stimulus control teaching data for Al.

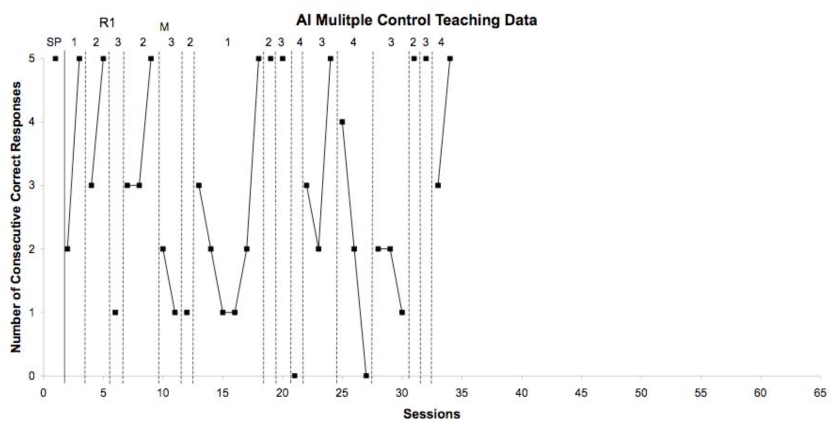

Figure 27. Multiple control teaching data for Al.

Figure 28. Number of teaching trials to criterion for Al.

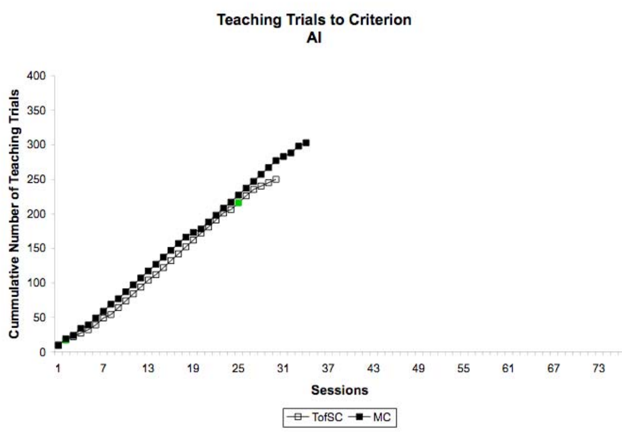

Figure 29. Number of teaching trials to criterion for each operant by condition for Al.

Colored squares represent when each operant was acquired.

Bea. Teaching data for Bea during transfer of stimulus control are depicted in Figure 30. Bea did not require any returns to previous fading levels during transfer of stimulus control to mand for R1. During transfer of stimulus control to tact for R2, Bea returned to fading level 1 once and to fading level 3 four times. No returns to previous fading levels were required when transferring control to mand for R2. Transferring control to tact for R4 necessitated a single return to fading level 3. No fading sessions were required for R5. Teaching data for multiple control are depicted in Figure 31. Bea did not require any returns to previous fading levels during teaching sessions for R1, R3, or R4, providing a within-subject replication for initial fades to mand control. R5 and R6 were acquired without fading sessions, also providing a within-subject replication.

The number of trials to acquire mands, tacts, and echoics for each experimental condition are presented in Figures 32 and 33. The data indicate that fewer teaching trials were required to learn mands, tacts, and echoics for three response topographies using multiple control (104:81, 158:20, and 24:5) than transfer of stimulus control. Another response topography required the same number of teaching trials in both conditions (55). The final response topography was acquired using multiple control in only 5 teaching trials. The overall number of teaching trials to criterion decreased across response topographies across conditions with the exception of R2 for transfer in stimulus control and R3 in multiple control. Figure 33 also indicates the number of teaching trials required to learn each verbal operant in each experimental condition. These data suggest that Bea learned echoic responses in transfer of stimulus control in 50, 15, 5, and 9 trials for response topographies taught. Bea required 105 teaching trials to learn to mand for R1, 117 trials to learn to tact and 158 trials to learn to mand for R2. Bea learned all three operants for R3 in 55 trials and in 24 trials for R4. During multiple control, Bea learned to mand for R1 in 34 trials and learned to tact R1 in 81 trials. Bea learned all operants for R2 in 20 trials, for R3 in 55 trials, and for R4 and R5 in 5 trials each.

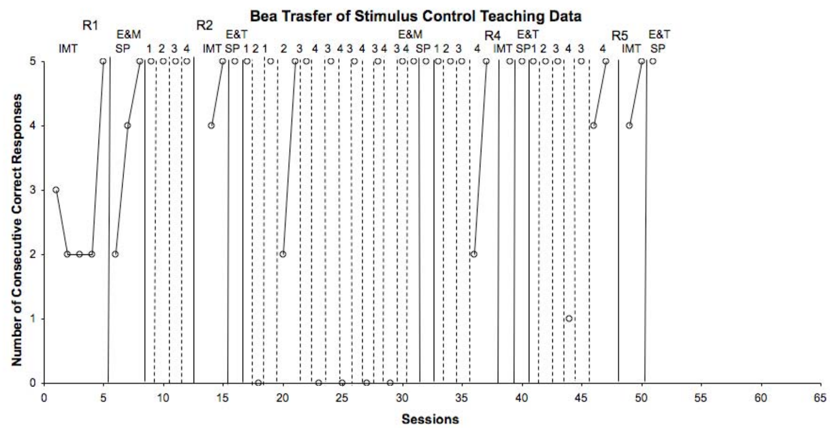

Figure 30. Transfer of stimulus control teaching data for Bea.

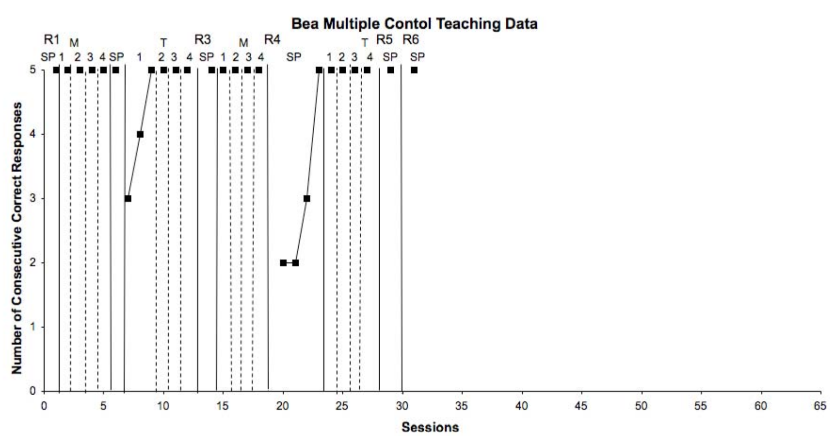

Figure 31. Multiple control teaching data for Bea.

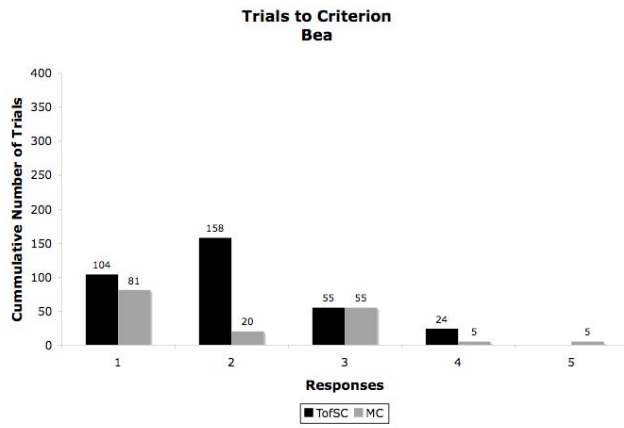

Figure 32. Number of teaching trials to criterion for Bea.

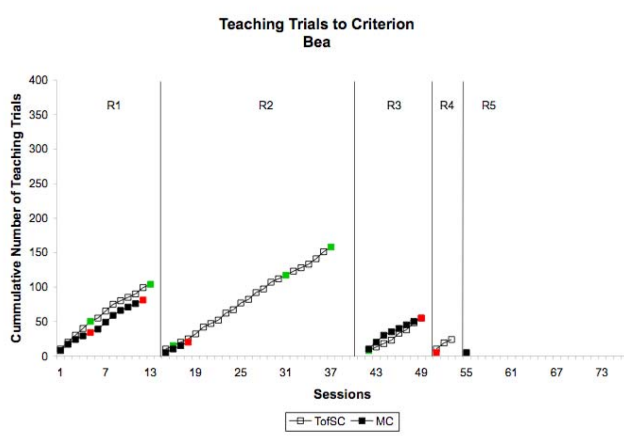

Figure 33. Number of teaching trials to criterion for each operant by condition for Bea. Colored squares represent when each operant was acquired.

Javier. Figure 34 shows teaching trial data for Javier in transfer of stimulus control conditions. The data suggest that Javier did not require any returns to previous fading levels for R1 or R2. Teaching trial data for multiple control conditions are depicted in Figure 35. The data suggest a return to fading level 2 for R1 during the fade to tact control and no returns to previous fading levels for R2; however, teaching was not completed for this response topography. The cumulative number of teaching trials to acquire mands, tacts, and echoics during both experimental conditions is represented in Figures 36 and 37. Javier required fewer teaching trials to acquire target operants using transfer of stimulus control than using multiple control. The first response topographies were acquired in 128 teaching trials using transfer of stimulus control and 145 trials using multiple control. Javier acquired his second response topography in 131 trials using transfer of stimulus control and had not acquired his second response topography after 177 teaching trials in multiple control. Figure 37 also indicates the number of teaching trials required to learn each operant. Javier acquired echoics in transfer of stimulus control after 45 and 37 teaching trials. Both mands and tacts were acquired after 131 and 128 teaching trials. Using multiple control, Javier required 145 teaching trials to learn mands, tacts, and echoics for R1 and had not acquired individual operants for R2 after 177 trials.

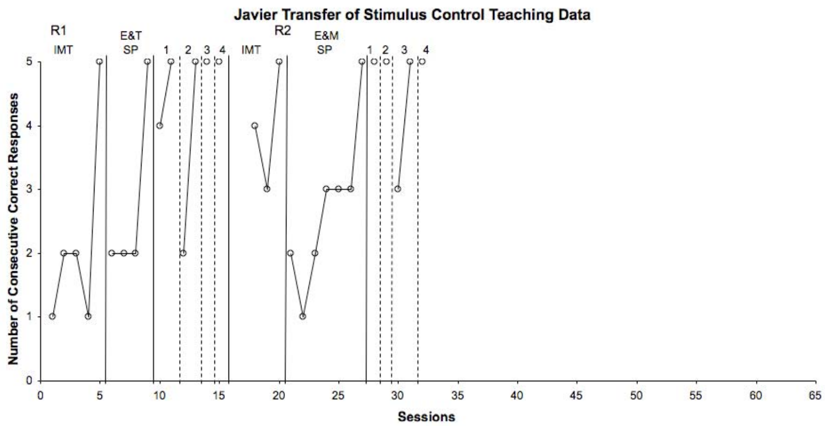

Figure 34. Transfer of stimulus control teaching data for Javier.

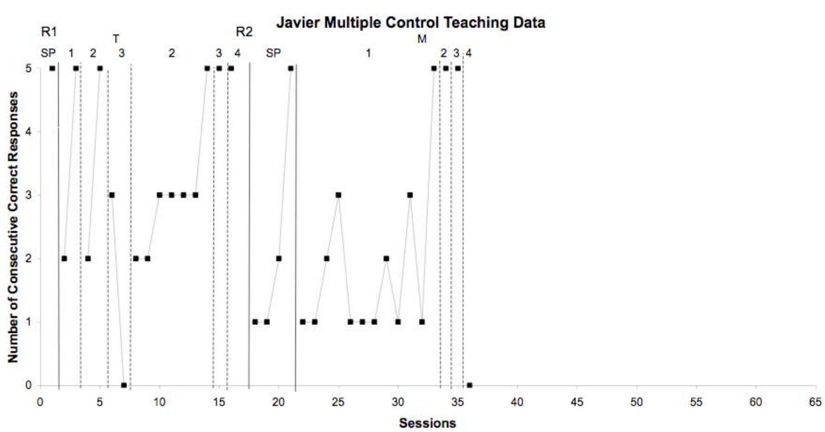

Figure 35. Multiple control teaching data for Javier.

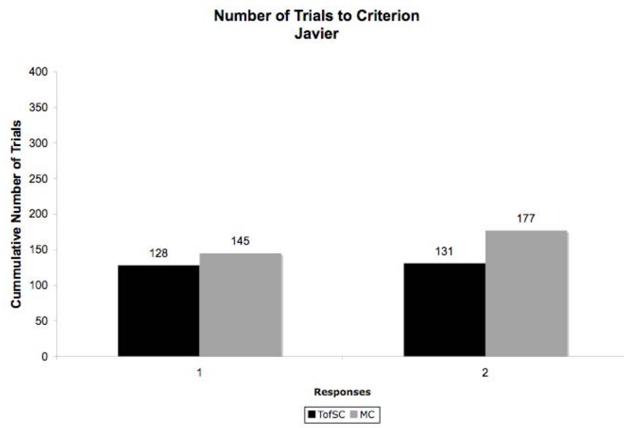

Figure 36. Number of teaching trials to criterion for Javier.

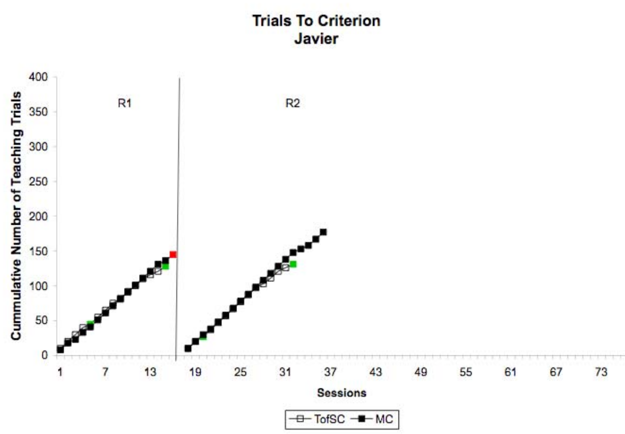

Figure 37. Number of teaching trials to criterion for each operant by condition for Javier. Colored squares represent when each operant was acquired.

Social Validity

A questionnaire was administered to two parents and one classroom teacher. Consumers were asked questions regarding the efficiency of the procedure, the effectiveness of the procedure, and the generality of the interventions and response topographies (see Appendix KK for a sample social validity questionnaire). Written consent from individuals participating in the social validity portion of the study was obtained (see Appendix LL).

Results of the social validity questionnaire suggest that direct consumers were satisfied with the progress their students or children made throughout the course of the study. All consumers reported gains in the operants targeted. One consumer reported a clear increase in echoics and tacts while two consumers reported increase in all operants. All consumers reported that they felt their child or student had benefited adequately from the time spent participating in the study. In addition, all consumers reported that they would let their children or students participate in a similar study in future.

CHAPTER 5

DISCUSSION

The results suggest that Teige, Herb, and Bea acquired mands, tacts, and echoics in fewer trials when operants were taught under multiple control while Al and Javier acquired the target operants in fewer teaching trials with transfer of stimulus control. Herb replicated this pattern across two response topographies and Bea showed replications across five response topographies. Teige's acquisition of subsequent response topographies in baseline did not allow for his results to be replicated. All three response topographies taught to Al and Javier were acquired in fewer teaching trials fewer teaching trials using transfer of stimulus control. Javier's data indicate one replication while Al did not progress to a second response topography. One set of response topographies for Bea was acquired with an equivalent number of teaching trials. These data provide support for teaching mands, tacts, and echoics using multiple control rather than transfer of stimulus control.

The number of returns to previous fading levels across conditions also suggests benefits to teaching verbal operants under multiple control. Teige, Herb, and Bea required more returns to previous fading levels in transfer of stimulus control teaching sessions than in multiple control teaching sessions while Al and Javier required more returns to previous fading levels in multiple control than in transfer of stimulus control. Herb replicated these results across two completed response topographies in multiple control and Bea's data replicated across six response topographies in multiple control. Javier's data were replicated across the two response topographies taught using transfer of stimulus control. In general, during transfer of stimulus control teaching sessions, participants required 19 returns to previous fading levels as compared to 14 returns during multiple control teaching conditions. These data suggest that previous acquisition of the echoic may have temporarily blocked transfer of stimulus control to other operants. Seventeen of the returns to previous fading levels occurred just as the vocal verbal stimulus was faded in its entirety (fading echoic to mand or tact level 3 to level 4). Only five returns occurred at this fading level during multiple control and one of the five occurred with Al who already emitted the echoic during baseline probes.

The nature of the teaching sessions also allowed an evaluation of trials to criterion across operants. In both experimental conditions, there were more returns to previous fading levels when transferring or fading to control by establishing operations than when transferring or fading to control by nonverbal stimuli. Participants returned to previous fading levels during transfer of stimulus control when transferring to mand control eleven times as opposed to eight times during transfer to tact control. In multiple control, eight returns to previous fading levels occurred during fading to mand control as opposed to six returns when fading to tact control. However, there were few within subject replications of these findings outside of Bea's data. Bea performed consistently when fading to mand

and tact first for two response topographies in both transfer of stimulus control and multiple control.

The data may be interpreted in several ways. First, the more frequent returns to previous fading levels when transferring to mand control may be indicative of the salience of the controlling stimulus. Specifically, a nonverbal stimulus is more tangible, given its visibility, than a state of deprivation. Second, many have suggested that the mand should be taught first, given its benefit to the speaker (Bondy et al., 2004; Skinner, 1957; Sundberg & Michael, 2001). These data do not suggest which operant should be taught first; however, they do suggest that teaching a mand repertoire may be more difficult than teaching an echoic or tact repertoire. Furthermore, these data could also suggest the effects of an abolishing operation rather than an establishing operant during teaching sessions. Pre-session exposure to target stimuli was controlled with a 30 min period of no access; although, after teaching mands for one set of target stimuli, the availability of other reinforcing stimuli may have come under contextual control and strengthened the likelihood of mands for these items. For example, Al and Javier frequently emitted mands for items that had been present in previous teaching sessions during teaching sessions for new target stimuli. For example, Javier often said, "I want movie" or "I want M&Ms" (previous target stimuli) during teaching sessions for nerds and the koosh ball. During a probe session for top, Al emitted the response "I want the blue top" on the first trial, but then did not request the item again. These data suggest responding was controlled by establishing operations. Nevertheless, the mean length of utterance was longer than the single word that was targeted during experimental conditions. This suggests that during periods of no responding for mand trials participants may not have been sufficiently motivated for the target items, thereby affecting the number of teaching trials and returns to previous fading levels necessary to meet criterion. Finally, it is possible that the number of fading levels constructed was not the optimum number. The number of fading levels was chosen was not a data based decision. It is possible that with additional fading levels, the number of returns would have been a less significant finding. In addition, some participants may have performed as well with fewer fading levels as indicated in sessions where Bea and Javier requested or labeled the target item before the partial echoic stimulus was emitted in fading levels 2 and 3. Some flexibility in the number of fading levels based on participant performance may have provided a different outcome.

Operants emerged without undergoing a fading sequence as a result of teaching in both experimental conditions. Six operants were acquired without fading under transfer of stimulus control conditions and 15 operants were acquired without fading under multiple control conditions. Echoics were explicitly taught using transfer of stimulus control but emerged without explicit teaching using multiple control. Three mands and 3 tacts emerged without fading under transfer of stimulus control conditions. Five mands and 3 tacts emerged without fading under multiple control conditions. In addition, Bea's data indicate that mands, tacts, and echoics emerged after five simultaneous presentation trials in multiple control. In fact, eight of the 15 operants that emerged during multiple control occurred after simultaneous presentation teaching sessions, whereas only one of the six untaught operants emerged after simultaneous presentation in transfer of stimulus control. These findings support teaching verbal behavior under multiple sources of control given the potential for operants to occur under single sources of control without training. These data are consistent with research regarding training for generalization by way of training sufficient exemplars under a sufficient number of relevant stimulus conditions (Stokes & Baer, 1977). Consequently, the data provide preliminary support for multiple control as a more efficient strategy than transfer of stimulus control for language acquisition.

The results are contradictory to what would be indicated given the functional independence of verbal operants. Previous research suggests that teaching one operant does not precipitate the emergence of other operants without explicit teaching (Partington & Bailey, 1993; Sundberg & Michael, 2001; Sundberg et al., 1990; Watkins et al., 1989). It is possible that teaching responses under multiple sources of control circumvents the need to teach each operant individually. Bringing the response under the control of multiple stimuli initially, all stimuli would acquire some control over the response after a history of reinforcement. It is possible that each of these stimuli may acquire enough control over the response to evoke the response when presented in isolation. The use of transfer of stimulus control does not present the opportunity for control by a compound stimulus until after an initial stimulus has acquired control over the response. Research on stimulus blocking would predict challenges attaining control by the compound and new stimulus due to previous conditioning with the initial controlling stimulus. This finding is consistent with both basic (Fields, 1978; 1979; 1981; Fields et al., 1976) and applied research (Didden et al., 2000; Glat et al., 1994; Partington et al., 1994; Singh & Solman, 1990; Sundberg et al., 2000) that indicates the occurrence of stimulus blocking may impede transfer of stimulus control.

The participants' pre-experimental verbal repertoires and history with language training may also influence how the data are interpreted. Al and Javier demonstrated the best outcomes with transfer of stimulus control. These participants differed from the other three participants on a number of variables. First, both Al and Javier were older than the other participants. This may have occasioned a longer history with educational approaches than the other participants who were three to five years younger. In fact, Al and Javier had previous instruction with discrete trial based teaching systems whereas Teige, Herb, and Bea had limited exposure to a behavior analytic teaching methodology. It may be possible that the history with such programming influenced rates of acquisition. In contrast, individuals with a history of natural environment training or teaching sessions that focus on the acquisition of verbal operants may better prepare an individual for training under multiple control. Finally, Al and Javier entered the study with more extensive verbal repertoires than the other participants, namely in the areas of receptive language and tacting, both characteristic of histories with discrete trial based programs. This learning history may also account for challenges associated with the transfer of control to that of an establishing operation given the strength of tact repertoires. Essentially, the rate of acquisition with transfer of stimulus control or multiple control may be dependent on one's history with particular teaching methodologies or one's pre-existing verbal repertoire.

There are several limitations to the current study. First, it could be argued that probe sessions did not ensure that responding was under the control of pure operants. This is particularly noteworthy for mand probes. Given that the nonverbal stimulus was presented briefly at the onset of a mand trial, one could argue that the establishing operation as well as the nonverbal stimulus controlled some aspects of the responses. Generally mands do not occur in the absence of contextual stimuli that increase the likelihood of a response topography receiving characteristic reinforcement. Flashing the nonverbal stimulus was intended to signal the availability of a particular stimulus, but did not remain present in order to minimize the likelihood of control by the nonverbal stimulus. Nevertheless, it could be argued that the mand was actually a mand-tact relation. In addition, one could argue that the establishing operations were not held constant given the inclusion of both edible and non-edible items as target stimuli. Further analysis of the data indicates that in some situations (e.g., Javier's first response topography) the non-edible item was acquired as mands, tacts, and echoics in fewer teaching trials than the edible item. This suggests that the preference assessment helped to control for the reinforcing value of the stimulus despite differences in terms of edibility.

Furthermore, some would contend that none of the operants measured constituted pure operants (Bondy et al., 2004; Sundberg & Michael, 2001) given the additional source of audience control. Skinner (1957) contends that one of the defining characteristics of verbal behavior is that the reinforcement of the verbal response is mediated through another individual, or a listener. Given that an audience is necessary for verbal behavior to be maintained (even if the speaker serves as one's own listener), it would be impossible to conduct the current study without audience control. If the participant's response forms differed (i.e., vocal verbal behavior with the experimenter and problem behavior with other caregivers or instructional providers) but served the function of mands or tacts, one could provide evidence of audience control. However, this was not the purpose of the current investigation; therefore, data are unavailable to draw strong conclusions regarding audience control. Also related to audience control was the potential for verbal behavior emitted within the session but not accounted for in treatment integrity data to acquire control over participants' responding. For example, as participants began to acquire operants, it is possible that the experimenter exhibited a change in inflection following the correct response emitted in later fading levels than earlier fading levels. In addition, conversation between the experimenter and secondary data collectors may have included emission of the target vocal verbal stimulus thereby affecting responding by adding an additional but unwanted source of control when the echoic stimulus was completely faded.

The role of establishing operations may also have affected responding during teaching and probe sessions. As previously noted, oftentimes it appeared as though participants were not sufficiently motivated during mand teaching and probe sessions. Lack of an establishing operation was also indicated when participants quickly returned the stimulus characteristic of their response or did not consume the edible items during mand sessions. Finally, the current study is limited also by the small number of participants and the small number of replications both within and across participants. An insufficient number of within subject replications were conducted to justify conclusions regarding some experimental questions. While some participants acquired more than one response topography within each condition, rarely were replications available across which operant control was first faded to (e.g., initial fade to mand control vs. initial fade to tact control).

It is possible that the social praise delivered contingent upon echoic and tact repertoires did not function as a reinforcer. This would explain decreasing trends in echoic responding during baseline probes. Further support could be obtained if untrained tacts rather than untrained mands occurred during baseline. For example, Bea often emitted tacts during baseline after echoic probes. During tact probes, the nonverbal stimulus was present until the participant emitted the vocal verbal response or 3 s elapsed. In contrast, during mand sessions, the nonverbal stimulus was presented and then quickly removed. It is possible that the "tact" was maintained by negative reinforcement, given that the nonverbal stimulus remained present until a response was emitted or for up to 3 s. Furthermore, time limitations prohibited the acquisition of maintenance data or natural environment probes. It would be interesting to examine the long-term benefits of participation. It is possible that one approach may be more beneficial in promoting maintenance.

Teachers and parents noted evidence of additional verbal behavior outside of experimental sessions. Formal assessment of the verbal repertoire outside of session could provide stronger evidence of these behaviors. The experimenter and additional data collectors noted several occurrences of spontaneous speech throughout teaching and probe sessions that was not explicitly taught in the context of this study. For example, during mand probes, Bea told the experimenter, “stop it” (when presenting and removing the target stimulus); Herb often said /o/ to have the door opened that led to the room where sessions were conducted; Al and Javier asked for movies or specific candies with full sentences; and Teige began emitting mands, tacts, and echoics during baseline probes after acquisition of the first response topographies.

Pragmatically, teaching operants under multiple sources of control may be easier to implement than teaching operants under single sources of control and then attempting to transfer stimulus control. It is more difficult to attempt to arrange an environment void of additional stimuli than to arrange for simultaneous presentation of stimuli. In addition, multiple control teaching procedures align well with incidental teaching or taking advantage of naturally occurring teaching opportunities. Consider the child who walks into the kitchen and stands near the refrigerator. If teaching under multiple sources of control, the parent or caregiver could show the child the juice and say juice (nonverbal stimulus, vocal verbal stimulus, and an establishing operation) possibly increasing the likelihood of a vocal response, “juice”. Now, the parent or caregiver can deliver the item characteristic of what is partially under mand control. If teaching using transfer of stimulus control, the parent or caregiver would first have to establish an echoic. As a result, when the child approaches the refrigerator, the parent or caregiver must first eliminate the establishing operation by giving the child juice. Then, the parent or caregiver will need to rid the environment of the nonverbal stimulus, gain the child’s attention and emit the vocal verbal stimulus. If the child repeats the vocal verbal stimulus, then the child will receive social praise. Future teaching sessions will be required to transfer control to additional stimuli. Given the results of the current study, it seems more likely that the child will acquire the response topography under more pure sources of control in the first scenario than the latter and in a shorter period of time.

Future research should replicate and extend the current study. One direction for future research would involve the inclusion of more participants who are taught more response topographies. This study could control for participant characteristics such as preexisting verbal repertoires or history with particular teaching strategies and assess how each may or may not impact the efficiency of transfer of stimulus control and multiple control. In addition, research that alters the potential influence of stimulus blocking during transfer of stimulus control could be conducted. Additional studies would strengthen conclusions regarding the effects of stimulus blocking during transfer of stimulus control and the relative efficiency of one approach or another. Such studies may benefit from the techniques used by previous researchers to minimize blocking effects but applied to the acquisition of mands, tacts, and echoics (Didden et al., 2000; Fields, 1979; Fields et al., 1976; Glat et al., 1994; Partington et al., 1994; Singh and Solman, 1990; Sundberg et al., 2000), particularly the potential blocking effects of a vocal verbal stimulus. These studies should also examine retention of taught responses and measure pre- and post- verbal behavior in the natural environment. Furthermore, it is unclear from the current participant characteristics whether stimulus blocking presents a larger challenge for children with autism than it may for children without autism. Extending the methods to participants with different diagnoses or to typically developing children may yield interesting information regarding typical and atypical language progression. Finally, basic research suggests evidence of stimulus blocking (Fields, 1979; Fields et al.) yet these effects are observed when transfer of stimulus control is used within the same response class. The examination of stimulus blocking with verbal behavior presents a unique challenge given that each operant is a member of a separate response class. Research applying stimulus equivalence teaching strategies with members of a single operant class (i.e., mand or tact) and applying class-specific reinforcers may provide additional information that is useful to an analysis of teaching verbal behavior.

In general, the current study suggests that the use of multiple control may be more efficient than the use of transfer of stimulus control to teach mand, tact, and echoic responses to individuals with developmental disabilities. Fewer teaching trials and fewer returns to previous fading levels were observed with response topographies taught via multiple control. In addition, more operants emerged without specific teaching by way of multiple control. This is suggestive of stimulus blocking as a by-product of using transfer of stimulus control; thereby providing preliminary support that stimulus blocking may impede the efficiency of using an existing echoic repertoire to teach mands and tacts.

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APPENDIX A

PURPOSE AND PROCEDURES

December 1, 2006

Dear Parent/Guardian:

My name is Traci Cihon and I am a doctoral candidate in Special Education at The Ohio State University. A requirement of completing my course of study is to conduct a research project under the supervision of my faculty advisors Drs. Nancy A. Neef and Helen I. Malone, professors in the College of Education and Human Ecology. This letter is being provided to you to explain my research and to ask your permission to include your son/daughter in my project. The following is a description of the study I plan to conduct and an explanation of your rights.

My study will examine the effects of two different teaching strategies on the rate of learning and acquisition of echoing, labeling items, and making requests. The strategies will differ in terms of the type and amount of items or conditions arranged before and after your child's responses. For example, your child may be taught to ask for a puzzle while the puzzle is in view, but out of reach and taught to say, "book", when the book is in view but out of reach and I say, "book" after a brief period of no interaction with books. The skills I will teach include: making requests, labeling items, and repeating words. I will work with your child three to five days per week, and each session will last approximately 30 minutes. During each session, your child will be tested on the skills I am teaching and will go through teaching procedures to learn the new material. Correct and incorrect responses will be tracked and graphed daily to assess progress.

At the conclusion of this study, I will meet with you to review your child's progress and inform you of any teaching strategies that demonstrated more effective and/or efficient learning or acquisition rates.

Your child would be involved in sessions, three to five days a week for approximately 12 weeks. Sessions would occur at your child's school. You are in no way obligated to grant permission for your child to participate in this research, and your child will not be penalized in any way for not participating. If your child does participate, you have the right to withdraw him/her from the study at any time without prejudice to you or your child. During any session, if your child asks to stop or shows signs of wanting to stop (beyond what might be expected in any routine teaching situation) the session will be terminated. Please be assured that you child's name will not be revealed in any publication, document, recording, computer storage, or any other form of report or presentation developed from this research.

Attached are two copies of the research consent form. By signing this consent form you are granting permission for you child to participate in this research project. You should return a signed copy of the form and keep the second copy for your records. Please return forms by November 30, 2006.

If you have any questions regarding this research or your rights related to participation in this research, please feel free to call me at (314) 583-5495, or call Dr. Nancy Neef at (614) 688-8107 or Dr. Helen Malone at (614) 286-4515. If you have questions about your son's/daughter's rights as a research participant, you can call the Office of Research Risks and Protection at (614) 688-4792. Thank you for your cooperation.

APPENDIX B

CONSENT FOR PARTICIPATION

PROTOCOL # ________________

CONSENT FOR PARTICIPATION IN RESEARCH

I give consent for my child, ____________________, to participate in research entitled: A Comparison of Transfer of Stimulus Control via Superimposition or by Multiple Control on the Acquisition of Verbal Behavior in Young Children being conducted by Nancy A. Neef, Ph.D., Principal Investigator, and her authorized representatives, Traci M. Cihon, M.A, BCBA and Dr. Helen I. Malone, Ph.D. The intention of this study is in fulfillment of course requirements of a Doctoral degree program at The Ohio State University.

The purpose of the study, the procedures to be followed, and the expected duration of my child's participation have been described to me. Possible benefits of the study have been described, as have alternative procedures, if such procedures are applicable and available. I acknowledge that I have had the opportunity to obtain additional information regarding the study and that any questions I have raised have been answered to my full satisfaction. Furthermore, I understand that my child is free to withdraw consent at any time and to discontinue participation in the study without prejudice to my child.

Finally, I acknowledge that I have read and fully understand the consent form. I sign it freely and voluntarily. A copy has been given to me. If any further questions arise I may contact the researcher at (314) 583-5495 to gain additional information. If I have questions about my rights as a research participant, I can call the Office of Research Risks Protection at (614) 688-4792.

_______________________________________ __________________
(Person authorized to consent for participant) (Date)

_______________________________________ __________________
(Principle Investigator or representative) (Date)

____
(Witness)

APPENDIX C

SITE PERMISSION LETTER

SAMPLE SITE PERMISSION LETTER

The Institutional Review Board
The Ohio State University
Columbus, OH 43210

To Whom It May Concern:

Traci Cihon will be conducting research for her Doctoral dissertation in our school, (school name), where I am (position). I have received the information regarding her proposed study entitled: A Comparison of Transfer of Stimulus Control via Superimposition or by Multiple Control on the Acquisition of Verbal Behavior in Young Children. I have also received a copy of the consent for participation, and I believe that the research study is in accordance with the standard teaching practices and in no way places students at risk. I understand the value of such research and give my permission and support for conducting this study in my school building.

Please feel free to contact me at (xxx) xxx-xxxx if any additional information is needed.

Sincerely,

Name
(position)

cc. Nancy A. Neef, Ph.D., Advisor

APPENDIX D

TRANSFER OF STIMULUS CONTROL TEACHING TRIAL DATA SHEET

Transfer of Stimulus Control Teaching Trial Data Collection

Participant: ____________________ **Response topography:** ________________

DISCRIMINATION	DATE					SUPERIMPOSITION	DATE					FADING (level ___)	DATE				
Echoic						Mand transfer						Mand control					
Trial 1						Trial 1						Trial 1					
Trial 2						Trial 2						Trial 2					
Trial 3						Trial 3						Trial 3					
Trial 4						Trial 4						Trial 4					
Trial 5						Trial 5						Trial 5					
Trial 6						Trial 6						Trial 6					
Trial 7						Trial 7						Trial 7					
Trial 8						Trial 8						Trial 8					
Trial 9						Trial 9						Trial 9					
Trial 10						Trial 10						Trial 10					

DISCRIMINATION	DATE					SUPERIMPOSITION	DATE					FADING (level)	DATE				
Echoic						Tact transfer						Tact control					
Trial 1						Trial 1						Trial 1					
Trial 2						Trial 2						Trial 2					
Trial 3						Trial 3						Trial 3					
Trial 4						Trial 4						Trial 4					
Trial 5						Trial 5						Trial 5					
Trial 6						Trial 6						Trial 6					
Trial 7						Trial 7						Trial 7					
Trial 8						Trial 8						Trial 8					
Trial 9						Trial 9						Trial 9					
Trial 10						Trial 10						Trial 10					

Beside the trial, under the specific date write either a plus sign for an independent correct response or a minus sign for no response, an incorrect response, or a partial response.

APPENDIX E

MULTIPLE CONTROL TEACHING TRIAL DATA SHEET

Multiple Control Teaching Trial Data Collection

Participant: ____________________ **Response topography:** _______________

SUPERIMPOSITION	DATE					FADING (level)	DATE				
Echoic, Mand, Tact						Echoic & Tact to Mand Control					
Trial 1						Trial 1					
Trial 2						Trial 2					
Trial 3						Trial 3					
Trial 4						Trial 4					
Trial 5						Trial 5					
Trial 6						Trial 6					
Trial 7						Trial 7					
Trial 8						Trial 8					
Trial 9						Trial 9					
Trial 10						Trial 10					

SUPERIMPOSITION	DATE					FADING (level __)	DATE				
Echoic, Mand, Tact						Tact & Mand to Echoic Control					
Trial 1						Trial 1					
Trial 2						Trial 2					
Trial 3						Trial 3					
Trial 4						Trial 4					
Trial 5						Trial 5					
Trial 6						Trial 6					
Trial 7						Trial 7					
Trial 8						Trial 8					
Trial 9						Trial 9					
Trial 10						Trial 10					

SUPERIMPOSITION	DATE					FADING (level __)	DATE				
Echoic, Mand, Tact						Echoic & Mand to Tact Control					
Trial 1						Trial 1					
Trial 2						Trial 2					
Trial 3						Trial 3					
Trial 4						Trial 4					
Trial 5						Trial 5					
Trial 6						Trial 6					
Trial 7						Trial 7					
Trial 8						Trial 8					
Trial 9						Trial 9					
Trial 10						Trial 10					

Beside the trial, under the specific date write either a plus sign for an independent correct response or a minus sign for no response, an incorrect response, or a partial response.

APPENDIX F

PROBE DATA SHEET

PROBE Data Collection

Participant: ____________________ **Response topography:** _______________

	DATE						DATE						DATE				
Echoic						MAND						TACT					
Trial 1						Trial 1						Trial 1					
Trial 2						Trial 2						Trial 2					
Trial 3						Trial 3						Trial 3					
Trial 4						Trial 4						Trial 4					
Trial 5						Trial 5						Trial 5					

	DATE						DATE						DATE				
Echoic						MAND						TACT					
Trial 1						Trial 1						Trial 1					
Trial 2						Trial 2						Trial 2					
Trial 3						Trial 3						Trial 3					
Trial 4						Trial 4						Trial 4					
Trial 5						Trial 5						Trial 5					

	DATE						DATE						DATE				
Echoic						MAND						TACT					
Trial 1						Trial 1						Trial 1					
Trial 2						Trial 2						Trial 2					
Trial 3						Trial 3						Trial 3					
Trial 4						Trial 4						Trial 4					
Trial 5						Trial 5						Trial 5					

	DATE						DATE						DATE				
Echoic						MAND						TACT					
Trial 1						Trial 1						Trial 1					
Trial 2						Trial 2						Trial 2					
Trial 3						Trial 3						Trial 3					
Trial 4						Trial 4						Trial 4					
Trial 5						Trial 5						Trial 5					

	DATE						DATE						DATE				
Echoic						MAND						TACT					
Trial 1						Trial 1						Trial 1					
Trial 2						Trial 2						Trial 2					
Trial 3						Trial 3						Trial 3					
Trial 4						Trial 4						Trial 4					
Trial 5						Trial 5						Trial 5					

Beside the trial, under the specific date write either a plus sign for an independent correct response or a minus sign for no response, an incorrect response, or a partial response.

APPENDIX G

REINFORCER ASSESSMENT FOR INDIVIDUALS WITH SEVERE DISABILITIES

THE REINFORCER ASSESSMENT FOR INDIVIDUALS WITH SEVERE DISABILITIES (RAISD)

Name: ________________________ Date: __________

Assessor: ______________________

The purpose of this structured interview is to get as much specific information as possible from the parent (or caregiver) as to what they believe would be useful reinforcers for the consumer. Therefore, this survey asks parents questions about categories of stimuli (e.g., visual, auditory, etc.). After the parent has generated a list of preferred stimuli, ask additional probe questions to get more specific information on his/her preferences and the stimulus conditions under which the object or activity is most preferred (e.g., What specific TV shows are his favorites? What does she do when she plays with a mirror? Does she prefer to do this alone or with another person?).

We would like to get some information on _____'s preferences for different item and activities.

1. Some individuals really enjoy looking at things such as a mirror, bright lights, shiny objects, spinning objects, TV, etc. What are the things you think _____ most likes to watch?

____

____

____

RESPONSE TO PROBE QUESTIONS:

____

____

____

2. Some individuals really enjoy different sounds such as listening to music, car sounds, whistles, beeps, sirens, clapping, people singing, etc. What are the things you think _____ most likes to listen to?

____

____

____

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APPENDIX H

MULTIPLE STIMULUS WITHOUT REPLACEMENT PREFERENCE ASSESSMENT

Student: _______________________ Date: __________________
Time: ________________________

Multiple Stimulus Without Replacement Data Sheet

Session #

APPENDIX I

EXPERIMENTER AND PARTICIPANT BEHAVIORS DURING TRANSFER OF STIMULUS CONTROL

Imitation Training - Echoic Teaching Trial			
Correct response			
Experimenter: Presents a vocal verbal stimulus (e.g., water) *Participant:* Repeats the vocal verbal stimulus (e.g., water) *Experimenter:* Presents a generalized conditioned reinforcer (e.g., thatÕs right, you said water) and moves to the next trial			
Incorrect response			
Experimenter: Presents a vocal verbal stimulus (e.g., water) *Participant:* Makes no response or emits a partial or incorrect response (e.g., wa- or doggie) *Experimenter:* Terminates trial and moves to the next trial			
Superimposition - Mand Transfer Trial			
Correct response			
Experimenter: Presents a vocal verbal stimulus (e.g., water) and flashes a nonverbal stimulus after 30 min state of deprivation *Participant:* Repeats the vocal verbal stimulus (e.g., water) under deprivation condition *Experimenter:* Presents a generalized conditioned reinforcer (e.g., thatÕs right, you said water), plus item characteristic of response (e.g., a sip of water) and moves to the next trial			
Incorrect response			
Experimenter: Presents a vocal verbal stimulus (e.g., water) and flashes a nonverbal stimulus after 30 min state of deprivation *Participant:* Makes no response or emits a partial or incorrect response (e.g., wa- or doggie) *Experimenter:* Terminates trial and moves to the next trial			
Superimposition - Tact Transfer Trial			
Correct response			
Experimenter: Presents a vocal verbal stimulus (e.g., water) in combination with the nonverbal stimulus *Participant:* Repeats the vocal verbal stimulus (e.g., water) in the presence of the nonverbal stimulus *Experimenter:* Presents a generalized conditioned reinforcer (e.g., thatÕs right, you said water) and moves to the next trial			
Incorrect response			
Experimenter: Presents a vocal verbal stimulus (e.g., water) in combination with the nonverbal stimulus *Participant:* Makes no response or emits a partial or incorrect response (e.g., wa- or doggie) *Experimenter:* Terminates trial and moves to the next trial			
Fading to Mand Control			
Step 1	Step 2	Step 3	Step 4
Experimenter: Presents a vocal verbal stimulus (e.g., water) and flashes a nonverbal stimulus after 30 min state of deprivation *Participant:* Emits the target response (e.g., water) *Experimenter:* Presents reinforcement specific to the response form (e.g., a sip of water)	*Experimenter:* Presents a partial vocal verbal stimulus (e.g., wa-) and flashes a nonverbal stimulus after 30 min state of deprivation *Participant:* Emits the target response (e.g., water) *Experimenter:* Presents reinforcement specific to the response form (e.g., a sip of water)	*Experimenter:* Presents the initial sound of the vocal verbal stimulus (e.g., w-) and flashes a nonverbal stimulus after 30 min state of deprivation *Participant:* Emits the target response (e.g., water) *Experimenter:* Presents reinforcement specific to the response form (e.g., a sip of water)	*Experimenter:* Flashes a nonverbal stimulus without presenting a vocal verbal stimulus after 30 min state of deprivation *Participant:* Emits the target response (e.g., water) *Experimenter:* Presents reinforcement specific to the response form (e.g., a sip of water)
Fading to Tact Control			
Step 1	Step 2	Step 3	Step 4
Experimenter: Presents a vocal verbal stimulus (e.g., water) and the nonverbal stimulus *Participant:* Emits the target response (e.g., water) *Experimenter:* Presents generalized conditioned reinforcer (e.g., thatÕs right, you said water)	*Experimenter:* Presents a partial vocal verbal stimulus (e.g., wa-) and the nonverbal stimulus *Participant:* Emits the target response (e.g., water) *Experimenter:* Presents generalized conditioned reinforcer (e.g., thatÕs right, you said water)	*Experimenter:* Presents initial sound of the vocal verbal stimulus (e.g., w-) and the nonverbal stimulus *Participant:* Emits the target response (e.g., water) *Experimenter:* Presents generalized conditioned reinforcer (e.g., yes, you said water)	*Experimenter:* Does not present vocal verbal stimulus but presents only the nonverbal stimulus *Participant:* Emits the target response (e.g., water) *Experimenter:* Presents generalized conditioned reinforcer (e.g., thatÕs right, you said water)

APPENDIX J

EXPERIMENTER AND PARTICIPANT BEHAVIORS DURING MULTIPLE CONTROL

Establishing Multiple Control
Correct response
Experimenter: Presents a vocal verbal stimulus (e.g., water) and a nonverbal stimulus (e.g., picture of water) after 30 min state of deprivation *Participant:* Emits the target response (e.g., water) *Experimenter:* Presents a generalized conditioned reinforcer (e.g., thatÕs right, you said water), reinforcement specific to the response form (e.g., a sip of water), and moves to the next trial
Incorrect response
Experimenter: Presents a vocal verbal stimulus (e.g., water) and a nonverbal stimulus (e.g., picture of water) after 30 min state of deprivation *Participant:* Makes no response or emits a partial or incorrect response (e.g., wa- or doggie) *Experimenter:* Terminates trial and moves to the next trial

Fading Echoic and Tact to Mand Control			
Step 1	Step 2	Step 3	Step 4
Experimenter: Presents a vocal verbal stimulus (e.g., water) and a nonverbal stimulus after 30 min state of deprivation *Participant:* Emits the target response (e.g., water) *Experimenter:* Presents reinforcement specific to the response form (e.g., a sip of water)	*Experimenter:* Presents a partial vocal verbal stimulus (e.g., wa-) and 2/3 of a nonverbal stimulus (e.g., a picture of water) after 30 min state of deprivation *Participant:* Emits the target response (e.g., water) *Experimenter:* Presents reinforcement specific to the response form (e.g., a sip of water)	*Experimenter:* Presents initial sound of the vocal verbal stimulus (e.g., w-) and 1/3 of a nonverbal stimulus (e.g., a picture of water) after 30 min state of deprivation *Participant:* Emits the target response (e.g., water) *Experimenter:* Presents reinforcement specific to the response form (e.g., a sip of water)	*Experimenter:* Does not present vocal verbal stimulus and flashes a nonverbal stimulus after 30 min state of deprivation *Participant:* Emits the target response (e.g., water) *Experimenter:* Presents reinforcement specific to the response form (e.g., a sip of water)

Fading Tact and Mand to Echoic Control			
Step 1	Step 2	Step 3	Step 4
Experimenter: Presents a nonverbal stimulus (e.g., a picture of water) and a vocal verbal stimulus (e.g., water) after a 30 min state of deprivation *Participant:* Emits the target response (e.g., water) *Experimenter:* Presents a generalized conditioned reinforcer (e.g., nice saying water)	*Experimenter:* Presents 2/3 of a nonverbal stimulus (e.g., a picture of water) and a vocal verbal stimulus (e.g., water) after a 20 min state of deprivation *Participant:* Emits the target response (e.g., water) *Experimenter:* Presents a generalized conditioned reinforcer (e.g., nice saying water)	*Experimenter:* Presents 1/3 of a nonverbal stimulus (e.g., a picture of water) and a vocal verbal stimulus (e.g., water) after a 10 min state of deprivation *Participant:* Emits the target response (e.g., water) *Experimenter:* Presents a generalized conditioned reinforcer (e.g., nice saying water)	*Experimenter:* Does not present nonverbal stimulus (e.g., a picture of water), presents a vocal verbal stimulus (e.g., water) without contriving a state of deprivation *Participant:* Emits the target response (e.g., water) *Experimenter:* Presents a generalized conditioned reinforcer (e.g., nice saying water)

Fading Echoic and Mand to Tact Control			
Step 1	Step 2	Step 3	Step 4
Experimenter: Presents a nonverbal stimulus (e.g., a picture of water) and a vocal verbal stimulus (e.g., water) after a 30 min state of deprivation *Participant:* Emits the target response (e.g., water) *Experimenter:* Presents a generalized conditioned reinforcer (e.g., correct, water)	*Experimenter:* Presents a nonverbal stimulus (e.g., a picture of water) and a partial vocal verbal stimulus (e.g., wa-) after a 20 min state of deprivation *Participant:* Emits the target response (e.g., water) *Experimenter:* Presents a generalized conditioned reinforcer (e.g., correct, water)	*Experimenter:* Presents a nonverbal stimulus (e.g., a picture of water) and the initial sound of a vocal verbal stimulus (e.g., w-) after a 10 min state of deprivation *Participant:* Emits the target response (e.g., water) *Experimenter:* Presents a generalized conditioned reinforcer (e.g., correct, water)	*Experimenter:* Presents a nonverbal stimulus without a vocal verbal stimulus or a contrived state of deprivation *Participant:* Emits the target response (e.g., water) *Experimenter:* Presents a generalized conditioned reinforcer (e.g., correct, water)

APPENDIX K

EXPERIMENTER AND PARTICIPANT BEHAVIORS DURING PROBES

Echoic Probe
Correct response
Experimenter: Presents a vocal verbal stimulus (e.g., water) *Participant:* Repeats the vocal verbal stimulus (e.g., water) *Experimenter:* Presents a generalized conditioned reinforcer (e.g., thatÕs right, you said water) and moves to the next trial
Incorrect response
Experimenter: Presents a vocal verbal stimulus (e.g., water) *Participant:* Makes no response or emits a partial or incorrect response (e.g., wa- or doggie) *Experimenter:* Terminates trial and moves to the next trial
Mand Probe
Correct response
Experimenter: Contrives a 30 min state of deprivation and presents and removes a nonverbal stimulus *Participant:* States the vocal verbal response (e.g., water) under deprivation condition *Experimenter:* Presents item characteristic of response (e.g., a sip of water) and moves to the next trial
Incorrect response
Experimenter: Contrives a 30 min state of deprivation and presents and removes a nonverbal stimulus *Participant:* Makes no response or emits a partial or incorrect response (e.g., wa- or doggie) *Experimenter:* Terminates trial and moves to the next trial
Tact Probe
Correct response
Experimenter: Presents the nonverbal stimulus *Participant:* States the vocal verbal response (e.g., water) in the presence of the nonverbal stimulus *Experimenter:* Presents a generalized conditioned reinforcer (e.g., thatÕs right, you said water) and moves to the next trial
Incorrect response
Experimenter: Presents the nonverbal stimulus *Participant:* Makes no response or emits a partial or incorrect response (e.g., wa- or doggie) *Experimenter:* Terminates trial and moves to the next trial

APPENDIX L

TREATMENT INTEGRITY FOR IMITATION TRAINING TRIALS

Treatment Integrity Checklist: Imitation Training
Echoic Teaching Trials

Participant: ____________________________ Date: ____________________________
Target response: _______________________

Check if experimenter behavior occurs for each trial	Behavior
1 2 3 4 5 6 7 8 9 10	
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Item representative of response topography is not present
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Participant had access to item prior to session
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Experimenter presents a vocal verbal stimulus (e.g., water)
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	If the participant repeats the vocal verbal stimulus in 3 s (e.g., water), the experimenter Presents a generalized conditioned reinforcer (e.g., that's right, you said water) and moves to the next trial
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	If the participant makes no response, emits a partial response, or emits an incorrect response, the experimenter terminates the trial and moves to the next trial

APPENDIX M

TREATMENT INTEGRITY FOR SIMULTANEOUS PRESENTATION MAND TRANSFER TRIALS

Treatment Integrity Checklist: Simultaneous Presentation Mand Transfer Trials

Participant: ____________________________ Date: ____________________________
Target response: _______________________

Check if experimenter behavior occurs for each trial	Behavior
1 2 3 4 5 6 7 8 9 10	
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Item representative of response topography is presented and quickly removed
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	30 min deprivation (no access to stimulus) of response topography stimulus has occurred
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Experimenter presents a vocal verbal stimulus (e.g., water)
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	If the participant repeats the vocal verbal stimulus (e.g., water) in 3 s, the experimenter presents a generalized conditioned reinforcer (e.g., that's right, you said water) plus the item characteristic of the response (e.g., a sip of water) and moves to the next trial
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	If the participant makes no response in 3 s, emits a partial response, or emits an incorrect response, the experimenter terminates the trial and moves to the next trial

APPENDIX N

TREATMENT INTEGRITY FOR SIMULTANEOUS PRESENTATION TACT

TRANSFER TRIALS

Treatment Integrity Checklist: Simultaneous Presentation
Tact Transfer Trials

Participant: ___________________________ Date: ___________________________
Target response: ______________________

Check if experimenter behavior occurs for each trial	Behavior
1 2 3 4 5 6 7 8 9 10	
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Item representative of response topography is present
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Participant had access to stimulus prior to session
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Experimenter presents a vocal verbal stimulus (e.g., water)
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	If the participant repeats the vocal verbal stimulus (e.g., water) in 3 s, the experimenter Presents a generalized conditioned reinforcer (e.g., that's right, you said water) and moves to the next trial
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	If the participant makes no response in 3 s, emits a partial response, or emits an incorrect response, the experimenter terminates the trial and moves to the next trial

APPENDIX O

TREATMENT INTEGRITY FOR FADING ECHOIC TO MAND CONTROL STEP 1

Treatment Integrity Checklist:
Echoic Fading to Mand Control (Step 1)

Participant: ____________________________ Date: ____________________________
Target response: ______________________

Check if experimenter behavior occurs for each trial	Behavior
1 2 3 4 5 6 7 8 9 10	
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Item representative of response topography is presented and removed
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	30 min deprivation (no access to stimulus) of response topography stimulus has occurred
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Experimenter presents a vocal verbal stimulus (e.g., water)
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	If the participant repeats the vocal verbal stimulus (e.g., water) in 3 s, the experimenter presents the item characteristic of the response (e.g., a sip of water) and moves to the next trial
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	If the participant makes no response in 3 s, emits a partial response, or emits an incorrect response, the experimenter terminates the trial and moves to the next trial

APPENDIX P

TREATMENT INTEGRITY FOR FADING ECHOIC TO MAND CONTROL STEP 2

Treatment Integrity Checklist:
Echoic Fading to Mand Control (Step 2)

Participant: ___________________________ Date: ___________________________
Target response: ______________________

Check if experimenter behavior occurs for each trial	Behavior
1 2 3 4 5 6 7 8 9 10	
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Item representative of response topography is presented and removed
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	30 min deprivation (no access to stimulus) of response topography stimulus has occurred
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Experimenter presents a partial vocal verbal stimulus (e.g., wa-)
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	If the participant emits the correct vocal verbal response (e.g., water) in 3 s, the experimenter presents the item characteristic of the response (e.g., a sip of water) and moves to the next trial
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	If the participant makes no response in 3 s, emits a partial response, or emits an incorrect response, the experimenter terminates the trial and moves to the next trial

APPENDIX Q

TREATMENT INTEGRITY FOR FADING ECHOIC TO MAND CONTROL STEP 3

Treatment Integrity Checklist:
Echoic Fading to Mand Control (Step 3)

Participant: ____________________________ Date: ____________________________
Target response: ______________________

Check if experimenter behavior occurs for each trial	Behavior
1 2 3 4 5 6 7 8 9 10	
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Item representative of response topography is presented and removed
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	30 min deprivation (no access to stimulus) of response topography stimulus has occurred
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Experimenter presents the initial sound of the vocal verbal stimulus (e.g., w-)
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	If the participant emits the correct vocal verbal response (e.g., water) in 3 s, the experimenter presents the item characteristic of the response (e.g., a sip of water) and moves to the next trial
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	If the participant makes no response in 3 s, emits a partial response, or emits an incorrect response, the experimenter terminates the trial and moves to the next trial

APPENDIX R

TREATMENT INTEGRITY FOR FADING ECHOIC TO MAND CONTROL STEP 4

Treatment Integrity Checklist:
Echoic Fading to Mand Control (Step 4)

Participant: ____________________________ Date: ____________________________

Target response: ______________________

Check if experimenter behavior occurs for each trial	Behavior
1 2 3 4 5 6 7 8 9 10	
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Item representative of response topography is presented and removed
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	30 min deprivation (no access to stimulus) of response topography stimulus has occurred
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Experimenter does not present a vocal verbal stimulus
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	If the participant emits the correct vocal verbal response (e.g., water) in 3 s, the experimenter presents the item characteristic of the response (e.g., a sip of water) and moves to the next trial
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	If the participant makes no response in 3 s, emits a partial response, or emits an incorrect response, the experimenter terminates the trial and moves to the next trial

APPENDIX S

TREATMENT INTEGRITY FOR FADING ECHOIC TO TACT CONTROL STEP 1

Treatment Integrity Checklist:
Echoic Fading to Tact Control (Step 1)

Participant: ____________________________ Date: ____________________________
Target response: _______________________

Check if experimenter behavior occurs for each trial	Behavior
1 2 3 4 5 6 7 8 9 10	
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Item representative of response topography is present
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Participant had access to stimulus prior to session
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Experimenter presents a vocal verbal stimulus (e.g., water)
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	If the participant repeats the vocal verbal stimulus (e.g., water) in 3 s, the experimenter presents a generalized conditioned reinforcer (e.g., that’s right, you said water) and moves to the next trial
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	If the participant makes no response in 3 s, emits a partial response, or emits an incorrect response, the experimenter terminates the trial and moves to the next trial

APPENDIX T

TREATMENT INTEGRITY FOR FADING ECHOIC TO TACT CONTROL STEP 2

Treatment Integrity Checklist:
Echoic Fading to Tact Control (Step 2)

Participant: ____________________________ Date: ____________________________
Target response: ______________________

Check if experimenter behavior occurs for each trial	Behavior
1 2 3 4 5 6 7 8 9 10	
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Item representative of response topography is present
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Participant had access to stimulus prior to session
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Experimenter presents a partial vocal verbal stimulus (e.g., wa-)
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	If the participant emits the correct vocal verbal response (e.g., water) in 3 s, the experimenter presents a generalized conditioned reinforcer (e.g., that's right, you said water) and moves to the next trial
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	If the participant makes no response in 3 s, emits a partial response, or emits an incorrect response, the experimenter terminates the trial and moves to the next trial

APPENDIX U

TREATMENT INTEGRITY FOR FADING ECHOIC TO TACT CONTROL STEP 3

Treatment Integrity Checklist:
Echoic Fading to Tact Control (Step 3)

Participant: ___________________________ Date: ___________________________
Target response: ______________________

Check if experimenter behavior occurs for each trial	Behavior
1 2 3 4 5 6 7 8 9 10	
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Item representative of response topography is present
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Participant had access to stimulus prior to session
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Experimenter presents the initial sound of the vocal verbal stimulus (e.g., w-)
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	If the participant emits the correct vocal verbal response (e.g., water) in 3 s, the experimenter presents a generalized conditioned reinforcer (e.g., that's right, you said water) and moves to the next trial
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	If the participant makes no response in 3 s, emits a partial response, or emits an incorrect response, the experimenter terminates the trial and moves to the next trial

APPENDIX V

TREATMENT INTEGRITY FOR FADING ECHOIC TO TACT CONTROL STEP 4

Treatment Integrity Checklist:
Echoic Fading to Tact Control (Step 4)

Participant: ___________________________ Date: ___________________________
Target response: ______________________

Check if experimenter behavior occurs for each trial 1 2 3 4 5 6 7 8 9 10	Behavior
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Item representative of response topography is present
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Participant had access to stimulus prior to session
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Experimenter does not present a vocal verbal stimulus
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	If the participant emits the correct vocal verbal response (e.g., water) in 3 s, the experimenter presents a generalized conditioned reinforcer (e.g., that's right, you said water) and moves to the next trial
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	If the participant makes no response in 3 s, emits a partial response, or emits an incorrect response, the experimenter terminates the trial and moves to the next trial

APPENDIX W

TREATMENT INTEGRITY FOR MULTIPLE CONTROL SIMULTANEOUS PRESENTATION

Treatment Integrity Checklist: Simultaneous Presentation
Multiple Control Trials

Participant: ____________________________ Date: ____________________________

Target response: _______________________

Check if experimenter behavior occurs for each trial										Behavior
1	2	3	4	5	6	7	8	9	10	
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	Item representative of response topography is present
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	30 min deprivation (no access to stimulus) of response topography stimulus has occurred
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	Experimenter presents a vocal verbal stimulus (e.g., water)
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	If the participant repeats the vocal verbal stimulus (e.g., water) in 3 s, the experimenter presents a generalized conditioned reinforcer (e.g., that's right, you said water) plus the item characteristic of the response (e.g., a sip of water) and moves to the next trial
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	If the participant makes no response in 3 s, emits a partial response, or emits an incorrect response, the experimenter terminates the trial and moves to the next trial

APPENDIX X

TREATMENT INTEGRITY FOR FADING ECHOIC AND TACT TO MAND CONTROL STEP 1

Treatment Integrity Checklist:
Fading Echoic and Tact to Mand Control (Step 1)

Participant: ____________________________ Date: ____________________________
Target response: ______________________

Check if experimenter behavior occurs for each trial										Behavior
1	2	3	4	5	6	7	8	9	10	
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	Item representative of response topography is present
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	30 min deprivation (no access to stimulus) of response topography stimulus has occurred
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	Experimenter presents a vocal verbal stimulus (e.g., water)
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	If the participant repeats the vocal verbal stimulus (e.g., water) in 3 s, the experimenter presents the item characteristic of the response (e.g., a sip of water) and moves to the next trial
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	If the participant makes no response in 3 s, emits a partial response, or emits an incorrect response, the experimenter terminates the trial and moves to the next trial

APPENDIX Y

TREATMENT INTEGRITY FOR FADING ECHOIC AND TACT TO MAND

CONTROL STEP 2

Treatment Integrity Checklist:
Fading Echoic and Tact to Mand Control (Step 2)

Participant: ____________________________ Date: ____________________________
Target response: ______________________

Check if experimenter behavior occurs for each trial	Behavior
1 2 3 4 5 6 7 8 9 10	
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	2/3 of a nonverbal stimulus (e.g., picture of water) representative of response topography is present
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	30 min deprivation (no access to stimulus) of response topography stimulus has occurred
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Experimenter presents a partial vocal verbal stimulus (e.g., wa-)
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	If the participant emits the correct vocal verbal response (e.g., water) in 3 s, the experimenter presents the item characteristic of the response (e.g., a sip of water) and moves to the next trial
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	If the participant makes no response in 3 s, emits a partial response, or emits an incorrect response, the experimenter terminates the trial and moves to the next trial

APPENDIX Z

TREATMENT INTEGRITY FOR FADING ECHOIC AND TACT TO MAND CONTROL STEP 3

Treatment Integrity Checklist:
Fading Echoic and Tact to Mand Control (Step 3)

Participant: ___________________________ Date: ___________________________
Target response: ______________________

Check if experimenter behavior occurs for each trial	Behavior
1 2 3 4 5 6 7 8 9 10	
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	1/3 of a nonverbal stimulus (e.g., picture of water) representative of response topography is present
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	30 min deprivation (no access to stimulus) of response topography stimulus has occurred
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Experimenter presents the initial sound of a vocal verbal stimulus (e.g., w-)
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	If the participant emits the correct vocal verbal response (e.g., water) in 3 s, the experimenter presents the item characteristic of the response (e.g., a sip of water) and moves to the next trial
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	If the participant makes no response in 3 s, emits a partial response, or emits an incorrect response, the experimenter terminates the trial and moves to the next trial

APPENDIX AA

TREATMENT INTEGRITY FOR FADING ECHOIC AND TACT TO MAND CONTROL STEP 4

Treatment Integrity Checklist:
Fading Echoic and Tact to Mand Control (Step 4)

Participant: ___________________________ Date: ___________________________
Target response: ______________________

Check if experimenter behavior occurs for each trial										Behavior
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	Nonverbal stimulus (e.g., picture of water) representative of response topography is presented and removed
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	30 min deprivation (no access to stimulus) of response topography stimulus has occurred
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	Experimenter does not present a vocal verbal stimulus
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	If the participant repeats the vocal verbal stimulus (e.g., water) in 3 s, the experimenter presents the item characteristic of the response (e.g., a sip of water) and moves to the next trial
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	If the participant makes no response in 3 s, emits a partial response, or emits an incorrect response, the experimenter terminates the trial and moves to the next trial

APPENDIX BB

TREATMENT INTEGRITY FOR FADING ECHOIC AND MAND TO TACT

CONTROL STEP 1

Treatment Integrity Checklist:
Fading Echoic and Mand to Tact Control (Step 1)

Participant: ______________________________ Date: ______________________________
Target response: ________________________

Check if experimenter behavior occurs for each trial	Behavior
1 2 3 4 5 6 7 8 9 10	
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Item representative of response topography is present
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	30 min deprivation (no access to stimulus) of response topography stimulus has occurred
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Experimenter presents a vocal verbal stimulus (e.g., water)
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	If the participant repeats the vocal verbal stimulus (e.g., water) in 3 s, the experimenter presents a generalized conditioned reinforcer (e.g., that's right, you said water) and moves to the next trial
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	If the participant makes no response in 3 s, emits a partial response, or emits an incorrect response, the experimenter terminates the trial and moves to the next trial

APPENDIX CC

TREATMENT INTEGRITY FOR FADING ECHOIC AND MAND TO TACT

CONTROL STEP 2

Treatment Integrity Checklist:
Fading Echoic and Mand to Tact Control (Step 2)

Participant: ____________________________ Date: ____________________________
Target response: ______________________

Check if experimenter behavior occurs for each trial	Behavior
1 2 3 4 5 6 7 8 9 10	
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Item representative of response topography is present
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	20 min deprivation (no access to stimulus) of response topography stimulus has occurred
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Experimenter presents a partial vocal verbal stimulus (e.g., wa-)
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	If the participant repeats the vocal verbal stimulus (e.g., water) in 3 s, the experimenter presents a generalized conditioned reinforcer (e.g., that's right, you said water) and moves to the next trial
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	If the participant makes no response in 3 s, emits a partial response, or emits an incorrect response, the experimenter terminates the trial and moves to the next trial

APPENDIX DD

TREATMENT INTEGRITY FOR FADING ECHOIC AND MAND TO TACT

CONTROL STEP 3

Treatment Integrity Checklist:
Fading Echoic and Mand to Tact Control (Step 3)

Participant: ___________________________ Date: ___________________________
Target response: ______________________

Check if experimenter behavior occurs for each trial										Behavior
1	2	3	4	5	6	7	8	9	10	
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	Item representative of response topography is present
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	10 min deprivation (no access to stimulus) of response topography stimulus has occurred
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	Experimenter presents the initial sound of the vocal verbal stimulus (e.g., w-)
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	If the participant repeats the vocal verbal stimulus (e.g., water) in 3 s, the experimenter presents a generalized conditioned reinforcer (e.g., that's right, you said water) and moves to the next trial
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	If the participant makes no response in 3 s, emits a partial response, or emits an incorrect response, the experimenter terminates the trial and moves to the next trial

APPENDIX EE

TREATMENT INTEGRITY FOR FADING ECHOIC AND MAND TO TACT CONTROL STEP 4

Treatment Integrity Checklist:
Fading Echoic and Mand to Tact Control (Step 4)

Participant: ___________________________ Date: ___________________________

Target response: ______________________

Check if experimenter behavior occurs for each trial										Behavior
1	2	3	4	5	6	7	8	9	10	
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	Item representative of response topography is present
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	Participant had access to stimulus prior to session
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	Experimenter does not present a vocal verbal stimulus
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	If the participant repeats the vocal verbal stimulus (e.g., water) in 3 s, the experimenter presents a generalized conditioned reinforcer (e.g., that's right, you said water) and moves to the next trial
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	If the participant makes no response in 3 s, emits a partial response, or emits an incorrect response, the experimenter terminates the trial and moves to the next trial

APPENDIX FF

TREATMENT INTEGRITY FOR FADING TACT AND MAND TO ECHOIC CONTROL STEP 1

Treatment Integrity Checklist:
Fading Tact and Mand to Echoic Control (Step 1)

Participant: ___________________________ Date: ___________________________
Target response: ______________________

Check if experimenter behavior occurs for each trial										Behavior
1	2	3	4	5	6	7	8	9	10	
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	Item representative of response topography is present
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	30 min deprivation (no access to stimulus) of response topography stimulus has occurred
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	Experimenter presents a vocal verbal stimulus (e.g., water)
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	If the participant repeats the vocal verbal stimulus (e.g., water) in 3 s, the experimenter presents a generalized conditioned reinforcer (e.g., that's right, you said water) and moves to the next trial
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	If the participant makes no response in 3 s, emits a partial response, or emits an incorrect response, the experimenter terminates the trial and moves to the next trial

APPENDIX GG

TREATMENT INTEGRITY FOR FADING TACT AND MAND TO ECHOIC CONTROL STEP 2

Treatment Integrity Checklist:
Fading Tact and Mand to Echoic Control (Step 2)

Participant: ___________________________ Date: ___________________________
Target response: ______________________

Check if experimenter behavior occurs for each trial	Behavior
1 2 3 4 5 6 7 8 9 10	
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	2/3 of a nonverbal stimulus (e.g., picture of water) representative of response topography is present
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	20 min deprivation (no access to stimulus) of response topography stimulus has occurred
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Experimenter presents a vocal verbal stimulus (e.g., water)
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	If the participant repeats the vocal verbal stimulus (e.g., water) in 3 s, the experimenter presents a generalized conditioned reinforcer (e.g., that's right, you said water) and moves to the next trial
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	If the participant makes no response in 3 s, emits a partial response, or emits an incorrect response, the experimenter terminates the trial and moves to the next trial

APPENDIX HH

TREATMENT INTEGRITY FOR FADING TACT AND MAND TO ECHOIC CONTROL STEP 3

Treatment Integrity Checklist:
Fading Tact and Mand to Echoic Control (Step 3)

Participant: ____________________________ Date: ____________________________
Target response: ______________________

Check if experimenter behavior occurs for each trial	Behavior
1 2 3 4 5 6 7 8 9 10	
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	1/3 of a nonverbal stimulus (e.g., picture of water) representative of response topography is present
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	10 min deprivation (no access to stimulus) of response topography stimulus has occurred
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Experimenter presents a vocal verbal stimulus (e.g., water)
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	If the participant repeats the vocal verbal stimulus (e.g., water) in 3 s, the experimenter presents a generalized conditioned reinforcer (e.g., that's right, you said water) and moves to the next trial
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	If the participant makes no response in 3 s, emits a partial response, or emits an incorrect response, the experimenter terminates the trial and moves to the next trial

APPENDIX II

TREATMENT INTEGRITY FOR FADING TACT AND MAND TO ECHOIC

CONTROL STEP 4

Treatment Integrity Checklist:
Fading Tact and Mand to Echoic Control (Step 4)

Participant: ____________________________ Date: ____________________________
Target response: ______________________

Check if experimenter behavior occurs for each trial	Behavior
1 2 3 4 5 6 7 8 9 10	
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	A nonverbal stimulus (e.g., picture of water) representative of response topography is not present
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Participant had access to stimulus prior to session
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Experimenter presents a vocal verbal stimulus (e.g., water)
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	If the participant repeats the vocal verbal stimulus (e.g., water) in 3 s, the experimenter presents a generalized conditioned reinforcer (e.g., that's right, you said water) and moves to the next trial
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	If the participant makes no response in 3 s, emits a partial response, or emits an incorrect response, the experimenter terminates the trial and moves to the next trial

APPENDIX JJ

TREATMENT INTEGRITY FOR PROBE TRIALS

Treatment Integrity Checklist: Probe Trials

Participant: ___________________________ Date: ___________ Target response: __________________

Check if experimenter behavior occurs	Behavior for Echoic Probes
1 2 3 4 5	
☐ ☐ ☐ ☐ ☐	A nonverbal stimulus (e.g., picture of water) representative of response topography is not present
☐ ☐ ☐ ☐ ☐	Participant had access to stimulus prior to session
☐ ☐ ☐ ☐ ☐	Experimenter presents a vocal verbal stimulus (e.g., water)
☐ ☐ ☐ ☐ ☐	If the participant repeats the vocal verbal stimulus (e.g., water) in 3 s, the experimenter presents a generalized conditioned reinforcer (e.g., that's right, you said water) and moves to the next trial
☐ ☐ ☐ ☐ ☐	If the participant makes no response in 3 s, emits a partial response, or emits an incorrect response, the experimenter terminates the trial and moves to the next trial
	Behavior for Tact Probes
1 2 3 4 5	
☐ ☐ ☐ ☐ ☐	A nonverbal stimulus (e.g., picture of water) representative of response topography is present
☐ ☐ ☐ ☐ ☐	Participant had access to stimulus prior to session
☐ ☐ ☐ ☐ ☐	Experimenter does not presents a vocal verbal stimulus
☐ ☐ ☐ ☐ ☐	If the participant repeats the vocal verbal stimulus (e.g., water) in 3 s, the experimenter presents a generalized conditioned reinforcer (e.g., that's right, you said water) and moves to the next trial
☐ ☐ ☐ ☐ ☐	If the participant makes no response in 3 s, emits a partial response, or emits an incorrect response, the experimenter terminates the trial and moves to the next trial
	Behavior for Mand Probes
1 2 3 4 5	
☐ ☐ ☐ ☐ ☐	A nonverbal stimulus (e.g., picture of water) representative of response topography is presented and removed
☐ ☐ ☐ ☐ ☐	30 min state of deprivation (no access to stimulus) of response topography stimulus has occurred
☐ ☐ ☐ ☐ ☐	Experimenter does not presents a vocal verbal stimulus
☐ ☐ ☐ ☐ ☐	If the participant repeats the vocal verbal stimulus (e.g., water) in 3 s, the experimenter presents reinforcement specific to the response form and moves to the next trial
☐ ☐ ☐ ☐ ☐	If the participant makes no response, in 3 s emits a partial response, or emits an incorrect response, the experimenter terminates the trial and moves to the next trial

APPENDIX KK

SOCIAL VALIDITY QUESTIONNAIRE

Social Validity Questionnaire for Study Entitled:

A Comparison of Transfer of Stimulus Control via Superimposition and Multiple Control in the Acquisition of Verbal Behavior for Young Children

1. Does your student/child repeat what you say more frequently after participation in this study? If so, what words is s/he repeating?

2. Does your student/child make requests more often after participation in this study? If so, what is s/he asking for?

3. Does your student/child label more items after participation in this study? If so, what is s/he labeling?

4. Do you feel as though your student/child has learned more language after participating in this study?

5. Do you think that the verbal repertoire your student/child has acquired is helping them to access new or more reinforcers?

6. Was the time required to complete the study justified in terms of what your student/child has gained from participating?

7. Would you let your student/child participate in a similar study in the future?

8. Any other comments/suggestions?

APPENDIX LL

CONSENT FORM FOR PARTICIPATION IN SOCIAL VALIDITY QUESTIONNAIRE

CONSENT FOR PARTICIPATION IN RESEARCH

I, ____, give consent to participate in research entitled: A Comparison of Transfer of Stimulus Control via Superimposition or by Multiple Control on the Acquisition of Verbal Behavior in Young Children being conducted by Nancy A. Neef, Ph.D., Principal Investigator, and her authorized representatives, Traci M. Cihon, M.A, BCBA and Dr. Helen I. Malone, Ph.D. The intention of this study is in fulfillment of course requirements of a Doctoral degree program at The Ohio State University.

I have been informed that experimenters may run teaching sessions in my classroom that focus on helping my students learn to communicate. I will be asked several questions at the conclusion of the study that assess how I felt about the procedures used and their effectiveness. Possible benefits of the study have been described, as have alternative procedures, if such procedures are applicable and available. I acknowledge that I have had the opportunity to obtain additional information regarding the study and that any questions I have raised have been answered to my full satisfaction. Furthermore, I understand that I am free to withdraw consent at any time and to discontinue participation in the study without myself or my child.

Finally, I acknowledge that I have read and fully understand the consent form. I sign it freely and voluntarily. A copy has been given to me. If any further questions arise I may contact the researcher at (314) 583-5495 to gain additional information. If I have questions about my rights as a research participant, I can call the Office of Research Risks Protection at (614) 688-4792.

____ ____________________________
(Person authorized to consent for participant) (Date)

____ ____________________________
(Principle Investigator or representative) (Date)

____
(Witness)