GENERALIZED INSTRUCTION FOLLOWING WITH TEXTUAL PROMPTS

By

CARA LUCIA PHILLIPS

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This manuscript is dedicated to my family, my little canine best friend, and to Jason.

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TABLE OF CONTENTS

LIST OF FIGURES

Abstract of Dissertation Presented to the Graduate School
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Cara L. Phillips

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The benefits of permanent prompts in enhancing maintenance and generalization are likely dependent on their degree of stimulus control and the extent to which their use is generalized. Previous research on pictorial prompts has demonstrated both control by and efficacy of the prompts. The present studies allowed for an explicit examination of stimulus control by textual prompts. Six school-aged children with intellectual disabilities were taught to complete four, five-step instructional sets using textual prompts such that the prompts would control responding. All six participants showed some generalization to the final set after training with three sets. None mastered any set without exposure to training, however. The results suggest that for some students training was required to establish control by the textual prompts or the ordinal sequence of the prompts, for others it addressed a reading deficit, and for some it addressed the lack of a motivating operation during baseline. These results also suggest that training a single task sequence may not be sufficient for acquisition of generalized textual instruction following. However, establishing stimulus control by the textual prompts may facilitate acquisition of a generalized textual-instruction-following repertoire.

CHAPTER 1
INTRODUCTION

Task analysis is a common method to breakdown complex tasks to teach individuals with Intellectual Disabilities (ID). Task analysis involves creating a chain of discrete steps in which each response serves as the discriminative stimulus for the next step and the conditioned reinforcer for the previous (Cooper, Heron, & Heward, 1987). Taken together, the chain comprises the whole of the complex behavior. Task analyses (TA) have been demonstrated to be effective in teaching a wide array of complex behaviors, including activities of daily living, vocational tasks, and leisure skills (e.g., Horner & Keilitz, 1975; Horner & Ingman, 1979; Page, Iwata, & Neef, 1976). Furthermore, a number of prompt forms used to establish the chains have been investigated, including pictorial (e.g., Pierce & Schreibman, 1994; Wacker & Berg, 1983; Wacker, Berg, Berrie, & Swatta, 1985), audio (e.g., Alberto, Sharpton, Briggs, & Stright, 1986; Lancioni, Klaase, & Goosens, 1995), video (e.g., Murzynski & Bourret, 2007; Rehfeldt, Dahman, Young, Cherry, & Davis, 2003; Shipley-Benamou, Lutzker, & Taubman, 2002), and textual (e.g., Rosenbaum & Breiling, 1976; O'Reilly & Cuvo, 1992; Taylor, Anderson, & Mudford, 2010).

A number of studies have reported dependence on instructor- delivered prompts with individuals with ID (e.g., Billingsly & Romer, 1983; MacDuff, Krantz, & McClanahan, 1993; Steed & Lutzker, 1997). Although prompt fading and prompt delay methods have been demonstrated to help reduce prompt dependency (e.g., Halle & Holt, 1981), they are not universally successful (e.g., Berkowitz, 1990). Furthermore, prompt dependence may not always be problematic. Even within the typically developing population, the use of some kind of (usually self-delivered) visual prompt is not unusual. Recipes, shopping lists, to-do lists, daily planners, and medication reminder alarms provide some examples of this type of prompt.

Researchers have examined the use of similar prompt forms with individuals with ID. Wacker and Berg (1983) taught five adolescents with ID to complete complex vocational tasks through the use of pictorial prompt albums, which were considered appropriate to use as a resource in the absence of instructor supervision. That is, it was not deemed necessary to fade these "permanent prompts."

Wacker and Berg (1983) suggested three benefits to the use of pictorial prompts when used as "permanent prompts," and these benefits can be extended to other similar, instructor-independent prompt forms: (a) support independence when used by individuals with ID for self-management; (b) enhance maintenance when used as permanent prompts, and (c) facilitate generalization to novel environments or to novel tasks. This first benefit is achieved when instructor-independent prompts function as a self-management tool that allows the individual to complete tasks in the absence of staff or caregiver supervision despite dependence on prompts. The second is achieved when the prompt system is transferred to the novel environment. The third is the most complicated; requiring the development of a generalized repertoire of following cues, or instructions, provided in a particular mode. All three of these potential benefits likely depend on the degree of stimulus control the permanent prompt exerts over the target behavior. That is, the individual must learn to respond to the cue, rather than simply to perform a task.

Although in some cases the subjects rapidly acquired the skills taught through the use of instructor-independent prompts (e.g., Feldman, Ducharme, & Case, 1999; Frank, Wacker, Berg, & McMahon, 1985; Martin, et al, 1983; Wacker & Berg, 1983), in other cases extensive training was required (e.g., Connis, 1979; Pierce & Schreibman, 1994; Wacker, et al., 1985). Few studies directly compare the efficacy of these prompt forms with more traditional prompting methods such as least-to-most prompt hierarchies (e.g., verbal gestural, than physical prompts; see

Murzynski & Bourret, 2007, for an exception to the former), however it seems possible that in some cases traditional methods might be more efficient. The benefit of the use of instructor-independent prompts, then, may depend largely on how generalized their use becomes, which in turn depends on the level of stimulus control exerted by those prompts.

The research involving permanent prompts has been interested primarily in demonstrating the efficacy of a particular prompt form in teaching tasks, rather than in the establishment of a generalized instruction following repertoire involving that prompt form. Therefore, the demonstration of stimulus control by the prompt was not a priority; however, several studies did implicitly test for control by the prompt. Studies involving three types of instructor-independent prompt forms will be discussed below (pictorial, video, and textual). The present study is designed to explicitly examine stimulus control by the prompt, while evaluating a procedure designed to enhance that control in order to establish a generalized instruction following repertoire regarding one prompt form (textual). This is done by enhancing the stimulus control exerted by the permanent prompt, rather than attempting to fade the prompt or transfer control to the naturally occurring discriminative stimuli embedded within the response chain.

A number of studies involving pictorial prompts allow for some evaluation of stimulus control by these prompts. The pictorial prompt literature can be divided into two main areas, studies involving TA of complex responses (e.g., Martin, et al., 1983; Steed & Lutzker, 1997; Wacker & Berg, 1983; Wacker, et al., 1985) and picture scheduling of vocational and leisure activities (e.g., MacDuff, et al.., 1993; Sowers, et al., 1985). In the former body of literature, the component behaviors in the chain were novel, but the sequence of behavior was consistent within each chain. In the latter body of literature, the component skills were mastered prior to the study, but the sequence of behavior was novel. Therefore, in the literature involving pictorial TA,

stimulus control was assessed either via removal of the picture (prompt) book or via generalization probes for novel tasks. In the literature involving pictorial schedules, stimulus control was assessed via re-sequencing the mastered activities into a novel sequence.

The results of these assessments have been mixed. Some suggest control by the pictorial prompts as indicated by decrements in performance when the book was removed (e.g., Pierce and Schreibman, 1994; Wacker, Berg, Berrie and Swatta, 1985;), generalization to novel tasks when novel pictorial TAs were provided (e.g., Wacker & Berg, 1993), or generalization to novel activitysequences with pictorial activity schedules(e.g., Sowers, et al.., 1985). The results of other studies call stimulus control by the pictorial prompts into question when responding was maintained in the absence of the pictorial prompts (e.g., Martin et al.., 1983; Steed & Lutzker, 1997). In these cases, it is possible that the prompts initially controlled responding, but control was transferred to the naturally occurring discriminative stimuli over the course of treatment. This finding can be interpreted in two ways, depending on the goal of the research. If the goal is to establish a task-analyzed behavior chain (an important goal), then this finding is encouraging; however, if the goal is to establish a generalized repertoire of following a particular instructional mode, then it may be troubling. The maintenance of responding in the absence of the pictorial prompts does not preclude the possibility that the individual has acquired a generalized repertoire, but it leaves the question open.

Phillips and Vollmer (2012), directly investigated the question of stimulus control by the pictorial prompt by combining features of the previous pictorial prompt literature on TA and schedules into one experimental procedure and by testing both novel sequences within task and on novel tasks within a multiple probe experimental design. Three children under the age of 5 with varying disabilities were taught to complete four, five-step instructional sets using pictorial

prompts such that the prompts would control responding using. Following an initial baseline in which the pictures were provided in a consistent sequence (BL:S1) without prompts or feedback, the first set was taught using the same consistent sequence of the 5-component steps, while the remaining three sets remained in baseline. Once the first set was mastered, the sequence of the component steps was re-arranged for a return to baseline. Stimulus control by the pictorial prompts was inferred if the participant completed the steps in the novel sequence; the absence of stimulus control was inferred if he continued to follow the initial sequence. In the latter case, stimulus control by the pictures was then enhanced through a condition in which the steps were presented one at a time in any sequence. Two of three subjects required this final training for at least one of the four sets. All three subjects showed generalization to the final set after training with three sets. These results suggest that training a single task sequence may not be sufficient for acquisition of generalized pictorial instruction following, but that establishing stimulus control by the pictorial prompts rather than teaching behavioral chains may facilitate acquisition of the generalized repertoire. In the Phillips and Vollmer study, this was accomplished with single instruction training, during which the component responses to each behavior sequence were presented one at a time, in any sequence.

According to a review by Lancioni and O'Reilly (2001), pictorial prompts are the most common non-instructor delivered prompt form when teaching individuals with ID to complete vocational tasks. However, there are some notable disadvantages to their use. They can be time consuming and expensive to create, and may not be the most socially acceptable form of permanent prompt available. The results of Phillips and Vollmer (2012) suggest another disadvantage to their use. For two of three subjects, the inability to determine the action in a

picture (e.g., did the picture depict opening or closing a door?) impeded generalization with one or more sets. Thus, alternative prompt forms should be considered.

Video modeling and video prompting provide alternatives to pictorial prompts. Although the distinction in terms is rather incidental, according to LeGrice and Blampied (1999), video modeling typically involves showing a video of an individual completing a task in its entirety, then giving the participant the opportunity to complete the task as a whole; whereas video prompting involves showing shorter video clips of a single step being completed, then giving the participant the opportunity to perform that step before showing a clip of the next step in the chain (e.g., LeGrice & Blampied, 1999). Video modeling and prompting have been used to teach a number of varied skills, including: verbal behavior (e.g., Charlop & Milstein, 1989), play sequences (e.g., D'Ateno, Mangiapanello, & Taylor, 2003), grocery shopping (e.g., Mechling, Gast, & Langone, 2002), meal preparation skills (e.g., Rehfledt, et al.., 2003), and activities of daily living (e.g., Shipley-Benamou, et al., 2002). Video prompts have several potential advantages over pictorial prompts. First, they can be more specific with respect to the action required. Second, they may take advantage of the history of reinforcement many individuals have with watching videos. Third, there is some evidence that with the current state of technology videos may be easier to create than pictorial prompts, because they do not require printing and laminating (e.g., Alberto, Cihak, & Gama, 2005; Mechling, et al.., 2002).

Unlike with the pictorial literature, there have been several comparison studies of video modeling. Charlop-Christy, Le, and Freeman (2000) compared video modeling and in-vivo modeling for teaching five children with Autism Spectrum Disorder (ASD) to complete activities related to their daily curriculum. The activities differed across subjects and included verbal behavior, play skills, and activities of daily living. Four of the five subjects acquired the tasks

more quickly in the video modeling condition. Furthermore, video modeling was more effective in promoting generalization across staff, settings, and stimuli. Although these findings offer strong support for video modeling over live modeling, this study did not compare either form of modeling with more traditional prompt forms (such as least-to-most prompts).

Murzynski and Bourret (2007) did compare video modeling to perhaps the most common prompt form, least-to-most prompts. They taught two children with ASD to complete two sets of matched tasks (two each of laundry and food preparation tasks), one in each matched set with video modeling plus least-to-most prompts and one with least-to-most prompts alone. The results strongly favored video plus least-to-most prompts; nearly twice as many trials were required for the tasks taught with least-to-most prompts alone.

Canella-Malone, Sigafoos, O'Reilly, de la Cruz, Edrisinha, and Lancioni (2006) compared video prompting and video modeling for teaching six adults with ID to complete two daily living tasks. Results showed that video prompting was far more effective, so much so that they taught all the modeled tasks via prompting in the final phase of the study. However, their results should be interpreted with caution. A multiple opportunity format was used for the video prompting condition (in which the therapist completed any incorrect or incomplete steps so that the entire chain could be presented), but not in baseline or in the video modeling condition (incorrect step immediately terminated the session). Therefore, it is possible that in baseline and the modeling condition, the participant may have been able to complete later steps in the chain had the opportunity been presented.

In another comparison involving video prompting, Alberto, Cihak, and Gana (2005) compared the use of video prompting and static pictures to teach 8 adolescents with ID to use an ATM and to purchase items from a grocery store. For 7 of 8 subjects, both methods were about

equally effective, for the remaining subject pictures were more effective than video. Again this result should be interpreted with some caution. Their conclusions were based on performance in the community setting following simulation training in the classroom. Although they considered these community sessions to be assessments, they used a least-to-most prompt hierarchy during the community-based-instruction (CBI) sessions. Therefore, it is possible that the resulting performance was a function of the CBI training rather than the simulation (although the results of Murzynski & Bourret, 2007, suggest this may not be the case).

Although there is an extensive body of literature demonstrating the efficacy of video modeling, the technique is not often used as a permanent, instructor-independent prompt in the same way that pictorial prompts are used. The reasons for this are unclear. Perhaps videos are more distracting to other people in the natural environment than are picture albums. Alberto et al.. (2005) suggested that it might be easier for individuals with ID to attend to the relevant features of the prompting stimulus in a static picture than a video. It may also be that although pictorial prompt albums are more time-consuming to create, they might still be more readily accessible than videos. Although current technology seems well equipped to create and provide portable video prompts via laptops, netbooks, tablets, smart phones – all of these still require access to technology that may be cost prohibitive for many individuals.

Textual prompts provide another mode of delivery of instructor-independent, permanent prompts. There are a number of potential advantages to the use of textual prompts. McAdam and Cuvo (1994) suggested that textual prompts take advantage of existing repertoires in individuals with more mild disabilities, while appearing more age-appropriate and socially acceptable than pictorial or audio cues. Textual instructions are far easier to create and modify than are pictorial or video cues. Like video models, textual prompts have the benefit of specificity, in that the

action can be completely described. Finally, Browder and Minarovic (2000) reported that some individuals with ID object to the use of any form of adaptive technology, such as pictorial prompt albums, that distinguishes them from typically developing peers. A list of textual instructions may be the most unobtrusive of these three prompt forms. Similar to the pictorial prompting literature, the research on textual prompts can be divided into two general areas: studies involving TA of complex responses and textual scheduling of vocational and leisure activities.

Several studies have investigated the use of textual prompts to establish behavior. Rosenbaum and Breiling (1976) taught a 12-year-old girl with ID to follow simple written instructions delivered on note-cards and by overhead projector and tested for generalization to a new series of instructions. However, although they reported mastery of 47 separate instructions and generalization to an additional 17, all but two of the trained instructions involved “point to” a body part or picture. Therefore, the participant showed generalization to the object of the preposition rather than to a completely novel instruction.

Browder, Hines, McCarthy, and Fees (1984) examined the use of textual prompts to teach 8 adults with moderate ID to complete daily living skills. The subjects were divided into three groups, each of which learned one task and were tested for generalization to a matched task with some common steps (e.g., those in the food group were taught to use a TA to make an orange smoothie and were tested with a novel textual TA for making a strawberry smoothie). All textual TAs were presented as sight word lists. Browder, et al.., discussed the importance of the stimulus control of the textual prompt but did not test for this control by removal of the book. However, they did report that generalization to the matched task only occurred for the overlapping components This suggests that the sight word prompts that were trained did control

responding, but that more training or more advanced reading repertoires would have been required to establish a generalized textual instruction following repertoire. It should be noted that the extent of this effect cannot be determined from the data provided. Only group averages were reported for all measures.

Other studies have focused on the use of textual prompts to teach individuals with mild disabilities to complete cleaning tasks (Cuvo, Davis, O'Reilly, Mooney, & Crowley, 1992; McAdam & Cuvo, 1994). In both cases, a least-to-most textual TA prompt hierarchy was evaluated (generic, describing only the outcomes of steps; specific, describing both outcomes and behavior required to achieve them; and individualized TA, with the generic steps supplemented with the specific only for steps for which errors were made). Textual prompts as provided in the specific TA were shown to be very effective, establishing criterion performance (100% correct for three consecutive sessions) in fewer than 10 training sessions across subjects. Both groups of researchers also assessed generalization to novel tasks, but again the tasks were very similar (all involved cleaning appliances). In addition, Cuvo et al.. (1992) and McAdam and Cuvo (1994) assessed stimulus control through removal of the textual prompts. They were interested in showing transfer of control from the textual prompt to the naturally occurring SD inherent in the response chain. This was achieved without any formal fading (that is, performance was at 100% accuracy in the first session in which the textual TA was removed and maintained during follow-up) for four out of five subjects and four of four subjects in the Cuvo et al.. and McAdam and Cuvo experiments, respectively.

Very few studies have examined the use of textual prompts as schedules. Browder and Minarovic (2000) examined the use of sight-word checklists as a self-management tool for three adults with moderate ID. None of the subjects could read prior to their participation. The

researchers taught the subjects to read words presented individually on flash cards, then associated each word with its task, and finally taught the subjects to use the checklists to initiate and make a transition between five job tasks specific to their employment situation. All three subjects acquired all five sight words rapidly and successfully initiated all five job tasks during the single follow-up probe in the natural environment. Although there were significant increases in rates of initiation from the baseline to the follow-up probe, it is not clear from this study if this increase was due to the prompts provided or the result of a practice effect from the repeated exposure to the tasks.

In a very similar study, Minarovic and Bambara (2007) more directly assessed stimulus control by textual prompts used by three adults with moderate ID to initiate job tasks. All three subjects could complete each of the six tasks included in their schedule checklists but required prompts to initiate or make transitions between the tasks. Again, none of the subjects could read prior to their inclusion in the study. The subjects were first taught to read a single word representative of each task in isolation, then taught the relation between the word and the task in isolation. Next, the subjects were taught to use a checklist to complete all six tasks, always presented in a consistent sequence. Once the subjects met mastery criteria with the consistent lists, the experimenters probed task initiation with novel, carried checklists in which the same six words were presented, but in a different sequence. The results showed that although the subjects continued to read all the words correctly, they were not able to use the novel, varied checklists to manage their work schedules. All three subjects required training with the varied checklists in order to do so.

The results of studies in both areas of the textual prompt literature thus somewhat call into question the amount of control exerted by the textual prompts. For example, the results of

the study by Minarovic and Bambara (2007) suggest that the initial sight word and consistent checklist training were insufficient to establish stimulus control by the textual prompts. It appears that the subjects learned a (complex) chain of tasks but did not learn to follow novel textual prompts. The results of Browder et al.., (1984) suggest that exposure to the sight word training resulted in stimulus control by those specific words, but did not result in a generalized repertoire with sight word instructions. However, all subjects in both the Cuvo et al.. and McAdam and Cuvo studies showed dramatic improvements in performance when the textual prompts were introduced, suggesting that at least initially these prompts controlled responding and that control transferred to the natural SD inherent in the response chain over the course of training. It is also possible, as suggested by Taylor, Anderson, and Mudford (2010), that the textual prompts might function as scripts, or self-delivered vocal prompts, which with repeated exposure became covert. Thus, the individuals might continue to prompt themselves in the absence of the overt prompts.

If a transfer to covert prompting is the case, then the potential for irreversibility of the behavior would make it impossible to assess stimulus control through simply removing the textual instruction. In addition, it should be noted that in all the aforementioned studies, the textual stimuli were not present in the baseline; thus, it is possible that these subjects already had established generalized textual instruction following repertoires. In fact, the rapidity and size of the initial effects in the Cuvo et al. (1992) and McAdam and Cuvo (1994) studies suggest this may have been the case. Therefore, it remains to be seen how to efficiently establish a generalized instruction following repertoire. The present study is designed to address the demonstration of both stimulus control by textual prompts and generalized responding to the same. The purpose of this study is to systematically replicate and extend Phillips and Vollmer

(2012) by using textual rather than pictorial stimuli. This study will include manipulation of the task sequence in order to: (a) allow for a more explicit demonstration of stimulus control by the textual prompts, (b) encourage the development of stimulus control by the prompts, and to (c) allow for the acquisition of a generalized skill set of following textual instructions as indicated by correct performance with respect to novel textual prompts. Thus, the purpose of this study is not to establish one or more behavior chains, but rather to establish a generalized repertoire of following textual instructions. Four very simple, five-step behavior sequences were developed such that the individual steps could be presented in any order. In addition, most of the previous research on textual prompts has involved sight words, allowing for individuals with less advanced or even non-existent reading repertoires to participate. However, it is possible that the use of single word prompts sacrifices the benefit of specificity of textual prompts. Therefore, short sentences (3- 6 words) were used to describe each step.

CHAPTER 2
GENERAL METHOD

Subjects, Setting, and Materials

School age children with autism spectrum disorders (ASD) or other intellectual disabilities (ID) who exhibited existing reading repertoires participated in this study. Three children participated in Study 1 (Nate, Ally, and Carl) and three children participated in Study 2 (Delbert, Hugo, and Wesley). All six subjects could communicate in full sentences and could follow multi-step vocal instructions. In order to be considered for inclusion in the study, the subjects had to: (a) be able to read three to four word sentences, (b) follow vocal instructions, and (c) demonstrate single word comprehension as indicated by word to picture matching, but (d) showed no indication of following written instructions during the baseline condition that will be described below. The first six children who met these criteria were included in the study.

Sessions were conducted in two public schools in a large common area adjacent to the subjects' classrooms, an empty classroom, or the children's classroom work area. Sessions were conducted at a table or desk. The subject sat oriented towards the wall, with the therapist seated to his or her left. Due to the nature of the settings, other children were sometimes present during sessions, but were not seated at the table with the subject and researchers.

The materials consisted of four toy sets with multiple component pieces that could be used to perform five distinct response sequences. These were selected from a bank of activities that included, amongst others: toy barn (barn, horse, hay, sheep, cow, tractor with farmer, airplane with farmer), plastic food task (plate, cutting board, knife, strawberry, onion, orange, peas), and dollhouse (dollhouse containing furniture, doll, dog, cat, truck). For each play set, five simple responses were developed. Each step was designed to be independent from the other steps, such that the order of the steps could be changed. Textual instructions corresponding to each step in

each sequence were individually laminated and a small piece of hook and loop tape was affixed to each. These instructions were presented vertically on a laminated board, measuring approximately 6 x 6 inches and numbered one through five on the left margin.

Response Definitions, Measurement, and Interobserver Agreement

Dependent Variables

The primary dependent variable was percentage correct or the percentage of steps completed correctly. This was calculated by dividing the number of steps completed independently (in the absence of any instructor delivered prompt) by five (the total number of steps in each task) and multiplying by 100. Correct performance was defined as completing a step in the correct place in the sequence and as described by the textual prompt. The response, however, would not have to be completed in response to the textual prompt to be considered correct, nor would any previous responses have to be correct. Thus each step was functionally independent from the other steps in the sequence, although not independent of the overall sequence of responses, and could be correct or incorrect regardless of performance on the other steps as long as it was performed in the appropriate ordinal space. That is, a subject could receive credit for the third step if he performed it correctly, regardless of what his first two responses were, but only if two responses of some kind preceeded that third response.

A step could be scored as incorrect for three reasons: (a) the child completed an action with the object indicated, but the action was not the one described; (b) the child performed an action with an object that was a part of the sequence, but did so out of sequence; (c) the child performed some response that was not consistent with any of the steps of the sequence. During training, the level of prompt required to ensure a correct response was recorded.

In addition, for Study 2 only, orientation toward the board was recorded as a secondary dependent variable. Orientation was defined as turning towards the instruction board, gazing at

or following text with the hand, or reading aloud. Orientation served as a secondary measure of stimulus control by the textual prompts.

Independent Variables

The primary independent variable was textual prompt sequence. During the initial sequence baseline (BL:S1), and training, each task was presented in a single, consistent sequence in which all five steps were presented simultaneously and always in the same order. The sequence was then changed during the novel sequence baseline (BL: S2) following training, but all five steps were still presented on the board at one time (simultaneously). If the participant did not meet mastery criterion with the novel sequence, then varied instruction training was implemented, in which the textual prompts were presented one at a time as the first instruction (next to the numeral 1).

Least-to-most prompting was a secondary independent variable. Tasks were trained using a six-step, least-to-most prompt hierarchy. The subject was allowed 5-10 seconds to respond between prompt levels. The prompting levels were: (a) delay – no prompt given for the 5-10 seconds following the presentation of the initial discriminative stimulus to engage with the items ("Show me how you play with _____") or following completion of a step; (b) vocal prompt (general) –therapist told subject to "read number ___"; (c) vocal prompt (specific) –therapist told subject to perform the desired action (e.g., "Put the plate on the circle"); (d) gestural –therapist pointed to the item or items required to complete the desired response while repeating the vocal (specific) prompt; (e) model – therapist performed the action while repeating the vocal (specific) prompt; (f) physical – therapist hand-over-hand guided subject to perform the desired response.

Measurement Procedures

Data were collected using paper and pencil on a data sheet in which the order of the steps could be recorded at the start of each session. The data sheet had columns for orientation to the

instruction board, independent step completion, each of the prompt levels described above, and a column to record any behavior not included in the sequence or out of sequence. Data collectors recorded “Y” or “N” in each column for correct (Y) or incorrect/no response (N), respectively, for each step in the sequence. In addition, during baseline and novel sequence probes the observers recorded exactly which form of behavior the subject engaged in when he or she was not performing the task steps or was performing them out of sequence.

Interobserver Agreement

Two observers independently recorded data on percentage correct and prompt level for Carl, Nate, and Ally in Study 1 on 33%, 43,% and 62% of sessions respectively and for Delbert, Wesley, and Hugo in Study 2 on 93% 34%, and 51% of sessions respectively. An agreement was scored for each step in each session if both observers recorded that step as independent or scored the same prompt level. For Study 2, the same procedure was also used to calculate agreement for percentage orientation. Interobserver agreement scores were calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100%. Mean agreement scores were 92% (range 0%-100%), 96% (range 40-100%), and 98% (range 80–100%) for Carl, Nate, and Ally, respectively. Mean agreement scores for percentage correct and orientation, in that order, were, 97% (range 80-100%) and 97% (range 60-100%), 93% (range 20-100%) and 97% (range 80-100%), 98% (range 20 -100%) and 98% (range 60 – 100) for Delbert, Wesley, and Hugo, respectively.

Experimental Design and Conditions

The effects of training and manipulation of textual prompt sequence within each toy play set and generalization across toy play sets were examined via a multiple-probe experimental design. Probes of each set in a single sequence were conducted prior to implementing training

with the first sequence of the first set. When the data were stable based on visual analysis, the first set was trained while the remaining sets remained in baseline. Following training with the initial sequence with the first set, a second sequence was assessed with the first set while probes with the other sets continued periodically using the consistent first sequence. If performance did not meet mastery criteria of three consecutive sessions at 100% correct during the second sequence baseline for the first set, then only this set entered the varied sequence training condition. Following this training, the second sequence was again assessed with this set. If the initial baseline for the second set was stable, training then began on set 2 if required. This pattern continued until generalization occurred or all sets were trained.

Assessment

Prior to beginning the treatment evaluation, the subjects were assessed to be certain that they had particular pre-requisite skills. First, they were tested for receptive identification of all of the items in each of the toy play sets. The items were placed in an array of 5-7 items at a time, and the subject was asked to "Give me _____." This continued until all items had been tested. Next, they completed a matching to sample procedure (word to object) in order to determine if they could demonstrate the relation between written words and the corresponding objects. Approximately 20 – 30 items not used in the toy play sets were tested in order to provide evidence of a generalized word to object relation. Next, the subjects completed an assessment of vocal instruction following in which they were asked to complete simple, single-step actions with a variety of objects. None of these actions were those depicted in the target tasks. Several of these instructions included four prepositional relations (on, under, in, and by). Any subject who could not demonstrate these prepositions receptively was taught to do so or was dropped from the study. Again, approximately 20 – 30 separate instructions were evaluated. Finally, their receptive sentence reading was assessed. The experimenter presented arrays of 4 – 8 printed

sentences containing 3 – 8 words. The experimenter than provided a vocal SD to “find the sentence that says _____.” The subject could point to or pick up the corresponding sentence. . Subjects completed two sessions of each of the above assessments and were required to demonstrate proficiency in all of the above to be included in the study (defined as scoring above 90% on both sessions in each of the assessments). Throughout all phases of the study, a 2 -5 min break with access to preferred toys, small bites of an edible item, or both, were provided between sessions, independent of performance.

Baseline Probes

During the initial baseline (BL: S1), the materials for one of the toy play sets were placed on the table in front of the subject (one set per session, set order determined at random). The subject was provided with the instruction board containing the steps for that toy play set and a specific verbal instruction (discriminative stimulus) to engage with the item (e.g., “show me how you set the table” or “show me how you play with the barn/ veggies/dollhouse”). No instructor-delivered prompts or specific feedback were provided. Non-specific praise (e.g., “I like how you are working.”), small bites of preferred edibles, or both, were provided for engaging with the materials, noncontingent on correct performance after approximately 30 s of attempts and at the end of the session. For each set, the steps were in the same sequence for all initial baseline and initial training sessions.

Training

The sessions were set up exactly as in baseline. The items for the targeted toy play sets were placed on the table. The subject was given the instruction board with the corresponding textual prompts for that set and the specific vocal discriminative stimulus to engage with the materials. The therapist then waited 5-10 s for the subject to orient to the instruction board. If he or she did not respond or began to engage in an incorrect response, the therapist began the least-

to-most prompt sequence (described under the independent variables heading, above) for the first step, increasing the prompt level every 5-10 s until the step was completed. The therapist then waited 5-10 s to allow the subject to perform the action described by the next textual prompt. This process was repeated for each step in the sequence. For each step that the subject completed independently (correctly and without requiring instructor-delivered prompts), the therapist provided specific praise (i.e. "Look at that! You did just what was in the picture. You put the cow in the barn.") and, for one subject (Wesley), a small bite of a preferred edible. Training continued until the subject met mastery criteria, defined as completing all five steps without any instructor delivered prompts for two consecutive sessions (100% correct).

Novel Order Probes (BL:S2)

When mastery criteria were met, the textual instructions were re-sequenced for the mastered set. The second textual prompt sequence was selected by continuously shuffling the sentence strips and selecting one at a time, such that no sentence remained in the same ordinal position as in the initial sequence. The sessions were conducted exactly as in the initial baseline. If mastery criteria were met in this phase, then the set was considered mastered and the next set was trained, if needed, until responses toward all four toy play sets met mastery criterion. If mastery criteria were not met but responding was stable, varied sequence training began. Figure 2-1 provides examples of intial and second sequences for three toy play sets.

Varied Sequence Training

This condition was designed to enhance the salience of the textual prompts and to establish stimulus control by the sentence strips. All the textual prompts/ sentence strips were removed from the instruction board. The materials and initial vocal prompt to engage with the materials were as in all other conditions. One sentence from the current target set was selected at random and placed next to the numeral 1 on the instruction board. Once the board and initial vocal

prompt were provided, training proceeded just as in the initial training, except that each textual prompt was presented one at a time always next to the numeral 1. Thus, after the subject completed the first response (with or without instructor delivered prompts), the therapist removed the corresponding prompt from the board while in view of the subject and replaced it with another prompt from that set. This pattern continued until all 5 actions were completed. The least-to-most prompt hierarchy was used to ensure compliance. Specific praise, and in some cases edibles, were provided for independent responses. The sequence of the steps varied across sessions. This phase continued until mastery criteria were met, then the subject again returned to the BL:S2 condition.

1. Drive the tractor.
2. Put the cow with the sheep.
3. Put the pig in the barn.
4. Make the horse eat hay.
5. Fly the airplane into the barn.

1. Put the pig in the barn.
2. Fly the airplane into the barn.
3. Make the horse eat hay.
4. Drive the tractor.
5. Put the cow with the sheep.

1. Open the doctor's bag.
2. Give the baby a shot.
3. Take the baby's temperature.
4. Listen to the baby's heart.
5. Look in the baby's ears.

1. Listen to the baby's heart.
2. Open the doctor's bag.
3. Look in the baby's ears.
4. Take the baby's temperature.
5. Give the baby a shot.

1. Put the cup on the red square.
2. Put the plate on the blue circle
3. Put the banana on the plate.
4. Put the knife under the plate.
5. Put the spoon in the cup.

1. Put the spoon in the cup.
2. Put the banana on the plate.
3. Put the plate on the blue circle.
4. Put the knife under the plate.
5. Put the cup on the red square.

Figure 2-1. The three panels on the left depict initial sequences used for BL:S1, test, and training conditions for three toy sets, from top to bottom: barn, doctor, table. The three panels on the right depict second sequences of these same sets used for BL:S2.

CHAPTER 3
STUDY 1

Method

Subjects

Nate, Ally, and Carl participated. All were diagnosed with ASD. Nate and Ally were each 4 years of age at the start of the study. They were both precocious readers, and could read single words and word combinations. Carl was 9 years of age at the start of the study. He could read multiple sentence passages.

Experimental Conditions

The experimental conditions for Study 1 were exactly as described in the general methods above with one exception. Whole sentence reading was not assessed prior to inclusion in the study for two of three subjects (Nate and Ally). Mastery criteria for Study 1 consisted of two consecutive sessions at 100% correct performance (all five steps completed in the proper sequence). Figure 3-1 depicts the order of conditions.

Results

Figure 3-2 depicts the results for Carl. The first panel of Figure 3-2 depicts Carl's responding to set 1 (barn). Carl did not perform any steps in the correct sequence for the initial baseline (BL:S1). However, he did occasionally perform some step correctly with the other sets prior to training set 1. When training was implemented, Carl acquired the initial sequence for set 1 very quickly, reaching mastery in only four training sessions. Furthermore, when the order of the steps was changed for the return to baseline (BL:S2), Carl performed four of the five steps correctly in the first session and mastered set 1 within three sessions. Varied sequence training was not required with this or any other set for Carl.

The second panel of Figure 3-2 depicts Carl's performance with set 2 (food task). Unlike with set 1, Carl did perform some steps correctly during the initial baseline (BL:S1; 4 sessions). After peaking at 60% correct during the second baseline session, Carl's performance dropped to and 0% correct (M = 20%). When training began, Carl mastered set 2 in only three sessions. As with set 1, when the steps were re-ordered with the second sequence for the return to baseline (BL:S2), Carl followed the new sequence. Carl mastered set 2 after only 2 BL:S2 sessions.

The third panel of Figure 3-2 depicts Carl's performance with set 3 (doctor). As with set 2, Carl did perform some steps correctly during some sessions in the initial baseline (BL:S1). Although his performance was somewhat inconsistent, it stabilized at 0% correct after five sessions (M = 8%). Once training was implemented, Carl required six sessions for his responding to reach mastery (M = 53%). As with the first two sets, when the sequence was rearranged for the return to baseline (BL:S2), Carl followed the second sequence. His performance reached mastery in five sessions (M = 88%).

The final panel of Figure 3-2 depicts Carl's performance with set 4 (set table). For the first two sessions of the initial baseline (BL:S1), Carl did not perform any of the steps correctly. His performance then improved to 40% correct and maintained until the final bl:S1 session (at which point it dropped to 20%; M = 26%). When training was implemented, Carl's performance gradually improved until mastery was met after seven sessions (M = 86%). When the steps were re-sequenced for the return to baseline (BL:S2), Carl performed with perfect accuracy. He met mastery criterion in only two sessions.

Figure 3-3 depicts the results for Nate. The first panel depicts Nate's performance with set 1 (set table). He did not perform any steps correctly in baseline for any task prior to training set 1. Once training was implemented with set 1, Nate met mastery criteria in 17 sessions with that

set. When the steps were re-sequenced in the return to baseline (BL:S2) condition, Nate did not adjust his responding to the novel sequence; thus, percent correct dropped to zero. Therefore, varied instruction training began. Nate required 14 sessions to reach mastery criterion with varied instructions. When the second sequence baseline was re-instated (BL:S2), Nate completed four out of five steps correctly for two sessions, then met mastery criteria after two additional sessions.

The second panel depicts Nate's performance with set 2 (dollhouse). Nate did not perform any steps in the correct sequence for any of the eight baseline sessions in which the steps were presented in the initial sequence (BL:S1). Once training began, Nate's performance met mastery criteria after 14 sessions. Nate's performance met mastery criteria within two sessions for the return to baseline with the novel second sequence (BL:S2) and was maintained at 100% for a follow-up probe with a third sequence. Single instruction training was not required for this or the remaining sets.

The results for the third set (toy farm) were very similar. These results are depicted in the third panel of Figure 3-3. Nate did not perform any steps correctly in the initial sequence baseline (BL:S1, five sessions). When training was implemented with set 3, Nate met mastery criteria after only five sessions. When the steps were re-sequenced for the return to baseline (BL:S2), Nate met mastery criteria after two sessions.

The results for set 4 (food task) are depicted in the final panel of Figure 3-3. Nate did not perform any steps in the correct sequence during the initial baseline for the first four sessions. Following the implementation of the varied instruction training with set 1, however, Nate's performance in the initial baseline increased to vary between 20 and 40% correct for the remaining six sessions in this condition (M = 12%). Nate's performance reached mastery after 7

training sessions and 3 sessions of the return to baseline with the novel second sequence (BL:S2).

Figure 3-4 depicts the results for Ally. Her results were similar to those of Nate. Like Nate, Ally did not perform any steps correctly with any sets prior to training set 1. The first panel of Figure 3-4 depicts Ally's responding to set 1 (food task). Ally did not perform any steps in the correct sequence for the initial baseline (BL:S1). When training was implemented, Ally quickly acquired the initial sequence for set 1, reaching mastery in only six training sessions. However, when the order of the steps was changed for the return to baseline (BL:S2), Ally continued to perform the steps in the initial sequence. She did not perform any steps in the correct sequence in this condition, requiring exposure to the varied training condition. Ally's performance reached mastery after 8 sessions of varied instruction training with set 1. However, due to experimenter error, training was continued. Ally's responding decreased to 80% correct for the next four sessions, before again reaching mastery. Following this training, Ally met the mastery criteria in the return to the second sequence baseline (BL:S2) after four sessions.

The second panel of Figure 3-4 depicts Ally's performance with set 2 (set table). Again, Ally did not perform any steps correctly in the initial baseline (5 sessions). When training began, Ally mastered the first task in only four sessions. As with set 1, when the steps were re-ordered with the second sequence for the return to baseline (BL:S2), Ally continued to perform the steps in the initial sequence. Set 2 was then trained with the varied instruction training. Ally required only five sessions of varied instruction training to reach mastery with set 2. The first two sessions of the return to baseline with the second sequence (BL:S2) were at 0% correct, after which Ally performed at 100% for the following two sessions.

The third panel of Figure 3-4 depicts Ally's results for set 3 (toy farm). Ally did not perform any steps correctly during the initial baseline (8 sessions). Ally required eight training sessions for her performance to reach mastery with set 3. When the steps were re-ordered for the return to baseline (BL:S2), Ally performed with perfect accuracy for three consecutive sessions. Therefore, the varied instruction training was not required with set 3. The results for the fourth set (dollhouse) are depicted in the final panel of Figure 4. Ally did not perform any steps correctly for the first five sessions in the initial baseline, then got 20% correct (one session), and finally stabilized at 40% correct (3 sessions). Ally's performance reached mastery after five training sessions. As with set 3, Ally performed with perfect accuracy in the return to baseline with the second sequence (BL:S2); thus, single instruction training was not required.

Discussion

There were two distinct patterns of performance exhibited by the subjects in Study 1. Nate and Ally performed similarly, whereas Carl displayed a different pattern. There results will be discussed individually before comparisons are made. For Nate for set 1, performance dropped to 0% correct when the order was re-sequenced following the initial training, indicating that he had acquired a behavior chain that was no longer under control by the textual prompts. That is, the textual prompt may not have been controlling responding with the second sequence. However, following varied instruction training with set 1, Nate performed with 100% accuracy on the next BL:S2 phase for set 1 (although it took five sessions for his performance to reach mastery). He did not require the single instruction training for any subsequent sets, suggesting that the initial exposure to the single instruction condition established stimulus control by the textual prompt. In addition, Nate showed a "savings effect," in that later sets required significantly fewer training sessions than did set 1 (17 training sessions vs 7 training sessions for the first and last sets, respectively).

These results were replicated with Ally. She also did not perform any steps correctly with any sets prior to training set 1. Ally required the varied instruction training with the first two sets only. She also showed a savings effect, but in her case it was seen in the comparison of the first and second applications of the single instruction training. She never required more than 8 sessions in initial training, but did not reach mastery during single instruction training for set 1 for 14 sessions – compared to only 5 sessions for set 2. Again, her results suggest that training the consistent order with set 1 served to establish a behavior chain that was no longer under the control of the textual instructions, rather than a generalized textual instruction following repertoire. However, the single instruction training was an effective method to establish stimulus control by the textual prompts, and possibly thereby established an emerging generalized instruction following repertoire.

Like Nate and Ally, Carl did not independently perform any of the steps in the correct sequence during the initial baseline with the first set. However, this is where the similarities end. Unlike the other two subjects, Carl never required the varied instruction training. When the steps were rearranged into the second sequence in BL:S2, Carl followed the second sequence. This could suggest that for some individuals (e.g., Carl) training with one set in one sequence is sufficient to establish stimulus control by textual prompts, whereas it is not sufficient for this purpose with other individuals (e.g., Nate and Ally). However, it should also be noted that Carl, unlike Nate and Ally, sometimes performed some steps in the correct sequence for the second through fourth sets prior to any training history with the textual instructions as provided in this study.

It is possible that these data are an artifact of the methods. That is, it might be the case that some subjects occasionally perform one or two steps in the correct sequence at random. For

example, if the first step for setting the table was to put the plate on the blue circle, this might be the first response anyone with a history of setting the table might complete. However, it is also possible that Carl's behavior was somewhat controlled by the instructions in baseline. If the latter explanation were true, then Carl's performance in baseline might be more indicative of a skill deficit or motivation issue than a stimulus control failure. In the case of the former, it is possible that Carl's behavior was partially under control of the textual instructions in baseline, but that he did not adequately comprehend the instructions to perform with perfect accuracy. In the case of the latter, it is possible that the lack of feedback or reinforcement in the baseline phases did not support performance of the target behavior.

In the cases of Nate and Ally, their performance in Bl:S2 with set 1 suggests that the initial training succeeded in establishing a response chain such that each response was under the control of the preceeding step, rather than in establishing control by the textual prompts. For both subjects, the varied instruction following was sufficient to establish control of the prompts. Carl's data are less clear. Carl's performance suggests that what might appear to be a failure of stimulus control within or generalization across sets might actually be skill deficit or a motivation issue. In each case, there was some evidence of generalization, but performance failed to reach mastery in the untrained sets. It is likely, given the results of the second sequence baselines for the latter sets, that the subjects' responding was controlled by the textual instructions by the time training commenced on the final set. However, a comprehension failure may have prevented each from performing with perfect accuracy. An additional measure of stimulus control (orientation) was added to Study 2 to strengthen the examination. There is also one additional possibility that could explain some of the results of all three subjects. It is possible that the response class of following textual instructions is under the control of a

discriminated stimulus not utilized in these methods. That is, it is possible that all three subjects may have followed the textual instructions had they been directed to do so. This possibility was examined in Study 2.

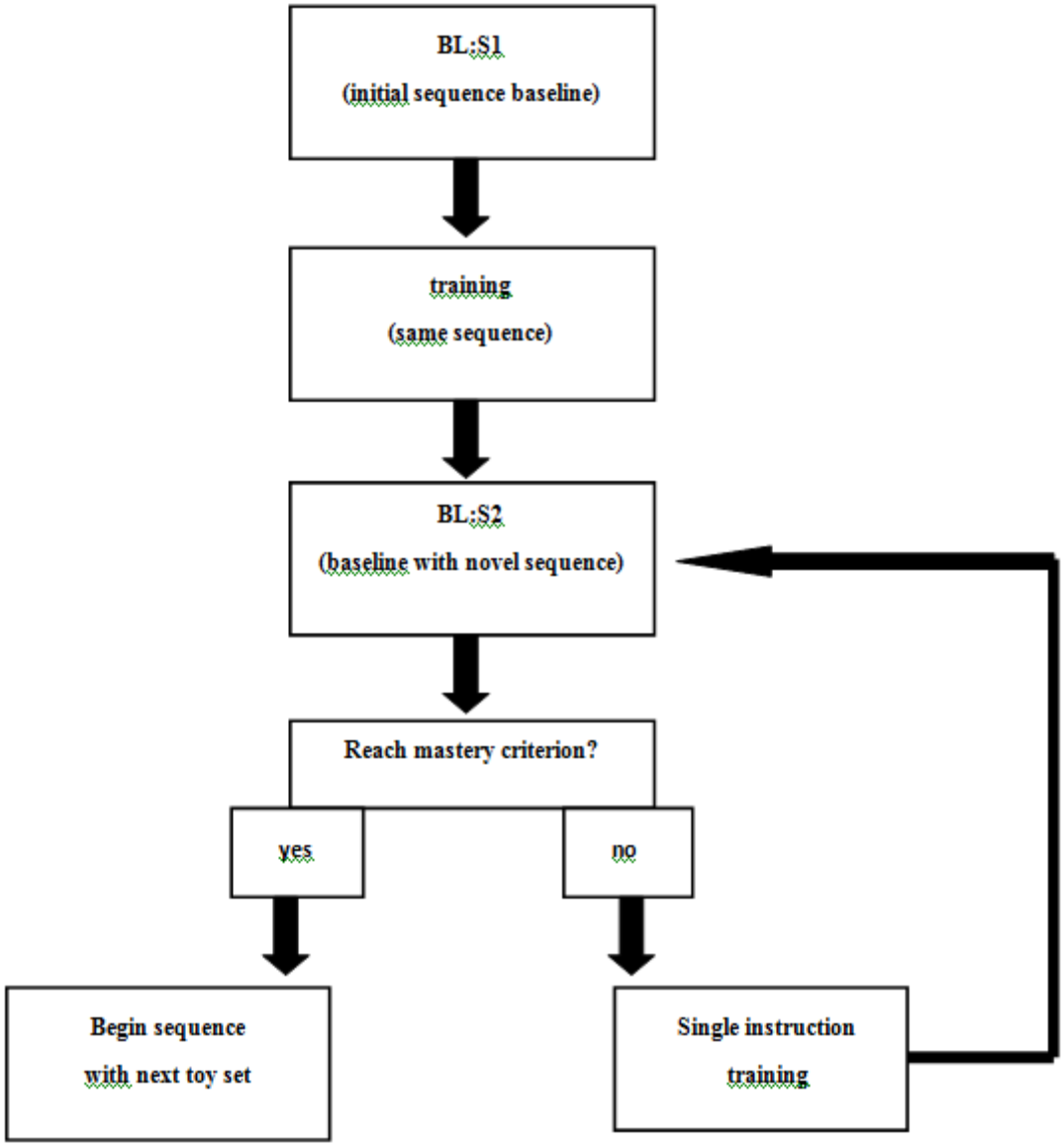

Figure 3-1. Diagram depicting the order of conditions for Study 1.

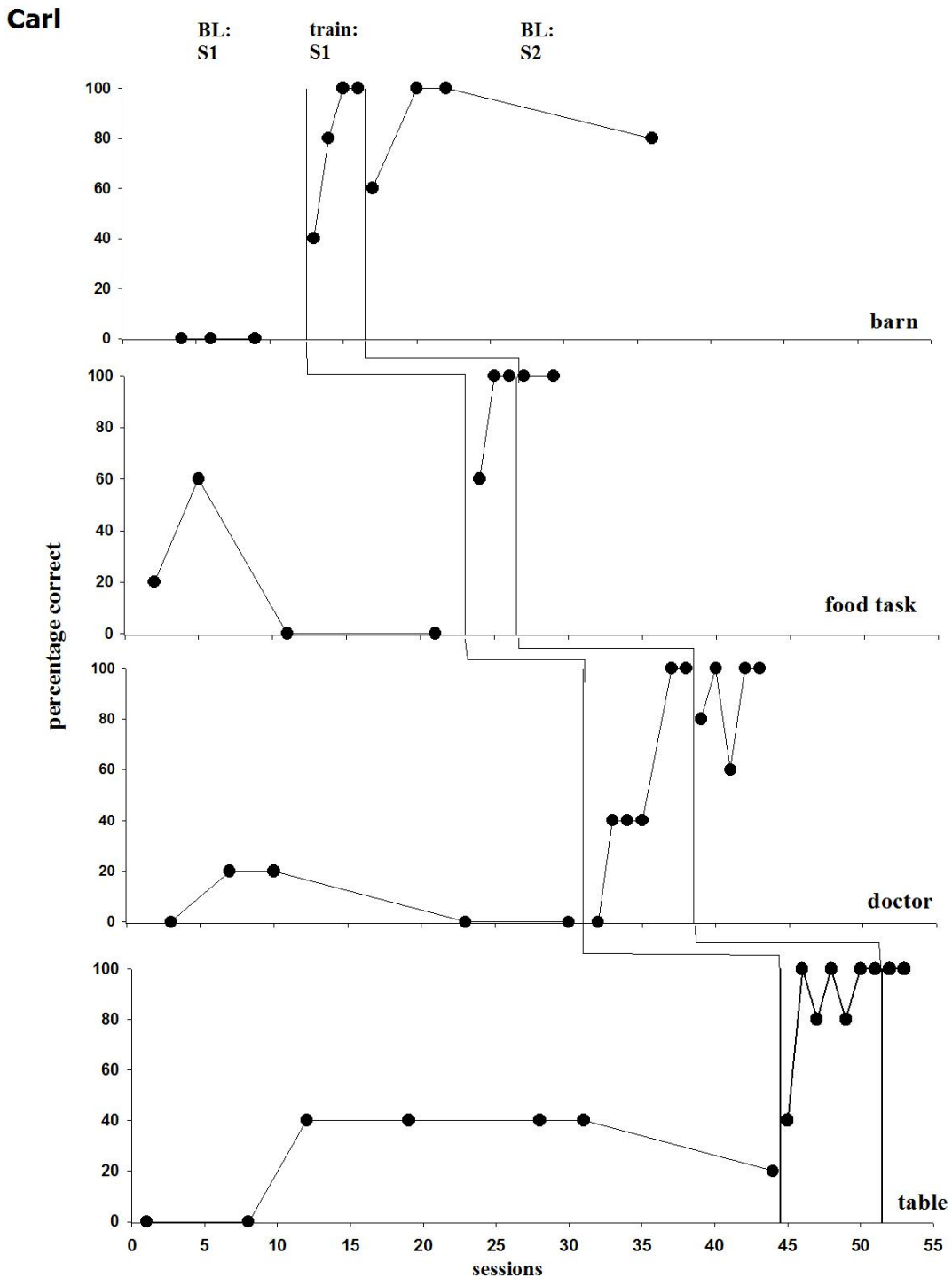

Figure 3-2. Percentage of steps completed correctly across the initial baseline sequence (BL:S1), training, and novel sequence baseline (BL:S2) for Carl. Each panel represents one of the four toy sets. Varied instruction training was not required for any set.

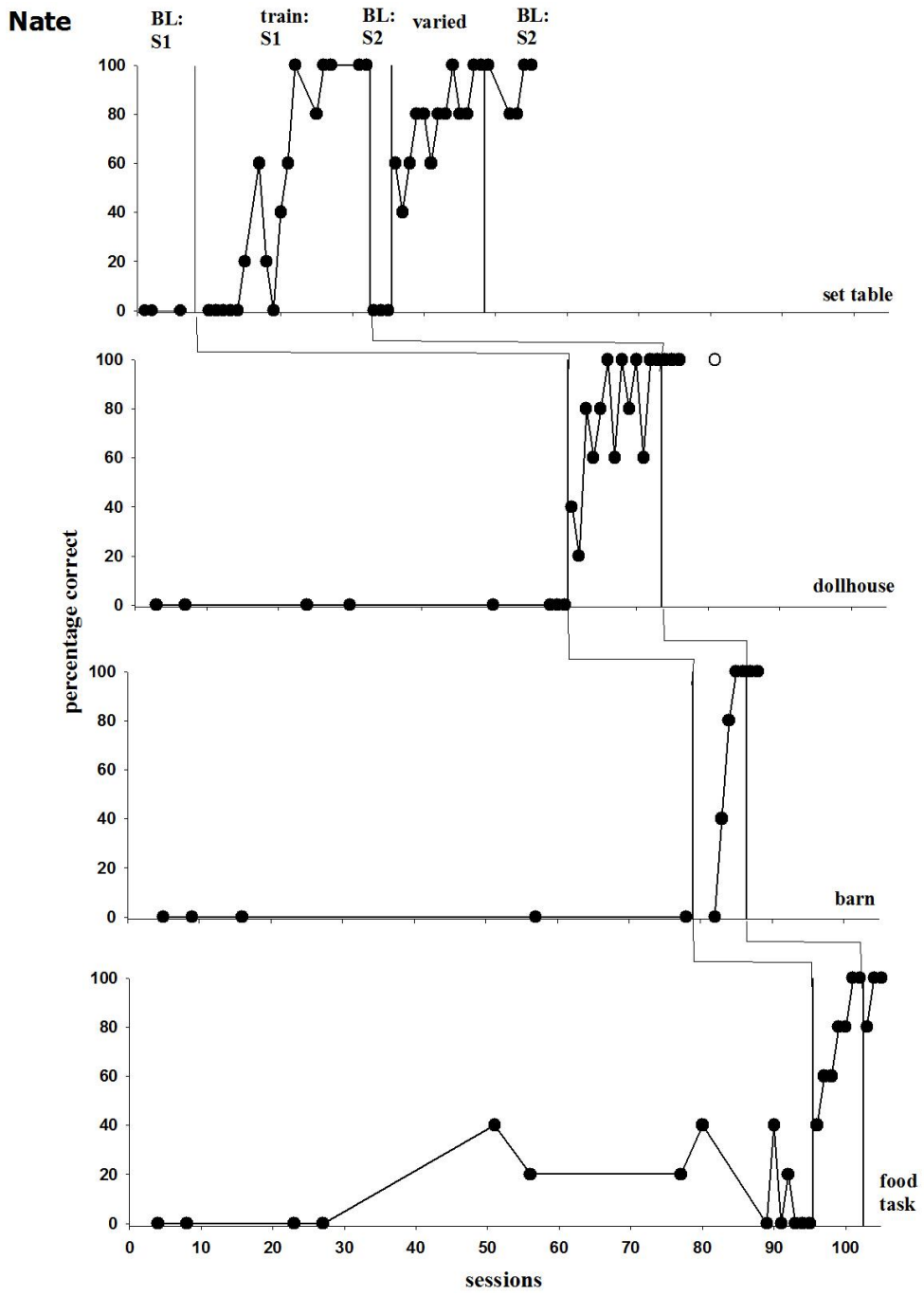

Figure 3-3. Percentage of steps completed correctly across the initial baseline sequence (BL:S1), training, and novel sequence baseline (BL:S2) for Nate. Each panel represents one of the four toy sets. Varied instruction training was required only for the first set. The open symbol in the second panel indicates a probe with a novel third sequence.

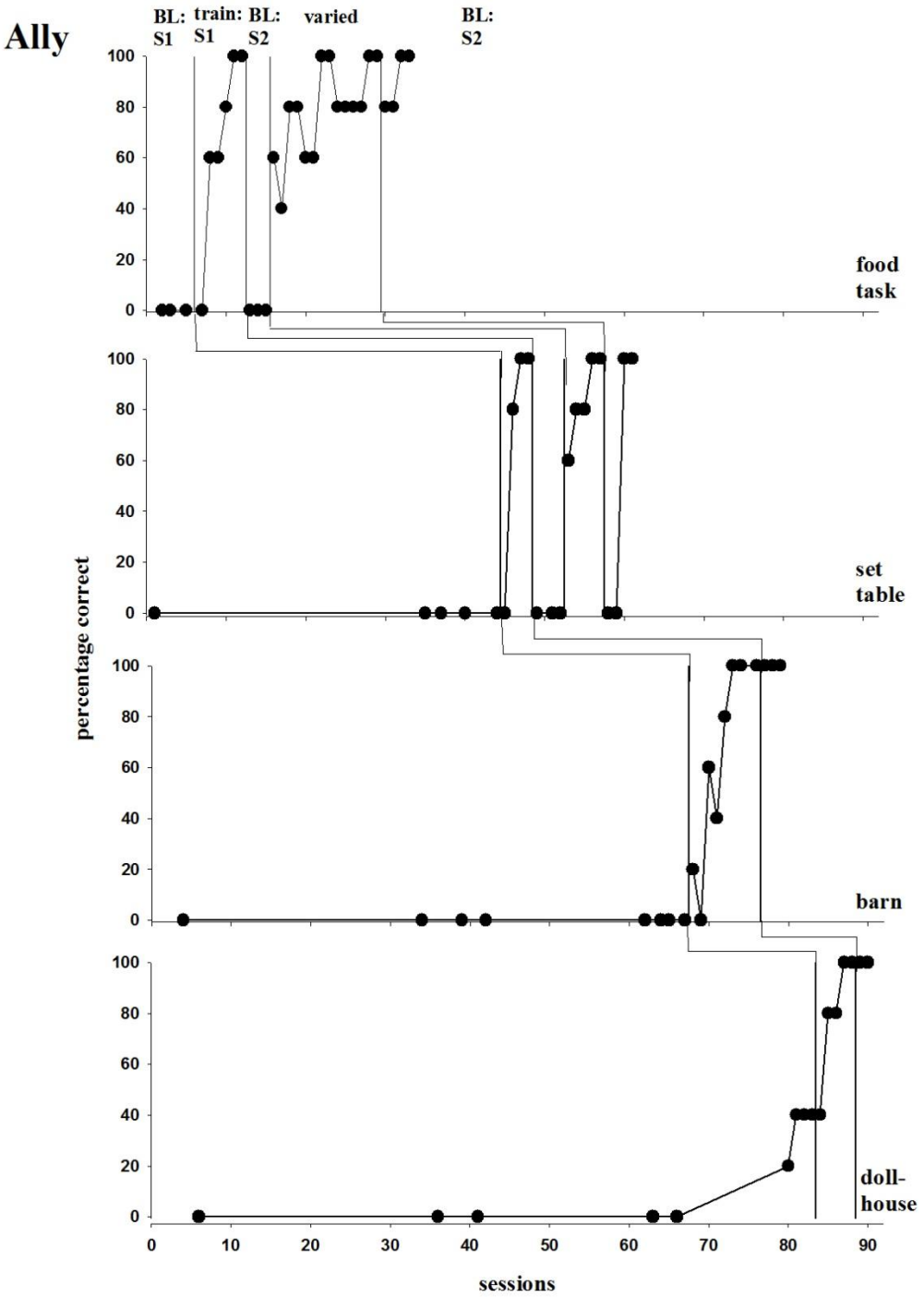

Figure 3-3. Percentage of steps completed correctly across the initial baseline sequence (BL:S1), training, and novel sequence baseline (BL:S2) for Ally. Each panel represents one of the four toy sets. Varied instruction training was required for the first two sets.

CHAPTER 4
STUDY 2

Purpose

The purpose of Study 2 was to replicate and extend Study 1 by including an analysis of a vocal instruction to follow the textual prompts and to add a secondary measure of stimulus control to those prompts (orientation).

Method

Subjects

Delbert, Hugo, and Wesley participated. Delbert was 7 years of age at the start of the study and had been diagnosed with ASD. He was able to read multi-sentence passages with assistance (prompt to stay on track). Hugo was 16 years of age at the start of the study and was diagnosed with ASD. Hugo could read multiple sentences if each was written on a separate line. Wesley was 19 years of age at the start of the study and diagnosed with Down Syndrome. Wesley could read multi-sentence passages with assistance (i.e., prompts to stay on task).

Experimental Conditions

The procedures used in Study 2 were identical to those in Study 1 with four exceptions. These were due in part to unpredictable response patterns that necessitated slight deviations from the planned protocol for two of the three subjects in Study 2. First, mastery criteria were increased to three consecutive sessions at 100% correct performance, as a more conservative measure of mastery. Second, orientation toward the board was recorded as a secondary dependent variable. Orientation was defined as turning towards the instruction board, gazing at or following text with the hand, or reading aloud. Only the percent of steps performed correctly, and not orientation to the instruction board, was considered in the determination of mastery. Third, three new experimental conditions were added (described below). The order of conditions

in Study 2 is depicted in Figure 2 and was: BL:S1, instruction test, train, BL:S2, varied instruction training (if needed), BL:S2.

The first new condition (instruction test) was designed to assess the possibility that the subject could perform the actions in response to the textual prompts, but required a vocal instruction in order to do so. In other words, it was to assess the possibility that stimulus control could be easily transferred from the instructor delivered prompt to the textual through the use of a rule (also in the form of an instructor delivered prompt). Following textual instructions is only one type of a larger repertoire of textual behavior. In fact, it would not be appropriate for an individual to always respond to textual stimuli as though they were instructions. Therefore, it is likely that textual instruction following is not only a generalized, but also a discriminated operant. Thus, it is possible that the subject may have a textual instruction following repertoire that is itself under the control of a different instruction. Conditions were as in baseline, with the exception of the form of the vocal prompt to engage with the items. In this phase of the study, the therapist added the phrase "do what these say" to the specific vocal discriminative stimulus. This phase was continued until the data were stable based on visual analysis or until mastery criteria were met, whichever came first. If mastery was not achieved in the instruction test, then training began. In addition, for Hugo, the effects of a modified instruction ("Do what these say. Start at the top.") was evaluated.

The second added condition was only used for Hugo and involved an adaptation of the varied sequence training to address his need for additional training. This condition was implemented exactly as the varied sequence, but the instructions were presented two (or three) at a time. This gradual increase in step number would have been continued until the instructions were once again all on the board at the same time. These conditions were added as a type of

fading procedure in which the terminal goal would be to present the steps all at once. This was intended to establish control not only by the individual prompts, but by the other relevant characteristic of instructions presented in a list (namely, ordinal sequence).

Similarly, two slight changes were made to the return to baseline and test conditions only for Wesley. His behavior seemed to indicate possible noncompliance during the return to baseline (BL:S2) with the first set. That is, it seemed that Wesley could complete the task in the second sequence, but the contingencies in place did not support the behavior. To test this hypothesis, mini chocolate candies were delivered at the end of sessions contingent on having completed all steps in the correct sequence. During BL:S2, no reinforcement was delivered if any errors were made, and no feedback was provided on which, if any, steps were incorrect. This contingency remained in place for all remaining sets in the second sequence baseline condition (BL:S2) only. In addition, a slight modification of the instruction test was implemented following the return to baseline only with the final set. This involved adding the instruction "read the steps out loud." This was added because of a persistent discrimination error between two steps, which corresponded with a failure to orient to those two steps during BL:S2 with set 4.

Results

Figure 4-2 depicts Delbert's results. In the initial baseline (BL:S1) with set 1, Delbert performed two of five steps correctly (40%) for the first session before his responding decreased to 20% correct for two consecutive sessions (M = 27%). In this phase, Delbert oriented to the instruction board for an average of 93% of the steps. The instruction test (test:S1) had no effect on Delbert's orientation toward the instruction board (M = 93%) with set 1 , and he was even less accurate with respect to the sequence of steps (M = 13%). Delbert mastered set 1 in only four training sessions and oriented to the board for all 5 steps in every training session. Following training, Delbert performed with perfect accuracy and oriented to the board for every

step in the return to baseline with the second step sequence (BL:S2). Delbert maintained his performance for four follow-up sessions.

The second panel of Figure 4-2 depicts Delbert's results for set 2 (set table) Delbert completed 3 of 5 steps correctly (40%) for three of four initial baseline sessions, and completed 4 of 5 (60%) correctly for the third session (M = 45%). He oriented toward the instruction board for all five steps across all initial baseline sessions (BL:S1). Again, the instruction test (test:S1) had no effect on responding with respect to the instructions (3 sessions, M = 40%) or orientation toward the instructions (M = 100%). Delbert mastered the initial sequence with set 2 in five training sessions, during which he consistently oriented toward the instruction board for all five instructions. When the steps were reorganized into the second sequence for the return to baseline, Delbert's performance with respect to the step sequence became quite variable, ranging from 0 – 100% correct, but eventually reaching mastery criteria after 8 sessions. However, he continued to orient to the board with every step for 7 of 8 sessions.

The third panel of Figure 4-2 depicts Delbert's responses to set 3 (toy farm). His responses to the instructions were somewhat variable in the initial baseline (M = 48%, 5 sessions). He performed 3 of 5 steps correctly, and oriented toward the instruction for 100% of steps, for the first three sessions. However, his responding became less accurate in the last two session of this condition. When the instruction test was implemented with set 3, Delbert showed an initial increase in the number of steps completed correctly (80% correct for 2 sessions), before decreasing to only 20% correct (M = 60%). His orientation towards the instructions actually increased from the first to the second and third sessions of the instruction test (from 20% to 80%; M = 87%). Delbert required four training sessions to meet mastery criteria with set 3, during which his orientation towards the board steadily increased to 100%. In the return to baseline with

the second sequence (BL:S2), Delbert's responding became extremely variable. Following seven sessions in which Delbert's responding ranged from 0% correct to100% correct, we began delivering social praise for correct performance. Once praise was provided, his responding maintained at 100% correct for 9 sessions, while praise was faded out. Orienting towards the board was more consistent throughout this phase, reaching and maintaining at 100% by the fifth session.

The final panel of Figure 4-2 depicts Delbert's responding to set 4 (food task). His responding was considerably more stable in the initial baseline of set 4 than with the previous set. Delbert did not orient towards the instruction board or perform any steps correctly for the first session. However, by the second session orientation reached and maintained at 100% (M = 89%). Performance with respect to the instruction increased by the third session and was maintained between 40 and 60% correct for the remaining session in BL:S1 (M = 38%) . The instruction test appeared to further stabilize Delbert's performance, although it did not improve it. All three test sessions were at 40% correct and 100% orientation. Delbert required four training sessions to reach mastery. He oriented towards the board for all five steps for all but the final training session, during which he only oriented towards the board once. In the return to baseline with the second sequence (BL:S2), Delbert performed with perfect accuracy, reaching mastery in only three sessions. His performance level was maintained during follow-up.

Figure 4-3 depicts Wesley's result. He did not perform any steps correctly in baseline for any task prior to training set 1 (soup). However, Wesley did orient to the board for one of five steps for one initial baseline (BL:S1) session with set 1 (M = 7%, 3 sessions). The instruction test (test:S1) had no effect on Wesley's orientation toward the instruction board (all 3 sessions at 0%) with set 1, nor on his performance on sequence of steps (all at 0%). Wesley mastered set 1 in

only four training sessions and oriented to the board for all 5 steps in all but one training session (M = 80%). When the steps were re-sequenced in the return to baseline (BL:S2) condition, Wesley's responding became quite variable. He oriented to the board and performed every step in the second sequence for the first session, then ranged from 20% to 100% with both for the remainder of the condition. Following the twenty-sixth session , Wesley began earning small candies for accurate performance. These were delivered only at the end of the session. No feedback was provided regarding performance on any individual steps. Wesley's performance met mastery criterion after 16 sessions (accuracy M = 71%, orientation M = 78%).

The second panel of Figure 4-3 depicts Wesley's results for set 2 (set table). Wesley did not finish any steps completely during the initial baseline (BL:S1), although he sometimes oriented towards the board (M = 30%). For set 2, the instruction test (test:S1) had a slight effect on correct responding with respect to the instructions (3 sessions, M = 13%) and orientation toward the instructions (M = 40%). Wesley mastered the initial sequence with set 2 in eight training sessions. Wesley initially oriented towards the board for every step, but orientation dropped out completely by the end of training (M = 58%). When the steps were reorganized into the second sequence for the return to baseline (BL:S2), Wesley initially performed only 2 of 5 steps correctly. However, his performance then improved and he reached mastery within five sessions. Wesley oriented towards the board for all five steps for all but one of the five BL:S2 sessions.

The third panel of Figure 4-3 depicts Wesley's responses to set 3 (tools). Again, Wesley did not perform and steps in the correct sequence in the initial baseline (BL:S1). Orientation was low and somewhat variable during this condition (M = 17%). As with the first two sets, there was a slight increase in performance when the instruction test was implemented with set 3 (M =

16%). However, orientation dropped out completely by the end of this condition (5 sessions, M = 12%). Wesley required six training sessions to meet mastery criteria with set 3, during which his orientation towards the board greatly improved from the test condition (M = 93%). In the return to baseline with the second sequence (BL:S2), Wesley again met mastery criterion after five sessions while orientation remained fairly stable (M = 88%).

The final panel of Figure 4-3 depicts Wesley's responding to set 4 (doctor). Wesley did not orient towards the instruction board or perform more than one step correctly for the first three sessions. However, by the fourth session orientation Wesley's performance of the steps gradually improved (M = 25%) as did his orientation towards the steps (M = 50%). Although his performance improved, it failed to meet mastery criterion thus the instruction test was implemented. The instruction test had no clear effect on orientation, but seemed to make performance with the step sequence more stable (M = 73% and 60%, respectively). Wesley required eleven training sessions to reach mastery. He oriented towards the board for all five steps for all but two training sessions (M = 87%). When the order of the conditions was rearranged for the return to baseline (BL:S2), Wesley began making a persistent error regarding steps 2 and 4, during which he failed to orient to the board. After nine sessions, the modified instruction test was implemented in which Wesley was told to read the steps aloud. He then mastered the final set in only three sessions. .

Figure 4-4 depicts Hugo's results. Like Wesley, he did not perform any steps correctly in baseline for any task prior to training set 1. However, Hugo did orient to the board for one of five steps for two initial baseline (BL:S1) sessions with set 1 (M = 13%). The instruction test (test:S1) appeared to initially influence Hugo's orientation, but this effect did not persist (3 sessions; M = 46.7%). There was no change in performance for the sequence of steps (all three

sessions were at 0% correct). Hugo required 12 training sessions to reach mastery with the initial sequence for set 1. However, he oriented toward the board (and read aloud) for all five steps across all training sessions. When the steps were re-sequenced in the return to baseline (BL:S2) condition, Hugo continued to orient towards the board and read aloud for all five steps in every session (3 sessions). He did not, however, perform any of the steps in the second sequence correctly. Instead, he continued to read and perform the steps in the initial sequence, regardless of their new position on the board.

Therefore, varied instruction training began. Hugo required 8 sessions to reach mastery criterion with varied instructions. When the second sequence baseline was re-instated (BL:S2), Hugo again oriented towards the board and read aloud (3 sessions; M = 93.3%), but also continued to do so in the initial sequence. He did not perform any of the steps in the correct second sequence. Hugo was then exposed to a variation of the initial instruction test condition for three sessions. This had no effect on his responding (orientation = 100%, performance = 0%). Thus a variation of varied instruction training began, in which the steps were presented two at a time (any 2). Hugo oriented towards the board for 100% of the steps for these and all subsequent conditions for set 1. Hugo's performance reached mastery in 4 sessions. When the second sequence baseline was once again re-instated (BL:S2), Hugo still continued to perform the responses in the initial sequence. Therefore, varied instruction training (any 3) began. Hugo's performance again met mastery criterion in 4 sessions. When the second sequence baseline was reinstated for the third time, Hugo performed with perfect accuracy (meeting mastery criterion in 3 sessions).

The second panel of Figure 4-4 depicts Hugo's results for set 2 (doctor). As with set 1, Hugo did not perform any steps correctly prior to training with set 2. He oriented towards the

board for only the first step for all 6 sessions on the initial baseline (BL:S1; M=20%). Unlike in the previous condition, the instruction test (test:S1; the second instruction) improved both responding to the instructions (5 sessions, M = 48%) and orientation toward the instructions (M = 100%). Hugo mastered the initial sequence with set 2 in 20 training sessions. Hugo oriented toward the board for all five instructions in every session for the remainder of the conditions in set 2. When the steps were reorganized into the second sequence for the return to baseline, Hugo performed with perfect accuracy in 5 of 6 sessions (making one error in the third session).

The third panel of Figure 4-4 depicts Hugo's responses to set 3 (soup). He did not perform any steps in the correct sequence in the initial baseline (BL:S1) until after exposure to varied instruction training with set 1, at which point his responding improved slightly (8 sessions, M = 17%). Hugo oriented to the board for only the first step in the first three sessions, but oriented for all steps for the last three sessions (M = 50%). As with the previous set, the instruction test resulted in some improvement in both accuracy and orientation (all 3 sessions were at 20% and 100%, respectively). Despite the improved performance, mastery criteria were not met and training began. Hugo required seven training sessions to meet mastery criteria with set 3. Orientation towards the steps was at 100% for this and all subsequent conditions for set 3. In the return to baseline with the second sequence (BL:S2), Hugo performed with perfect accuracy (3 sessions).

The final panel of Figure 4-4 depicts Hugo's responses to set 4 (set table). Again, he did not perform any steps in the correct sequence in the initial baseline (BL:S1) until after exposure to varied instruction training with set 1, at which point his responding became somewhat variable (M = 33%, generally ranging between 60 and 80% for the last 6 of 11 sessions). Hugo oriented to the board for only the first step in the first several sessions, but oriented for all steps for the last

six sessions (M = 52%). As with sets 1 and 2, the instruction test resulted in some improvement in both accuracy and orientation (all 3 sessions were at 60% and 100%, respectively). Despite the improved performance, mastery criteria were not met and training began. Hugo again required seven training sessions to meet mastery criteria with set 4. Orientation towards the steps was at 100% for this and all subsequent conditions for set 4. In the return to baseline with the second sequence (BL:S2), Hugo performed with perfect accuracy (3 sessions).

Discussion

Delbert required the least training of these three subjects. In many respects, his behavior was very similar to that of Wesley. Like Wesley, his responding was somewhat variable during BL:S2 for multiple sets. Also like Wesley, Delbert never required varied instruction training. However, Delbert both oriented towards and correctly performed steps for all four sets in the initial baselines before any exposure to training. This suggests that Delbert may already have had a generalized textual instruction following repertoire prior to his participation in this study. He might simply have lacked full comprehension of the specific instructions provided for these toy play sets. This could explain why the instruction test had no effect on his behavior. He already was attempting to do as the instructions said, but was unaware that he was making errors because of the lack of feedback during baseline. Delbert mastered all four toy play sets within 80 sessions (including baseline). He demonstrated generalization to the classroom during follow-up probes.

Wesley's results were in many respects quite similar to Delbert's, in that he never required varied instruction training. His results were similar to Hugo's, in that he did not orient towards the textual instructions nor did he perform any steps in the correct sequence in the initial baseline of set 1. Wesley never read any of the steps aloud. The instruction test for set 1 had no effect on either response (as with Hugo). Unlike Hugo, Wesley very rapidly acquired the initial sequence once training was initiated (4 sessions). Also unlike Hugo, Wesley performed every

step in the correct second sequence when the steps were rearranged for the return to baseline (BL:S2). However, after this initially promising performance, Wesley's responding to both orientation and accuracy became quite variable in BL:S2. It seemed possible that this pattern of responding might have been indicative of a motivational problem, rather than a failure of stimulus control. That is, the responding seemed to be an example of non-compliance rather than a skill deficit or stimulus control issue.

A contingency was thus placed on correct performance during BL:S2 for this (after the eighth session) and the remaining sets, in which Wesley could earn 5 mini chocolate candies if he performed all five steps correctly. After the contingency was in place, his responding improved until it reached mastery (despite the lack of any feedback regarding which steps were correct or incorrect). The varied instruction training was not required for this or any of the other sets. A similar contingency was put in place for training, starting with set 2. However, during training, Wesley's performance on each set received immediate feedback and he earned one mini chocolate candy for each correct step.

Wesley showed similar patterns of responding with all remaining sets, although the initial sequence with set 2 required more extensive training than did any of the others. In addition, Wesley's orienting dropped out completely by the end of training with set 2, but came back up in the return to baseline (when it would have to for his performance to meet the contingency). He was the only subject to show this pattern, and only for one set. He complained vocally when corrected or prompted during training, putting his hands up and repeating, "I know! I know!" in response to corrective feedback. This resistance to assistance may help to explain his unusual response pattern. Wesley showed generalization to both orientation to and correct performance of the final set in the initial baseline. Like Delbert, this trend towards generalized textual

instruction following was not sufficient to result in mastery. In this case, it appeared to be a skill deficit rather than a compliance problem. Wesley oriented towards the board for all steps

Hugo's required the most training of any subject. Hugo did not perform any steps correctly in any initial baselines until he had extensive training with the textual instructions. Hugo read the steps aloud when he oriented towards the board. Therefore, his orientation data provide a reliable indicator of his reading behavior. Although Hugo often looked at the board during the initial baseline sessions, he never read a complete sentence. Instead, he would find a word contained in the vocal SD to engage with the materials, point to it, and repeat it (e.g., "show me how you make soup," he pointed to and repeated the word "soup"). The instruction set had no clear effect on either orientation or performance. Once training was initiated with set 1, Hugo's orienting (reading) response was well established by the initial vocal prompt and he quickly acquired four of the five steps, but exhibited a persistent error on one particular step.

When the order of the steps was changed for the return to baseline, Hugo's behavior was somewhat unexpected. He continued to perform the steps in the previous sequence, but also read each step before performing it. That is, he looked for the steps in the order he had initially learned and read them in that order, regardless of their current position on the board. For example, if "hammer the peg" had been number one, but was now three, he would begin by pointing to it in its new position, reading it, and then completing the corresponding action. Then he would find what had been the second step, but was now the fifth, and do the same. He did this until he had completed all five steps. His behavior was perfectly consistent across all three sessions.

This performance seemed to indicate that the training was sufficient to establish a chain under control by the individual textual instructions, but not by other relevant characteristics of

the instructional set (i.e., the placement of the steps in numbered order). Said another way, Hugo's responses were under the control of the individual instructions, but not of the overall sequence of instructions. It seemed possible that providing an instruction to complete the instructions in order might rectify this problem. Thus an adapted instruction test was performed. It had no effect on responding, but this adapted instruction was used for the test and training conditions for all remaining sets.

Hugo mastered varied instruction training in only 8 sessions (compared to 12 training sessions to establish the initial sequence). When the instructions were again all placed on the board at one time for the return to BL:S2, Hugo performed exactly as he had in the previous baseline despite a delay of at least 3 weeks since last seeing the initial order. Hugo was then exposed to an adapted form of varied instruction training (any 2) in which any two steps were placed on the board, then any other two, and finally the last remaining in isolation. The rationale for this series of conditions was to gradually build up to all five instructions present on the board at once. Hugo's performance very quickly reached mastery in this condition (4 sessions), but it again failed to establish the correct behavior with respect to all five steps in the return to BL:S2. Hugo persisted in his unusual response pattern. Training with any three steps was thus initiated. Again, Hugo's performance reached mastery very quickly. After this condition, Hugo performed the steps in the second sequence in the return to baseline, making the next fading step (any 4) unnecessary.

Unlike with set 1, the instruction test resulted in immediate improvement with respect to orienting towards the instructions. There was a concurrent improvement in Hugo's performance with respect to the instructional sequence, although his behavior did not meet mastery criteria. This suggests that Hugo's responses were under control of both the individual steps and the

overall sequence, but he lacked comprehension of individual steps. Training the initial sequence with set 2 took longer than had set 1 (20 sessions v. 12 sessions). As with set 1, Hugo exhibited a persistent error on one particular step. In this case, response blocking had to be used to prevent the error in order to adhere to the prompting sequence. However, Hugo performed the steps in the second sequence when the steps were rearranged for the return to baseline (Bl:S2).

Hugo demonstrated some generalization with both orientation and correct performance to sets 3 and 4 after training was initiated with set 2. In both cases, orientation towards the instruction board was at 100% by the end of baseline, and the instruction test had no effect in either case. Hugo also acquired the initial sequence with sets 3 and 4 far more rapidly than he had with the first two sets. Finally, as with set 2, Hugo responded in the correct sequence when the steps were rearranged for the return to baseline. He did not require the varied instruction training in any form for sets 2 -4. It is possible that the repeated exposure to the adapted instruction ("do these in order") through the extensive training with set 1established control by that instruction, such that the instruction became an effective SD. Hugo required a total of 133 sessions to complete the study, at least 74 of which involved this instruction.

Both Wesley and Delbert's results might indicate that the baseline condition did not provide an accurate picture of the subjects' textual instruction following repertoires prior to training. It might be better to follow up this baseline with a condition in which feedback, but no additional prompts are provided. This would allow for some evaluation of incorrect responding as a function of a failure to comprehend the instructions rather than as a failure of stimulus control or the lack of a generalized repertoire. Hugo and Delbert both read all steps on most sessions, but there was not a strong correlation with correct responding. Given the results of varied probes once reinforcement was included, does the lack of correlation indicate a lack of

stimulus control or an extinction effect? The results of Study 2 suggest that it could be either. This should be examined more systematically in future research.

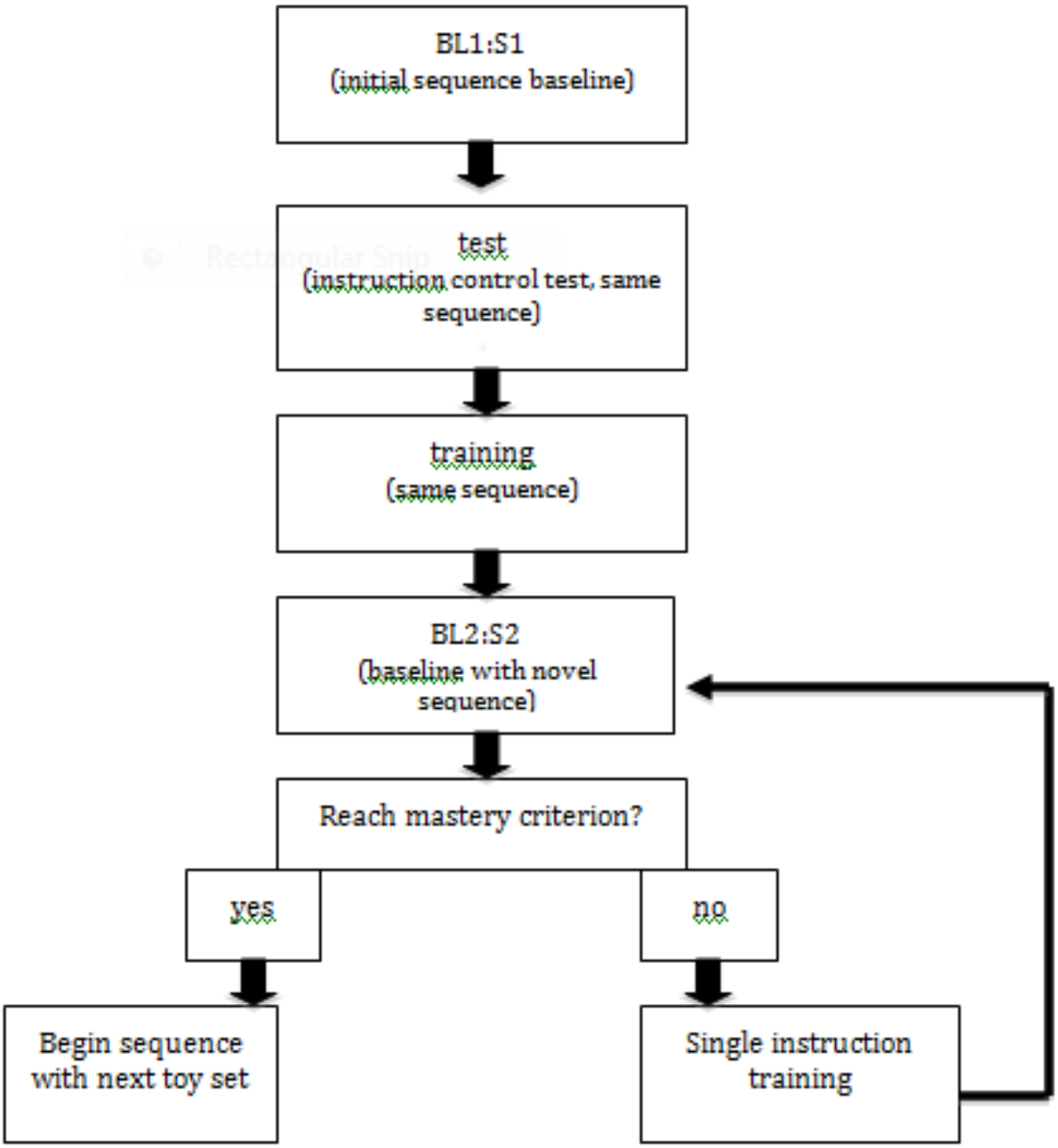

Figure 4-1. Diagram depicting the order of conditions for Study 2.

Delbert

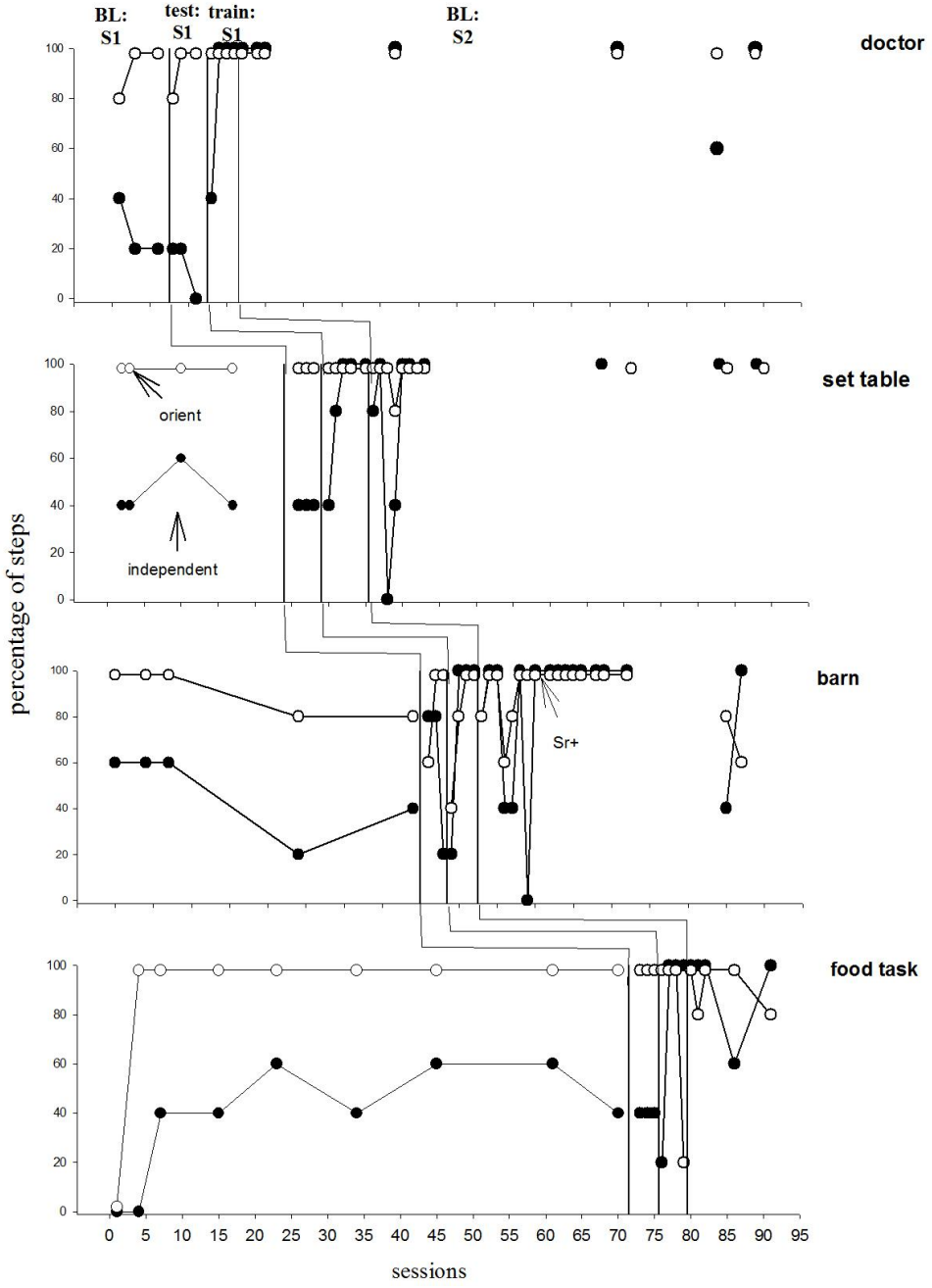

Figure 4-2. Percentage of steps completed correctly across the initial baseline sequence (BL: S1), instruction test (test:S1), training, and novel sequence baseline (BL: S2) for Delbert. Each panel represents one of the four toy sets. Varied instruction training was not required for any set.

Wesley

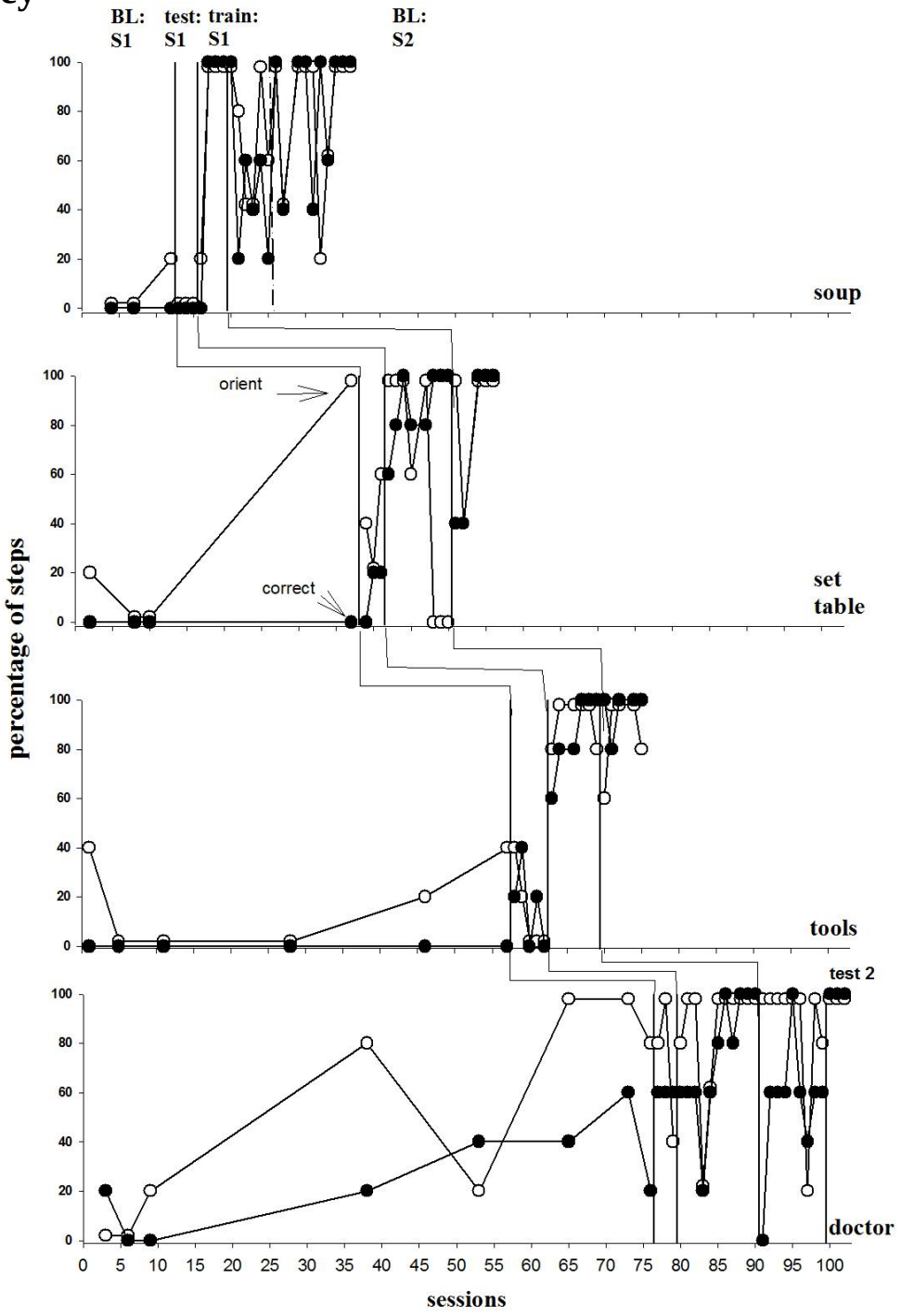

Figure 4-3. Percentage of steps completed correctly across the initial baseline sequence (BL:S1), instruction test (test:S1), training, and novel sequence baseline (BL:S2) for Wesley. Each panel represents one of the four toy sets. Varied instruction training was not required for any set. The dashed line in the first panel indicates when reinforcement began.

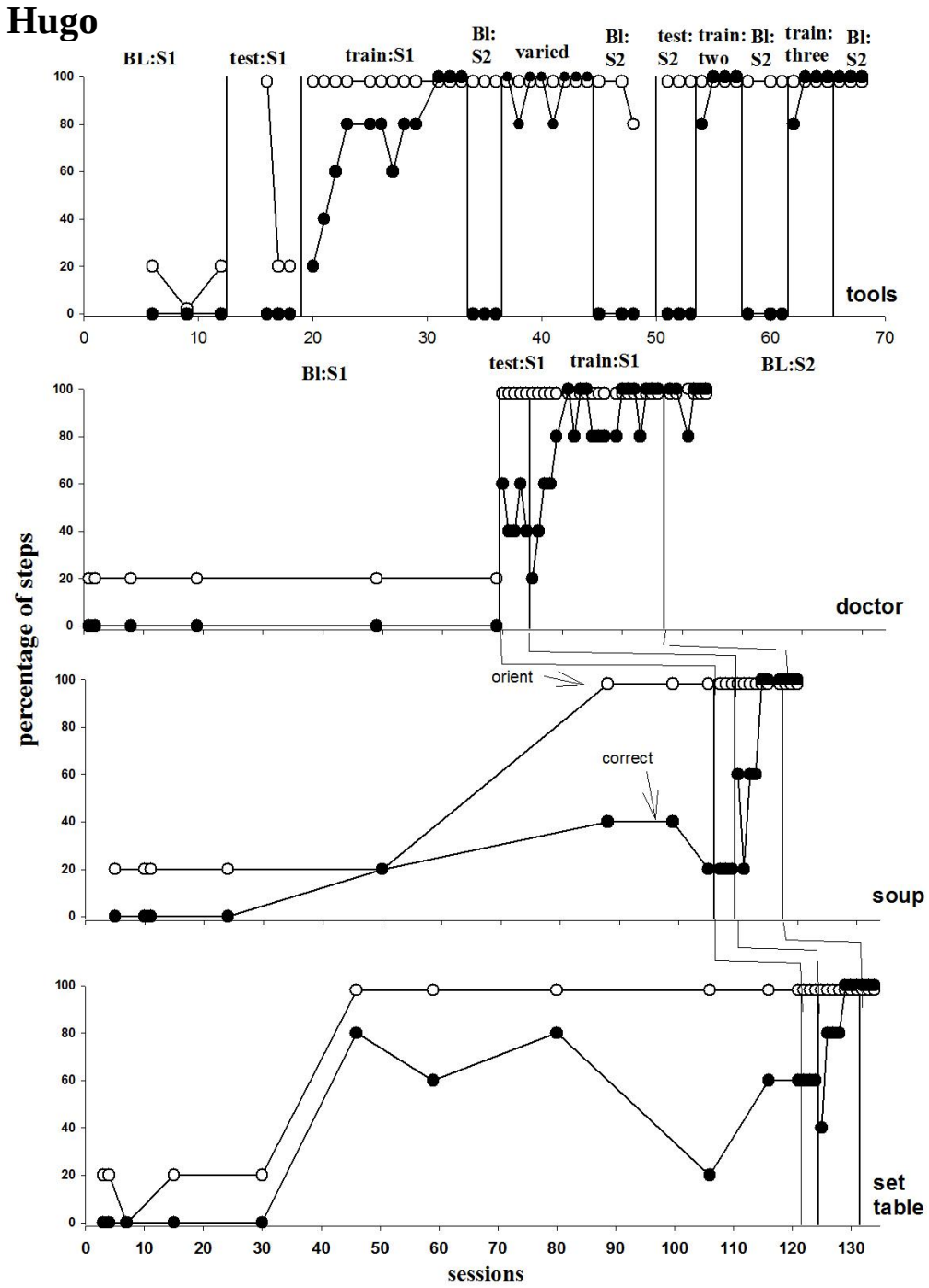

Figure 4-4. Percentage of steps completed correctly across the initial baseline sequence (BL: S1), instruction test (test:S1), training, novel sequence baseline (BL: S2), varied and any2/3 training for Hugo. Each panel represents one of the four toy sets. Varied instruction training was required only for the first set.

CHAPTER 5
GENERAL DISCUSSION

In Study 1, only Carl was able to follow the second sequence when the steps were rearranged for the return to baseline (BL:S2) with all four sets after training with only one sequence. Both Nate and Ally continued to follow the initial sequence when the steps were rearranged for BL:S2 with the first set. Moreover, Nate and Ally both read the steps aloud during training, but did not read any of the steps during BL:S2 with set 1. Nate required the varied instruction training with only the first set, after which he reliably followed the second sequence during BL:S2 sessions for the remainder of the study. Ally required exposure to the varied instruction for the first two sets before showing similar results. All three participants showed some generalization to the fourth set after training with three. However, none of the participants mastered any of the sets without training with at least one sequence.

In Study 2, both Delbert and Wesley were able to follow the second sequence when the steps were rearranged for the return to baseline (BL:S2) with all four sets after training with only one sequence. Delbert oriented towards the board, and read the steps aloud, for the majority of sessions for all conditions across all sets. Wesley's orientation towards the board, and his correct performance on the steps, was quite variable throughout the study. Moreover, he almost never read the steps aloud. Wesley displayed a persistent error during BL:S2 with the set 4 (doctor), in which he consistently switched two of the steps. He also failed to orient towards the board for those two steps. Therefore, a novel instruction was evaluated ("Show me how you play with the monkey. Read the steps aloud"). Wesley complied with this instruction and his correct performance immediately improved, reaching mastery after just three sessions. These results suggest that a more specific instruction might have had a more significant influence on responding than did the standard instruction tested here.

Hugo's results showed a distinctively different pattern of responding. He continued to follow the initial sequence during BL:S2. He also continued to read the steps aloud. However, he read them in the initial sequence, regardless of their new position on the instruction board. Exposure to the varied instruction training failed to establish control by the ordinal sequence of steps, therefore a modification of the varied training was implemented to establish control by the sequence of the steps. After fading back to training with any three steps present at a time, Hugo was able to complete set 1 in the next return to the second sequence baseline (BL:S2). Hugo did not require any additional exposure to any version of the varied instruction training for the remaining sets. Although all three Study 2 subjects showed some generalization to a fourth set after training with three, none mastered any of the sets without exposure to training with at least one sequence.

Despite the fact that all of the subjects in both studies required at least some training to master each set, there is still evidence of early indicators of a generalized textual instruction following repertoire by the end of the study. The evidence of this can be seen in three ways. First, for some subjects (Nate and Hugo), there is a clear "savings effect" in which later sets required significantly less training than did earlier sets. Second, all six subjects showed improvements in performance with the final set following training with one or more earlier sets. Finally, all six subjects were able to complete the untrained second sequence for all four sets by the end. This last finding both suggests that the textual prompts had stimulus control over their responses and also demonstrates within- set generalization. Taken together, these three types of evidence could indicate that these methods were sufficient to establish both stimulus control by the textual prompts and a generalized textual repertoire, but that the subjects' reading abilities prevented the demonstration of a across-set generalization.

Collectively, the results of these studies suggest that the use of textual instructions to teach a single response sequence may not always be sufficient to establish stimulus control by the textual prompts and is likely never sufficient to establish a generalized repertoire of textual instruction following. The varied instruction following was required by three of six subjects. Of these 3 subjects, it was sufficient to establish control by the textual prompts for 2 of 3. However, none of the subjects demonstrated a generalized repertoire of following textual instructions, as would have been indicated here by generalization to one or more untrained sets. At best, they showed generalization to novel sequences of trained steps. There are several possible explanations for the lack of generalization in these studies: (a) lack of stimulus control by the textual prompts or the general presentation of the prompts (Nate, Ally, Hugo), (b) a skill deficit (Hugo, Delbert), or (c) non-compliance or a lack of a sufficient motivating operation (Wesley, Carl).

It might be interesting to attempt to identify subject characteristics that result in each of the above. Doing so might allow training to be tailored to the needs of the individual student. For example, it is possible that the failure of stimulus control following training with one consistent sequence exhibited by three subjects (Nate, Ally, and Hubert) was the result of the rigid behavior that is one of the three core behavioral hallmarks of ASD. Hugo's data in particular could be interpreted as an example of behavioral rigidity, in that training with the initial sequence established a chain under the control of the textual prompts that was insensitive to changes in the prompt sequence. Another interesting example is provided by Wesley who was the only subject in Study 2 whose orientation toward the steps decreased during set 2. It seems possible that this response was due to his refusal to rely on any prompt or instruction. Wesley was also the only

subject who did not have ASD (he had Down Syndrome). His results stand out somewhat, and it might be interesting to replicate this research with subjects with varying diagnoses.

The results of these studies are fairly consistent with the body of research on the use of pictorial and textual prompts both to teach novel tasks and to establish activity schedules, precisely because they were idiosyncratic. Previous studies have reported quite disparate findings regarding the amount of training required, the degree of generalization, and the demonstration of control by the permanent prompt. Although the aforementioned mixed findings were across studies, and these are within, it seems very possible that they can be attributed to the same variable – the previous history with and mastery of instruction following of various modes. In the previous literature on pictorial prompts (with the exception of Phillips & Vollmer, 2012) stimulus control by the prompts was assessed through the removal of the prompts. These studies suggest an alternative method for assessing stimulus control of permanent prompts, namely the reordering of the steps.

It should be noted that these methods were less successful in establishing a generalized instruction following repertoire of the target mode than were pictorial prompts in previous research (Phillips & Vollmer, in press). This suggests that, much as the benefit of permanent prompts is dependent on stimulus control, the proposed advantages of textual prompts are in turn dependent on a relatively well-developed textual repertoire that may exceed that of most individuals with ASD and other ID. The subjects in these studies were all able to read full sentences, and many could read full passages. However, they all required some training beyond the mere presentation of the textual prompts, even when stimulus control was well established and clearly demonstrated. Although textual prompts should have the advantages of specificity and ease of production when compared to pictorial, they may simply be less effective with this

population. Future research could compare the two methods when used with individuals who can read.

The methods used in this research also differed from the previous research using textual prompts in one potentially significant way. The majority of the prior research on the use of textual prompts used single word prompts. This required pre-training sessions in which the subjects were taught the response to each individual textual stimulus. In the current research, full sentences were used in order to avoid ambiguity in the instructions in the hope that it would decrease the total amount of instructor-delivered training required. Again, sentences should have the benefit of specificity when compared to single words. For example, the word “table” could be used as a textual prompt, but could be associated with any number of responses. Although it is logical to assume that the use of sentences might thus be beneficial, these data do not bear that out. The failure to generalize completely to any set across participants, even after clear demonstration of control by the textual prompts, indicates a skill deficit. This deficit essentially invalidated the benefit of the full sentence instruction for these subjects.

There were inconsistent results across subjects within both Study 1 and Study 2. In both studies, at least one subject required varied instruction training in order to complete the toy sets in the second sequence (Bl:S2), suggesting that training with one consistent sequence was not always sufficient to establish stimulus control by the textual prompts. For Study 1, two subjects required exposure to the varied instruction training, whereas only one subject required it in Study 2. This difference might not hold with more subjects, and more subjects should be examined. However, if there is a difference it might be an effect of subject characteristics, given the great diversity in ability amongst individuals with ASD and other ID.

Even amongst the three subjects to require the varied instruction training, there were distinct patterns of responding. Hugo's response pattern only superficially resembled that of Nate and Ally. Although there are no formal data on orientation for Nate and Ally, it can be noted anecdotally that each stopped reading the steps aloud once they were no longer prompted to do so during training with the first set. Hugo continued to read all the steps aloud following the instruction training with the first set. Therefore, although all three subjects continued to follow the initial sequence in BL:S2, Hugo's behavior indicated control by the individual textual prompts, whereas Nate and Ally's did not. This difference in their response patterns might explain why the varied instruction training was sufficient to establish control by the prompts for Nate and Ally, but had no effect on Hugo's responding. The issue with his responding in BL:S2 was not lack of control by the individual prompts but by the ordinal nature of the list as denoted by the instruction board.

If there is a difference in the results of studies 1 and 2, and if it cannot be attributed to the age or ability of the subjects, then it would have to be the effect of the instruction test (as the only significant difference in the methods). For each subject in Study 2, the first exposure to the instruction test had little to no effect on responding, but subsequent exposures with later sets did have at least some effect on responding within the set. It is possible that the addition of the instruction to "do what these say" during the training (when reinforcement was provided for correct, unprompted performance) with the first set was sufficient to establish the phrase as a more effective discriminative stimulus than was the general vocal instruction to engage with the items. This more effective SD might either have better controlled textual instruction following already in the individual's repertoire or it might have helped to establish control by the textual prompts by increasing their salience (to much the same effect as the varied instruction training).

There were several limitations to these studies. First, although single word comprehension and sentence reading were both assessed, sentence comprehension was not. It is possible that none of the subjects had sufficiently advanced reading repertoires to allow for the establishment of a generalized repertoire of textual instruction following. In future investigations, sentence comprehension should be assessed. Second, the lack of reinforcement for correct responding during baseline may have functioned as extinction for some subjects. Thus it is possible that the repertoire was present, but not demonstrated. It might be interesting to investigate this possibility by following up baseline by a condition in which feedback on individual steps is not provided, but a contingency for overall correct performance is in place (similar to BL:S2 with Wesley; see research on increasing compliance, e.g., Davis, Brady, Williams, and Hamilton, 1992; Parrish, Cataldo, Kolko, Neef, & Egel, 1986).

A third limitation is the lack of testing for generalization outside of the training environment or to functional tasks. There were two anecdotal exceptions to this last limitation. After training with the toy play sets, textual instructions were used to teach Delbert to put on a shirt. Once he mastered the task, he maintained responding even once the textual prompts were removed. This finding is consistent with previous research on pictorial prompts (e.g., Martin et al.., 1983; Steed & Lutzker, 1997). This could mean that either control transferred to the naturally occurring SD in the chain or that Delbert did not have a truly generalized textual instruction following repertoire. Similar results were obtained when Hugo was taught to fold a shirt. These studies suggest a number of future directions. First, the benefits of permanent prompts such as textual or pictorial instructions over standard prompts (e.g., least-to-most prompts) have been suggested (e.g., Wacker & Berg), but have not been clearly demonstrated. It is possible that standard prompt forms may be as effective as, and more efficient than, permanent

prompts. Direct comparisons of these different prompt forms are in order. The methods of Mirzynski and Bourret (2007) suggest one possible method for making such a comparison: use of a parallel treatment design with matched tasks. Similarly, given that some form of varied instruction following was required to establish control by the complete textual instruction stimuli, it may be helpful to directly compare traditional teaching using textual prompts (e.g., the methods described in the standard training herein) to varied instruction training.

In addition, some secondary anecdotal findings from these studies have suggested other possible uses of textual prompts. Several of the subjects were not able to follow vocal instructions containing prepositions. The instructions used here required comprehension of four prepositional relations (on, under, in, and by). As noted earlier, any subject who could not demonstrate these prepositions receptively was taught to do so or was dropped from the study. At least 2 of these subjects were not able to acquire the discrimination of on and under without the addition and fading of a textual prompt. Thus, it might be interesting to evaluate the use of textual prompts when training prepositions. Finally, these methods could be replicated with additional modes of instructional delivery such as vocal instructions, computer-delivered instructions, sign language instructions, and others. The recent emergence of computer-based prompting and communication systems seems like an especially ripe area for follow up research.

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BIOGRAPHICAL SKETCH

Cara L. Phillips was born in Miami and raised in south Florida and New York. She received her Bachelor of Science degree, cum laude, in psychology from the College of William and Mary in 1998. After college, Cara worked as a behavioral therapist in residential treatment, public schools, in-home programs, and autism clinics. In 2003, Cara began graduate training at Florida State University under the supervision of Drs. Al Murphy and Jon Bailey. Cara worked as a senior behavior therapist with the ABOVE ALL Autism program while studying at FSU. Cara sat for and passed the board certification exam upon completion of her Master of Science degree.

Immediately after completing her master's program, Cara began attending the doctoral program in behavior analysis at the University of Florida under the mentorship of Dr. Timothy Vollmer. At UF, Cara focused her research in the area of language acquisition with children with ASD and other ID. In 2009, she won the Sidney and Janet Bijou Fellowship award presented by the Society for the Advancement of Behavior Analysis for her research on teaching instruction following, one example of which was published in the Journal of Applied Behavior Analysis (Phillips & Vollmer, 2012). Cara provided in-home consultation services to a number of families in Gainesville under Dr. Vollmer's supervision. In addition, she was one of several of Dr. Vollmer's students to serve as a behavioral consultant for the City of Davenport, Iowa school district. In this capacity, she provided services to four school sites with self-contained ASD classrooms, integrated students, or both. Cara also assisted Drs. Vollmer and Lewis in the development of an R21 NIH grant application related to rigidity with play behaviors in children with ASD. She worked as a research assistant on the funded project from the spring of 2011 until graduation. After earning her doctorate, Cara went on to a postdoctoral fellowship at the Kennedy Krieger Institute in Baltimore.