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Evaluating Task-Interspersal Outcomes with Children Diagnosed with Autism: Systematic and Direct Replications

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EVALUATING TASK-INTERSPERSAL OUTCOMES WITH CHILDREN DIAGNOSED WITH AUTISM: SYSTEMATIC AND DIRECT REPLICATIONS

by

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EVALUATING TASK-INTERSPERSAL OUTCOMES WITH CHILDREN DIAGNOSED WITH AUTISM: SYSTEMATIC AND DIRECT REPLICATIONS

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This study sought to replicate findings by Charlop et al. (1992) in which presenting the same consequences for maintenance (previously learned tasks) and nonacquired tasks was found to stagnate learning on nonacquired tasks during task interspersal. Initially, we conducted a systematic replication (Study 1). However, presenting the same consequences for maintenance and nonacquired tasks did not appear to stagnate learning for our participants. All participants reached mastery criterion for the nonacquired vocal task during baseline and two of three participants reached mastery criterion for the nonacquired motor task during baseline. Subsequently, we conducted a direct replication (Study 2). Again, all participants reached mastery criterion for the vocal task during baseline and one participant reached mastery criterion for the motor task during baseline. The results are discussed in the context of the differences between studies that might have contributed to the discrepant findings.

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INTRODUCTION

According to the Diagnostic and Statistical Manual of Mental Disorders (4th ed.), pervasive developmental disorders including autistic disorder and PDD-NOS (pervasive developmental disorder - not otherwise specified) are typically characterized by marked impairments in multiple areas of development, including: a) reciprocal social interaction, b) communicative skills, c) the presence of stereotypical or repetitive behaviors, and d) a limited range of interests (American Psychiatric Association, 1994). These disorders are first diagnosed in early childhood and their prevalence is approximately 5-15 per 10,000 children (Howlin, 1997).

Although the specific etiologies of the pervasive developmental disorders are largely unknown, children who do not receive specialized treatment run the risk of more restricted residential placements during their adult lives. According to Howlin (1997), treatment and education are essential in minimizing behavioral problems and ensuring the development of existing skills. Nonetheless, only a small percentage of children diagnosed with autism will go on to lead typical adult lives (Howlin). Studies suggest that early intensive behavioral intervention may result in significant gains in overall level of functioning (e.g., Lovaas, 1987; Lovaas, Koegel, Simmons, & Long, 1973; Lovaas, Schreibman, & Koegel, 1974; McEachin, Smith, & Lovaas, 1993). Further, early intensive behavioral intervention has been demonstrated to be successful in integrating children into general education classroom and research suggests that approximately one third of all cases will achieve some level of independence (Green, 1999; Maurice, Green, & Luce, 1996).

From a behavioral perspective, autism is viewed as "a syndrome of behavioral deficits and excesses that have a neurological basis," but is subject to change with highly specific, structured intensive training (Green, 1996, p. 29). Early behavioral intervention is based on one of the fundamental tenets of operant conditioning, that behavior is primarily governed by its consequences (Skinner, 1953). Consequences that increase the future frequency of a behavior are reinforcers, while those that decrease the future frequency of behavior are punishers. Behavior classes whose frequencies are modifiable by consequences are termed operants. In early behavioral intervention, procedures based on reinforcement and punishment are used to increase appropriate behaviors and reduce aberrant behaviors within various areas.

In one common behavioral approach, discrete-trial (i.e., restricted operant) training, blocks of learning trials are presented to provide an increased number of learning opportunities for the child. According to Lovaas (1987), each discrete trial is a method to present an instruction and training material to the child in a clear and concise manner, with a clear start and finish. A discrete trial is a single teaching unit that starts with an instruction and ends with the delivery of a consequence. Preferred items, praise, or physical interactions typically follow a correct response. Incorrect responding or a failure to respond may result in verbal feedback (e.g., "no") or physical guidance. It is not uncommon in early intervention programs for multiple academic areas to be concurrently taught in thousands of trials per week. This training format may be presented to the child over several hours of training per day and up to 40 or more hours per week (Smith, 2001). Depending on the type of task and the type of item delivered as the consequence, there may be 1 to 50 trials (i.e., learning opportunities) per min (Lovaas).

Early behavioral intervention typically involves a structured curriculum that is developmentally sequenced. As such, easier skills are taught first and may include proper sitting, proper attending, non-vocal imitation, matching-to-sample, following instructions, vocal imitation, play/social skills, and object identification (e.g., Leaf & McEachin, 1999; Lovaas, 1981, Maurice et al., 1996). It has been hypothesized that the combination of a hierarchical curriculum, an increased number of learning opportunities, the use of discrete-trial training, and the deliberate programming of consequences has led to the success of children diagnosed with autism who receive this type of therapy (Maurice et al.).

In one of the first studies in the behavioral intervention literature, Ferster and DeMyer (1962) conducted a series of studies in which three children diagnosed with autism received reinforcement for engaging in simple behaviors, such as matching-to-sample. The authors found that training in an experimental setting led to significant positive changes in the children's repertoires. According to Lovaas et al. (1974), "these early studies were the first to show that the behavior of autistic children could be related in a lawful manner to certain explicit environmental changes" (p. 113).

Other studies have suggested that early intensive behavioral intervention can result in significant improvement to overall level of functioning such as improved intellectual abilities as measured by standardized tests or developmental scales (Lovaas, 1987; Lovaas et al., 1974; McEachin, Smith, & Lovaas, 1997). In a seminal study conducted by Lovaas (1987), 19 children diagnosed with autism received 40 or more hours per week of one-to-one behavioral treatment from trained undergraduate students. A control group of 19 comparable children received 10 or fewer hours of similar treatment, while a second control group of 21 children were treated in other programs. It was reported that 90% of the experimental group made improvements on measures of intellectual ability. Moreover, 47% of the experimental group of children were found to achieve IQs in the "normal" intellectual functioning range after treatment. In a follow-up study conducted by Lovaas and colleagues, 42% of the children from the original treatment group were found to maintain significant, long-lasting gains, which led to less restrictive educational placements (McEachin et al.).

In a more recent study conducted by Sheinkopf and Siegel (1998), the efficacy of home-based intensive behavioral intervention delivered by parent-managed therapy teams was assessed with 11 pairs of students diagnosed with autistic disorder or PDD-NOS drawn from a larger longitudinal study. Eleven students who had received treatment developed by Lovaas et al. (1981) participated in the experimental condition and were matched to students in a control group based on IQ, gender, diagnosis, and interval between pre- and post assessments prospective to treatment. Children in the experimental group were found to have significantly higher IQ scores and received lower severity symptom ratings post-treatment than children in the control group. Additionally, five of the children from the experimental group were placed in a general education classroom.

Given that the literature is generally supportive of the behavioral approach in the treatment of autism, and that many behavioral programs are based on the presentation of numerous trials, research on trial presentation formats is warranted. One of the most salient issues in this area concerns the distribution of maintenance and nonacquired tasks within a session. Some professionals (e.g., Maurice et al., 1996; Smith, 2001) have found that the presentation of new tasks in a massed- or continuous-trial format to be most effective, whereas others have advocated interspersed-trial training (i.e., maintenance tasks are distributed with nonacquired tasks; e.g., Dunlap, 1984). Task interspersal has been demonstrated to be effective with several populations, including children and adults diagnosed with mild to severe retardation, autism, learning disabilities, brain injuries, among others (e.g., Dunlap, 1984; Dunlap & Koegel, 1980; Neef, Iwata, & Page, 1980; Singh, Farquhar, & Hewett, 1991; Weber & Thorpe, 1989; Winterling, Dunlap, & O'Neill, 1987). Further, task interspersal has been used to increase acquisition and maintenance in areas as diverse as pre-academic skills, spelling performance, money skills, and physical education.

In general, the literature on task interspersal has produced mixed findings. Some studies have found that task interspersal can lead to a higher rate of acquisition, generalization, and maintenance when compared to massed presentation of training trials (e.g., Dunlap, 1984; Dunlap & Koegel, 1980; Neef et al. 1980). While some studies have not found significant differences in the rate of nonacquired and maintenance during training between massed and interspersal formats (e.g., Panyan & Hall, 1978), others have found task interspersal to be superior only when specific types of tasks (e.g., Dunlap, 1984) or reinforcers (e.g., Charlop, Kurtz, & Milstein, 1992) are utilized.

In one of the first studies assessing task interspersal with children diagnosed with autism, Dunlap and Koegel (1980) examined rates of acquisition while training pre-academic skills. Two girls that were diagnosed with autism were included in the study. Using a multiple-baseline design across tasks, the authors evaluated the differential effectiveness of two teaching formats (massed vs. interspersal) on acquisition rate during pre-academic training sessions. During baseline (massed condition), a single task was presented throughout the session. For the experimental condition (task interspersal), the same task was interspersed with a variety of other tasks. For all participants, unprompted responses increased during the experimental condition.

Additionally, when the massed condition was re-introduced as a brief reversal, acquisition on the same task stagnated or declined. The types of consequences used and the schedule of reinforcement were not discussed in the study. In summary, the authors found the rate of correct responding to increase when maintenance tasks were interspersed with the nonacquired task. However, the authors suggest that the results be interpreted with caution since it was not clear whether partial acquisition of the target task occurred during the early stages of baseline. Finally, the authors suggested that moderate to high rates of acquisition may have occurred early during baseline, and that a subsequent decline in responding may have occurred due to "boredom", while task interspersal provided novelty in training and facilitated maintenance of the tasks.

In a follow-up study, Dunlap (1984) evaluated the rate of acquisition during training using an alternating treatments design. Four children diagnosed with autism participated in the study. Three conditions were examined during this study: massed-task, interspersal with nonacquired tasks, and interspersal with maintenance tasks. During the massed-task condition, a single nonacquired task was presented consecutively during a session. For the interspersed-acquisition task condition, 10 nonacquired tasks were randomly interspersed throughout a session. Finally, for the interspersal with maintenance condition, five nonacquired tasks were interspersed with five tasks that had been previously acquired (i.e., a mastery criterion had been met). Praise and edibles were provided on a fixed-ratio (FR) 1 schedule of reinforcement for correct responding across all conditions and phases of the study. Again, the interspersal-with-maintenance-task condition was found to produce the highest rate of acquisition, as measured by percentage of correct unprompted responses and number of trials required to reach criterion. The massed-task and interspersal-with-nonacquired-task conditions were found to be comparable. Additionally, higher levels of positive affect and rates of responding were observed during the interspersal-with- maintenance-task condition. In summary, the findings suggest that merely interspersing tasks is not sufficient to improve acquisition rate. It is necessary to intersperse maintenance items with nonacquired items in order to boost rate of acquisition during training.

In an extension of the aforementioned studies, Charlop et al. (1992) evaluated the use of task interspersal in conjunction with various consequence types and schedules of reinforcement. In their study, two female (between 4 and 5 yrs) and three male (between 5 and 6 yrs) participants diagnosed with autism were exposed to interspersed trials of both maintenance (i.e., performing at 80% for at least 3 months) and nonacquired (i.e., material that had never before been presented to the child) tasks. Specifically, the effect of type (i.e., food, praise, no programmed consequence) and schedule of reinforcement (i.e., continuous versus intermittent) upon nonacquired task performance was examined using a multiple baseline design across tasks. During baseline, the experimenters provided continuous reinforcement [i.e., fixed-ratio (FR) 1] on the nonacquired tasks and used a variable-ratio (VR) 3 schedule for the maintenance tasks. During treatment, three reinforcement contingencies were compared. During the praise-only condition, correct responding resulted in positive verbal feedback. During the condition in which no programmed consequences were in effect, correct responses were ignored. Finally, during the return to baseline (i.e., reinforcement condition), edibles were used to reinforce all correct responses. A return to baseline was incorporated to examine whether using edibles once criterion was met would affect responding. The authors found that when the same reinforcers (i.e., edibles) were presented for both types of tasks, learning on the nonacquired task was impeded. However, when praise alone or no programmed consequence was provided for the maintenance task, and edibles continued to be provided for the nonacquired tasks, rate of learning on the nonacquired task increased dramatically. Further, utilizing edibles once the participant met criterion (mastery) on the nonacquired tasks was not found to influence responding, suggesting that type of reinforcer used during initial training to be an important variable in acquisition rate.

Charlop et al. (1992) provided two possible explanations for their provocative finding. The authors suggested that responding increases when the magnitude and quality of a reinforcer are increased. The authors posited that a richer schedule of reinforcement favored the maintenance tasks. Although a thinner schedule of edible consequences was provided for maintenance tasks, these behaviors may have been more likely to be emitted because they were already in the participants' repertoires. Consequently, the participants were more likely to receive edibles for the maintenance tasks. When food was no longer presented as a consequence for the maintenance tasks, the magnitude and density of reinforcement now favored the nonacquired tasks. Thus, it was hypothesized that the participants might have favored the nonacquired tasks during treatment due to this increase of reinforcement magnitude and density. However, visual inspection of their findings suggests that the ratio of reinforcers for responding on maintenance tasks was not higher than those for responding on nonacquired tasks during baseline.

A second possibility discussed by Charlop et al. is behavioral contrast. According to Catania (1998), behavioral contrast may occur when the reinforcement schedule in only one of two components of a multiple schedule is changed. That is, a decrease in reinforcement in the presence of the first discriminative stimulus will lead to an increase in performance in the presence of the second stimulus, even though the reinforcement in the second component remains unchanged. Charlop et al. surmised that differences in the schedules and type of reinforcement during treatment might have favored responding on the nonacquired tasks by providing a contrast in reinforcement density. However, behavioral contrast effects are highly variable and most often specific to multiple schedules. Although the preparation employed by Charlop et al. is similar to a two-component multiple schedule, a key difference is that each component required a qualitatively different response.

The study by Charlop et al. (1992) was the first to examine reinforcement schedule and type in conjunction with task interspersal. The authors found that presenting the same type of consequence for maintenance and nonacquired tasks during training hindered rate of acquisition. This is a provocative finding given that task interspersal is a common technique used to teach children with autism (e.g., Stahmer, 1999). Thus, replication of the Charlop et al. investigation is warranted.

The initial purpose of the current study was to systematically replicate the Charlop et al. (1992) study. Although similar task interspersal procedures and schedules of reinforcement were used, our investigation differed from Charlop et al.'s in several ways. Although Charlop et al. assessed only motor tasks, we examined the effects across both motor and vocal tasks because early intervention programs typically involve training for both vocal (e.g., tact training) and motor (e.g., receptive discrimination) tasks (e.g., Leaf & McEachin, 1999). Further, we trained functionally similar tasks (i.e., sub-tasks) instead of maintenance compliance behaviors to be used for task interspersal prior to the onset of the study because such interspersal arrangements are common during early intervention (Lovaas, 1981). Finally, we excluded the no programmed consequence condition, as it is unlikely for parents and teachers to ignore correct responding in the natural environment.

The systematic replication study did not produce findings similar to Charlop et al. (1992). In other words, the negative effects of task interspersal were not replicated. Thus, a direct replication was conducted with the same participants to determine whether the failure to replicate was a result of procedural differences between the studies.

METHOD

Participants

Three children who had received a prior diagnosis of autistic disorder according to DSM-IV criteria were included in the study. All participants were recruited from the Center for Autism at Western Michigan University. Jay was 7 years of age, Keith was 5 years of age, and Will was 3 years of age. Participants were assessed for three prerequisite learning skills before admission into the study: generalized non-vocal imitation (NVI), vocal imitation (VI), and listener behavior (i.e., following instructions) as defined using the Behavior Language Assessment [1] (Sundberg & Partington, 1998). These criteria were chosen to ensure that participants could be taught using standard prompting procedures (e.g., prompting, modeling). One participant who did not meet the aforementioned criteria was not admitted to the study. In addition, participants that exhibited problem behaviors (e.g., aggression, self-injury) were excluded. One child initially referred for the study was subsequently excluded due to the presence of significant problem behavior.

Setting and Materials

Sessions took place in a quiet area either at the participant's home or in a small university research room. The experimenter was seated either across from or adjacent to the participant at a table, where all training occurred. Most sessions were

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[1] The Behavior Language Assessment is an informant rating scale, which is administered as an interview to an individual that is familiar with the child's abilities. We administered the scale to the participant's parent(s) or teacher. The scale contains 12 different sections that provide an overview of basic learning and language skills based on Skinner's (1957) analysis of verbal behavior. Each section is subdivided into 5 levels, where level 1 represents no skills in an area, and 5 represents strong skills in an area. Information obtained from the assessment is typically used to guide a professional in making initial curriculum decisions in an early intervention program for a child.

videotaped for subsequent data scoring purposes. The video camera was placed in the room in the most unobtrusive manner possible. An observer, in addition to the experimenter, was present for some of the sessions to collect data. Consent for videotaping was attained prior to the study.

In this study, a task was defined as a new form of behavior consisting of several training sub-tasks (i.e., exemplars). For example, for the task of object labeling, several sub-tasks were trained, such as the vocal response of "car" and "doll" in the presence of those items. The materials depended on the type of task being taught (see Table 1). Finally, preferred food items (as identified via stimulus preference assessments) were used as consequences for correct responses during nonacquired and maintenance tasks, depending on the experimental condition.

Stimulus Preference Assessment

Prior to the study, parents were asked to complete the Reinforcer Assessment for Individuals with Severe Disabilities (RAISD; Fisher, Piazza, Bowman, & Amari, 1996) to identify four to eight items for subsequent stimulus preference assessments. A paired stimulus preference assessment (Fisher et al., 1992) was then conducted to identify a hierarchy of preferred items. During the assessment, a pair of items was placed in front of the participant. When the participant chose one of the stimuli, the remaining item was removed. Another pair of items was then presented and the participant was prompted to "pick one." This method continued until all of the stimuli were presented in pairs and a hierarchy of preferred items was determined. In order to control for continually changing preferences, a brief multiple stimulus without replacement assessment (MSWO; DeLeon & Iwata, 1996) was conducted prior to each session for each of the participants. For the brief MSWO assessment, the top two to three edibles as identified from initial preference assessments, were placed in a row in front of the participant and he or she was be prompted to select one item. The first two items touched or eaten were used as putative reinforcers and were varied randomly during the sessions for that day. Parents were instructed to restrict, as much as possible, delivering to their child food items that were used during the study.

Response Definitions and Measurement

Response definitions depended on the type of tasks used for each participant (see Table 1). Responses were measured within a discrete-trial teaching format in which the target task was presented in blocks of 10 trials. Each block of 10 trials constituted one session. One to six sessions were conducted each day, with a 5-min break provided between each session. Each trial was scored as either correct or incorrect. A correct response was defined as a response that was accurately and independently emitted by the participant (i.e., not prompted by the therapist) within 3-5 s of the instruction. The percentage of correct responses during each session constituted the dependent measure.

Tasks were selected with the consultation of the participant's parent and schoolteacher. *Maintenance* tasks for Study 1 consisted of tasks that the participant had previously mastered during pre-training. The mastery criterion required that the participant score 90% or above during at least three consecutive sessions, with the first trial being correct during our pre-training sessions. *Nonacquired* tasks consisted of an additional sub-task from the same program from which the maintenance tasks were selected. Parents were instructed not to practice the nonacquired and maintenance tasks with their children at any time during the course of the study.

Motor tasks. Motor tasks were defined as tasks that required an observable motor response only. An example of a motor task might include pointing to or retrieving an object (i.e., receptive discrimination; see Table 1).

Vocal tasks. Vocal tasks were defined as tasks that required an audible vocal response. Vocal tasks for this study included answering questions and beginner conversational skills (i.e., intraverbal training; see Table 1).

Experimental design. A multiple-baseline design across task type (motor vs. vocal) was used for both Study 1 and Study 2. Motor and vocal tasks were taught in separate sessions. If a sub-task was acquired during baseline, a second sub-task was taught for that participant. If acquisition was again reached during baseline, training for that particular task type (i.e., motor or vocal) was completed. However, training on the other task type continued. If mastery was met during baseline for the second task type, we proceeded to Study 2, in which a new task was trained with the participant using the same procedures as Charlop et al. (1992). That is, new motor and/or vocal tasks were trained and interspersed with three functionally dissimilar tasks.

Treatment integrity. Treatment integrity data were collected for quasi-randomly selected sessions for each participant. Treatment integrity was calculated by dividing the number of correctly implemented trials by the total number of trials conducted by the experimenter multiplied by 100%. Trials were scored as correct or incorrect based on the following categories: (1) Discriminative stimulus (S^D) – The

S^D for the correct response was provided by the experimenter at the beginning of each trial, (2) Delay – A delay of 3-5 s was given in which the participant was provided an opportunity to respond, (3) Reinforcement – If the participant independently responded correctly, an edible and/or praise was immediately provided for the response, (4) Correction – if the participant responded incorrectly or did not respond, the experimenter initiated the error correction procedure, (5) Intertrial interval (ITI) – the onset of the next trial was delayed by approximately 3 s in which there was no interaction between the experimenter and the participant. A correct trial was defined when the experimenter completed all of the aforementioned steps.

Treatment-integrity data are provided in Table 2 for each participant. Treatment integrity was calculated for at least 28% of sessions and was 100% for all participants across task types in both studies. Interobserver agreement (IOA) on treatment-integrity measures (e.g., delay, correction) was collected for at least 30% of the sessions in which treatment integrity was assessed and was 100% for each participant.

Study 1: Systematic Replication of Charlop et al. (1992)

Procedures

Pre-experimental sessions. Prior to baseline, participants were taught three sub-tasks (exemplars) for each of the chosen program areas to a criterion of 90% correct or higher for three consecutive sessions with the first response of each session being correct (mastery criterion). These tasks were taught in blocks of 10 massed trials and subsequently used as maintenance items during the remainder of the study. Participants were taught to emit the target response for each sub-task using FR-1 reinforcement (food and verbal praise), modeling, and physical prompts (when necessary). Failure to respond (within 3-5 s) or an incorrect response resulted in error correction. Error correction consisted of a vocal "no" and a prompted trial (using a least-to-most prompt hierarchy), followed by an independent opportunity to respond.

Only correct and independent responses were followed by programmed consequences, in which the type of reinforcement depended on the phase of the experiment. Trials were presented when the participant was attending and not engaged in aberrant or off-task behaviors. When each participant could independently perform a response without prompting and the aforementioned mastery criterion was met, the task was considered mastered. Each pre-training session consisted of blocks of 10 discrete trials. Once mastery criterion was met for each of the three sub-tasks during pre-experimental sessions, participants proceeded into baseline of Study 1.

Baseline. During this phase, a nonacquired sub-task (motor or vocal) was quasi-randomly interspersed with the three sub-tasks taught during pre-experimental sessions in the same training area. That is for each presentation of a nonacquired trial, one maintenance trial was presented. The sub-tasks presented during maintenance trials were randomly selected. This interspersal method (i.e., 1:1 of nonacquired to maintenance tasks) was used throughout the study to ensure an equal number of trials of each type of task across participants. Preferred edibles were provided on an FR-1 schedule for correct responding on nonacquired tasks and on a VR-3 schedule for maintenance tasks. Praise was provided for correct responding for both types of tasks. Incorrect responding resulted in the error correction procedure previously described in Pre-experimental sessions section.

Treatment. The treatment sessions were identical to baseline sessions, except that correct responses on the maintenance tasks were only praised. Correct responding for the nonacquired task continued to be reinforced on an FR-1 (edibles) schedule. However, the reinforcement schedule for maintenance tasks was changed from a VR-3 edibles/FR-1 praise schedule to an FR-1 praise-only schedule.

Interobserver agreement. Interobserver agreement (IOA) was calculated using the overall agreement formula: agreements divided by agreements plus disagreements multiplied by 100% (Poling, Methot & LeSage, 1995). An agreement referred to an instance in which two independent observers agreed on whether the response was correct or incorrect. IOA was assessed by having a second observer record data either in vivo or from videotape. For Jay, IOA data were collected for 66% and 36% of sessions for motor and vocal tasks, respectively. Mean IOA was 100% for both task types. For Keith, IOA data were collected for 60% of motor-task sessions and 50% of vocal sessions. Mean IOA was 93% (range, 80-100%) and 98% (range, 90-100%) for the motor and vocal tasks, respectively. For Will, IOA data were collected for 66% of sessions for both motor and vocal tasks. Mean IOA was 100% for both task types.

Study 2: Direct Replication of Charlop et al. (1992)

Procedures

Baseline. During this phase, a nonacquired task (motor or vocal) was quasi-randomly interspersed with three functionally dissimilar maintenance tasks. That is, previously learned behavior (i.e., cooperation behaviors) such as making eye contact, placing hands in lap, and sitting nicely were used as maintenance tasks. Edibles were provided on an FR-1 schedule for correct responding during nonacquired tasks and on a VR-3 schedule during maintenance tasks. Praise was provided for correct responding for both types of tasks. Incorrect responding resulted in the error correction procedure previously described in Pre-experimental sessions section in Study 1.

Treatment. The treatment sessions for Study 2 were identical those in Study 1, with the exception that a second treatment was implemented for Jay. Due to his failure to acquire the task and increasing levels of self-injurious and aggressive behavior, treatment 1 (i.e., praise only for maintenance tasks) was terminated and treatment 2 (i.e., two-item massed trial) was implemented. For treatment 2, 5 sessions of massed trials were conducted, in which correct responses were reinforced on an FR-1 schedule with edibles and praise. When acquisition was observed, we returned to three-item sequences (i.e., identical to baseline). We were unable to return to task interspersal prior to the participant's exit from the study.

Interobserver agreement. For Jay, IOA data were collected for 50% and 64% of sessions for motor and vocal tasks, respectively. Mean IOA was 100% for both task types. For Keith, IOA data were collected for 28% of motor-task sessions. Mean IOA was 93% (range, 80-100%). IOA data were collected for Jay's vocal-task sessions for 33% of sessions. Mean IOA was 94% (range, 70-100%). For Will, IOA data were collected for 29% and 33% of motor and vocal tasks, respectively. Mean IOA was 100% for both task types.

RESULTS

Study 1

Figures 1 through 3 display the results of the systematic replication for all participants. All participants achieved the mastery criterion for the nonacquired vocal task during the baseline condition within 22 sessions. In addition, Keith and Will reached the mastery criterion for the nonacquired motor tasks within 4 sessions during baseline. Each participant's data are described in detail below.

Jay's data are shown in Figure 1. As seen in the upper panel, his performance on the nonacquired vocal task was 60% correct during the first session, but quickly dropped to 0% correct by the fourth vocal-task session. However, an upward trend was subsequently observed and the nonacquired task was mastered shortly thereafter. Jay's performance of the maintenance task was consistently high throughout the evaluation. As seen in the lower panel, responding on the nonacquired motor task initially occurred at a low and variable level and subsequently increased. Unfortunately, a procedural error was made and the treatment was implemented when the skill had already reached a level of 60-80% correct. After treatment (i.e., food consequences were discontinued for correct maintenance responses), responding remained at this level for a few sessions before quickly reaching the mastery criterion. Because of the significant upward trend already evident before treatment, it is unclear whether treatment actually produced a change in behavior.

Figures 2 and 3 display the results for Keith and Will, respectively. Both participants show similar learning trends, as the nonacquired motor and vocal tasks were quickly mastered. As soon as mastery of each nonacquired task was achieved, an additional sub-task was taught to each participant. These sub-tasks were then also quickly mastered.

Study 2

Figures 4 through 6 display the results of the direct replication for all participants. All participants achieved the mastery criterion for the nonacquired vocal task during the baseline condition within 30 sessions. Will reached the mastery criterion for the nonacquired motor task within 20 sessions during baseline. Although 100% correct responding was achieved during two sessions (sessions 5 & 21), Keith did not meet mastery criterion on the motor task due to increasing levels of problem behavior and an early exit from the study. Each participant's data are described in detail below.

Jay's data are shown in Figure 4. As seen in the upper panel, his performance on the nonacquired vocal task rapidly increased and reached the mastery criterion within 9 vocal-task sessions. As seen in the lower panel, responding on the nonacquired task remained low throughout baseline. Thus, when the nonacquired vocal task reached its mastery criterion treatment was implemented for the motor task. During treatment, responding on both maintenance and nonacquired tasks remained stable and similar to baseline. In other words, the treatment appeared ineffective. During the 6 sessions in which treatment was implemented (sessions 18 through 23), Jay became increasingly agitated during sessions. Further, increasing levels of problem behavior became a concern to researchers and his guardian. Thus, a decision was made to terminate treatment and initiate an alternative treatment (i.e., treatment 2). An increase in correct responding on the nonacquired vocal task was observed during the first session of treatment 2, during which five massed-trial sessions were implemented using a 2-card sequence before returning to the 3-card sequence format. Although an increasing trend was observed during the alternative treatment, due to personal reasons, Jay's guardian requested that he be excused from the study. Thus, we were unable to return to the interspersal-teaching format and Jay was unable to reach mastery criterion for the nonacquired motor task (however, the last massed trial session was 80% correct). Anecdotally, it should be noted that problem behavior returned to pretreatment (lower) levels during the second treatment.

Figure 5 shows Keith's responding on the vocal (upper panel) and motor (lower panel) tasks. Keith reached mastery on the nonacquired vocal task in 12 sessions. His initial responding on the nonacquired motor task quickly increased to a level of approximately 60%-80% correct. However, at session 24, both the maintenance and nonacquired tasks became increasingly variable and decreased to a level of 60% correct. Due to increasing demands on Keith's guardian, Keith exited the study prior to reaching mastery criterion on the nonacquired motor task. Figure 6 shows Will's responding on the vocal (upper panel) and motor (lower panel) tasks. Will's performance on the vocal task was initially stable at 40% correct for 5 consecutive sessions. However, responding soon increased to a higher level and became significantly more variable, resulting in a longer time to reach the mastery criterion (which he did after 30 vocal-task sessions). A similar pattern was observed with Will's motor task. It should be noted that the increase in variability in Will's responding began at the same point in time and was evident in both the vocal and motor tasks. Further, his responding on both maintenance tasks was high and variable (considerably more variable on the motor task).

Although both studies failed to demonstrate a reliable suppression of nonacquired tasks due to shared reinforcer types with maintenance tasks, nonacquired tasks in the direct replication (Study 2) generally resulted in more variability and more trials to criterion than their counterparts in the systematic replication.

DISCUSSION

The current manuscript includes systematic and direct replications of a study reported by Charlop et al. (1992). Charlop et al. demonstrated that presenting the same consequences for both maintenance and nonacquired tasks during task interspersal training prevented learning of the nonacquired tasks with autistic children. Study 1 was an attempt to systematically replicate and extend the Charlop et al. study. However, utilizing the same consequences for maintenance and nonacquired tasks did not appear to prevent learning for our participants. All participants reached the mastery criterion for the nonacquired vocal task during baseline and two of three participants reached mastery criterion for the nonacquired motor task during baseline. It is possible that at least two methodological differences between Study 1 and the Charlop et al. study might have affected the findings. That is, it is possible that stalled learning of nonacquired tasks, when using the same type of reinforcers for maintenance and nonacquired tasks, is a phenomenon observed only when interspersing specific types of tasks under some conditions.

One of the primary differences between Study 1 and the Charlop et al. (1992) study is that Charlop et al. used maintenance tasks on which participants had reached mastery criteria at least 3 months prior to the study. In Study 2, maintenance tasks were taught and mastered during pre-training, only one month before the study began. It is possible that interspersing tasks that had only recently been mastered inadvertently affected our findings. In addition, research has shown that for certain types of tasks (e.g., imitation training), mastery on the first few exemplars often leads to more rapid acquisition on subsequent exemplars (Martin & Pear, 1999). Charlop et al. employed cooperation behaviors as their maintenance tasks. However, previous sub-tasks (exemplars) in the same program area were used as maintenance tasks in Study 1.

It is possible that the recency with which maintenance tasks were mastered or the nature of the tasks themselves rendered neutral the effect reported by Charlop et al. (1992). Thus, we subsequently conducted a direct replication (Study 2) to determine whether these methodological differences in Study 1 were responsible for neutralizing the effects. Again, all participants reached mastery criterion for the vocal task during baseline and one participant reached mastery criterion for the motor task during baseline. Although treatment was implemented for one participant (Jay), we were unable to replicate the findings by Charlop et al.

As with any failure to directly replicate a previous study, examination of differences between studies is crucial. One of the differences between Study 2 and the Charlop et al. (1992) study is the participants' backgrounds. All of the participants in our study attended for at least a year a local public school in which pre-academic and academic skills were taught primarily using the discrete-trial-training format. Thus, all participants in this study had extensive experience with the teaching format used in the study. By contrast, the participants in the Charlop et al. study attended an after-school program twice per week that utilized discrete-trial-training methods. Typically, for children in the early stages of intensive behavioral intervention, this is the first time that they have been required to sit and attend for more than a minute. Consequently, most children resist teaching efforts early in therapy by attempting to leave the therapy area, crying, and they may even exhibit aggression or self-injury (Anderson, Taras, & O'Malley-Cannon, 1996). Children with a longer history of intensive intervention may "learn" more readily in such teaching situations. It is possible that the detrimental affect of task interspersal reported by Charlop et al. (1992) is limited to children who are in the early stages of training and require more than task interspersal procedures to promote learning.

A second, potentially critical, difference between the Charlop et al. (1992) study and Study 2 is that, in the latter, stimulus preference assessments were conducted before each session. Thus, edible consequences used during Study 2 were empirically demonstrated to be preferred by the participants. In contrast, Charlop et al. did not conduct systematic preference assessments. It is well documented in the literature that children diagnosed with autism are difficult to motivate (Dunlap & Koegel, 1980), display a restricted preference for reinforcers (Lovaas, 1987), and sometimes display changing preferences (Carr, Nicolson, & Higbee, 2000). It is possible that the consequences provided by Charlop et al. were not sufficient to motivate both the maintenance and nonacquired tasks. Thus, when the food consequences were no longer delivered for maintenance tasks, a reinforcing effect was finally able to be demonstrated

A third difference between the studies is that special screening of participant characteristics occurred in the current study. Only participants that could follow simple instructions and exhibited minimal problem behavior[2] were admitted into the study. However, the five children that participated in the Charlop et al. study engaged in some form of stereotypy, aggression, or general noncompliance. Research has found that problem behavior (including stereotypy) restricts learning opportunities because much time must be devoted to minimizing those problem behaviors (Dunlap, 1984; Lovaas, 1987). It is possible that the presence of problem behavior (including noncompliance), perhaps in combination with the aforementioned variables, contributed to the Charlop et al. finding.

When evaluating the outcome of the current study, at least three noteworthy limitations must be addressed. First, treatment was implemented for Jay during the systematic replication even though an increasing trend was identified. Due to this procedural error, it is unknown whether mastery criterion would have been met in the absence of treatment. Second, Keith did not reach the mastery criterion on the nonacquired motor task during study 2 (direct replication) due to an early exit from the study. Thus, the findings of this study must be interpreted with caution, because the length of time required for mastery is unknown for two of three participants on the motor task. Third, it was our initial intention to use a multiple-baseline design to demonstrate experimental control. Because treatment was implemented for only one participant, on one task, we were unable to utilize a multiple-baseline design.

[2] It should be noted that participants were initially screened for problem behavior. If problem behavior developed during the study, compliance procedures were used to manage these behaviors.

Although experimental control was not technically demonstrated, it should be noted that the requirement for implementing treatment (i.e., suppression of the nonacquired task during baseline) was not present.

It is important to note that we do not intend to diminish the contributions or discredit the findings of Charlop et al. (1992). Although we failed to replicate the finding, the effect clearly exists under certain conditions. The contribution of the current studies is the knowledge that the detrimental task-interspersal effect reported by Charlop et al. is not a reliable finding. It is the task of future researchers to determine under what conditions the finding can be reproduced. The most likely topics of such research would be to replicate the procedures with children who are first entering early intervention programs to determine whether this phenomenon is specific to children with minimal exposure to intensive intervention. An evaluation of the contribution of stimulus preference assessments might also be warranted.

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APPENDIX A

Tables

Table 1

Descriptions of tasks, responses, and sample instructions (S^Ds).

Task Type/Participant	Task	Response	Sample S^D
Study 1			
Motor			
Jay	Receptive	child identifies correct item	"touch bowl"
Keith	3-item Sequence	child puts story cards in order	"put in order"
Will	2-item RFFC	child identifies item by feature, function, or class	"which one do you sit on?"
Vocal			
Jay	Tact	child vocally identifies item	"what is this?"
Keith	Phonemes	child vocally identifies letter sound	"what sound?"
Will	Intraverbals	child completes sentence	"you eat with <noun>"
Study 2			
Motor			
Jay	3-item Sequence	child puts story cards in order	"put in order"
Keith	Receptive	child identifies weekday	"what day?"
Will	2-item RFFC	child identifies item by feature, function, or class	"give me two things you eat"
Vocal			
Jay	Tact	child vocally identifies item	"what is this?"
Keith	Tact	child vocally identifies item	"what is this?"
Will	Intraverbals	child answers question	"tell me something you eat"

Table 2

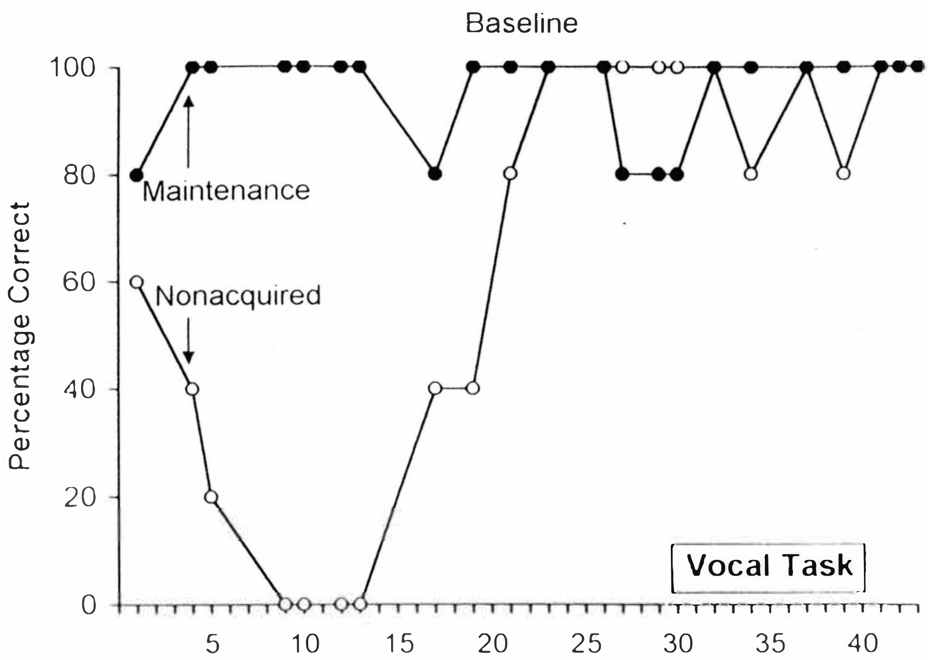
Treatment integrity collected for each participant during Studies 1 and 2.

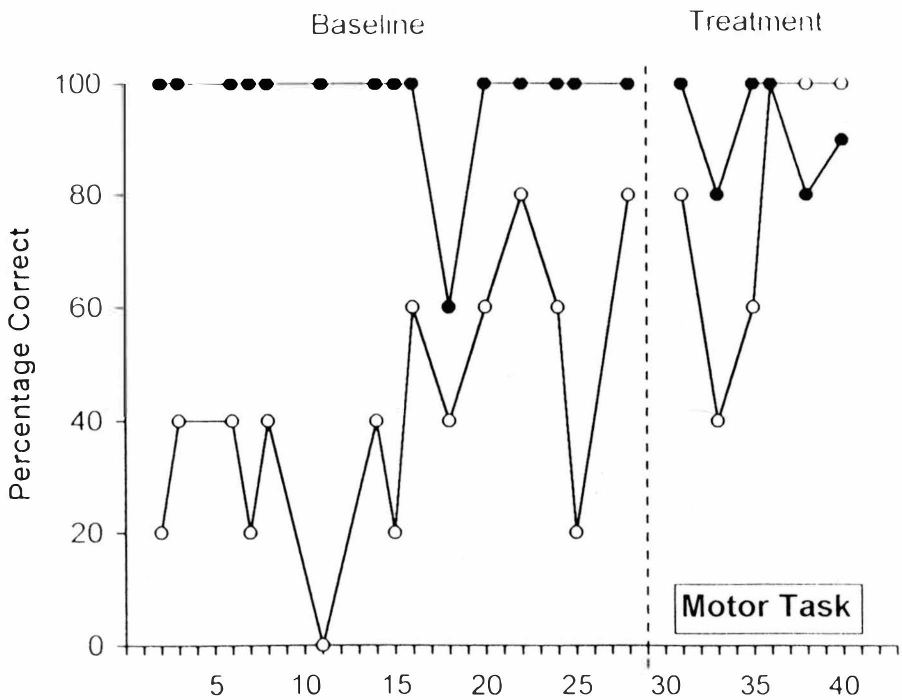
Task Type/Participant	% of sessions	Mean IOA
Study 1		
Motor		
Jay	50%	100%
Keith	60%	100%
Will	66%	100%
Vocal		
Jay	36%	100%
Keith	62%	100%
Will	66%	100%
Study 2		
Motor		
Jay	50%	100%
Keith	28%	100%
Will	29%	100%
Vocal		
Jay	64%	100%
Keith	33%	100%
Will	33%	100%

APPENDIX B

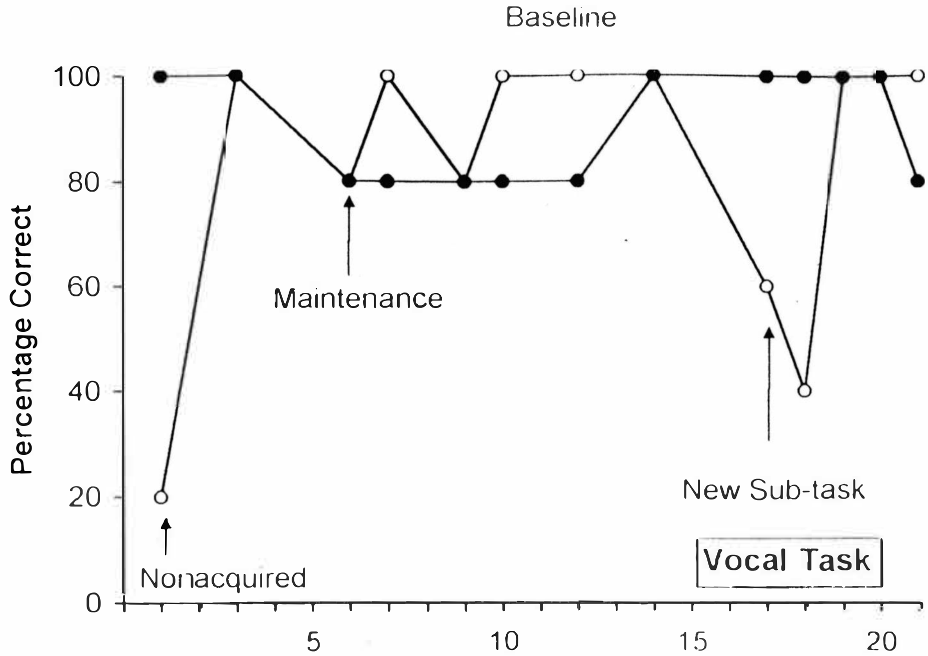
Graphs for Study 1

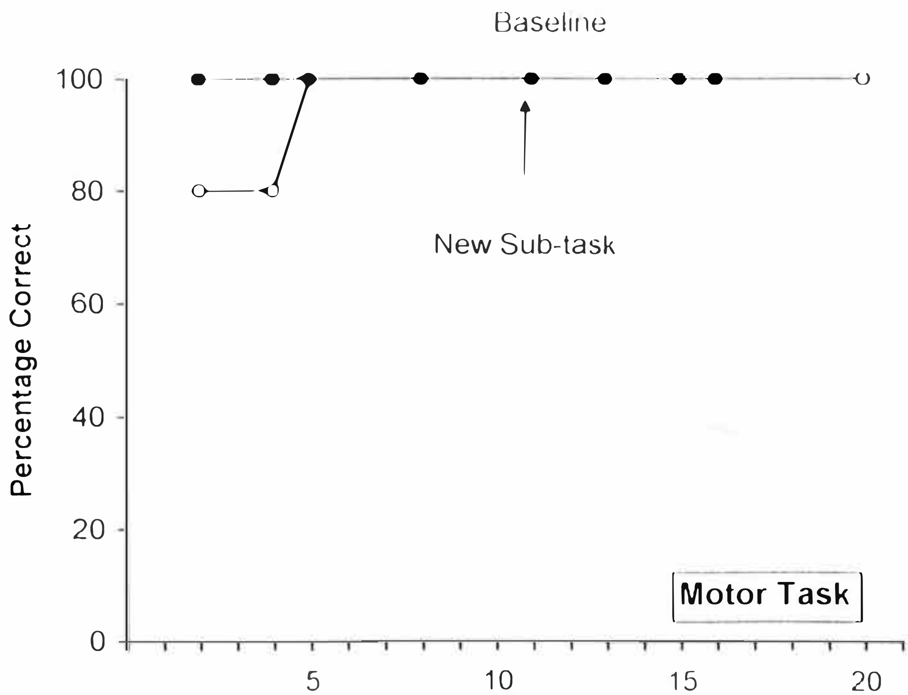
Jay


Baseline
100
80
60
40
20
0
Percentage Correct
Maintenance
Nonacquired
Vocal Task
5
10
15
20
25
30
35
40

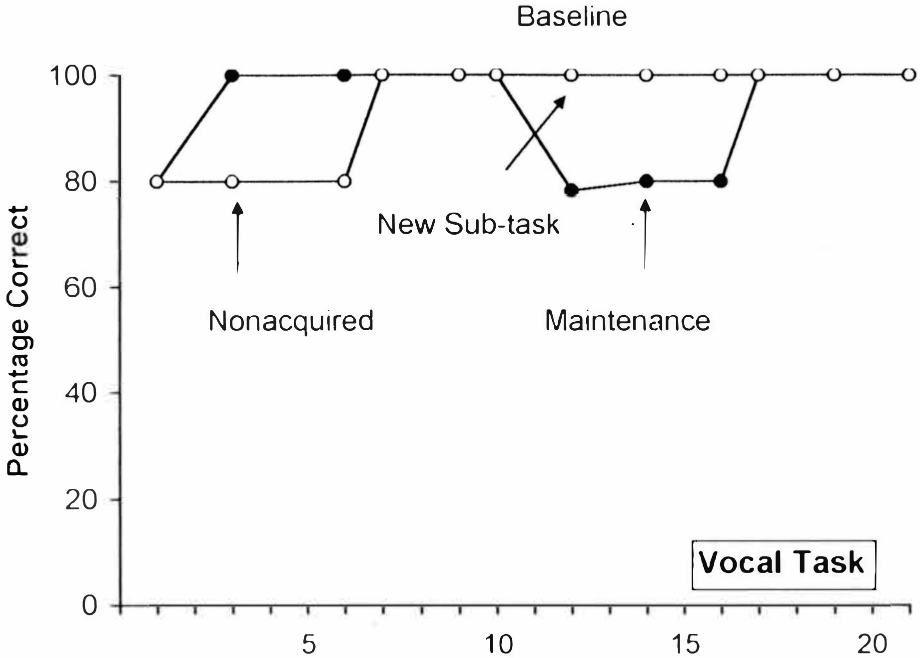

Baseline
Treatment
100
80
60
40
20
0
Percentage Correct
Motor Task
5
10
15
20
25
30
35
40

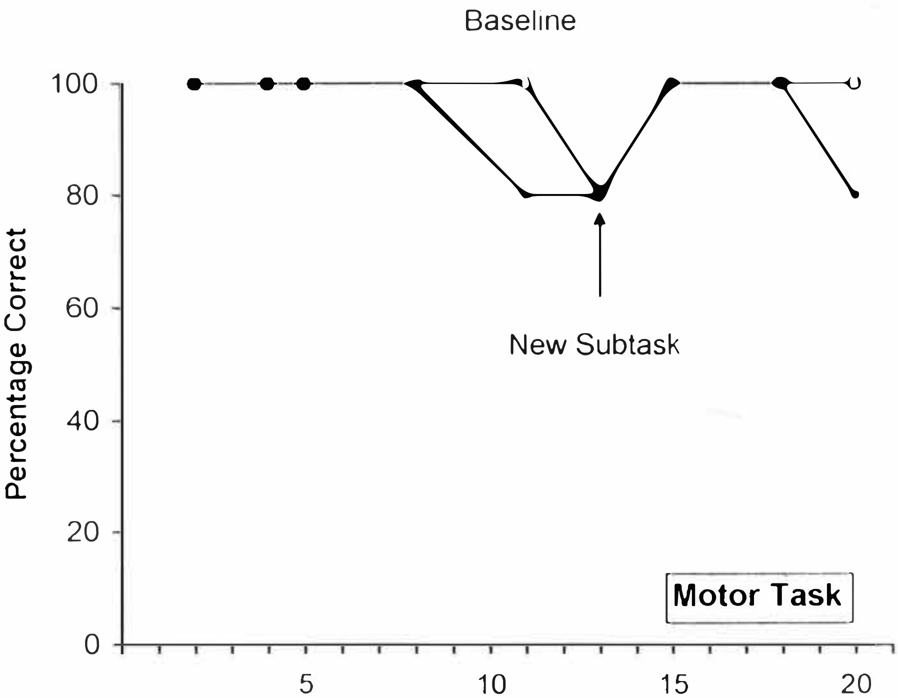
Keith


Baseline
100
80
60
40
20
0
Percentage Correct
Maintenance
New Sub-task
Nonacquired
Vocal Task
5
10
15
20


Baseline
100
80
60
40
20
0
Percentage Correct
New Sub-task
Motor Task
5
10
15
20

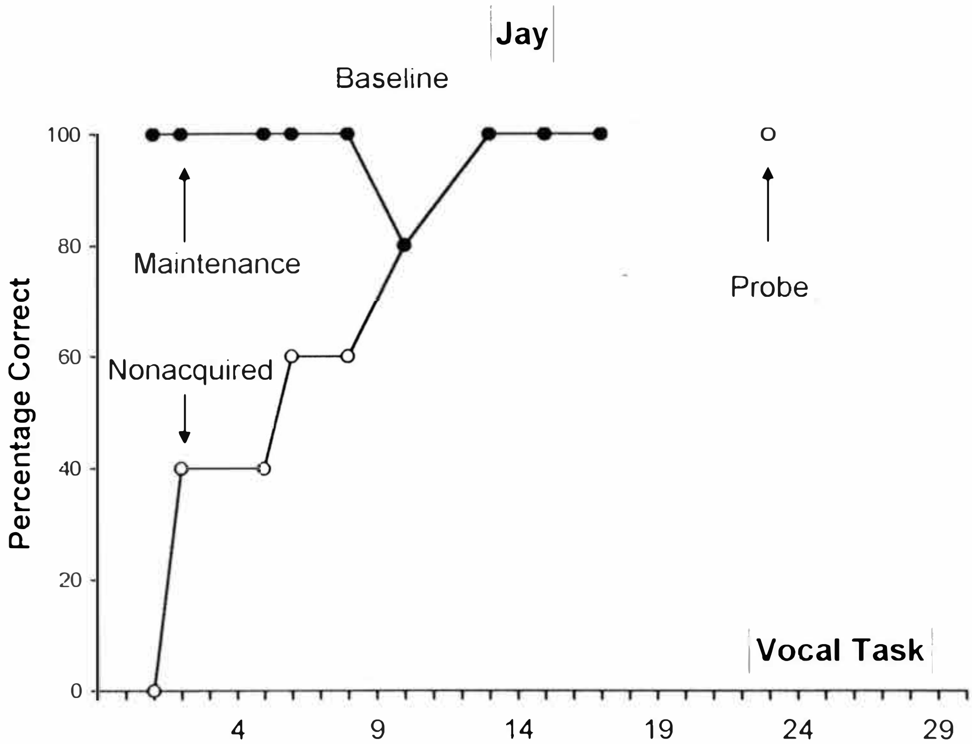
Will

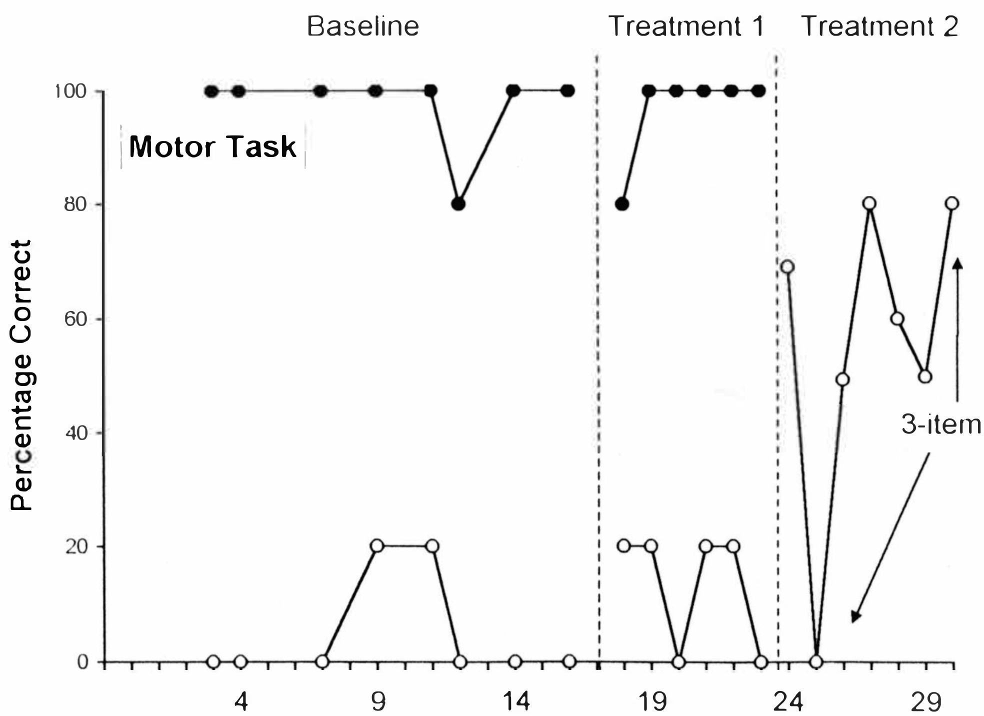

Baseline
100
80
60
40
20
0
Percentage Correct
New Sub-task
Nonacquired
Maintenance
Vocal Task
5
10
15
20

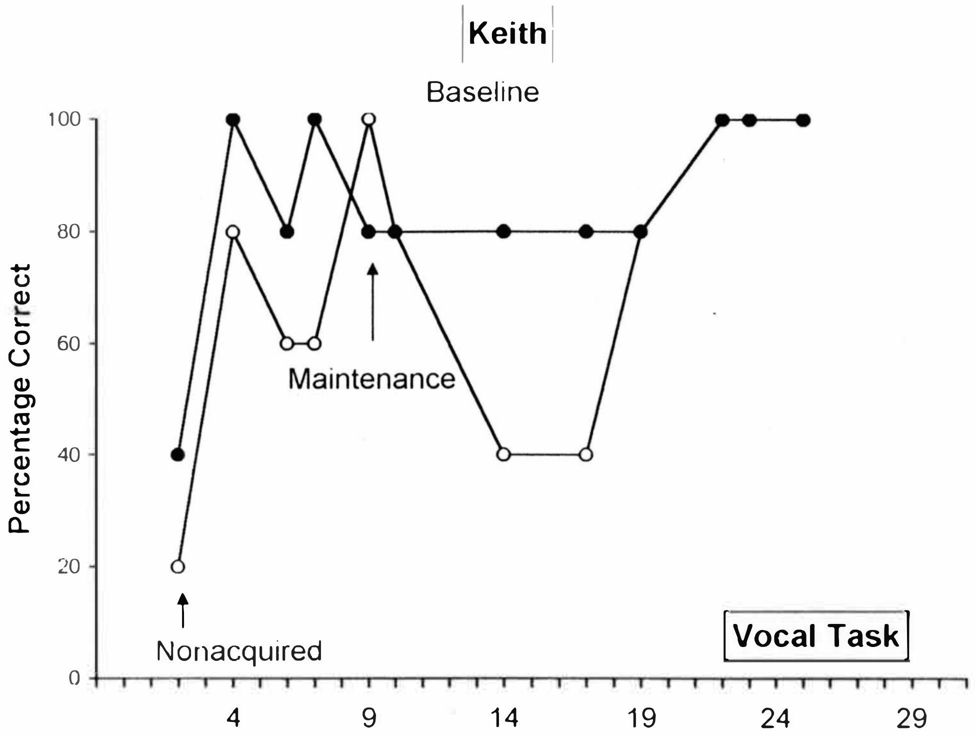

Baseline
100
80
60
40
20
0
Percentage Correct
New Subtask
Motor Task
5
10
15
20

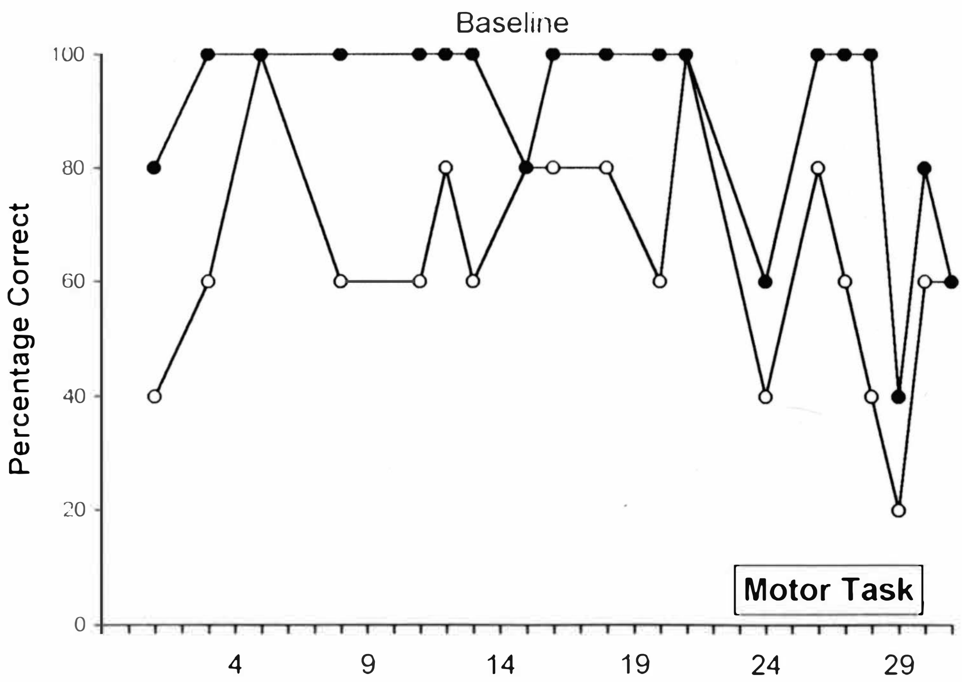
APPENDIX C

Graphs for Study 2

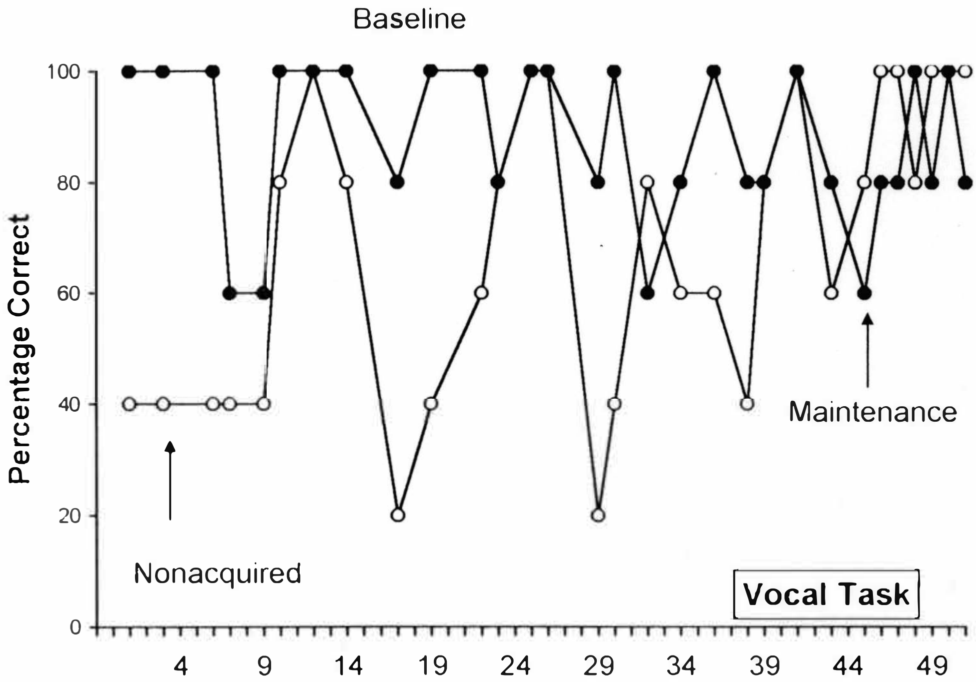

Jay
Baseline
100
80
60
40
20
0
Maintenance
Nonacquired
Probe
Percentage Correct
Vocal Task
4
9
14
19
24
29

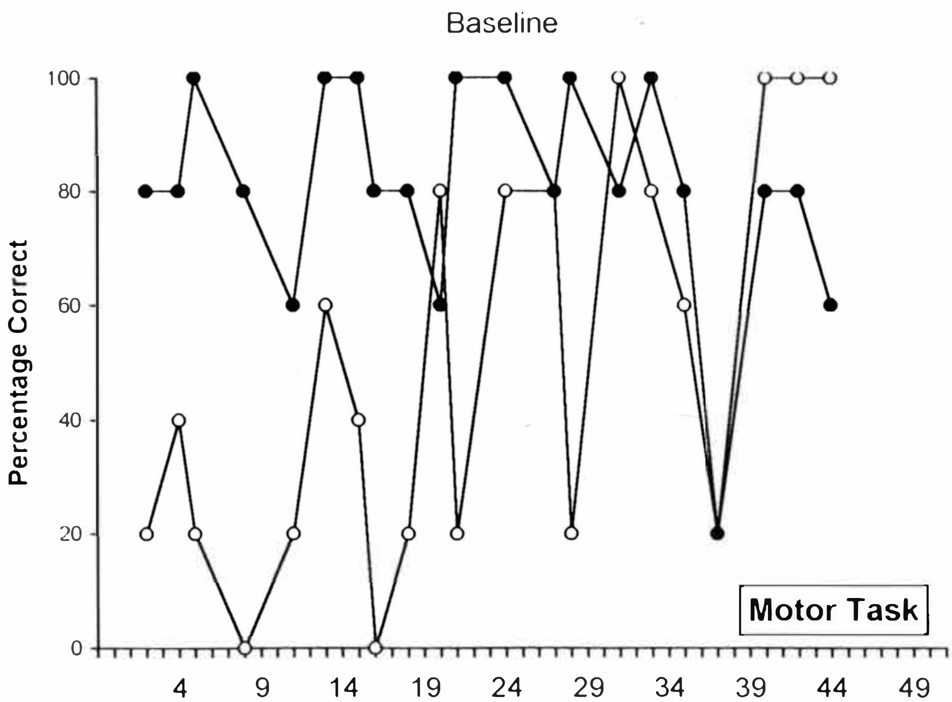

Baseline
Treatment 1
Treatment 2
100
80
60
40
20
0
Motor Task
Percentage Correct
3-item
4
9
14
19
24
29


Keith
Baseline
Percentage Correct
100
80
60
40
20
0
Maintenance
Nonacquired
Vocal Task
4
9
14
19
24
29


Baseline
Percentage Correct
100
80
60
40
20
0
Motor Task
4
9
14
19
24
29

Will


Baseline
Percentage Correct
100
80
60
40
20
0
4
9
14
19
24
29
34
39
44
49
Nonacquired
Maintenance
Vocal Task


Baseline
Percentage Correct
100
80
60
40
20
0
4
9
14
19
24
29
34
39
44
49
Motor Task

APPENDIX D

Research Protocol Approval

Human Subjects Institutional Review Board

Kalamazoo, Michigan 49008-5162
616 387-8293

WESTERN MICHIGAN UNIVERSITY

Date: March 19, 2001

To: James Carr, Principal Investigator
Ivy Chong, Student Investigator for thesis

From: Michael S. Pritchard, Interim Chair

Re: HSIRB Project Number 01-02-14

This letter will serve as confirmation that your research project entitled "Assessing Task Interspersal Techniques with Children Diagnosed with Autism: A Systematic Replication" has been **approved** under the **full** category of review by the Human Subjects Institutional Review Board. The conditions and duration of this approval are specified in the Policies of Western Michigan University. You may now begin to implement the research as described in the application.

Please note that you may **only** conduct this research exactly in the form it was approved. You must seek specific board approval for any changes in this project. You must also seek reapproval if the project extends beyond the termination date noted below. In addition if there are any unanticipated adverse reactions or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the HSIRB for consultation.

The Board wishes you success in the pursuit of your research goals.

Approval Termination: February 21, 2002

WESTERN MICHIGAN UNIVERSITY
H. S. I. R. B.
Approved for use for one year from this date:

FEB 21 2002

x [signature]
HSIRB Chair

WESTERN MICHIGAN UNIVERSITY
DEPARTMENT OF PSYCHOLOGY

Permission of Parent or Guardian

Principal Investigator: James E. Carr, Ph.D.
Student Investigator: Ivy M. Chong, B.A.

My child has been invited to participate in a research project entitled "Assessing Task Interspersal Techniques with Children Diagnosed with Autism: A Systematic Replication." The purpose of this study is to compare two different types of task interspersal to determine which is more effective.

My permission for my child to participate in this project means that my child will receive in-home, individualized treatment in the areas of language and motor actions. The treatment study will be divided into three phases. First, my child will be taught several motor and vocal tasks using food as rewards. I will be involved in selecting which tasks and food rewards are used in the study. When my child has learned these tasks, phase two will begin. In phase two, my child will be taught new motor and vocal tasks, with the already learned tasks being mixed in with the new. During this phase, my child will receive food rewards for all correct responses. During the third and final phase, my child will receive food only for the new tasks, and will be praised for correct responses on the old ones. My child will be asked to participate for approximately 3-6 months, with approximately 3-5 sessions per week. Each session will include approximately 20-30 learning opportunities for my child and will last approximately one hour. In a typical session, my child will be seated at a small table, with the experimenter seated either beside or across from him or her. The experimenter will then begin a stopwatch to record the session, which will last approximately 10 minutes, or until a block of 10 trials is completed.

The primary benefits my child may receive during this study include learning new motor and vocal skills. However, in the event that the study is unsuccessful, there may be no benefits resulting from participation in the study.

The primary risk associated with participation in this study is possible frustration that might occur when food rewards are no longer available for acquired tasks. To counteract this risk, sessions will be kept brief and will be terminated if my child appears frustrated. If at least five sessions in a row are terminated, the researchers will have the option of excusing my child from the study without penalty. As in all research, there may be unforeseen risks; however, these risks should be no different from those associated with the typical school environment. If an accidental injury occurs, appropriate emergency measure will be taken; however, no compensation or treatment will be made available except as otherwise specified in this permission form.

All of the information collected in this study will remain confidential. That means that my child's name will be omitted from all data collection forms and a code number will be attached. The principal investigator will keep a separate master list with the names of the children and the corresponding code numbers. No names will be used if the results are published or reported at a professional meeting. During the study, the staff will videotape the sessions with my child so the researchers and their assistants can analyze the data at a later time. These videotapes are to be used only for the purposes of data collection and are to be kept confidential. The researchers may use the videotapes for training my child's staff; however, if this happens, they will need to obtain additional permission from me. The videotapes are to be stored in a locked cabinet in the Clinical Behavior Research Laboratory in Wood Hall. Only research staff involved with this project will have access to these videotapes.

Regardless of my child's participation in the study, the experimenters will, at my request, inform me about alternative services in the community for my child. At any time, I may withdraw my child from this study. Refusal to participate or withdrawal from this study will not negatively affect my child's opportunity to receive therapeutic services at the WMU Center for Autism or their ability to seek other services through independent vendors or school systems. If I have any questions or concerns about this study, I may contact either of the Investigators, Dr. James Carr (616-387-4925) or Ivy Chong (616-387-4629). I may also contact the Human Subjects Institutional Review Board (616-387-8293) or the Vice President for Research (616-387-8298).

This permission document has been approved for use for one year by the Human Subjects Institutional Review Board as indicated by the stamped date and signature of the board chair in the upper right corner. I will not participate in this project if the corner does not have a stamped date and signature.

My signature below indicates that, I, as parent or guardian, can and do give my permission for [redacted] (child's name) to participate in the previously described experimental intervention.

[redacted]
Parent Signature [redacted]

9-18-02
Date 09/18/02

Permission Obtained By

9-18-02
Date