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AN EXPLORATORY ANALYSIS OF TASK-INTERSPERSAL PROCEDURES WHILE TEACHING OBJECT LABELS TO CHILDREN WITH AUTISM

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Research has demonstrated that interspersing mastered tasks with new tasks facilitates learning under certain conditions; however, little is known about factors that influence the effectiveness of this treatment strategy. The initial purpose of the current investigation was to evaluate the effects of similar versus dissimilar interspersed tasks while teaching object labels to children diagnosed with autism or developmental delays. We then conducted a series of exploratory analyses involving the type of reinforcer delivered for correct responses on trials with unknown or known object labels. Performance was enhanced under the interspersal condition only when either brief praise was delivered for all correct responses or presumably more preferred reinforcers were provided for performance on known trials rather than on unknown trials.

DESCRIPTORS: autism, behavioral momentum, high-probability instructional sequence, interspersal procedures, reinforcer potency

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The results of previous research have suggested that interspersing mastered tasks with new or unknown tasks facilitates learning of the new tasks (e.g., Browder & Shear, 1996; Dunlap, 1984; Neef, Iwata, & Page, 1977, 1980; Rowan & Pear, 1985). For example, Dunlap compared the acquisition of skills (e.g., spelling, placing action sequence cards in order) across three conditions with 5 children who had been diagnosed with autism. All children acquired the skills in fewer trials during the condition in which mastered tasks were interspersed with new tasks. Research also has suggested that interspersing instructions associated with a high probability of compliance (high *p*) with instructions associated with a lower probability of compliance (low *p*) results in increased compliance with low-*p* instructions, a procedure that has been referred to as behavioral momentum (Mace et al., 1988; Nevin, Mandel, & Atak, 1983). Mace et al. presented a series of high-*p* instructions immediately before a low-*p* instruction to adults with mental retardation who had a history of noncompliance. Compliance with the low-*p* requests increased under this intervention.

Even though the results of a number of studies have demonstrated that interspersal and the high-*p* instructional sequence may be effective (e.g., Chong & Carr, 2005; Mace et al., 1988; Neef et al., 1977, 1980; Patel et al., 2006; Rowan & Pear, 1985), the results of other studies have indicated that the interspersal procedure and high-*p* instructional sequences may not always improve performance (e.g., Charlop, Kurtz, & Milstein, 1992; Zarcone, Iwata, Hughes, & Vollmer, 1993). For example, in Charlop et al., 5 children with autism initially failed to acquire simple responses when instructed with a task-interspersal procedure.

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During the baseline condition, correct performance on unknown tasks produced praise and food reinforcers on a fixed-ratio 1 schedule. Correct responses on mastered tasks produced praise on a fixed-ratio 1 schedule and food reinforcers on a variable-ratio 3 schedule. The authors hypothesized that the dense schedule of reinforcement for the mastered tasks hindered acquisition of the unknown tasks. Thus, in subsequent conditions, correct responses on the mastered tasks produced either no reinforcement or praise only, whereas correct responses on the unknown tasks continued to be reinforced with praise and food reinforcers. The responses associated with the unknown tasks were acquired only when participants did not receive food reinforcers for correct responding on the mastered tasks, thus raising the question of whether the quality of reinforcement for mastered tasks affected the acquisition of the unknown tasks.

Mace, Mauro, Boyajian, and Eckert (1997) examined the extent to which the quality of the reinforcer provided for compliance to high-*p* requests (food rather than praise, presumably a lower quality reinforcer) influenced compliance to low-*p* requests, which was reinforced with praise throughout the study. For both participants, compliance to low-*p* requests improved only when food reinforcement rather than praise was provided for compliance to high-*p* requests.

The results of studies on interspersal and the high-*p* instructional sequence raise a number of questions regarding the conditions under which these procedures are effective. First, in most studies, the reinforcer for compliance to unknown or low-*p* tasks was not selected empirically and, in fact, was commonly praise (e.g., Dunlap & Koegel, 1980; Mace & Belfiore, 1990; Mace et al., 1988; Neef et al., 1977, 1980), which may or may not be a high-quality reinforcer for children with developmental disabilities. Thus, additional research is needed to further clarify the role of the quality of the reinforcer for mastered tasks on the effects of task interspersal.

Second, the potentially important distinction between improving performance on mastered tasks and enhancing the acquisition of new skills has been largely overlooked. In some studies, the interspersal technique was intended to promote acquisition of new skills (Charlop et al., 1992; Dunlap, 1984; Neef et al., 1980; Rowan & Pear, 1985). Other studies did not specify whether participants had previously acquired the skills that were targeted for improvement (Robinson & Skinner, 2002; Wildmon, Skinner, Watson, & Garrett, 2004). Most important, mastered and unknown tasks may not have been differentiated adequately in many of these studies (see Lerman et al., 2005, for a discussion).

Third, in most studies on the interspersal technique, the targeted and interspersed tasks involved similar skills, materials, and instructions. For example, in Neef et al. (1980), words that the child could already spell correctly were interspersed with new spelling words, and in Patel et al. (2006), one presentation of food on a spoon was preceded by three presentations of water on a spoon to increase food acceptance by 1 participant. Research has not yet investigated whether the type of interspersed task contributes to the success of the interspersal procedure.

Finally, the interspersal technique is often recommended for use with children with autism, yet many studies on interspersal have been conducted with children of typical development or those with learning disabilities (e.g., Cooke, Guzaukas, Pressley, & Kerr, 1993; Cooke & Reichard, 1996; Logan & Skinner, 1998; Roberts & Shapiro, 1996; Robinson & Skinner, 2002; Wildmon et al., 2004).

The purpose of Experiment 1 was to examine the benefits of the interspersal technique when (a) food reinforcers were selected on the basis of a systematic preference assessment, (b) interspersed maintenance tasks involved similar versus dissimilar materials and instructions relative to the unknown task, and (c) more reinforcement was provided for correct responses on the unknown tasks than for correct responses on the known tasks (Charlop et al., 1992). After no clear benefits of the interspersal technique were found, it was hypothesized that reinforcer quality may influence the effectiveness of the interspersal procedure. Therefore, several exploratory analyses of this hypothesis were conducted in Experiment 2 to evaluate the extent to which the quality of the reinforcer (e.g., praise vs. preferred food reinforcers) provided for correct unknown or known responses influenced the effectiveness of the interspersal technique.

GENERAL METHOD

Participants and Setting

Five children who had been diagnosed with autism (Jack, Luke, Bobby, and Paul) or developmental and language delays (Sal) participated in the study. Paul had also been diagnosed with attention deficit hyperactivity disorder. All of the children reportedly engaged in problem behavior or noncompliance during instruction. Results of functional assessments conducted separately from this study indicated that problem behavior was at least partly maintained by escape from demands. Prior to this study, all of the participants had been exposed to treatment with escape extinction, which remained in effect throughout the study. These participants were selected because they displayed some spontaneous vocal communication and labeled a few objects. Jack was a 4-year-old boy who communicated primarily using four- to five-word utterances and followed simple instructions. Luke was a 4-year-old boy who spoke in up to seven-word sentences and answered simple questions. Bobby was a 6-year-old boy who mainly used two- to three-word utterances to communicate, although he rarely engaged in spontaneous speech. Sal and Paul were both 5 years old, spoke in complete sentences, and followed complex demands (e.g., two or more demands presented simultaneously). None of the children had any apparent sensory or motor impairment or received medication during the course of the study.

Luke and Bobby participated in Experiment 1. Jack participated in both experiments. Paul and Sal participated in Experiment 2. Sessions were conducted either at the participants' school in a room other than the classroom or in classrooms at a university-based summer program for children with autism. The work areas contained a table and chairs or a desk, and the therapist sat either directly across from or beside the participant. Sessions were conducted 3 to 5 days a week, and one to three session blocks were conducted per day. There were four to eight sessions in each session block and no more than 16 sessions in a day.

Response Measurement, Procedural Integrity, and Interobserver Agreement

The primary dependent variable was the number of correct independent object labels, defined as the child stating the correct name of a pictured object without a model prompt. Data were recorded on laptop computers by previously trained graduate or undergraduate students. Number of correct labels was expressed as a percentage by dividing the number of correct responses by the total number of trials in the session and converting this ratio to a percentage. An object label was considered acquired when a correct response occurred on at least 80% of trials across three consecutive sessions.

Integrity data also were collected on therapist behavior (using frequency recording) to evaluate the extent to which reinforcement was delivered as planned. *Brief verbal praise* was defined as a three- to four-word statement (e.g., "great job, buddy") at conversational level with varying tone or inflection. *Enthusiastic praise* was defined as a five- to eight-word statement (e.g., "wow, you are so smart, wonderful work") above conversational level with varying tone or inflection, along with hand clapping. *Neutral feedback* was defined as a one- to two-word statement at conversational level (e.g., "that's right"), delivered in monotone. *Food delivery* was defined as the provision of a preferred food. A trial was scored as either correct or incorrect. For the trial to be considered correct, the consequence had to be delivered as planned. That is, the therapist provided the appropriate type of consequence for an independent or prompted response within 5 s of the response. For example, if the participant exhibited a correct independent response on an unknown task trial in Experiment 1, the trial would have been scored as incorrect if the therapist delivered praise but not a food reinforcer. For each session, integrity of reinforcement delivery was calculated for unknown and known task trials by dividing the number of trials with correct reinforcement delivery by the number of trials with correct and incorrect reinforcement delivery and converting this ratio to a percentage. Across participants, mean integrity of reinforcement delivery during unknown and known trials was 97% (range, 94% to 100%) and 90% (range, 65% to 100%), respectively.

Interobserver agreement was assessed by having a second observer collect data simultaneously but independently during a mean of 61% of the sessions (range, 19% to 85%) for each child. Agreement was determined by dividing each session into consecutive 10-s intervals and comparing agreements (both observers scoring a correct independent object label in a 10-s interval) and disagreements (one observer scoring and one observer not scoring a correct independent object label in a 10-s interval) of the two observers. Agreement coefficients were calculated by dividing the number of agreements by the number of agreements plus disagreements and converting this ratio to a percentage. Across participants, mean interobserver agreement on correct independent objects labels was 98% (range, 96% to 99%). Across participants, mean agreement on praise and food delivery was 99% (range, 98% to 100%) and 99% (range, 97% to 100%), respectively.

Design and Task Selection

The primary experimental design was a combined multielement and nonconcurrent multiple baseline design. A reversal design also was used in some cases (see description below). For each child, three to eight object sets were formed. Each object set consisted of three to six unknown objects from the same category (e.g., animals, shapes, U.S. presidents). One or two objects were then assigned to each training condition (see description below). The objects were pictured on cards. Each participant's caregivers were asked to generate a list of possible unknown and known object labels and possible known motor tasks (e.g., stringing beads, putting blocks in a bucket). Each of the identified objects and motor tasks were presented to the participant during a 10-trial pretest to verify informant report. Highly preferred reinforcers identified via a systematic preference assessment (Fisher et al., 1992) were provided for correct object labels that were reportedly unknown. Including a reinforcement component decreased the likelihood that a known object label would be incorrectly classified as unknown due to noncompliance (Lerman et al., 2005). However, the type of reinforcer provided for reportedly known object labels and motor tasks depended on the experiment and phase. Correct responses produced the same reinforcers that would be used during the training condition (e.g., brief praise only). It was important to verify that these consequences would maintain responding on the known tasks while we trained the unknown object labels. An object label was classified as unknown if the participant responded correctly on 30% or fewer trials during the pretraining assessment and as known if the participant responded correctly on at least 80% of trials.

EXPERIMENT 1

METHOD

Three conditions—constant, interspersal (similar), and interspersal (dissimilar)—were alternated to examine the benefits of the interspersal technique when the reinforcer was selected on the basis of a systematic preference assessment and to compare the outcomes when interspersed maintenance tasks involved materials and instructions that were topographically similar or dissimilar to the unknown task.

Procedure

Baseline. Baseline consisted of 10 unknown object label trials. The same unknown object (pictured on a card) was presented each trial. To begin a trial, the therapist placed the picture card in front of the participant and delivered a verbal instruction ("What is this?"). The therapist moved immediately to the next trial following correct or incorrect responses or if no response occurred for 10 s. No consequences were provided for correct or incorrect responses.

Constant. Sessions consisted of 10 unknown object label trials. The same unknown object was presented on each trial. The trial began as described in baseline. Initially, the therapist provided a model prompt (i.e., said the name of the object) if no response occurred within 5 s. The model prompt was faded within the session using a prompt-delay procedure to a maximum of 10 s. The delay to the prompt was increased by 1 s following three consecutive trials with a correct independent or prompted response. The trial was terminated if the child did not engage in the correct response within 5 s of the model prompt. Brief verbal praise (e.g., "good job") and a highly preferred food reinforcer (alternated between two food items identified via a paired-choice preference assessment) were provided for each correct independent or prompted unknown object label. If the child labeled the object incorrectly (e.g., named the wrong object), the therapist said "no," and then stated the correct name of the object. All responses following error correction were ignored, and the therapist moved immediately to the next trial.

Interspersal (similar). Each session consisted of 10 unknown object label trials and 10 known object label trials. One unknown object and three known objects from the same category as the unknown object (e.g., animals) were presented in each session. Each unknown object label trial was preceded by a known object label trial. The unknown and known trials were conducted in the same manner as in the constant condition with two exceptions. First, prompt fading and error correction were not used during known object trials. The model prompt was held constant and was presented if the participant did not respond within 5 s of the verbal instruction. Incorrect responses or no responses within 5 s of the model were ignored, and the therapist proceeded immediately to the next trial. Second, brief verbal praise was provided for each correct independent or prompted known object label, and a highly preferred food reinforcer was provided for every third correct independent or prompted known response (e.g., after two independent responses and one prompted response, the preferred food was provided).

Interspersal (dissimilar). Procedures were similar to those described in the previous condition except that the known responses involved three motor tasks (e.g., putting blocks in a bucket, stacking rings, clapping hands, stomping feet). To begin a motor response trial, the therapist provided a verbal instruction (e.g., "clap your hands"). After 5 s of no response, the therapist modeled the desired response.

Across all treatment conditions, training was discontinued with an object label when the participant met the acquisition criterion (80% of trials with a correct response for three consecutive sessions).

Several procedural modifications were made for some children and object sets after no differences were obtained across the three training conditions. First, two unknown object labels (instead of one) were assigned to each condition (Sets 2 through 5 for Jack, Sets 4 and 5 for Luke, and Sets 1 and 2 for Bobby) to increase the difficulty of the task. Second, the reinforcement for both unknown and known responses was thinned for 2 participants (Sets 3 through 5 for Jack and Sets 4 and 5 for Luke) based on the results of Charlop et al. (1992). A food reinforcer was provided only for correct independent unknown object labels (i.e., prompted responses produced praise only), only brief verbal praise was provided for every third correct independent known object label or motor response, and neutral feedback was provided for the remaining correct known responses (i.e., food reinforcers were no longer provided for known responses, and no consequences were provided for prompted responses). Finally, the conditions were compared in a reversal design following initial acquisition (Set 4 for Jack and Sets 1 and 2 for Bobby) or during acquisition (Sets 3 and 5 for Jack) to reduce the possibility of interaction effects associated with the multielement design.

Results

Acquisition in the constant condition was similar to or superior than acquisition in the interspersal conditions for all participants (see Figures 1 though 3). In addition, no consistent differences in levels or rates of acquisition were obtained under the two interspersal conditions. These findings were replicated even when the difficulty of the task was increased, reinforcement was thinned for the known tasks, and a reversal design was used. Mean levels of correct responding on the known task trials were above 90% for all participants during the interspersal sessions.

EXPERIMENT 2

It was hypothesized that the interspersal technique did not improve performance beyond that obtained in the constant condition because high-quality reinforcers were used, which produced a ceiling effect. That is, the rapid acquisition of object labels under the constant condition suggested that there was limited room for improvement when the interspersal procedure was combined with reinforcement. The reinforcers were highly preferred food items combined with praise, even though praise alone was used in most studies that have demonstrated the benefits of the interspersal procedure (e.g., Browder & Shear, 1996; Neef et al., 1977, 1980). Thus, in Experiment 2, acquisition of object labels was compared across the constant and interspersal conditions when either high-quality reinforcement (praise plus food or enthusiastic praise) or low-quality reinforcement (brief praise only) was provided for correct responses to the unknown tasks. Nonetheless, the interspersal procedure still provided no benefit over the constant condition for 2 of 3 participants. Therefore, high-quality reinforcers were introduced for correct known responses based on the results of Mace et al. (1997).

Method

Procedure

The procedure for baseline and the constant and interspersal training conditions was identical to that described above, with the exception of the reinforcement procedure during the training conditions. Two unknown object labels were assigned to each training condition, and one interspersal condition was alternated with the constant condition. With some exceptions (see results below), training was discontinued with an object label when the participant met the acquisition criterion (80% of trials with a correct response for three consecutive sessions) or if the participant failed to meet the acquisition criterion within 10 sessions of the first object label acquired in the set.

Interspersal versus constant with high-quality reinforcement. Only Sal (Set 1) and Paul (Sets 1 and 2) were exposed to this condition because Jack participated in this condition during Experiment 1 (Sets 1 through 5). Praise and highly preferred food reinforcers identified via a paired-choice preference assessment (Fisher et al., 1992) were provided following each correct independent and prompted unknown object label for Sal. During Sal's interspersal sessions, brief verbal praise was provided for each correct

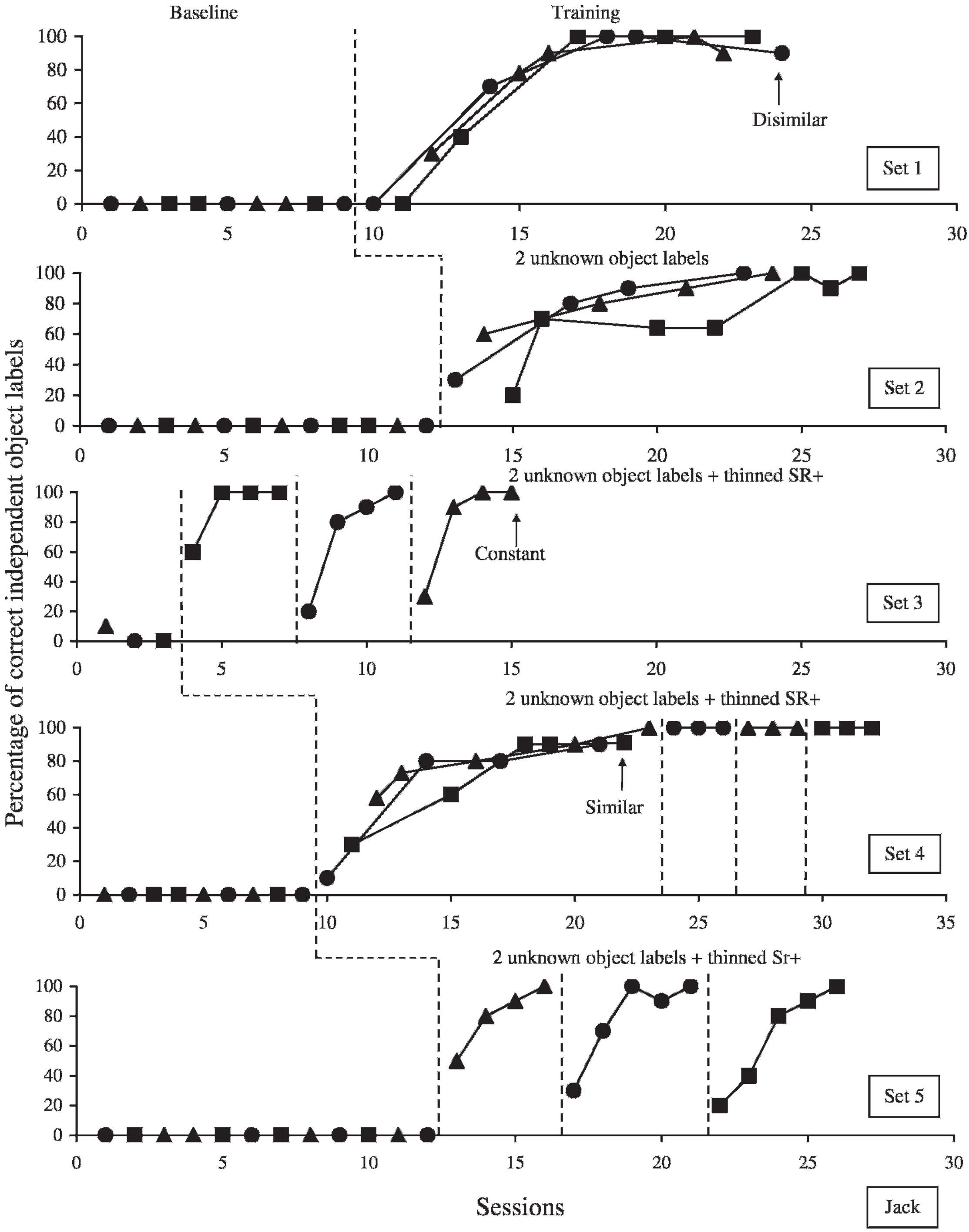

Figure 1. Percentage of correct independent object labels for Jack during Experiment 1.

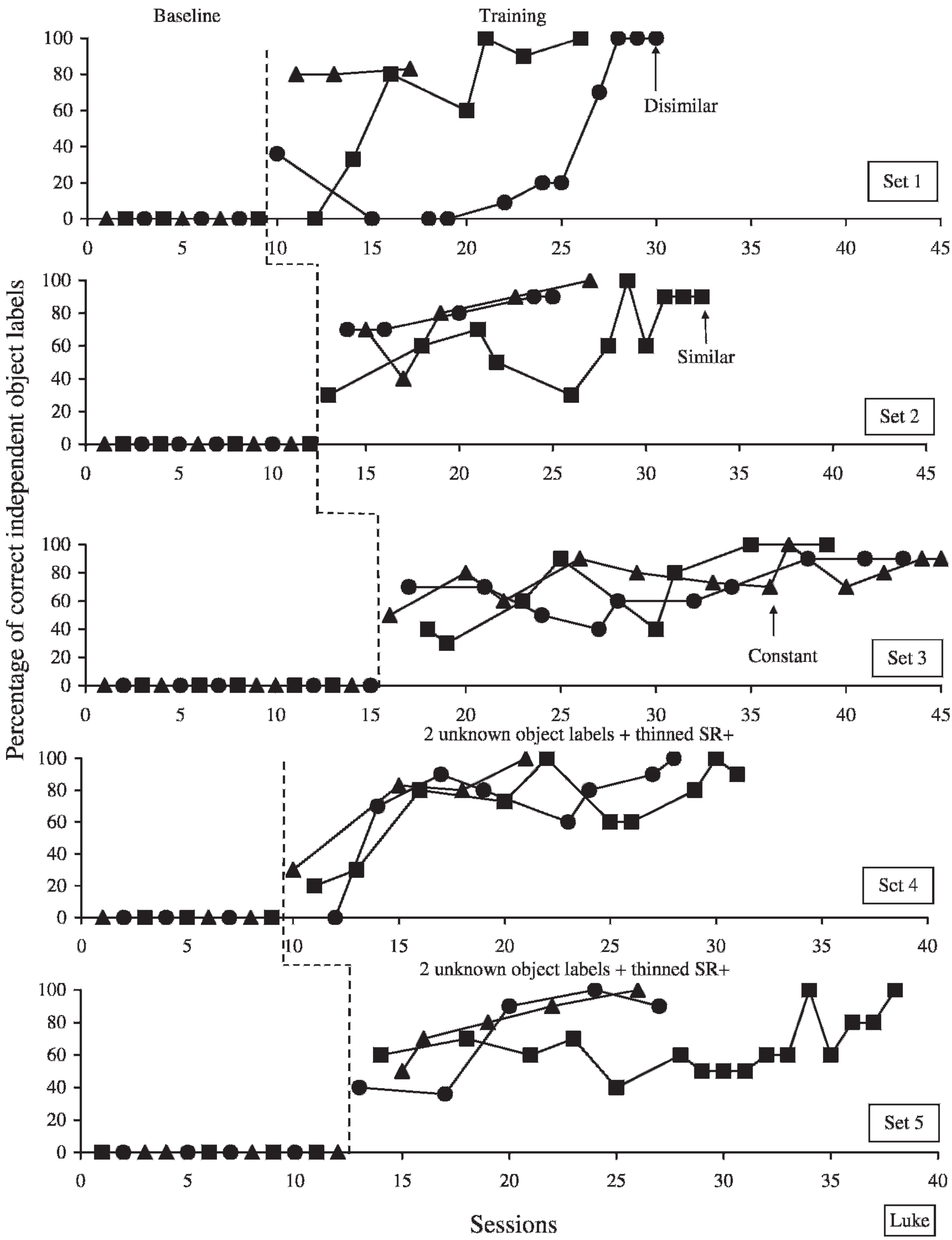

Figure 2. Percentage of correct independent object labels for Luke during Experiment 1.

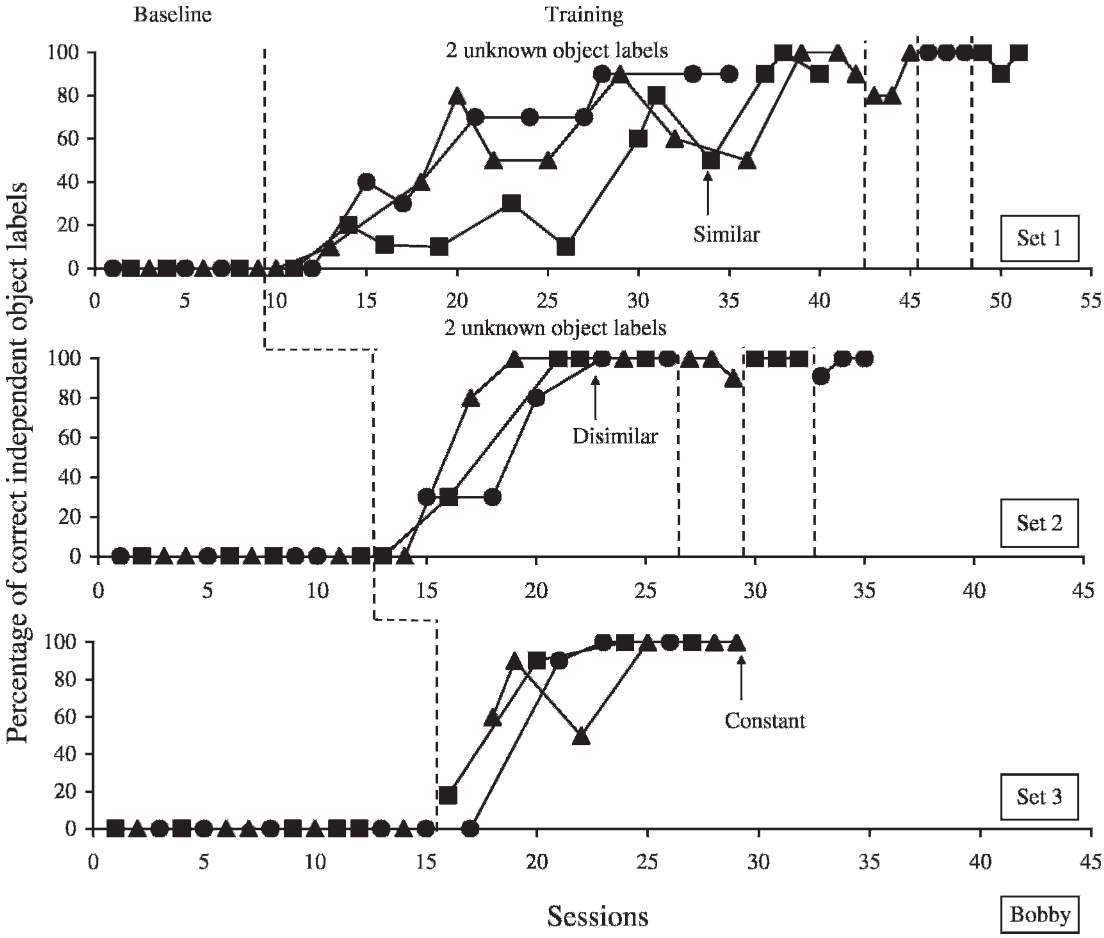

Figure 3. Percentage of correct independent object labels for Bobby during Experiment 1.

independent or prompted known response, and a highly preferred food reinforcer was provided for every third correct independent or prompted known response (the same contingency used for Jack in Experiment 1).

Anecdotal observations during Paul's initial sessions indicated that enthusiastic praise functioned as a potent reinforcer for responding and appeared to be equally or more preferred than food reinforcers. Thus, enthusiastic praise was delivered following each correct independent unknown and known object label, and brief verbal praise was provided following each prompted unknown and known object label for Paul.

Interspersal versus constant with low-quality reinforcement. All participants were exposed to this condition (Sets 2 and 3 for Sal; Sets 6, 7, and 8 for Jack; and Sets 3 and 4 for Paul). Brief verbal praise (e.g., saying "good job, Jack") was provided for each correct independent unknown object label, and feedback (e.g., saying "right" or "correct" in a neutral tone of voice) was provided for correct prompted unknown object labels. The consequences for correct known responses varied somewhat across participants. For Sal, brief verbal praise was provided following every third correct known response, and neutral feedback was provided for the remaining correct known responses. No consequences were provided for correct prompted known responses. However, for Jack and Paul, the reinforcement schedule was modified slightly after Jack's compliance with known tasks began to decrease across sessions. Brief verbal praise was provided following each correct known response, and neutral feedback was provided for prompted known responses.

Interspersal versus constant with high-quality reinforcement for known responses. This condition was introduced for Jack (Sets 7 and 8) when he failed to meet the acquisition criteria after a lengthy number of sessions under the previous condition. The comparison was then replicated with Paul (Sets 5 and 6), who did not show differential responding in the previous condition. As in the previous condition, each correct unknown object label was followed by brief praise. However, brief verbal praise and a highly preferred food item (Jack) or enthusiastic praise (Paul) was provided for each correct known response (Mace et al., 1997).

RESULTS

Results are organized on the basis of the procedures used because different procedures were employed across object sets. For Sal and Paul, acquisition under the constant condition was similar to or superior than acquisition under the interspersal condition when praise plus food were provided for correct responses (see Set 1 for Sal and Sets 1 and 2 for Paul in Figure 4). This replicates the results obtained in Experiment 1. It should be noted that Sal's sessions with Set 1 were discontinued before he met the acquisition criterion due to time constraints (end of the school year).

Inconsistent results were obtained across participants when brief praise only (a presumably lower quality reinforcer) was used instead. When Jack received praise alone for correct responses, he required 15 sessions to meet the acquisition criteria in the interspersal condition but had not done so after 20 sessions in the constant condition (Set 6; Figure 5). However, this outcome was not replicated across two other object sets because Jack failed to meet the acquisition criterion despite numerous training sessions (see further discussion of those object sets below). For Sal, object labels were acquired much more rapidly in the interspersal condition than in the constant condition when brief praise was delivered for correct responses (Sets 2 and 3; Figure 5). Although there was an initial clear advantage to the interspersal condition over the constant condition for Set 3, performance began to improve under the constant condition after the sixth training session. However, sessions could not be continued due to time constraints (end of school year). This differential effect was not replicated with Paul (Sets 3 and 4; Figure 5).

As noted above, Jack had not acquired the object labels in Sets 7 and 8 under either the constant or interspersal conditions after a lengthy number of sessions when he received only praise for correct responses. Thus, training with these object sets continued; however, high-quality reinforcement (food reinforcers combined with praise) was introduced for correct known responses (beginning with Session 44 in Set 7 and 42 in Set 8) (Mace et al., 1997). For both object sets, Jack met the acquisition criterion for the object labels in the interspersal condition but not in the constant condition after high-quality reinforcement was introduced for correct known responses (see Figure 6).

Procedures used with Jack were replicated with Paul to determine if providing high-quality reinforcement for known responses would enhance the effectiveness of the interspersal procedure. As shown in Figure 6, Paul met the acquisition criterion in fewer sessions under the interspersal condition than under the constant condition with Sets 5 and 6.

Mean levels of correct responding on the known task trials were above 90% for Jack and Paul during the interspersal sessions. The mean level for Sal was somewhat lower (76%). Interestingly, correct responding on the known task trials was generally above 90% for Sal except when praise plus food reinforcers were provided for both known and unknown tasks.

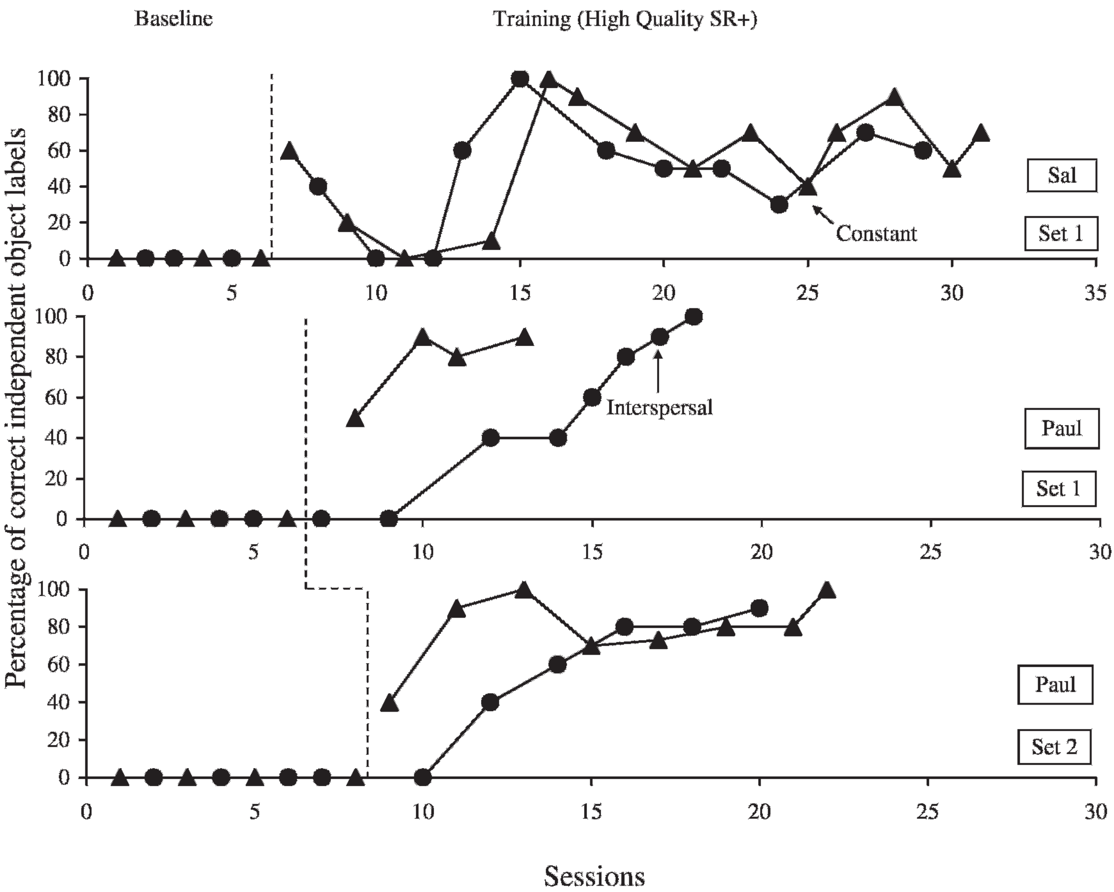

Figure 4. Percentage of correct independent object labels during the interspersal and constant conditions with high-quality reinforcement for Sal and Paul in Experiment 2.

DISCUSSION

Overall, results showed no benefit to interspersing mastered tasks with new tasks when highly preferred food reinforcers and praise (or enthusiastic praise for Paul) were provided for correct unknown object labels. Results of Experiment 1 further indicated that the type of task interspersed (similar vs. dissimilar) did not influence the effectiveness of the interspersal procedure. Results of the exploratory analyses in Experiment 2 were more equivocal. For one participant (Sal), performance clearly improved under the interspersal condition relative to the constant condition when only brief praise was delivered for correct responses for Sets 2 and 3. These results suggest that the negative outcomes obtained in Experiment 1 were due to ceiling effects, and that the interspersal technique may not provide additional benefits when highly potent reinforcers are used. The interspersal technique may function primarily as a motivating operation by increasing the reinforcing value of the consequence for correct responses. Further increases in reinforcer value, however, may not occur when highly preferred reinforcers are provided for correct responding.

Nonetheless, the results for Sal were only partially replicated with the other participants (with one of three object sets for Jack and none of the object sets for Paul). In fact, acquisition was more difficult when only brief praise was used (see Sets 7 and 8 for Jack and Set 4 for Paul), regardless of whether known tasks were

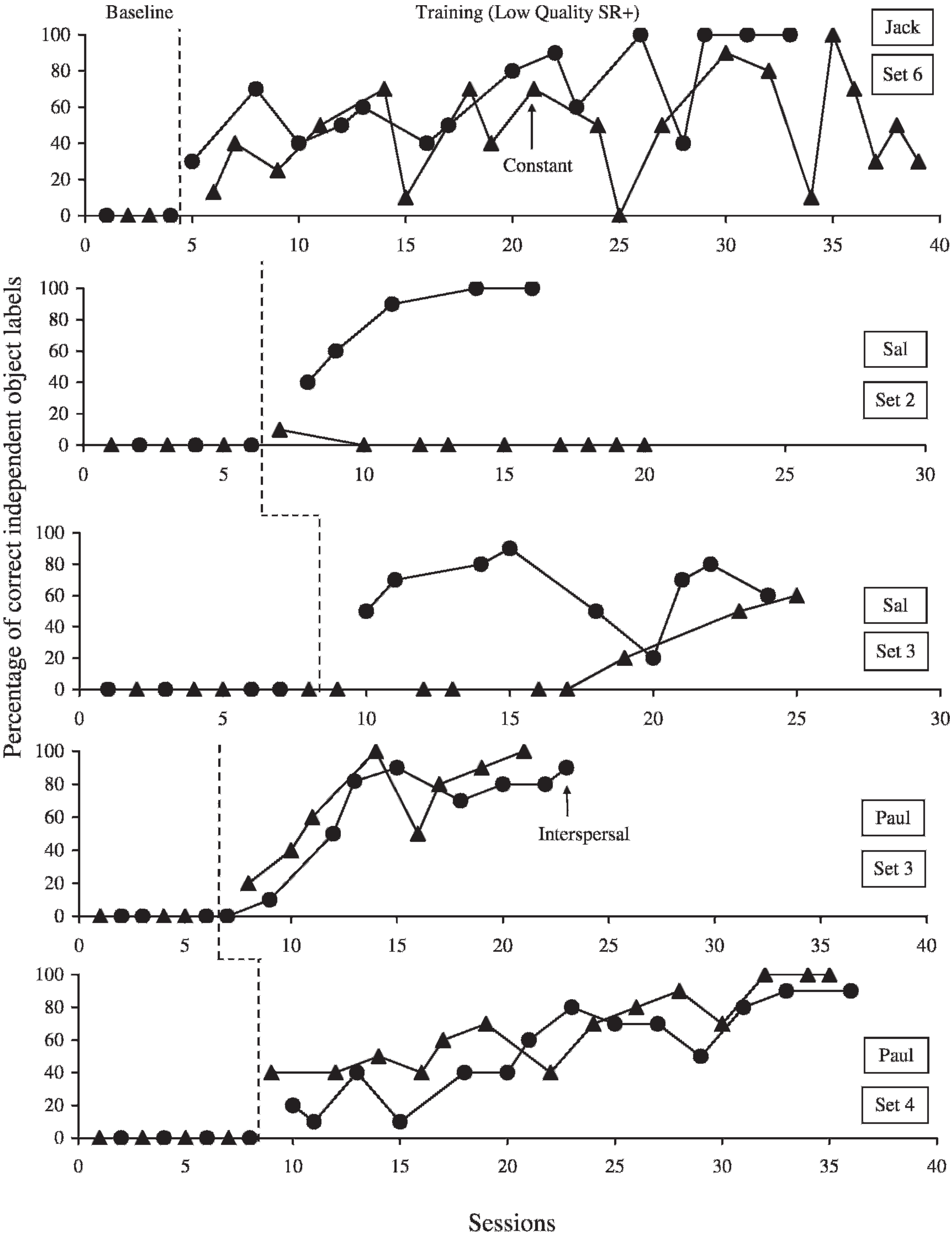

Figure 5. Percentage of correct independent object labels during the interspersal and constant conditions with low-quality reinforcement for Jack, Sal, and Paul in Experiment 2.

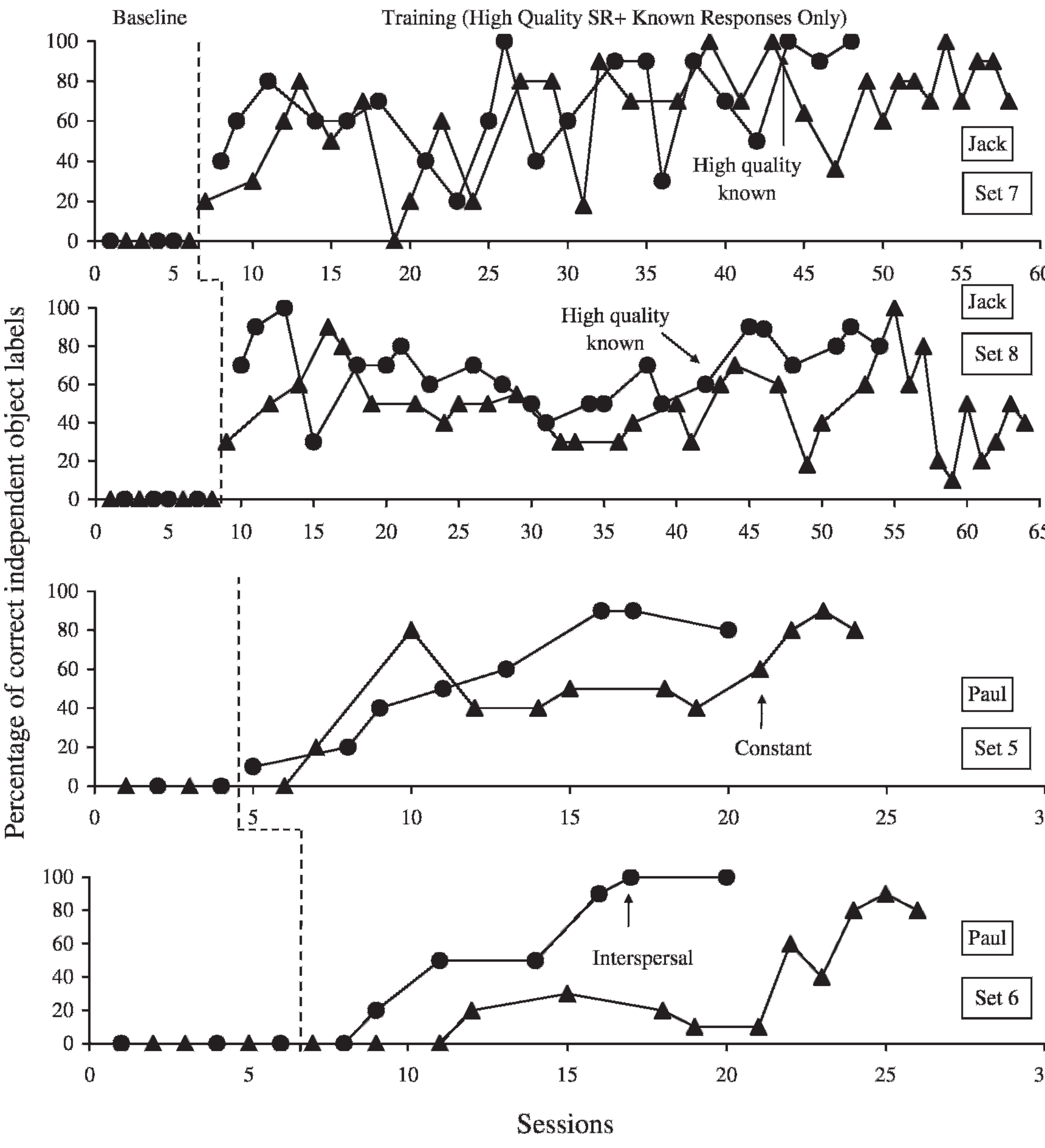

Figure 6. Percentage of correct independent object labels during the interspersal and constant conditions with high-quality reinforcement for known responses only in Experiment 2 for Jack and Paul.

interspersed with unknown tasks. This might be expected if brief praise functioned as a relatively weak reinforcer. Acquisition for these participants appeared to be enhanced in the interspersal condition (relative to the constant condition) when high-quality reinforcers (food reinforcers combined with praise for Jack or enthusiastic praise for Paul) were provided for correct responses on known task trials, even though brief praise continued to be delivered for correct responses on unknown task trials. This latter finding is interesting because it is inconsistent with recommendations for using the interspersal technique (Charlop et al., 1992). However, this finding is analogous to that of Mace et al. (1997), suggesting that similar mechanisms may be associated with the high-probability instructional sequence and interspersal procedures.

It should be noted that the quality of praise relative to praise plus highly preferred food reinforcers (or enthusiastic praise) was assumed rather than objectively determined. Although this limits our understanding of the outcomes, the reinforcers were selected based on prior relevant studies (e.g., Charlop et al., 1992; Mace et al., 1988, 1997; Neef et al., 1980) so that the results would be directly comparable. In fact, results of the current investigation may have differed from those obtained with typically developing children because praise and other forms of feedback for correct responding may be a less potent form of reinforcement for children with autism. Therefore, children with autism may have responded differently than in previously published studies because praise as a reinforcer may not have served as a similarly powerful reinforcer.

Nonetheless, broad conclusions about the effectiveness of the interspersal technique cannot be drawn on the basis of this study because other variables may be important to its effectiveness. For example, only one or two object labels were taught during each instructional session, far fewer than the number of unknown tasks taught in previous studies on the interspersal technique (Dunlap, 1984; Neef et al., 1980). This could have generated a ceiling effect on performance, limiting the impact of the interspersal procedure in this study. The effects of interspersing known tasks with unknown tasks may depend on the number of tasks taught simultaneously or the difficulty level of those tasks.

The interspersal technique also may be beneficial when a child's failure to respond correctly is due, at least in part, to noncompliance rather than to a skill deficit. In the current investigation, the pretraining task assessment was designed to increase the likelihood that object labels would be correctly classified as unknown because highly preferred reinforcers were delivered for correct responses. Moreover, the participants' problem behavior, including noncompliance to task demands, was exposed to escape extinction throughout the study. Nonetheless, it appears that the differences across conditions may have reflected differences in response maintenance rather than acquisition in some cases. For example, Jack correctly labeled 100% of the objects in Sets 6, 7, and 8 under the constant condition even though he failed to meet the acquisition criterion.

Some authors have suggested that reinforcement rate may be important to the effectiveness of the interspersal technique (Neef et al., 1977, 1980; Rowan & Pear, 1985). Mean rates of reinforcement for each participant in the constant and interspersal conditions were calculated by dividing the number of reinforcers earned by the number of minutes in the session (combined reinforcers were considered a single reinforcer). No consistent relation was found between differential rates of reinforcement and training outcome. For instance, in Experiment 1 for all participants, mean rates of reinforcement were lower in the constant condition than in the interspersal conditions. Although rates of reinforcement were always lower in the constant condition, acquisition was sometimes superior to one or both of the interspersal conditions; at other times acquisition was equivalent to the interspersal conditions.

The present study contains additional limitations that warrant discussion. First, results may have been influenced by carryover effects due to rapidly alternated conditions of the multielement design. However, this seems unlikely given that interspersal still provided no benefits over the constant condition when a reversal design was used in Experiment 1. Second, sessions with two object sets were terminated prematurely for Sal due to time constraints. Third, the number of trials was not equivalent across the constant and interspersal conditions. The increase in trials (and session length) during the interspersal sessions may have increased the aversiveness of the instructional sessions which, in turn, may have decreased compliance with the acquisition task. In addition, the intertrial interval for the acquisition tasks differed across the constant and interspersal conditions. The longer intertrial interval during the interspersal conditions may have hindered acquisition in some instances.

Further examination of commonly used procedures such as task interspersal and high-probability instructional sequences is needed to improve our understanding of these instructional strategies and to further develop best practices for individuals with developmental disabilities. In particular, future investigations should determine if high-probability instructional sequences and interspersal procedures share the same underlying mechanism. Other factors that may interact with the efficacy of interspersal procedures also should be examined, including the number of skills taught simultaneously and preference for the interspersed task. Although more research is needed, these findings indicate that clinicians and researchers should not assume that interspersing known tasks with unknown tasks is superior to teaching acquisition tasks alone.

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