INCREASING THE NUMBER OF PLAY ACTIVITIES CHOSEN BY CHILDREN WITH AUTISM: EFFECTS OF EXPOSURE AND RESPONSE-INDEPENDENT REINFORCERS

By

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Abstract

INCREASING THE NUMBER OF PLAY ACTIVITIES CHOSEN BY CHILDREN WITH AUTISM: EFFECTS OF EXPOSURE AND RESPONSE-INDEPENDENT REINFORCERS

by

Dana R. Reinecke

Adviser: Dr. Nancy Hemmes

The present study examines the effects of exposure to play activities, with and without additional edible stimuli, on choice of these activities during discrete-trial teaching for children with autism. During baseline, discrete-trial teaching sessions were conducted once per day, in which students earned tokens for correct responding. Tokens were exchanged for the opportunity to choose among three play activities previously identified as low-preference for each student. In the intervention phase, the two play activities that had been chosen less frequently during baseline were targeted for treatment (exposure or exposure plus snack) while the third play activity served as a comparison stimulus. During the intervention phase, discrete-trial teaching sessions were conducted once per day as in baseline; however, a 5-minute period of exposure to one of the two least-frequently chosen play activities was presented prior to the discrete-trial teaching session. One of these play activities was always presented by itself (the exposure-only condition); the other was always presented along with a snack (the exposure + snack condition). In both cases, students were prompted to engage in the play activity in the event that they

did not spontaneously do so. During discrete-trial teaching following each 5-minute exposure period, students were given free choice of the three play activities—the two exposed activities (only one of which was exposed in that session) and the comparison activity. The effects of this intervention were examined in a multiple-baseline across-subjects design, as well as an alternating-treatments design within subjects, and in an ABA reversal for one participant and an ABAB reversal for two participants. Each student chose the two exposed play activities with a greater frequency during intervention in comparison to baseline sessions. Furthermore, in each session, students tended to choose the specific play activity to which they had been exposed in that session. There was an effect of presentation of edible stimuli during exposure on choice of play activities for only one participant. It was concluded that exposure to play activities might be sufficient to increase choice of these activities for some students. Some possible explanations for the effectiveness of this procedure are discussed.

Dedication

This work is dedicated to my parents, Lu and Bill Reinecke, in honor of their loving support throughout my life. They gave me my roots and my wings, and made it possible for me to do and be so much. I give them back my love and my thanks.

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Increasing the Number of Play Activities Chosen by Children with Autism: Effects of Exposure and Response-Independent Reinforcers

Autism is a profound, lifelong disorder characterized by severe deficits in language and social skills. There is a great deal of research regarding language and social deficits and many advances have been made in remediating these core features of the disorder (Koegel & Koegel, 1995). Another common feature of the autistic-spectrum disorders, however, is a severely restricted range of interests and preferences (American Psychiatric Association, 2000), which can lead to problems in learning and in daily functioning. When individuals choose to engage in only a few activities, satiation may occur, in which the reinforcing value of stimuli may be decreased. Students may also become dependent on age- or socially-inappropriate activities, or reinforcers that are too cumbersome to be used in a practical way in the natural environment.

Relatively little research on the problem of restricted range of preferences has been reported in the applied behavior analytic literature. Of this research, most suggest procedures that involve restricting access to stimuli (e.g., Hanley, Iwata, Roscoe, Thompson, & Lindberg, 2003; Hanley, Iwata, Lindberg, & Conners, 2003; Klatt, Sherman, & Sheldon, 2000). Other studies that use less restrictive means of influencing choices of appropriate activities do not experimentally dissociate some of the factors that might alter this behavior (e.g., Hoch, McComas, Johnson, Faranda, & Guenther, 2002; Hanley, Iwata, & Lindberg, 1999). The present research extends the study of non-restrictive means of influencing the activity reinforcers chosen by students with autism. The students who were targeted for intervention tended not to vary their choices of reinforcers during teaching tasks. Two simple, unintrusive means of influencing choices

of play activities--exposing students to rarely chosen play activities, and pairing such activities with additional reinforcing stimuli during exposure--were studied to determine their control over students' choices of these lower-preference play activities. Additionally, experimental controls were used in an attempt to determine the extent to which exposure alone would be sufficient to alter choices, and the extent to which pairing with known reinforcers is also influential.

In examining this problem, choice can be seen as an operant that results in more or less reinforcing outcomes. A large body of literature has been devoted to preference and reinforcer assessment procedures (e.g., Pace, Ivancic, Edwards, Iwata, & Page, 1985; Fisher, Piazza, Bowman, Hagopian, Owens, & Slevin, 1992; DeLeon & Iwata, 1996). These procedures are based on the assumption that the probability of choosing a stimulus reflects the reinforcing value of that stimulus. Stimuli that are chosen more frequently than others are said to be high-preference, and those chosen less frequently are said to be low-preference. High-preference stimuli are usually more effective reinforcers than low-preference stimuli (Fisher, et al., 1992). Low-preference stimuli have a lower probability of being selected because they are less reinforcing. Choosing a low-preference stimulus is not followed by a highly-reinforcing consequence, so these choices are made less frequently.

Some researchers have attempted to influence choice by altering the reinforcer effectiveness of given stimuli. A common procedure for increasing reinforcer effectiveness is deprivation, or restriction of access to the potential reinforcer. For example, Klatt, et al. (2000) restricted access to at-home activities that had been evaluated as high- and low-preference for their participants, who were adults with

developmental disabilities. Restriction of 15 minutes or 2 hours in duration did not affect the students' tendency to choose either the high- or low-preference activities. Restriction of one to four days did increase engagement with high-preference activities, but not low-preference activities.

In another study, Hanley, Iwata, Roscoe, et al. (2003) used a response-restriction procedure not to alter reinforcer value, but rather to simply force students to make other choices. That is, certain activities were eliminated from the students' choice alternatives such that they were forced to choose other activities. For two adults with developmental disabilities, simple restriction from high-preference activities increased engagement with the remaining activities available to them, which were formerly considered low-preference. For two other subjects, simple restriction alone did not change engagement with low-preference activities. A contingency based upon Premack (1962) was added, in which high-preference activities were restricted and available only upon engagement with low-preference activities. This contingency increased low-probability responding for these participants.

Response restriction can be a valuable tool in encouraging students to make different choices. There are drawbacks to this procedure, however. As shown by Klatt, et al. (2000) and Hanley, Iwata, Roscoe, et al. (2003), it is not always effective in increasing responding, especially when low-preference activities are restricted. Furthermore, response restriction requires the removal of a preferred stimulus or activity, which can be disruptive and possibly aversive to students with disabilities (Hanley, Iwata, Lindberg, et al., 2003). At times, response restriction may be inconsistent with respect of the personal liberties of people with disabilities (Bannerman, Sheldon, Sherman, &

Harchik, 1990). Furthermore, if the restricted responses are not overtly harmful to the individual, this practice may be inconsistent with the notion of the least-restrictive treatment environment (Van Houten, Axelrod, Bailey, Favell, Foxx, Iwata, & Lovaas, 1988). Finally, response restriction does not allow for the evaluation of changes in preference for lower-preference activities in the presence of competing reinforcers. While restricted access to some higher-preference activity may result in increased responding on a lower-preference activity, it is possible that responding will decrease when the high-preference activity is made available again.

High-preference activities were not available during data collection for the present study; however, the procedure itself was not restrictive. Students were given free choice of three specific activities throughout all phases of the study, independently of the intervention being examined. It should be noted, however, that only providing lower-preference activities during the sessions of the study may have increased variability in choice responding for some subjects, independently of the intervention. As restriction of choices was not part of the intervention under investigation and did not vary systematically with the treatment, potential effects on responding were not experimentally examined.

Other environmental manipulations can be used to influence reinforcer value, and thus, choices of activities. These manipulations include simple prior exposure to a stimulus (e.g., Zajonc, 2001), conditioning through association with established reinforcers, increasing the magnitude or improving the quality of a stimulus, and manipulations of response effort, reinforcer rate, and reinforcer delay.

In their 1968 study, Ayllon and Azrin showed that reinforcer sampling was sufficient to increase the duration of engagement in various activities by patients in a psychiatric facility. When patients were required to engage in activities for a short time whenever the activities were available, overall duration of engagement in the activities increased, including those times when patients were not required to engage in the activities. This increase might be seen as evidence of increased preference for the activities, because the subjects were choosing to engage in the activities more frequently than prior to the intervention.

Another method for increasing choices of low-preference activities that has gained recent attention in the literature involves the addition of known reinforcers to low-preference activities. A distinction can be made between contingent and non-contingent presentation of additional reinforcers. Contingent additional reinforcers are presented according to an operant conditioning paradigm in which the behavior of choosing to engage with a low-preference activity is followed by the consequence of a more potent reinforcer. In this case, the subject is receiving a reinforcer contingently on choosing or engaging in the low-preference activity; thus, the low-preference activity will be chosen more frequently in the future.

In the non-contingent procedure, the additional reinforcer is paired with the low-preference activity, but is not made contingent on choosing or engaging in the low-preference activity. This procedure is based on a classical conditioning paradigm, in which a neutral stimulus becomes reinforcing through pairing and association with a reinforcing stimulus. Behavior change under this procedure is more difficult to analyze than under the contingent procedure, because it can be argued that making the additional

reinforcer available only in association with the low-preference activity necessarily sets up a contingency for choosing that activity. That is, the additional reinforcer is available only for choosing or engaging in the low-preference activity, therefore, it is contingent on that activity. One way to avoid this dilemma is to make the additional reinforcer available in association with both high- and low-preference activities. Another way might be to conduct test trials in which the low-preference activity is available in the absence of the additional reinforcer. Choice of the low-preference activity under these conditions might suggest that the low-preference activity has taken on the properties of a conditioned reinforcer in the absence of additional contingent reinforcement.

Some recent studies have included access to non-contingent or contingent reinforcement during low-preference activities. For example, Hanley, Iwata, Roscoe, et al. (2003) attempted conditioning of low-preference activities by delivering non-contingent reinforcers during low-preference activities. When participants were given the opportunity to choose between the low- and high-preference activities, in the absence of non-contingent reinforcement, choice shifted toward the low-preference activity. This effect was transitory for one of the two subjects, suggesting that a lasting change in reinforcer effectiveness did not occur.

In another study, Hanley, et al. (1999) increased choice of low-preference activities that were deemed more socially-appropriate than the activities that participants generally chose. Adults with developmental disabilities were offered additional edible reinforcers for engaging in appropriate behavior during the low-preference activities (not directly for choosing the activities). Participants were more likely to choose the low-preference activities under these conditions than when additional reinforcers were not

available. Increased choice of lower-preference activities was transitory; rate of choosing these activities immediately returned to baseline levels when the additional reinforcers were eliminated. This temporary effect of adding stimuli indicates that the reinforcing value of the activities themselves was not altered by the procedure.

Hoch, et al. (2002) used additional reinforcers to influence the choices of three children with autism between playing in an area where no peers were present versus playing in an area containing peers. Prior to treatment, the children chose to enter and play in the area that did not include peers. Unlike the studies by Hanley and colleagues, additional reinforcers (toys) were available in both high- and low-preference conditions, but the variables of magnitude and quality of reinforcement were altered to favor the low-preference condition. For one of the subjects, simply increasing the amount of time that the student could play with toys in the peer play area relative to the other area increased the subject's frequency of choosing to enter the peer play area. For two subjects, presenting higher-preference toys in the peer play area than in the other play area increased choice of the peer-play area. Results were generalized to home and school settings and across multiple peers for two of three subjects, indicating that for these subjects, some aspect of the peer condition became reinforcing. Higher magnitude and quality of reinforcement were not needed in the generalization settings to maintain responding. Peers may have become conditioned reinforcers through pairing with toys, or the participants may have contacted natural reinforcers embedded in the peer situation through simple exposure. In practice, it is often assumed that exposing students to new activities results in the new behavior being trapped by the natural contingencies of reinforcement (Stokes & Baer, 1977). Studies such as this, however, are limited to

manipulations of exposure to activities. The effects of contact with natural contingencies associated with the activities are not examined.

These studies by Hanley, Iwata, Roscoe, et al. (2003), Hanley, et al. (1999), and Hoch, et al. (2002) show that it is possible to influence the choices of people with developmental disabilities by altering reinforcing aspects of their choices. These methods are not as restrictive as the methods that require high-preference activities to be withheld from the subjects. Moreover, they are relatively benign and easy to implement. The simple addition of known reinforcers to less-preferred activities can be a valuable tool for broadening the reinforcer and activity repertoires of people with disabilities. Methodologically, however, it can be difficult to isolate the variables responsible for changes in activity preferences. Making an additional reinforcer available for a chosen activity may impact reinforcing value of the activity in several different ways. Mere exposure to the activity might be sufficient to increase its reinforcing value, especially if the student had not contacted the activity at all in the past. Previous research has shown that simply exposing people to stimuli leads to increased choice of these stimuli in forced-choice tasks (e.g., Kunst-Wilson & Zajonc, 1980; Zajonc, 2001). Furthermore, exposure through active engagement with a novel activity may introduce one to intrinsically reinforcing properties of the activity.

The addition of a known reinforcer might evoke a choice response from the student, thereby producing this exposure. Alternatively, the association between the known reinforcer and the low-preference activity might lead to classical conditioning, in which the low-preference activity becomes a conditioned reinforcer, thus increasing the probability of choosing the activity. Finally, many procedures create a contingency

between making the choice of the low-preference activity and the consequence of receiving the additional reinforcer. Assessing the impact of additional reinforcers during the actual choice test is problematic because it potentially confounds classical and operant conditioning procedures. That is, the student might choose the low-preference activity because this choice results in the additional reinforcer, and not because the low-preference activity has become reinforcing by virtue of its association with the additional reinforcer.

These methodological considerations have complicated interpretation of prior studies in which extra reinforcers were added to low-preference activities. For example, although additional reinforcers were not made explicitly contingent on the specific choice-making behavior of the student in the studies by Hanley, et al. (1999), and Hanley, Iwata, Roscoe, et al. (2003), it can be argued that the differential outcome of choosing certain activities that were presented with additional reinforcers did comprise a reinforcer contingency for choice behavior. In the present study, the lower-preference play activity was paired with a reinforcer during a period of time immediately prior to the discrete-trial teaching session; choices were then made during the discrete-trial teaching session, when the added reinforcers were no longer available. In this way, the behavior of choosing a particular play activity was not reinforced by the presence of additional stimuli during the activity itself following the choice.

It is also important to dissociate experimentally the differential effects of exposure to activities from those of pairing activities with reinforcers. Previous studies that have added reinforcers to low-preference activities have not controlled for the effects of additional exposure to these activities (e.g., Hoch, et al., 2002). Not requiring subjects

to enter the play area in the absence of reinforcer manipulations makes it impossible to evaluate whether simple exposure to peers might have increased the reinforcing value of the situation. Hanley, Iwata, Roscoe, et al. (2003) did control for amount of exposure to the less-preferred activity by matching sessions of pairing the less-preferred activity with reinforcers with sessions of the high-preference activity alone. That is, for every session in which participants were exposed to the low-preference activity paired with a reinforcer, they also experienced a session of exposure to the high-preference activity. While this form of matching controls for differences in amount of exposure to high- and low-preference activities during the study, it does not control for the effects of exposure alone versus pairing the activity with additional reinforcers.

The benefit of the procedures used by Hoch et al. (2002), Hanley et al. (1999), and Hanley, Iwata, Roscoe, et al. (2003) is that they are completely non-restrictive. Subjects were not required to engage in any activities at any time. Rather, one activity was associated with additional reinforcement. While these procedures are certainly consistent with the least-restrictive treatment model and with allowing for personal choices, they do not permit experimental validation of a particular independent variable. One goal of the present study was to determine the extent to which simple exposure to the activity may be sufficient to increase choice of low-preference play activities for students with autism. Pairing of low-preference activities with additional known reinforcers may not always be necessary. To achieve this comparison, however, it was necessary to restrict access to high-preference choices during data collection for the present study. This restriction did not systematically vary with the introduction of the intervention, however, and was not considered part of the treatment.

Another purpose of the present study was to extend the previous work of Hanley and colleagues by assessing choice manipulations for children with autism. The participants in Hanley et al. (1999) and Hanley, Iwata, Roscoe, et al. (2003) were adults with developmental disabilities. Hoch et al. (2002) assessed children with autism, but assessed choice of social versus isolated play rather than choice of particular play activities. The present study also examined the effects of reinforcer manipulations on the effectiveness of the lower-preference play activities as reinforcers for other behavior. Previous studies have assessed the effects of reinforcer manipulations when choice of activities was not made contingent on other behavior, such as in a teaching situation. Such manipulations might not be durable under conditions in which activities are being chosen as reinforcers for more effortful responding in a teaching context.

The present study examined the effects of prior exposure to activities on choices of play activities in students with autism. During intervention phases, each daily session included a 5-minute exposure period followed by discrete-trial teaching. The dependent variable was students' choice of play activities as reinforcers during discrete-trial teaching, and the independent variable consisted of three levels of the exposure manipulation: a) simple exposure to the play activity, b) exposure to the play activity along with access to preferred snacks, and c) no prior exposure. The relative effects of exposure and no exposure were evaluated under a multiple-baseline design across subjects. The relative effectiveness of exposure and exposure with added snacks was assessed within an alternating-treatments design in which exposure periods included or did not include concurrent access to snacks (demonstrated to be preferred in an initial preference assessment). It was anticipated that simple exposure to play activities prior to

teaching would increase the likelihood that these activities would be chosen as back-up reinforcers for tokens earned during discrete-trial teaching. It was also expected that pairing the play activities with reinforcers during the exposure period would further increase the likelihood that these activities would be chosen as back-up reinforcers for tokens earned during discrete-trial teaching.

Method

Subjects

Subjects were four school-aged children diagnosed with autism by an individual or agency not associated with the school in which the study took place. These participants were between the ages of six and nine, and all were students in a self-contained classroom for children with autism. A school psychologist within the students' home school district had evaluated each student within the past three years, using the Wechsler Intelligence Scale for Children (WISC).

Luis was 9 years old, and had a Full Scale IQ in the average range (91). He had near-normal verbal skills, but a tendency to perseverate on certain activities and to become aggressive when redirected from activities. Maria was also 9 years old, and her Full Scale IQ tested in the deficient range (58). She spoke in 3-4 word utterances, and perseverated on activities, including writing lists of words. Bob was 6 years old, and had a Full Scale IQ in the average range (90) and strong verbal skills. He verbally perseverated on selected topics. Alan was 8 years old, and had a Full Scale IQ score in the deficient range (62). He spoke in full sentences, and perseverated on movies and certain toys.

Setting and General Procedure

The study took place in the students' regular classroom, which used applied behavior analysis in teaching new skills and in remediating problem behavior. The author of this study is the regular consultant to the classroom, providing training and programming for the students. The classroom teacher, who was a certified special education teacher, and three classroom aides, each of whom had no academic training in this area, carried out the experiment. Three other students were also part of the class, but did not participate in the study because their teacher felt that they sufficiently varied their choices. The experiment occurred during regular teaching procedures, using furniture and materials that are typically used in the classroom.

All baseline and experimental sessions took place within the context of discrete-trial teaching sessions, and were conducted by the teacher and/or teaching assistants regularly assigned to that classroom. One session was conducted per day. Teaching sessions were comprised of programming consistent with each student's individual educational plans (IEP), which outlined goals and objectives that had been determined to be important for the student by the student's teacher and parents. Four programs were selected to be taught for each student during data collection for this study. These programs are listed in Table 1. The same programs were taught across phases for each student; however, each student progressed through succeeding steps of his/her programs at his/her own pace throughout the experiment. Programs were taught as traditional discrete-trial teaching plans, in which students were presented with an antecedent for behavior, and then behavior was followed by a consequence. If the student responded correctly to the antecedent, a token was placed on a token board. If the student did not

respond correctly to the antecedent, the consequence was the delivery of a prompt for the appropriate response, followed by the presentation of the same antecedent again. This sequence was repeated until the student responded correctly and independently (without prompting) to a given antecedent. When the student earned a specific number of tokens, he or she was given the opportunity to choose among three play activities as a back-up reinforcer. The student was then given the opportunity to play with the chosen activity. Each student had been taught using this methodology as a part of the regular classroom routine, and all staff members had been trained in these procedures. The students' responses were recorded as correct or prompted on each trial of each discrete-trial teaching program, consistent with methods in place prior to this study.

During all phases of the experiment, students participated in one discrete-trial teaching session per day as typical for this class, which was taught mostly in a small-group incidental teaching format. Each session lasted until students made five choices of back-up reinforcers. The amount of time each session lasted varied between students and across sessions within students, and was not experimentally controlled. The dependent variable was the frequency with which three different play activities were chosen as back-up reinforcers during the five opportunities to choose in each discrete-trial teaching session. During the baseline phase, experimental sessions commenced with the first trial of the discrete-trial teaching procedure. The participants' activities during the five minutes prior to each baseline session were not controlled. During intervention phases, a 5-minute period of exposure to one play activity preceded discrete-trial teaching. In all other regards, baseline and experimental sessions were procedurally identical.

Materials

Each student had a token board on which nickels were placed as generalized reinforcers to be traded for the opportunity to choose play activities. Students chose play activities using a choice board containing pictorial and written representations of available activities, including legos, drawing, trains, Play-Doh, blocks, books, books on tape, chalkboard, dolls, magnetic letters, puzzles, and patterning blocks. Six age-appropriate play activities had been identified for each student by the classroom teacher, based on the student's preferences. The choice board contained pictures of the three activities identified as low-preference. Pictures were placed on the board randomly prior to the first choice opportunity, and were not rearranged for the duration of the study to avoid any systematic variation concurrent with experimental changes. Position bias did not occur, as students did vary their choices with intervention.

Pretraining was conducted to insure that students correctly associated pictures of play activities with the activities themselves. An array of all play activities was presented, and the student was given a picture of each activity. The student was instructed to match the pictures to the activities. All students demonstrated 100% accuracy in matching pictures to activities, so this skill was considered mastered and the pre-experimental phases commenced.

Design

Four types of phases were conducted in this study (see Figure 1). The first two phases were pre-experimental phases, and the last two phases were experimental phases. Pre-experimental phase 1, *Assessment of Added Reinforcers*, consisted of a preference assessment procedure to determine preferred snacks for later use in the study. Pre-

experimental phase 2, *Assessment of Activity Reinforcers to be Used in Discrete-Trial Teaching*, was used to determine relative preference for play activities. Experimental phase 1, *Baseline*, was used to evaluate students' tendency to choose play activities prior to introduction of the experimental procedures. In experimental phase 2, *Intervention*, the intervention was introduced at different points in time for each subject, in a multiple-baseline across-subjects design. This design allowed for the evaluation of the effects of exposure and exposure plus snacks, in comparison to no exposure. Type of exposure—exposure alone or exposure plus snack—was manipulated in this phase according to an alternating-treatments design across sessions. This design was used to compare the effectiveness of pre-session exposure to play activities with or without added snacks in altering students' choices of activities.

A reversal procedure was also conducted for three of the subjects. For Luis, the set of play activities was changed after the first intervention phase, and baseline and intervention phases were replicated with a new set of play activities. For Maria, a complete ABAB reversal design was conducted with the same play activity set. For Bob, an ABA reversal design was conducted with the same play activity set. For Alan, an unstable baseline lead to the introduction of a second baseline with a new play activity set, followed by an intervention phase. Time constraints prevented a return to treatment phase for Bob, and a return to baseline phase for Alan.

Pre-Experimental Phase 1: Assessment of Added Reinforcers. Prior to experimentation, a preference assessment was conducted according to the methods of Fisher, et al. (1992) to evaluate potential preferred snacks for use during the activity period. Four edible stimuli were selected by the classroom teacher for each student. The

stimuli were presented to the student in pairs, until the student had been presented with each stimulus paired with each other stimulus. The stimulus that was chosen on the highest percentage of opportunities overall was selected for use as the additional reinforcer in some exposure periods for the remainder of the study. This stimulus was then made unavailable to the student during the school day at any time outside of data collection for this experiment for the duration of the study. Only one preference test was conducted for each student prior to the study. Research has shown that the outcomes of paired-choice preference assessments are durable over time (Green, Reid, Canipe, & Gardner, 1991).

Pre-Experimental Phase 2: Assessment of Activity Reinforcers to be Used in Discrete-Trial Teaching. A second reinforcer assessment procedure was conducted to select three age-appropriate play activities for further study. Each student was presented with a set of six of the following play activities: legos, drawing, trains, play-doh, blocks, books, books on tape, chalkboard, dolls, magnetic letters, puzzles, and patterning blocks. These activities were presented according to Fisher, et al. (1992), in pairs, until each play activity had been paired with each other activity. Upon choice of a play activity, students were given approximately one minute to play with the activity before the next pair of activities was presented. The play activities were then ranked by preference according to how frequently each activity was chosen.

The three play activities that were chosen least often were considered low-probability choices, and were selected as the targeted and comparison activities in this study. If all six play activities were chosen with the same frequency, that is, within 10%

of each other, they would have been replaced with different activities; however, this outcome did not occur for any student.

Experimental Phase 1: Baseline. A baseline phase was conducted in which choice of each of the three low-preference play activities was evaluated during one discrete-trial teaching session per day. Students had the opportunity to choose among the three low-preference play activities following completion of their token economies in discrete-trial teaching. A given session included 5 opportunities to make choices. These sessions continued until stability was noted in students' choices. The play activity that was chosen most frequently by the student in the baseline condition was assigned as the *comparison* activity. One of the two play activities that were chosen less frequently during baseline was randomly assigned to the *exposure-only* condition; the other infrequently chosen play activity was assigned to the *exposure + snack* condition. Play activities assigned to each condition are listed for each student in Table 2 (see Comparison 1, Exposure-only 1, and Exposure + Snack 1), along with the snack presented in the exposure + snack condition for each student (see last column). In the event that students did not make clearly differentiated choices in baseline sessions, a new activity set was assessed and introduced. Alan's initial baseline responding was highly variable, so a second baseline phase with new activities was initiated (in Table 2, see Comparison 2, Exposure-only 2, and Exposure + Snack 2).

Experimental Phase 2: Intervention. The intervention phase consisted of a comparison between exposure-only sessions and exposure + pairing sessions. In both conditions, experimental sessions began with an exposure period in which the student was given five minutes of access to one of the two targeted low-probability play

activities, with the instruction, "Play with (activity)." Experimenters evaluated engagement with play activities, defined as touching and looking at materials. The experimenter used a momentary-time sampling system (MTS) to measure engagement with play activities. Every 3 seconds, the experimenter observed the student to determine if the student was looking at and touching the materials. If the experimenter noted that the student was not looking at and touching the materials, prompting was used to increase engagement. A prompt hierarchy was followed, consisting of gestural, verbal, and physical prompts. If the student did not respond to a gestural prompt (the teacher pointed to the materials), a verbal prompt ("Play with [activity]") was delivered. If the student did not respond to the verbal prompt, the teacher physically guided the student's hands to make contact with the materials.

In exposure-only sessions, the student was given access to the exposure-only play materials as described above. In exposure + pairing sessions, the student was given access to the exposure + snack materials in the same manner as in exposure-only sessions; however, a preferred snack, selected during the initial reinforcer assessment, was also made available non-contingently during the exposure period. Single pieces of the snack (e.g., one potato chip, one pretzel, or one goldfish) were delivered to the student on a fixed time 30 seconds (FT 30-s) schedule throughout the 5-minute exposure period. This schedule of non-contingent reinforcement was selected because it did not result in a too-frequent delivery of food that would interfere with play, and because it was easy for the teacher and teacher assistants to administer. Examination of the data show that students' level of engagement with activities was not affected by the delivery or consumption of food.

Following either of these exposure conditions, a regular teaching session commenced. The procedures were the same as those used in baseline. The teacher used the pictorial choice board to give the student a choice of the three play activities—the comparison activity, the exposure-only activity, and the exposure + snack activity—as back-up reinforcers for the tokens. Data were collected on the student's selections of play activities at each opportunity, and on his/her responses during discrete-trial teaching. Exposure-only or exposure + pairing conditions were counterbalanced across sessions according to an ABBABAAB design.

Experimental Phase 3: Return to Baseline. For three students, a second baseline phase was implemented. For Maria and Bob, this phase was identical to the initial baseline phase, in which regular discrete-trial teaching sessions were conducted with no within-session prior exposure to the play activities offered as reinforcers. The same play activities offered as backup reinforcers in the first baseline phase and the intervention phase were offered in the return-to-baseline phase. For Luis, a new set of play activities (in Table 2, see Comparison 2, Exposure-only 2, and Exposure + Snack 2) was introduced in the return-to-baseline phase.

Experimental Phase 4: Return to Intervention. The intervention of prior within-session exposure to play activities was replicated for Maria and Luis, in a phase identical to the initial intervention phase. For Maria, the same play activities used in the initial and return to baseline phases, and the initial intervention phase, were used. For Luis, the second play activity set that was introduced in the second baseline phase was used.

Interobserver Agreement

Two independent observers collected data on students' choice of activities and level of engagement with exposed activities on an average of 20% of sessions across the study–percentages for each student ranged from 11-50% across phases.

The frequency with which a second observer was present was determined, in part, by the level of available staffing. One observer was the teacher or teacher assistant conducting the procedure with the student, and the other observer was either the author of the study or a graduate student volunteer who had been trained by the author in the observation procedures. Interobserver agreement was calculated by dividing agreements by agreements plus disagreements and multiplying by 100. Observers agreed on 98% of observations across data collected on both choice of activities and engagement with activities. Level of agreement ranged from 80-100% on choice of activities, and from 92-100% on engagement with activities. Interobserver agreement data are broken down by student and phase in Table 3.

Data on procedural reliability were collected with a checklist. The experimenter observed teacher behavior during 20% of sessions for all students, and recorded data on the following responses: providing exposure period for the correct length of time, prompting engagement with the materials when necessary, providing non-contingent reinforcers during the exposure + snack condition, conducting discrete-trial teaching sessions (including token delivery), and providing choices of the two targeted and one comparison play activities as a consequence for earning tokens. Percentages of sessions for which the procedural reliability measures were collected for each student ranged from

11-25% across phases. Mean level of procedural reliability was 97% (range: 90-100%) correct responding across teachers and students.

Results

Each student's play activity choices during each experimental phase are presented on Figures 2, 3, and 4. The percentage of choice opportunities on which each play activity was chosen is plotted as a function of sessions, which occurred once per day and included 5 opportunities to choose play activities as back-up reinforcers. On all graphs, larger symbols in the intervention phases indicate the play activity exposed during that session.

Figure 2 shows the percentage of opportunities each student chose the comparison activity, to which prior exposure was not given, across sessions. Students generally chose the comparison activity at high levels during baseline phases and at lower levels during intervention phases. Luis chose the comparison activity almost exclusively in each of two baseline phases. He continued to choose the comparison activity exclusively on 11 out of the first 15 sessions in the first intervention phase, then chose the comparison activity only once during the remaining 10 sessions of this phase. Luis continued to choose the comparison activity on 80% or more opportunities during the first five sessions of the second intervention phase. He then chose the comparison activity on 60% of opportunities for the 6^{th} session, and did not choose the comparison activity at all for 4 out of the 5 remaining sessions for this phase.

Maria's choice of the comparison activity ranged from 0 to 100% of opportunities during the first 19 sessions of her initial baseline phase. She then chose the comparison activity exclusively for the remaining 8 sessions of this phase. With the introduction of

the first intervention phase, she chose the comparison activity exclusively for 2 sessions (sessions 30 and 41), and not at all for another session in this phase. Maria chose the comparison activity exclusively on all but one session (session 53) during the second baseline phase. She then did not choose the comparison activity at all during the final intervention phase.

Bob did not choose the comparison activity at all during the first 10 sessions of the first baseline phase. He then chose the comparison activity for 40% of opportunities during 4 sessions, followed by varying levels of choice for this activity until session 26. He then chose this activity exclusively for the remaining 18 sessions of this phase. With the introduction of the intervention phase, Bob chose the comparison activity on only 2 sessions (sessions 45 and 48). During the second baseline phase, Bob chose the comparison activity exclusively on 3 out of 9 sessions, and not at all on the other 6 sessions.

In the first baseline phase, Alan chose the comparison activity on 80% or more opportunities for 30 out of 54 sessions. The set of play activities was then changed, and he chose the comparison activity exclusively on all sessions of a second baseline phase. When the intervention was introduced, Alan continued to choose the comparison activity exclusively on the first 3 sessions (sessions 66, 67, and 68) and on sessions 70 and 75. He chose this activity on 60% or less of opportunities on sessions 69, 71, and 72.

Figure 3 shows the percentage of opportunities each student chose the exposure-only activity across sessions. All students had near-zero baseline levels of selecting the exposure-only activity at the time that the intervention was introduced, and all showed an increase in level of choice of the exposure-only activity from baseline to intervention.

Choice of the exposure-only activity was most likely when that activity had been exposed earlier in a given session. Luis chose the exposure-only activity only once in the first baseline phase. He then chose this activity on three sessions when it was exposed in the first 7 sessions of the first intervention phase, then not at all for the rest of the phase. When the new play activity set was introduced in the second baseline phase for Luis, he chose the exposure-only activity exclusively on the first session, on 60% of opportunities for the second session, and not at all for the rest of the phase. For the second intervention phase, Luis chose the exposure-only activity on 40% of opportunities in session 70, which was a session in which this activity was exposed. He did not choose it at all in any other session of this phase.

Maria chose the exposure-only activity between 0 and 100% of opportunities for the first 13 sessions of the first baseline phase. She then did not choose this activity at all for the remainder of Baseline 1 sessions, and she chose it in only one session (session 53) of Baseline 2. In the first intervention phase, Maria chose the exposure-only activity exclusively on all sessions in which it was exposed, except for two (sessions 32 and 41). In the second intervention phase Maria chose the exposure-only activity exclusively on all sessions in which it was exposed. She did not choose this activity at all when it was not exposed in either intervention phase.

Bob chose the exposure-only activity exclusively for the first 10 sessions of the first baseline phase. He then chose this activity from 0% to 100% of opportunities on the next 14 sessions, then not at all for the remaining 18 sessions of the phase. With the introduction of the intervention phase, Bob chose this activity exclusively on all sessions in which it was exposed except for one (session 48), when he chose it on 20% of

opportunities. He did not choose this activity at all when it was not exposed during this phase. In the second baseline phase, Bob chose the exposure-only activity exclusively on 6 out of 9 sessions.

Alan chose the exposure-only activity on 0% to 100% of opportunities throughout the first baseline phase. When a new set of play activities was introduced, he did not choose the exposure-only activity at all for a second baseline phase. He then chose this activity on 40% of opportunities for 2 out of 8 sessions in the intervention phase.

Figure 4 shows the percentage of opportunities each student chose the exposure + snack activity across sessions. Similar to the data presented for the exposure-only activities in Figure 3, students chose the exposure + snack activities at low levels during baseline phases prior to the introduction of the intervention. These activities were chosen more frequently during the intervention phases, particularly on days when they had been exposed. Luis did not choose this activity at all during the first baseline phase, or on the first 7 sessions of the first intervention phase. He then chose it on 40% of opportunities on session 14, and not at all again until session 24. Luis then chose this activity on 100% of opportunities for all sessions for the remainder of the phase, except for session 26, when he chose it on 80% of opportunities. Luis was given a new set of play activities with the introduction of the second baseline phase. In this phase, he chose the exposure + snack activity twice – once on session 35 and once on session 49. When the second intervention phase was introduced, Luis chose the exposure + snack activity once on the third session of the phase, then exclusively on 4 out of the last 5 sessions of the phase.

Maria chose the exposure + snack activity on 0% to 100% of sessions in the first 19 sessions of the first baseline phase. She then did not choose this activity at all for the

remaining 8 sessions of this phase. In the first intervention phase, Maria chose the exposure + snack activity exclusively on all but one (session 30) of the sessions in which it was exposed, and on one session in which it was not exposed (session 31). She then did not choose this activity at all in the second baseline phase. Maria chose the exposure + snack activity exclusively in all sessions in which it was exposed in the second intervention phase, and not at all when it wasn't exposed.

Bob chose the exposure + snack activity on 20% of opportunities in session 19 and 40% of opportunities in session 24 of the first baseline phase. He did not choose this activity at all for the remaining 40 sessions of this phase. With the introduction of the intervention, Bob chose the exposure + snack activity exclusively on all sessions in which this activity was exposed except for session 45, when he did not choose it at all. He did not choose this activity at all when it wasn't exposed in a given session, or in the second baseline phase.

Alan chose the exposure + snack activity on 20% to 100% of opportunities in 5 out of 46 sessions in the first baseline phase. When a new set of play activities was introduced in the second baseline phase, he did not choose the exposure + snack activity at all. He then chose this activity on 100% of opportunities in session 69 and 60% of opportunities in session 72 in the second intervention phase. This activity was exposed in both of these session. He did not choose it at all in any other session of this phase.

Figure 5 is a bar graph showing the mean percentage of opportunities each activity was chosen within each phase. Solid black bars represent comparison activities, light gray bars represent exposure-only activities, and dark gray bars represent exposure + snack activities. Error bars represent the standard error of the mean. The vertical

dashed lines on the graphs for Luis and Alan indicate the change in the set of play activities for which choice was studied.

Figure 5 indicates that all participants showed a decrease from baseline to intervention in percentage of opportunities that the comparison activity was chosen. This was obtained in AB transitions for Luis and Alan, in an ABA manipulation for Bob, and in an ABAB manipulation for Maria. Level of experimental control by the two exposure procedures differed across participants. Luis showed in increase in choice from baseline to intervention for the exposure + snack activity, but little change for the exposure-only activity. Maria showed increases for both exposed activities—the exposure-only activity and the exposure + snack activity—from baseline to intervention in both AB transitions, and a decrease from Intervention 1 to Baseline 2. Bob showed an increase in choice of the exposure + snack activity from Baseline 1 to Intervention 1, and a decrease with the transition back to baseline conditions. There was no change in Bob's level of choice of the exposure-only activity from Baseline 1 to Intervention 1, and a slight increase in choice of this activity with the return to baseline. Alan showed no choice of either of the exposed activities during the Baseline 2 phase, and some choice of these activities in the intervention phase. In examining this figure, it should be recalled from Figures 3 and 4 that for Maria, Bob, and Alan (but not for Luis), the variable governing choice during the intervention phases was the activity exposed on a given day (see Figures 3 and 4).

Data collected on students' engagement with the exposed play activities are presented in Table 4. On average, percentage of time samples students engaged in exposed activities ranged from 92-97%.

Data collected on student performance on specific discrete-trial teaching programs are displayed on Figure 6. [the scale for all participants should be identical. If there is a problem w/ different levels of responding across participants, you can put breaks in the y-axis when needed.] For each program, a given mastery criterion was established for all steps within the program, and each step was mastered before beginning the next step. The figure shows the average number of sessions to achieve the mastery criteria for a step in a given program prior to the experiment and during the experiment. The black bars represent the average number of sessions prior to the experiment, and the grey bars represent the average number during the experiment. For Luis, Bob, and Alan, steps were mastered more quickly during the experiment for two programs, more quickly prior to the experiment for one program, and equally quickly during and prior to the experiment for one program. For Maria, all programs were mastered more quickly during the experiment.

Discussion

For all students, choice of the comparison (non-exposed) activity decreased from baseline levels when the intervention was introduced. Levels of choice of both types of exposed activities increased systematically with the introduction of the intervention in nearly all cases. Furthermore, all students chose play activities to which they had been previously exposed at the beginning of a given session more frequently than play activities for which exposure was not programmed on that session. One student, Luis, chose the play activity that had been paired with snacks more frequently than the exposure-only activity. Differential effects on choice of the pairing operation were not shown for the other students, however. Rather, these students demonstrated a tendency to

choose the play activity that had been exposed on that day, suggesting that the effect of exposure is transitory and limited. The durability of this procedure was also assessed in a return to baseline phase with Maria and Bob. Maria's behavior returned to baseline levels, although Bob continued to choose the exposure-only activity on a majority of sessions during his return to baseline. The failure to reverse in Bob's case may be seen as a lack of experimental control, particularly since he did consistently choose the exposure-only activity early the first baseline phase. His choice behavior during the intervention phase was clearly governed by the exposure prior to each session, however, as he exclusively chose the activity previously exposed on all but one session (number 45) of this phase.

Some variability in choice responding occurred in the initial baseline phases for Maria, Bob, and Alan. These students were chosen for this study because they tended to choose the same activities on a regular basis in their everyday classroom behavior. It is possible, however, that the restriction from choosing high-preference activities imposed at the onset of the baseline phase may have increased the variability of their responding. This restriction was held constant across all experimental phases, however, and cannot account for the tendency that these students had to choose the activity exposed on the current day.

The present study was designed to address several questions that exist in the research literature on choice. One major goal was to assess the effects of mere exposure on choice of low-preference activities. In previous studies, choice of low-preference activities was increased by pairing those activities with more preferred reinforcers; however, these studies were not designed to determine whether exposure alone was

sufficient to increase choice of that activity (e.g., Hanley et al., 1999; Hanley, Iwata, Roscoe, et al., 2003; Hoch, et al., 2002). In the present study, students were exposed to some activities along with preferred snacks, and they were exposed to other activities without snacks. For three out of four participants, it was found that exposure alone was sufficient to increase choice of previously less-preferred activities. Another parametric investigation made by the present study was assessment of choice of activities in the absence of additional reinforcers. Prior studies could not determine if students' choice of activities was motivated simply by the activity itself, or by the stimuli with which the activity was paired. The present study also controlled for amount of exposure to each target activity by requiring students to engage in each activity for a particular period of time. Finally, the present study examines these procedures in the context of play activities for children with autism. The participants in most of the prior studies were adults with developmental disabilities (e.g., Hanley et al., 1999; Hanley, Iwata, Roscoe, et al., 2003), and none of the prior studies targeted play activities.

This study shows that previously exposed play activities served as reinforcers for the choice behavior of each student; for 3 students, this was true even in the absence of additional reinforcers during exposure. Furthermore, these play activities appeared to serve as effective reinforcers for the responses made during discrete-trial sessions following the exposure period. This observation is supported by data showing that all students made progress toward their discrete-trial teaching goals commensurate with or better than their progress before the introduction of this study. Because the students' progress on discrete-trial teaching programs was not a major focus of this study, many aspects of the discrete-trial teaching situation were not controlled. Different programs

were in place for each student, and level of difficulty in mastering steps may have differed across programs and across sessions and experimental phases. These data are therefore offered only as an informal indication that the procedures used in this study were not harmful to the students' rate of progress on the goals that were deemed important for them. The use of low-preference activities presented as reinforcers could have had a deleterious effect on skill acquisition and maintenance. On the contrary, however, the participants appeared to learn as well using these activity reinforcers as they had learned prior to the study, when they had had a much broader range of reinforcers from which to choose.

As in any applied research study, it should be noted that variables that were not controlled could possibly account for some of the differential responding shown between the baseline and treatment conditions of this study. For example, discrete-trial teaching was conducted by four different individuals (the classroom teacher and three teaching assistants). Variables such as pacing of the delivery of instructions, ratio of responses to delivery of token reinforcement, and how students' disruptive behavior was addressed, were not controlled in this study. Rather, they were left to the discretion of the individual instructor and to classroom protocol. It is therefore possible that factors other than the levels of the independent variable affected students' choice of back-up reinforcers; however, it is assumed that such factors were unlikely to vary systematically with the treatment across a multiple-baseline and reversal designs.

It should be acknowledged that the likelihood that play activities would be conditioned as new reinforcers by virtue of pairing the activity with edible reinforcement (the exposure + snack period) may have been diminished by an aspect of the procedure:

the duration of the exposure + snack period (5 minutes) was short in comparison to the amount of time students contacted that activity during the choice procedure when it was not paired with the snack. Had the ratio of exposure + snack duration to exposure without snack duration been more favorable, it is possible that participants other than Luis would have shown an effect of pairing above that attributable to exposure alone.

Procedural limitations notwithstanding, some inferences can be made. First, for three out of four participants, mere exposure was sufficient to increase choice of low-preference play activities. Independence of this effect from presence of edible stimuli indicates that classical conditioning with food reinforcement did not account for the enhanced conditioned reinforcing value of the exposed play activities for these students. Another potential explanation for the increase in choice of play activities to which students have been exposed is that the choice response produced contact with natural reinforcing properties associated with the activity (Hoch, et al., 2002).

Either of these explanations would imply a longer-lasting effect than was seen in this study, however. It would be expected that if the reinforcer value of the less-preferred play activities had been increased through classical conditioning, the students would have continued to respond as though these activities were reinforcers, even if for a relatively small number of sessions. Similarly, if students had come into contact with naturally-occurring reinforcers during the course of their exposure, it would be expected that they would continue to select those play activities on days when they had not been exposed to the activities. For three students, however, responding was governed entirely by the immediately preceding exposure session. There did not appear to be any carryover within the intervention phases, nor during the return to baseline sessions conducted for Bob and

Maria. Luis did not experience a return-to-baseline condition with the same play activity set, but he did favor the activity paired with food, which was replicated with a second play activity set. It is therefore possible that for this student, classical conditioning resulting from pairing with food did alter the value of an activity as a reinforcer.

An alternative and simple explanation for the results of this study may lie in the participants' strong history of reinforcement for compliance with instructor demands. The students who participated in this study had all had several months to several years of experience in receiving reinforcement for compliance with instructions presented by the staff in this classroom. For the two students who reliably chose the activity exposed earlier in each given session, it is possible that their choices were not governed by the reinforcing consequence of receiving the activity. Rather, they may have been responding to the instructor's earlier instruction to "play with (activity)" and the implied instruction of her prompts during the exposure period immediately preceding choice opportunities. A replication of this study with students who have not as strong a history of compliance training might help to analyze this possibility, and to determine if this procedure would be as useful for students who present with compliance challenges.

Another basis for understanding the behavior of the participants in this study might have to do with the establishing operations of satiation and deprivation (Michael, 2000). Given a satiation/deprivation model, one might predict that presenting a potential reinforcer for a period of time prior to teaching might reduce its effectiveness as a reinforcer, because of satiation. In the present study, however, this was not the case. Activities became stronger reinforcers for choice behavior when they were presented prior to teaching and choice-making opportunities. As shown by Klatt, et al. (2000),

however, deprivation is not an effective method for increasing choice of a less-preferred activity. It would therefore stand to reason that satiation might not occur easily with a less-preferred activity such as those used in this study. Instead, the somewhat brief exposure period might have been sufficient to produce an effect of deprivation when the activity was removed and discrete-trial teaching commenced.

In yet another point of view, Murphy, McSweeney, Smith, and McComas (2003) discuss the common practice of deprivation for the purpose of increasing the value of a stimulus as a reinforcer in terms of habituation. Similarly, they argue that sampling, or prior exposure to a stimulus for the purposes of increasing its value, might be viewed as a sensitization process. The psychobiology literature refers to this process as "priming." For example, Cornell, Rodin, and Weingarten (1989) found that adult human subjects who had eaten to the point of satiation would consume more pizza or ice cream when given a brief taste of it than those who were not so primed. Other examples exist in the area of drug addiction research, as described by deWit (1996): humans and animals are both more likely to self-administer drugs when given a small amount of prior exposure to them.

According to McSweeney and Swindell (1999), the effect of increasing reinforcer value through prior exposure to a reinforcer might be viewed as sensitization, and the effect of reduced reinforcer value through repeated exposure as habituation. Sampling is a procedure; it does not define a process. Using the concepts of sensitization and habituation allows us to consider potential processes behind the procedure of sampling.

Although sampling may be a common technique for motivating students to earn reinforcers, it has not been extensively studied in the literature. Other means of

increasing the reinforcer value of less-preferred stimuli have been studied, but without sorting out the potential effects of prior exposure alone on reinforcer effectiveness. The present study demonstrates that for three of four students with autism, simple exposure to a less-preferred play activity had the temporary effect of increasing the reinforcer value of that activity for choice behavior. Furthermore, the reinforcing value of the play activity was sufficient to support the maintenance of learned skills and acquisition of new skills in discrete-trial teaching programs. This study thus identifies basic processes in the alteration of reinforcer effectiveness, and demonstrates its applied usefulness.

Future research might examine the effects prior to exposure to a stimulus on choice of that stimulus in terms of sensitization. While the process of reinforcer sampling has been identified and labeled as early as Ayllon and Azrin in 1968, it has not been satisfactorily explained in terms of basic learning theory. McSweeney and Swindell (1999) offer a solution to the problem, which allows for a range of useful applications, including the use of habituation to reduce the appeal of problematic reinforcers, presentation of extra stimuli to promote sensitization, and dishabituation to reinstate the effectiveness of a reinforcer to which an individual has habituated.

Much of the research in habituation and sensitization has involved non-human subjects. Further exploration of the topic with individuals with developmental disabilities may lead to improved techniques for altering reinforcer effectiveness in a population in whom age- and socially-appropriate reinforcers are often difficult to identify or establish. Initially, simply observing the effectiveness of reinforcers as a function of repeated exposure, perhaps in a concurrent operants arrangement, would document the parameters of sensitization and habituation. Later experimental manipulations can help to identify

the maximally effective conditions for presenting non-contingent exposure to potential reinforcers, and for maintaining the effectiveness of reinforcers during teaching.

The data presented in this study might be characterized as showing perseveration on the part of the students. Continuing to choose an activity that has become familiar through exposure is a common behavior pattern for students with autism, who tend to avoid change and to emit ritualistic and repetitive behavior. Each of the students in this study showed some form of perseverative behavior, as evidenced by their original reluctance to choose a variety of activities. The intervention used in this study may have inadvertently taken advantage of this tendency by using it to manipulate choice of reinforcers in a given session. Although this is not a long-term solution to the problem of restricted range of reinforcers, because the effect did not carry over between sessions, it can be made a part of students' daily routines to make their natural tendency to perseverate more productive in their daily lives. Moreover, these findings may provide insight into the nature of perseveration within a habituation/sensitization model. Students with autism may perseverate because of a deficiency in the normal process of habituation, or because of an extreme sensitization response. This theory would also help to explain some of the difficulties that some students with autism appear to have in tolerating certain sensory stimuli. Further exploration of the processes of sensitization and habituation in people with developmental disabilities may yield further ways to reduce problem behavior and to capitalize on their typical behavioral patterns to increase desirable behavior.

Table 1. *Programs taught during discrete-trial teaching for each student during data collection for this study.*

Student	Programs
Luis	Identifying money, phonics, math concepts, writing
Bob	Telling time, sequencing, identifying money, phonics
Alan	Pronouns, prepositions, telling time, action identification
Maria	Yes/no, requesting, prepositions, action identification

Table 2. *Assignment of activities to experimental conditions, and preferred snacks paired with activities.*

Student	Comparison 1	Exposure-Only 1	Exposure + Snack 1	Comparison 2	Exposure-Only 2	Exposure + Snack 2	Snack
Luis	Crayons	Play-doh	Legos	Trains	Blocks	Puzzles	Chips
Bob	Blocks	Play-doh	Crayons	---	---	---	Pretzels
Alan	Legos (baseline condition only)	Books (baseline condition only)	Chalk (baseline condition only)	Book on tape	Patterns	Chalk	Goldfish
Maria	Crayons	Legos	Letters	---	---	---	chips

Table 3. *Interobserver agreement across phases for each student.*

Student	Baseline 1		Intervention 1			Baseline 2		Intervention 2		
	% sessions	IOA - choices	% sessions	IOA - choices	IOA - engage	% sessions	IOA - choices	% sessions	IOA - choices	IOA - engage
Luis	33%	100%	15%	100%	99%	29%	100%	27%	100%	98%
Bob	15%	100%	36%	100%	98%	11%	100%	--	--	--
Alan	19%	97%	--	--	--	22%	100%	25%	100%	95%
Maria	11%	100%	36%	100%	98%	21%	100%	50%	100%	98

Table 4. *Average percentage of 3-second momentary time samples during which students were looking at and touching materials during exposure and exposure + snack periods.*

Student	Overall Average	Overall Range	Intervention Phase 1 Averages		Intervention Phase 2 Averages	
			Exposure-only	Exposure + snack	Exposure-only	Exposure + snack
Luis	97%	75-100%	99%	99%	93%	98%
Bob	96%	78-100%	99%	94%	--	--
Alan	96%	92-100%	96%	96%	--	--
Maria	92%	71-100%	96%	87%	97%	92%

Figure Captions

Figure 1. Organizational chart showing the pre-experimental (dotted boxes) and experimental (plain boxes) phases of the study.

Figure 2. Percentage of opportunities on which the comparison activity, to which students received no prior exposure during the study, was chosen across students and across sessions.

Figure 3. Percentage of opportunities on which the exposure-only activity was chosen across students and across sessions. Larger symbols on a given session indicate that the exposure-only activity was exposed in that session.

Figure 4. Percentage of opportunities on which the exposure + snack activity was chosen across students and across sessions. Larger symbols on a given session indicate that the exposure + snack activity was exposed in that session.

Figure 5. Percentage of opportunities each activity was chosen within each phase for each student. Black bars represent the comparison activity, light gray bars represent the exposure-only activity, and dark gray bars represent the exposure + snack activity. Error bars represent the standard error of the mean.

Figure 6. Average number of sessions to mastery for each of four discrete-trial programs for each student, comparing sessions to mastery prior to the experiment and during the experiment. Black bars indicate sessions conducted prior to the experiment and grey bars indicate sessions conducted during the experiment. Error bars represent the standard error of the mean.

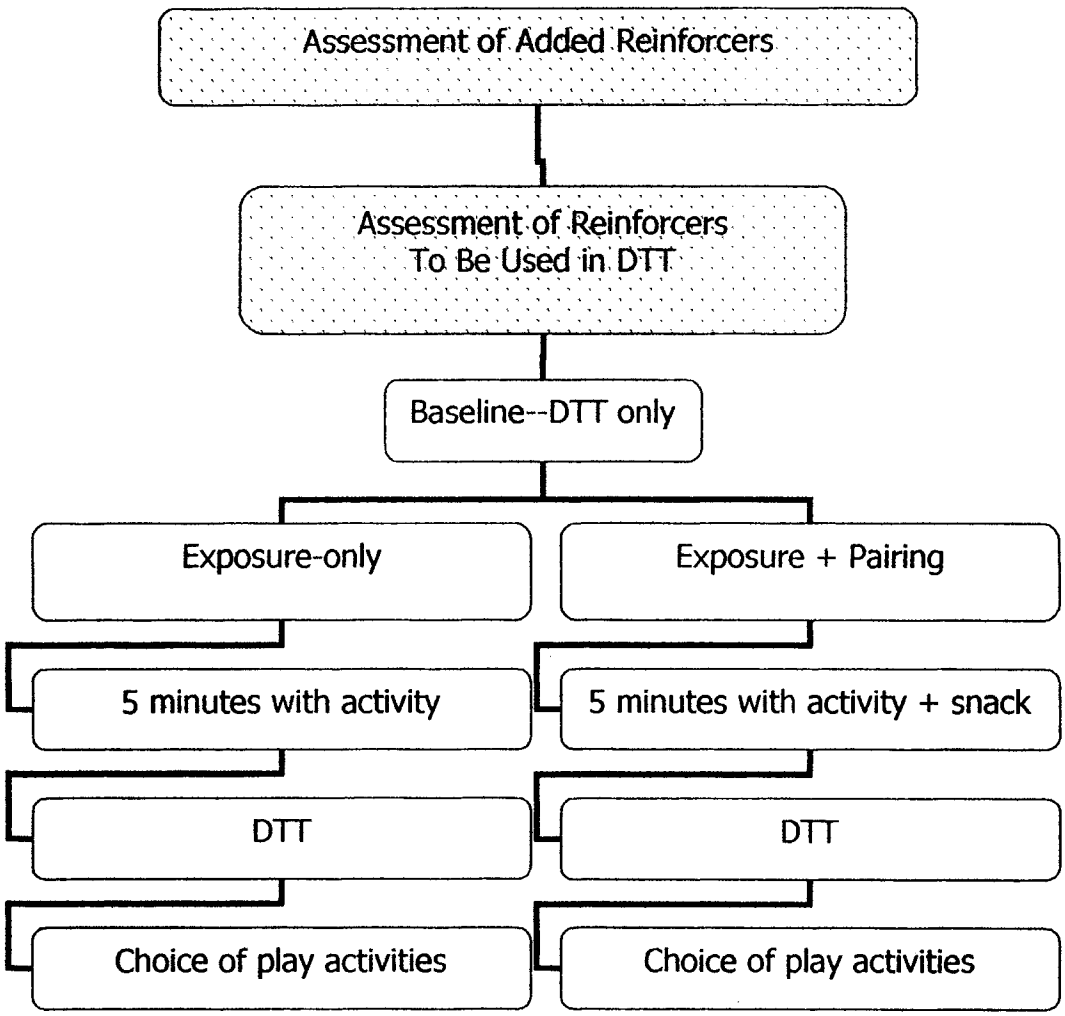

Figure 1

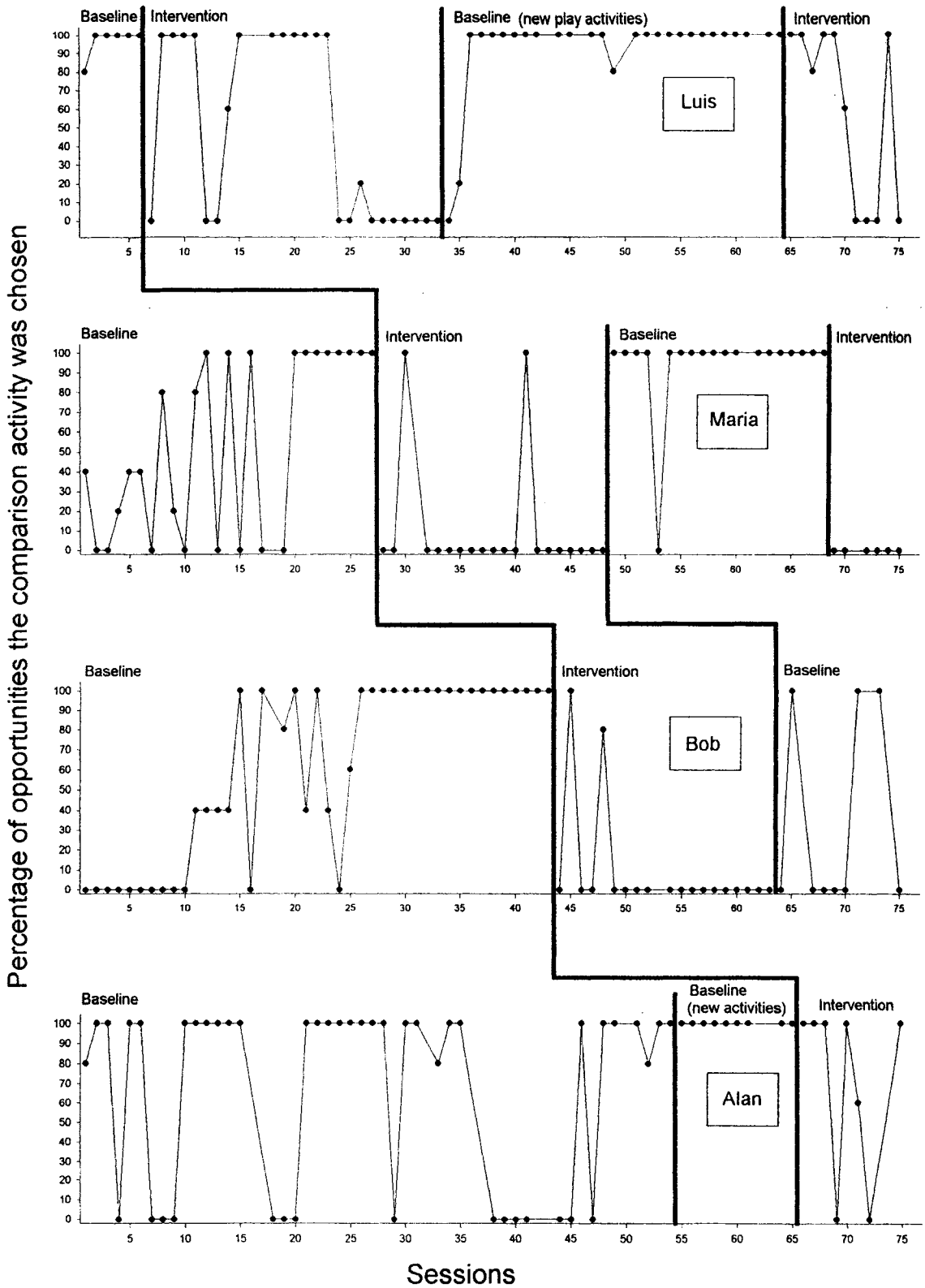

Figure 2

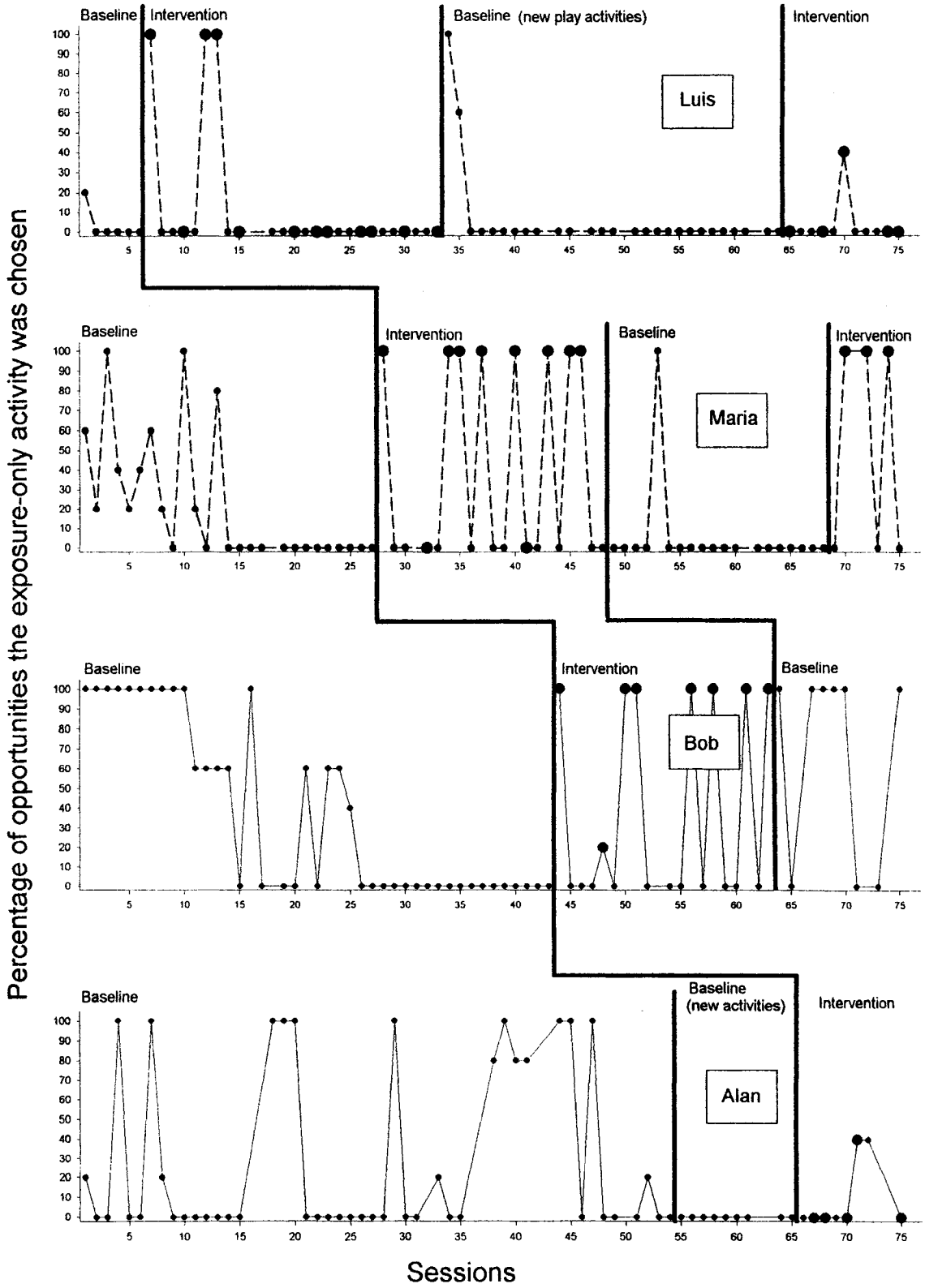

Figure 3

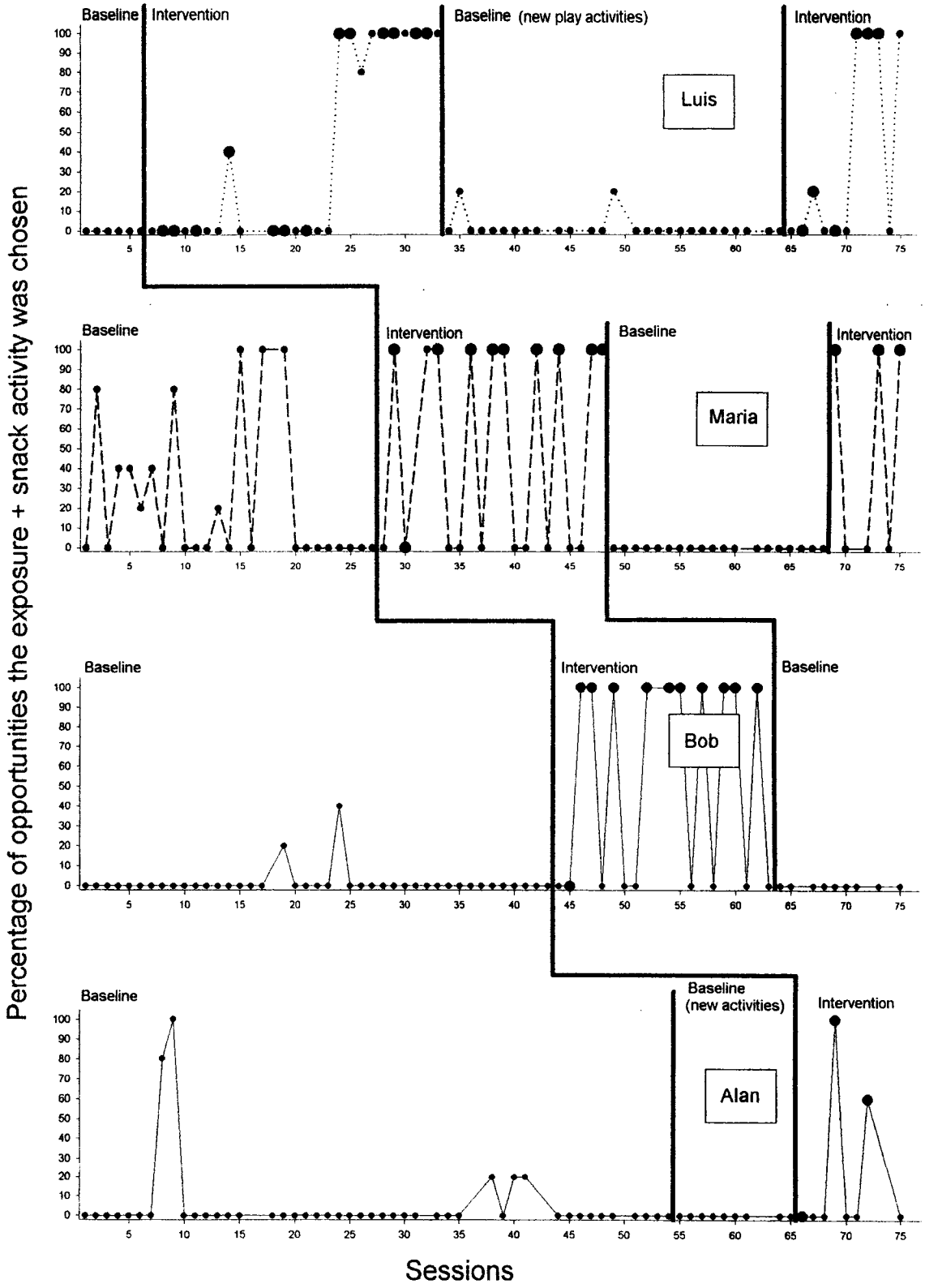

Figure 4

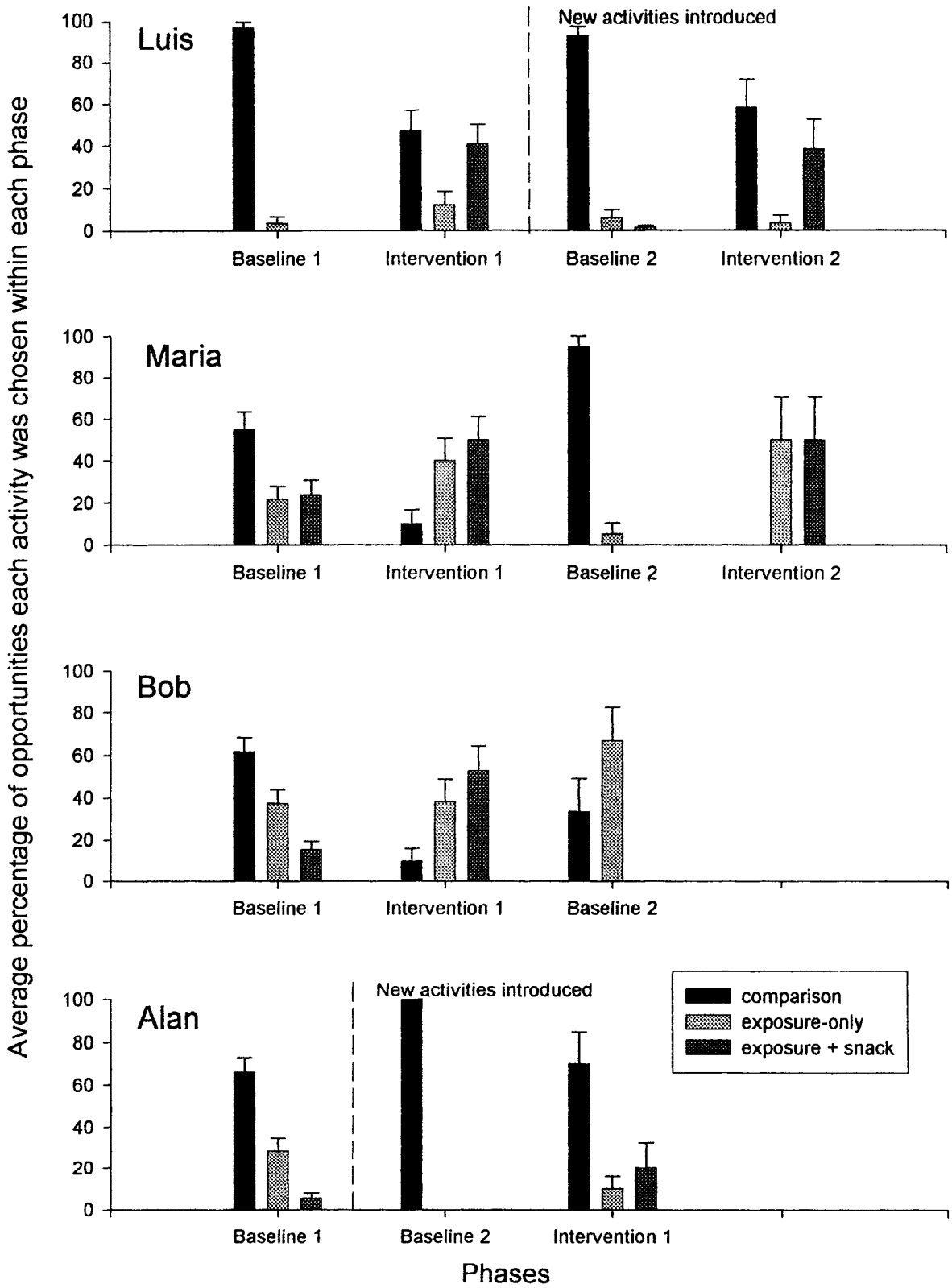

Figure 5

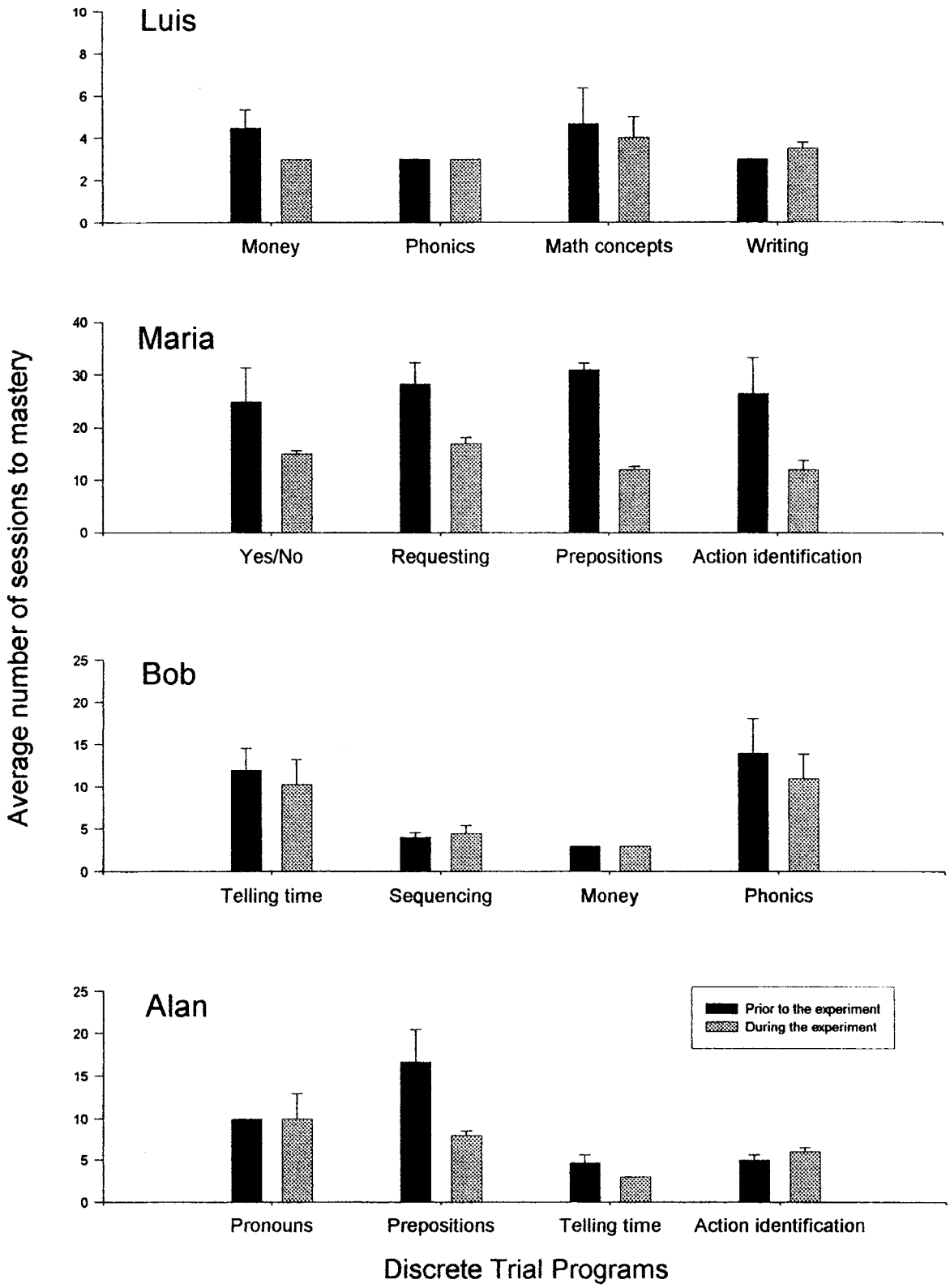

Figure 6

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