THE EFFECTS OF PROMPT FADING AND DIFFERENTIAL REINFORCEMENT ON SELECTION OF NOVEL ACTIVITIES BY CHILDREN WITH AUTISM

by

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Abstract

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by

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Individuals with autism often show limited variability in selecting leisure activities. Repeatedly engaging in only one or a few activities may lead to decreased opportunities for social interaction and leisure skill development. The current study evaluated the effects of prompt fading and differential reinforcement on selection of novel activities (activities which had not yet been chosen during a given session), activity engagement, frequency of activity selection, and trials on which each activity was selected, in three students with autism. Prompting consisted of placing a small sticker dot below activities (or on their pictorial representations) that had already been selected during a session. Sticker size was faded systematically. The results show that the use of prompt fading and differential reinforcement for selecting novel activities increased selection of novel activities. Engagement in the activities selected was initially high for each of the three participants, and remained high throughout the study. Although the frequency of selection for each activity became more similar across activities in the post-baseline conditions for all participants, the activity with the highest average frequency of selection in baseline remained the highest throughout the study for two participants. The third participant equalized his selections so that the activity with the highest frequency of selection in baseline had the same average frequency as two other activities in all post-baseline conditions, with those having the highest

overall frequency of selection. With respect to the trials on which each activity was selected, the activity chosen on the first trials in baseline continued to be chosen on the first trials throughout the study for one participant. The remaining two participants did show some shift in the activities chosen on the initial trials. This study then, demonstrates the efficacy of a treatment package in increasing the selection of activities not yet chosen in a session. The implications of these findings are discussed with regard to social validity and stimulus control of novel selection behavior.

Dedication

This project is dedicated to my husband, Anthony Pesca, and to my mother, Kathleen Garruto. Mom - your unconditional support and love is the source from which I draw resilience and perseverance. Your unwavering encouragement and acknowledgement of my efforts all of these years have allowed me to develop the tools to navigate this process. You have seen me through every level of my educational career and have encouraged me every step of the way. I am eternally grateful to you for this. Anthony - you have supported me in all that I do from the day I met you. Despite that there were many hurdles throughout this process, you always found the words to refocus me and motivate me. There are no words to describe how lucky I feel to have you as my voice of reason. Thank you for always believing in me.

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Introduction

Children with autism display a number of behavioral excesses and deficits. According to the *DSM IV-TR* (2000), one diagnostic criterion for autism is, "*encompassing preoccupation with one or more stereotyped and restricted patterns of interest that is abnormal either in intensity or focus"* (p. 70). These restricted patterns of interest are often apparent in the selection of leisure activities. Individuals from this population often have a small repertoire of preferred leisure activities, and many engage in the same activity repeatedly (Green & Striefel, 1988, Hanley, Iwata, Roscoe, Thompson, & Lindbert, 2003, and Hanley, Iwata, Lindberg, & Conners, 2003). Disruption of this activity may be met with resistance from the individual, and if the activity is unavailable, the individual may engage in disruptive or aggressive behavior. It can be said, then, that varied activity selection may be a low probability response for individuals with autism.

Currently, methods such as response restriction (Green & Striefel, 1988; Hanley, Iwata, Roscoe, Thompson, & Lindberg, 2003; and Rapp, Vollmer, St. Peter, and Dozier, & Cotnoir, 2004), Premack-type contingencies (Charlop, Kurtz, & Casey, 1990, and Hanley et al., 2003), differential reinforcement (Cammilleri & Hanley, 2005), and teacher prompts (Prater, Hogan, & Miller, 1992; Krantz & McClannahan, 1998; Krantz & McClannahan, 1993; Pierce & Schreibman, 1994; and MacDuff, Krantz, & McClannahan, 1993) are used to increase low probability responding. Researchers have targeted increasing the variability of a wide array of responses, such as gestures (Duker & van Lent, 1991), block building (Goetz & Baer, 1973), toy play (Lalli, Zanolli, & Wohn, 1994), verbalizations (Lee, McComas, & Jawor, 2002; and Lee & Sturmey, 2006), keyboard sequences (Miller & Neuringer, 2000), activities (Cammilleri & Hanley, 2005), and mands (Grow, Kelley, Roane, & Schillingsburg, 2008), among other responses.

When response restriction is used for increasing low probability responding, the method can involve removing an item from an array of items so that it is no longer available for selection. Under a free-operant procedure, Green and Striefel (1988) measured baseline responses where participants (four students with autism) were initially allowed to engage in six responses that were considered to be 'play' or 'adaptive' (e.g. number puzzle, picture book, writing worksheet, etc.). High probability responses were made unavailable for successive conditions; the number of available response options decreased from five to four to three to two in subsequent conditions. Results showed that as high probability response options decreased, both 'play and 'adaptive' responses increased. Hanley et al. (2003) also used a free-operant procedure with four individuals with developmental delays, and identified a hierarchy of preferred activities for each participant. The experimenters then presented a highly preferred activity with a less preferred activity using a concurrent choice paradigm. Once stable levels of interaction were observed, the experimenters removed the highly preferred activity, leaving only the less preferred activity. Two of the four participants engaged with the less preferred activity when the highly preferred activity was no longer available, but the other two did not. For the latter two participants, access to the highly preferred activity then was made contingent on engagement with the less preferred activity. Arranging this Premack-like contingency was effective in increasing interaction with the less preferred activities for both participants. Rapp et al. (2004) conducted another study for which response restriction was used. Unlike those previously described, the high probability responses for each of the four participants were either body-movement or vocal repetitions. Each repetitive target response was restricted by removing an item that was a part of the response (e.g. removing a pot so that pot spinning could not be emitted), presenting a verbal reprimand contingent on emission of the target response, or

physical blocking of the response by the therapist. Results showed that restricting the high probability stereotyped response resulted in an increase in one or more lower probability stereotyped responses in three of the four participants. In general, response restriction seems to be a method that, for some individuals, results in the reallocation of responding to lower probability responses. Response restriction, however, is not a reinforcement procedure and may be considered a less desirable method than others currently available.

Premack contingencies are also used to increase low probability responding. These procedures provide access to high probability responses contingent on engagement in lower probability responses (Premack, 1959). In the study by Hanley et al. (2003) described above, when response restriction alone proved ineffective, a Premack contingency was arranged and was effective in increasing low probability responses for two participants. Similar contingencies were arranged by Charlop et al. (1990), who used aberrant behavior (a form of stereotypy) as a reinforcer for engaging in lower probability responses (correct responding on academic tasks). The effects of this consequence were compared to the effects of using food as a consequence, and to the effects of a varied group in which the participants were able to choose between food and aberrant behavior as the reinforcer, for four participants. Results showed that for all participants, allowing the emission of aberrant behavior as a consequence was the most effective in increasing task performance, followed by the mixed consequence group, and then by the food consequence. Similar results were obtained by Hanley, Iwata, Thompson, and Lindberg (2000), who allowed opportunities to engage in stereotypy contingent on manipulating leisure materials. Three participants were exposed to each of three procedures: baseline (during which the students had continuous access to leisure materials), prompting (during which the researcher prompted the student to manipulate the materials every 30 s), and response blocking (during which the

therapist blocked attempts by the students to engage in stereotypy). One participant was exposed to a fourth procedure: contingent access to stereotypy (during which the researcher prompted material manipulation and blocked stereotypy). The results indicated that continuous access to materials and prompting was insufficient to maintain decreased levels of stereotypy for the three participants. For two participants, prompting and response blocking were sufficient in decreasing stereotypy. The contingent access to the stereotypy condition was implemented for the third student, who did not show a decrease in stereotypy in the response blocking condition. For this student, allowing access to stereotypy contingent on material manipulation was necessary to decrease stereotypy. It is important to note that, while Premack contingencies do involve reinforcement, they also involve response restriction. The individual can only engage in the high probability response when (s)he has engaged in the low probability response.

Differential reinforcement procedures involve reinforcing one or more responses (which are generally appropriate behaviors), while not reinforcing another response (which is generally inappropriate). Cammilleri and Hanley (2005) used a differential reinforcement procedure to increase novel activity selection and varied activity engagement in two individuals who were typically developing. An array of index cards on which different activities were printed was presented on a table. While the participants were allowed to engage in any activity they chose (thus, response restriction was not imposed), reinforcement (attention) was presented for engaging in an activity not yet selected in that session. When each of the activities had been selected, the contingency was reset. Results showed increases in novel activity selection and in the variability of activity engagement in both participants. Thus, differential reinforcement is a treatment procedure that is effective in increasing low probability responses. Another such procedure is teacher prompts.

Teacher prompts are often used to increase behavior that occurs at very low rates. Prompts can be visual, auditory, and tactile, among other modalities. One crucial element in using prompts to increase behavior is to gradually fade the prompt—a procedure known as prompt fading —resulting in the individual engaging in the behavior independently. Visual prompts have been used to increase on-task behavior (Prater, Hogan, & Miller, 1992), social interaction skills (Krantz & McClannahan, 1998), social initiation skills (Krantz & McClannahan, 1993), and self-help skills such as setting a table, making lunch, making a bed, etc. (Pierce & Schreibman, 1994), among other behaviors. The use of activity schedules —a form of visual prompting—has been effective in increasing engagement with varied leisure activities in students with disabilities (MacDuff, Krantz, & McClannahan, 1993). To promote independence, the physical activity schedule remains in place, while the involvement of the instructor is gradually faded. Thus, activity schedules and ordered picture prompts are generally not faded.

It is important to consider the implication of using the aforementioned treatment procedures on generalization and stimulus control. Response restriction requires that an individual is always present to restrict or withdraw response options after they are selected, thus limiting the stimulus control of the varied selection to remain with the individual implementing the procedure. This decreases the likelihood that varied or novel selection will occur in the absence of the facilitating individual. Similarly, because activity schedules are rarely faded, the source of stimulus control for varied activity engagement remains within the ordered pages of the schedule. For these two procedures then, the individual is never taught to respond variably without these external and obvious prompts. The previously emitted activities do not serve as

sources of stimulus control to respond variably. These factors make these treatment procedures less ideal when external validity is a priority.

The current study evaluated the effects of prompt fading and differential reinforcement on selection of novel activities, the frequency with each activity was selected, the trials within a session on which an activity was selected, and engagement in the activities selected by three students with autism. Novel activity selection was directly reinforced, while activity engagement and the two additional dimensions of selection behavior did not result in programmed consequences.

Method

Participants

Experimental Participants. Three male participants, ages 4, 4, and 5 years, participated in this study. Inclusion criteria were 1) a diagnosis of an Autism Spectrum Disorder, 2) enrollment in a special educational program that addresses the needs of this population, and 3) referral from the educational staff based on observation that the student demonstrated selection of only one or a few activities, when given a choice. The exclusion criterion for selection was having a curriculum goal(s) that included differential reinforcement for selection of varied activities. Each of the three selected participants communicated verbally using full sentences; two were integrated into a typical preschool setting throughout the week.

Social Validity Respondents. Five additional participants were used from whom social validity data were collected. Three educational staff members and two parents volunteered to serve as social validity respondents.

Setting

Participants were enrolled in a special educational program that provides intervention across a number of areas (e.g. communication, academics, motor skills, etc.), but did not have a reinforcement protocol in place for increasing varied activity selection and engagement. The study was conducted in a conference room that contained a table, chairs, a video camera, and two arrays of activities: training and generalization activities.

Stimuli and Reinforcers

A set of 24 leisure activities was chosen for each participant with autism. These activities were identified for each participant based on age-appropriateness, teacher reports of one or two activities per participant with which each frequently selected and engaged (as mentioned above),

and the skill of each participant (for example, if a participant's motor abilities limited or prohibited fine motor activities, these activity types were not included). The activities chosen for a given participant were divided into two sets of 12 activities: training and generalization activities. The activities were non-systematically assigned to these categories with the restriction that no type of activity (e.g. sensory-based, musical, motor, etc.) was disproportionately placed in one group. Activities are listed alphabetically for each category and participant in Table 1. In addition to the activities, laminated pictures (approximately 2.5"x 2") of the activities were also used in the study, as were circular sticker dots (diameter = 1 inch), a foam choice board (9" x 12"), and an auditory timer.

A structured interview – the RAISD (Reinforcer Assessment for Individuals with Severe Disabilities) (Fisher, Piazza, Bowman, & Amari, 1996) - was administered to educational staff members to identify a potential reinforcer for each participant.

Response Definitions

Data were collected on the following dependent measures: novel selection, activity engagement, frequency of selection, and trials on which each activity was selected. A *novel selection* is defined as selecting an activity that has not yet been selected during the current session. *Activity engagement* is defined as appropriately touching or looking at materials related to a given activity. Both the frequency of selection with which each activity was chosen for a given session and the trials on which each activity was selected were listed using a numerical index: 1-8 for training trials and 1-4 for generalization trials.

Experimental Design

A concurrent multiple-baseline across participant design was used to evaluate the effects of prompt fading and differential reinforcement on the dependent measures. A reversal design was embedded for two of the three participants.

Procedure

Pre-experimental Procedures.

Two pre-experimental procedures were conducted: matching training and pre-exposure to the activities. These procedures were used to ensure that a prerequisite skill set had been acquired, and to allow initial introduction to the activities. The spatial position of the pictures and the activities varied independently across sessions.

Matching training. Matching training was conducted to determine that the participants could accurately match a laminated picture of an activity to the actual activity for all activities. During each session, the training activities were presented first, followed by the generalization activities. The laminated pictures of the 12 training or generalization activities were presented in a horizontal row across the table, and the 12 corresponding training activities were presented in a horizontal arrangement on the floor, spaced approximately 4-6" from each other. Graduated guidance, delivered from behind the participant, was used to help the participant point to the first picture in the row, walk over to and touch the corresponding activity, and walk back to the table. The completion of these actions for one activity constitutes one trial. The participant would then complete the above sequence for the second picture, then third, and so on. The session ended when the participant completed the above sequence for all 12 training activities and for all 12 generalization activities. Graduated guidance was faded systematically on a trial-by-trial basis

so that once a participant initiated pointing to the card successfully with a given prompt level, a less restrictive prompt was provided on the next trial (e.g. hand on the back to hand on the elbow). The spatial position of the pictures and the activities varied independently across sessions. The matching training procedure ended after one session had been conducted for both training and generalization activities during which no prompts were delivered.

***Pre-exposure to Activities*.** The participants then entered the pre-exposure procedure, which allowed exposure to, as well as opportunities to engage with, both training and generalization activities. The arrangement of the stimuli was identical to that of the matching training procedure. The 12 training activities were presented first, followed by the 12 generalization activities. Graduated guidance was used when necessary to guide the participant to the first laminated activity picture, point to the picture, walk to the corresponding activity, and sit down with the activity. The experimenter also guided the participant to engage with the activity appropriately if he did not do so. After the participant sat with the activity, the researcher started a timer for 1.5 minutes. If the participant left the activity before the interval ended, the researcher verbally prompted the participant by saying, "Play with the (activity) until the timer goes off". At this time, the researcher sat in a chair within 10 feet of the participant. After 1.5 minutes, the researcher stopped the timer and directed the participant to put the activity back against the wall and to return to the next picture in the horizontal arrangement. Reinforcement was not delivered for engagement with the activities. After the participant engaged with the 12 training and generalization activities as described above, he entered the baseline condition.

Experimental Conditions.

The following sequence of conditions was presented to one participant (Zeke): Baseline 1, Treatment 1, Baseline 2, Treatment 2, Treatment of Generalization Activities 1, Baseline of Generalization Activities 2, and Treatment of Generalization Activities 2. Howie was exposed to all but the last condition, and Andrew participated on only the first two conditions. The first conditions constitute the multiple-baseline design, Sessions within each experimental condition consisted of 8 training trials and 4 generalization trials. There were fewer trials for the generalization activities to maintain overall session time at 30 minutes. The spatial position of the pictures and the activities varied independently across sessions for all experimental conditions.

The experimental procedures differed somewhat across participants, as described below.

Baseline 1. The structure and procedure of the baseline sessions were similar to those of the pre-exposure procedure, except that a choice board on which the laminated activity pictures were affixed (by Velcro) was used for two participants, and that 8 training trials were followed by 4 generalization trials for each session. Twelve different leisure activities (either training activities or generalization activities) were attached in four rows and three columns. The 12 leisure activities were those used during the matching training and the pre-exposure procedures. Unlike the pre-exposure procedure, the baseline trial structure for Howie and Andrew included holding the choice board in front of the participant and delivering the S^D ("Pick an activity"), the participant selecting any activity on the choice board without restriction, sitting with the activity for 1.5 minutes, returning the activity back against the wall, and moving back to the choice board.

The baseline procedure for Zeke differed from that of the other participants in two respects. It was observed that Zeke showed perseverative activity selection when given the opportunity to select among a group of activities presented before him, but did not show perseveration when selecting among pictures of the activities. For this reason, Zeke was asked to make his selections from the group of actual activities, arranged on the floor as described for Howie and Andrew, rather from the pictures of activities. At the beginning of the trial, Zeke was brought in front of the 12 activities and asked, "What are you going to play with?" He then selected an activity by approaching it and bringing it to the middle of the floor, and the remainder of the trial was conducted as for the other participants. In a second procedural difference, the auditory timer was not used to avoid Zeke's strong tendency to approach timers.

During this and all subsequent experimental conditions, verbal praise was delivered on every trial for ancillary behaviors, such as sitting and playing nicely. There were no programmed consequences for selecting a given activity, outside of immediate access to the selected activity.

Treatment 1. The treatment sessions were procedurally identical to the baseline sessions for all participants with the exception of the implementation of the treatment package during the training trials. Sticker dots were used to mark each activity when it was selected, and selection of novel activities was reinforced. After a participant selected an activity, the researcher placed the sticker dot on the center of the picture (Howie and Andrew) or on the floor directly below the physical activity (Zeke) to indicate that the activity had been selected. The placement of the sticker dot changed the activity from an S^D to an S^Δ, because its subsequent selection would not result in reinforcement for the remainder of the session.

Reinforcement for novel activity selection (selecting an activity that has not yet been selected during the current session) was access to a preferred edible (as reported by the structured interview) and performance-related feedback, such as, "Great job choosing something new!" If the participant selected an activity that had already been selected, the researcher provided performance-related feedback, such as, "I can't give you a (preferred edible) because that's not something new; you've already chosen that activity." The participant was permitted to continue to select and engage with that activity.

*Prompt-fading***.** In prompt fading, reduction of the sticker size in 3 steps began after the first session in which novel selection was at 100%, or after two consecutive sessions in which novel selection was ≥ 80% for Howie and Zeke. Because Andrew's novel selection was never high enough to meet those criteria, sticker reduction began after three consecutive sessions of steady or increasing selection of novel activities, or four consecutive sessions where the number of novel selections did not differ by more than 2 between sessions. On the first fading step, the circular sticker was cut in half along its 1-inch diameter, and only 1 half was used. On the next fading step, the sticker was cut in half again, along the radius, and one quarter was presented. On the last step, no sticker was placed. A performance-based criteria for returning to a higher prompt level was not established, and there were no instances in which a higher prompt level was reintroduced.

While the treatment package was applied for the training trials, the baseline procedure continued to be implemented for the generalization trials.

After Zeke and Howie's behavior showed a stable and reliable increase during the treatment condition and all prompts had been faded, the second baseline condition began. Only Zeke and Howie advanced to the next experimental condition.

Baseline 2. The procedure of the second baseline condition was identical to that of the initial baseline condition for each respective participant.

Treatment of Generalization Activities 1. Because Zeke and Howie's level of novel selection for training activities was maintained in the absence of extrinsic reinforcement during the preceding baseline condition, both participants were exposed to a condition in which the treatment package was applied to the generalization activities. Treatment of the generalization activities was identical to the procedure used for treatment of training activities for each participant, with the exception that reinforcement was available for the four baseline trials only. During this and all subsequent conditions, trials with training activities were run under to the baseline conditions.

After Zeke and Howie's behavior on trials with the generalization activities showed a stable increase during the treatment condition and all prompts had been faded, the second baseline condition for the generalization trials began.

Baseline for Generalization Activities 2. This condition was procedurally identical to the Baseline for Generalization Activities 1 condition for each participant. After Zeke's behavior showed a stable decrease during this condition, the Treatment for Generalization Trials 2 condition began. Zeke was the only participant to exposed this condition, as Howie ended this condition by responding with 4 novel selections.

Treatment of Generalization Activities 2. This condition was identical to the Treatment of Generalization Activities 1 condition.

Social Validity

Social validity assessments were administered to three educational staff members–each assigned to a different participant–and to Howie and Andrew's mothers after the study had been

completed. Each staff member served as an observer for one participant, and the parent served as an additional observer for her child. The observers watched a randomly selected videotaped session from one baseline and one treatment condition. The observers were not told which condition was the baseline condition and which was the treatment condition. They then were asked to respond to statements using 5-point Likert scales, where a score of 1 indicated a rating corresponding to 'Strongly Disagree' and a score of 5 indicated a rating corresponding to 'Strongly Agree'. They rated the following statements for both sessions that they viewed: "I believe the participant is choosing activities appropriately"; and "I would praise this participant for choosing different activities in an every day setting". The educational staff members, only, were asked to rate the following statement for both observed sessions: "I believe the procedure used can be implemented relatively easily".

Data Collection

Novel activity selection was scored as the number of activities (0-8) selected that had not yet been selected during a given session. The first activity selected during each session was included in the analyses.

Activity engagement was measured using a momentary time sampling schedule of 5 seconds. These data were converted to a percentage of intervals during which the participant was scored as being engaged with the activity.

Frequency of selection was measured for each activity by obtaining a numeric value between 0–8 for training trials, and 0-4 for generalization trials, corresponding to the frequency with which the activity was selected during a given session.

Trials on which each activity was selected was measured by indicating for each session the trial numbers on which each activity was selected (trial numbers 1-8 for training trials and 1-4 for generalization trials). Activities could be selected on more than one trial per session.

Inter-observer Agreement

Inter-observer agreement (IOA) was assessed by having a second observer collect data for novel activity selection and activity engagement. Agreement was calculated for each session by dividing the number of agreements by the total number of trials, and multiplying this value by 100. These data were collected for 29-40% of sessions of each condition for Zeke. The same data were collected for 30-38% of sessions of each condition for Howie, and for 32-33% for Andrew. Percentages are presented in Table 2 for each participant and condition. Agreement between the two observers was 100% for novel activity selection across each of the three participants in each condition. The average agreement across conditions between the two observers for activity engagement for Zeke, Howie, and Andrew was 98%, 98%, and 99%, respectively.

Results

Selection of novel activities was sensitive to the experimental procedures. Figure 1 shows the number of novel activity selections per session across all experimental conditions for the three participants. The abscissa shows consecutive sessions while the number of selections of novel activities is scaled on the ordinate. The solid data points represent novel selections for training trials and the open data points represent novel selections for generalization trials. Breaks in the data paths represent sessions where data could not be collected, such as during the unavailability of a participant (due to absence from school or a schedule change), or an incomplete session due to interfering behavior or time limitations. Table 3 lists the explanation for each break in the data paths. The 'A' and 'B' symbols on the graphs represent school vacations resulting in a 13-day and 9-day absence from the study, respectively.

The top panel illustrates the number of novel activity selections for Zeke across all experimental conditions. Data for the training trials will be described first. During baseline, Zeke initially made 2 novel selections for two sessions, and then made 1 novel selection for the remainder of the baseline condition. Upon entering the treatment condition, the number of novel selections increased to 8 per session, the maximum number of novel selections that could occur per session. The numbered arrows indicate the prompt level, where 1 corresponds to a full sticker prompt, 2 corresponds to half of the sticker prompt, 3 corresponds to a quarter of the sticker prompt, and 4 corresponds to no sticker prompt. Zeke's responding maintained at 8 novel selections while the sticker prompt was reduced. Zeke demonstrated maintenance of responding for treatment activities upon introduction of the second baseline condition, and, with the exception of a brief decrease in responding, through all remaining experimental conditions. During generalization trials, novel selections remained at 1 (the minimum possible) throughout

the first three conditions. Generalization of the treatment effect from the training trials to the generalization trials was not demonstrated. The treatment package was then introduced in the generalization trials in the Treatment of Generalization Activities 2 condition. Upon introduction of the treatment, novel selection increased from 1 to 4 (the maximum value, given that there were 4 generalization trials conducted). Zeke's responding maintained at 4 novel selections while the sticker prompt was reduced across all levels. Upon returning to the baseline condition for the generalization trials, responding maintained at 4 novel selections for one day, and then returned to 1 novel selection per session. With the reintroduction of treatment to the generalization trials, responding sharply increased to 4 novel selections for the remainder of the session.

The middle panel of Figure 1 illustrates the number of novel activity selections for Howie across all experimental conditions. Howie initially made between 5 and 6 novel selections of activities during training trials in Baseline 1. Upon entering the Treatment 1, novel activity selection increased to 8 for the training activities. Responding maintained well during fading of the sticker prompt. With the return to the baseline condition (Baseline 2) and the two remaining conditions, responding maintained at 8 novel selections during training trials. Generalization of the treatment effect from the training trials to the generalization trials was not demonstrated. Novel selections in the generalization trials averaged 3.7 during Baseline 1, and then decreased when the treatment package was applied during the training trials in Treatment 1, averaging 1.8. Novel responding varied between 2-3 in Baseline 2. When the treatment package was introduced in the generalization trials, novel selections increased and remained high when prompts were faded. Novel selections also remained high in Baseline for Generalization Activities 2, when treatment was removed. When the treatment package was first introduced to

the training trials in Treatment 1, novel selections during generalization trials initially decreased, then increased, and maintained between 2-3 throughout Treatment 1 and Baseline 2.

With the exception of two sessions, Andrew showed low levels of novel activity selection with the training activities in baseline. He chose the same activity on every trial for six sessions before treatment. Upon entering Treatment 1, novel activity selection increased from one to three for three sessions. While there was some variability in the data, the average number of novel selections in Treatment 1 was 3.4. Andrew initially demonstrated very low levels of novel activity selection with the generalization activities in baseline. These levels increased prior to the introduction of treatment of the training activities, and remained variable for the remainder of the study.

While the data on training activities for Zeke and Howie show a clear change in level between the initial baseline and treatment, the variability in the data for Andrew make interpretation more difficult. Accordingly, statistical analyses were conducted. An often-used non-regression analysis of single subject data is the percentage of non-overlapping data (PND), however, it is not appropriate for use when one or more data points in the baseline condition are at the floor or the ceiling levels (Scruggs & Mastropieri, 1998). Another non-regression analysis of single subject data is the percentage of data exceeding the median (PEM). Criteria for effect sizes were suggested by Scruggs, Mastropieri, Cook, & Escobar (1986), where PEM scores of $\geq .9$ correspond to highly effective treatments, scores between .7 - .9 represent fairly effective treatments, scores between .5 and .7 represent questionable treatment outcomes and scores $\leq .5$ correspond to unreliable treatment outcomes. Based on data from the Baseline 1 and Treatment 1 conditions, the PEM scores for Zeke, Howie, and Andrew are 1, 1, and .92, respectively.

Table 4 shows means for novel selection of the training activities for Baseline 1, Treatment 1, and Baseline 2 for Zeke and Howie, and for Baseline 1 and Treatment 1 for Andrew. This summary shows that average novel selections increased from baseline to treatment, and remained high during the return to baseline for Zeke and for Howie. It also shows the increase in the average novel selections from baseline to treatment for Andrew.

In general, percent of engagement was high for each participant and did not vary across experimental conditions. For Zeke, activity engagement was at a moderate level (60%) during the first session, but high thereafter. Zeke showed the greatest degree of variability in these data compared to the other two participants (range: 60-97%; *M*=84%). For Howie, activity engagement was initially high, and maintained at high levels throughout the remainder of the study (range: 94-100%, *M*=98%). For Andrew, activity engagement was initially high, and maintained relatively high throughout the remainder of the study (range: 74-100%, *M*=95%).

Figure 2 indicates the trials on which each training activity was chosen across all experimental conditions for Zeke, where the abscissa shows session dates and the ordinate displays the trial number. Throughout the study, Zeke consistently chose the fishing game on the first trial. On 26 of the 43 sessions (60%), piano was selected on the second trial, with this pattern occurring throughout the study. Selections were less predictable for trials 3-8. The initial trials on which activities were selected, then, did not vary with experimental procedure.

Figure 3 shows data for the frequency of training activity selection for each training activity for Zeke. The abscissa shows each of the 12 activities in the training set and the ordinate displays the mean frequency of activity selection for each experimental condition (indicated by the shading of the bars). Note that the ordinate has been broken to better view the data for the activities that occurred with lower average frequencies. This figure shows that the fishing game

had the highest frequency of selection in Baseline 1 (*M* = 5.2), followed by cars and fusion (*M* = 1.4, *M* = 1.4, respectively). With the exception of the treatment condition, the fishing game had equal or higher frequencies when compared to the other activities for the remaining conditions. In Treatment 1, the average frequency of selecting piano slightly exceeded that of selecting the fishing game (*M* = 1.23, *M* = 1.08, respectively). It is important to note that to maximize the rate of reinforcement, each participant could not choose an activity more than one time per session. The average frequency of selection across all training activities for all post-baseline conditions for Zeke was .67. Although there were sessions during which he chose an activity more than once, he generally engaged in selection behavior that maximized the rate of reinforcement. Throughout the study, the activity with the highest average frequency of selection remained the fishing game *(M*= 1.89).

Figure 4 shows data for the trials on which each generalization activity was chosen across all conditions for Zeke. Throughout the study, Zeke consistently chose the bubbles on the first trial of the generalization trials. When treatment was introduced in generalization trials, Zeke showed varied selection on trials 2-4.

Figure 5 shows data for the frequency of selection for each generalization activity for Zeke. This figure illustrates that Zeke choose the bubbles with the highest average frequency possible during the baseline conditions for the generalization activities (Baseline 1, Treatment 1, Baseline 2 conditions). During the Treatment of Generalization Activities 1 condition, Zeke did not choose an activity more than one time per session, thereby maximizing the rate of reinforcement in each treatment session.

The trials on which training activities were chosen across each condition for Howie are shown in Figure 6. Howie chose dinosaurs on the first trial during most of the sessions of the

first two experimental conditions. As the study progressed, there was more variability in the activity selected on the first trial, and dinosaurs were chosen on later trials in the sessions.

Figure 7 depicts data for the frequency of selection for each training activity across each condition for Howie. This figure illustrates that dinosaurs were selected with the highest frequency during Baseline 1 (*M*=6). In the post-baseline conditions, only two activities exceeded a selection frequency of 1 on two sessions: construction kit in the treatment condition, and Play-Doh in the return to baseline for generalization activities condition (*M*=1.2, *M*=1.14, respectively). The figure illustrates that with the exception of these two instances, Howie distributed his selections in the post-baseline conditions in such a way that maximized the rate of reinforcement. The average frequency of selections across all of the activities for the post-baseline conditions was .66. Although dinosaurs were selected with the highest frequency during baseline, Howie distributed his selections more equally in the post-baseline conditions so that dinosaurs were selected with the same average frequency as fusion and Play-Doh (*M*=1).

Figure 8 illustrates the trials on which every generalization activity is chosen across each experimental condition for Howie. Throughout the study, Howie chose the bubbles on 68% of the sessions. Activity selections were varied on the first trial for the other sessions. There was no effect of condition on the activity selected on the first trial.

The frequency of selection of each generalization activity for Howie across all experimental conditions are depicted in Figure 9. This figure shows that bubbles were selected with the highest average frequency in each condition. It was also selected with the highest average frequency throughout the study (*M* = 1.8). The figure also illustrates that in the Treatment of Generalization Activities 1, Howie's responses were in almost always in accordance with the contingency, allowing him to maximize the rate of reinforcement.

The trials during which each training activity was selected for Andrew are illustrated in Figure 10. Throughout the study, Andrew chose the piano on the first trial on 55% of the sessions. After the 23rd session, there was an increase in the variability of activity selected on the first trial.

Figure 11 depicts the frequency of selection for each training activity for Andrew. This figure shows that the piano had the highest average frequency of selection during Baseline 1 (M=5.44). Although its frequency did decrease in Treatment 1, the piano continued to have the highest average frequency of selection during this condition (M=2.29).

Figure 12 shows data for the trials on which every generalization activity is chosen for Andrew. Andrew chose bubbles on the first trial on 80% of the Baseline 1 sessions. His selections on the first trial of each session became more variable with the introduction of treatment of the training activities. Andrew chose bubbles first on 25% of the treatment sessions, the voice recorder first on 20% of the sessions, and the coloring book first on 20% of the sessions. His selections were less predictable on the remaining 35% of the sessions. Note that the treatment package was never introduced during the generalization trials, and that the increase in variability in selections on the first trial may be evidence of generalization of the treatment effect from the training activities to the generalization activities.

The frequency with which each generalization activity was chosen on every session for Andrew across each experimental condition is shown in Figure 13. This figure shows that Andrew chose bubbles with the highest frequency in Baseline 1 (M=3.14). In Treatment 1, the average frequency of selection of the voice recorder was slightly higher than that of the bubbles (M=3.00, M=2.83, respectively). This figure shows that the treatment effect did not generalize

to the generalization activities. However, there was an increase in the variability in activity selection across sessions.

A sequential analysis was conducted for each participant to determine whether any sequential dependencies existed between pairs of training activities. Tables 5-7 list the conditional probabilities of each activity followed by every other activity for each participant. Each training activity was assigned a number 1 through 12. The initial activity is denoted by the A symbol and the subsequent activity is denoted by the B symbol. Thus, these tables show the conditional probabilities of responses A1-A12 followed by Response B1-B12 for all post-baseline conditions. Because some responses occurred with a very low frequency in the post-baseline conditions, only those that occurred on at least 10% of the post-baseline trials have been shaded in the tables.

Tables 5, 6, and 7 show activity-based conditional probabilities for Zeke, Howie, and Andrew, respectively. As can be seen from Table 4, the only conditional probability that exceeds .5 is A10|B8, the conditional probability of which is .61. This response chain (the fishing game followed by the piano) is also evident via visual inspection of Figure 2. The remaining shaded response combinations showed low conditional probabilities. There were no response combinations that showed conditional probabilities of .5 or higher for Howie. For Andrew, the only conditional probability that exceeded .5 was A1|B1, which had a probability of .83. However, this combination (Star Wars followed by Star Wars) is an indicator of response repetition rather than chaining.

Another possible basis for sequential patterning could be based on position of the activities. This was noted on a few occasions with Zeke. Accordingly, the percentage of post-baseline sessions during which 3 or more selections of adjacent activities occurred was

calculated. Of 37 post-baseline sessions, Zeke made 3 or more selections of adjacent activities on 5 sessions. Four of these sessions contained selections of 3 adjacent activities, while the fifth contained selections of 5 adjacent activities. A sequential analysis of position (specifically, the conditional probability of choosing an activity at one fixed location after another fixed location across sessions) was also conducted for Zeke. The conditional probability of one fixed location given another fixed location did not exceed .21 across the study. Howie and Andrew showed no tendency to select adjacent activities.

Table 8 shows the results of the social validity assessment. The values in the columns under each participant represent the scores assigned by the social validity respondent for that participant. The top half of the table are scores assigned by the educational staff members, and the bottom half of the table shows scores assigned by the parents. The first statement was rated lower for the baseline session than the treatment session for all participants by each social validity respondent. Staff members assigned high ratings to the second statement after watching both the baseline and treatment sessions, and all social validity respondents assigned high ratings to the third statement.

Discussion

The results of the current study demonstrate the effectiveness of prompt fading and differential reinforcement on increasing the selection of novel activities. Figure 1 shows experimental control through the multiple baseline design, where stable increases in responding occurred only when treatment was introduced for the training activities in the second condition. These effects were confined to the training activities. Novel activity selection during the generalization trials increased only when the treatment package was introduced for Zeke and Howie. Additionally, the generalization activities showed sensitivity to the presence versus the absence of treatment under the reversal design for Zeke.

Novel selection of the training activities remained high in the absence of extrinsic reinforcement during the return to baseline (Zeke and Howie). This pattern of results, where maintenance of the behavior is seen after the withdrawal of treatment, has been noted in behavior analytic literature (Duker & Van Lent, 1991; Kohler & Fowler, 1985; and Reynolds, Dallery, Schroff, Patak, & Leraas, 2008). Reynolds et al. (2008) found that carbon monoxide (CO) samples from smoking participants did not return to baseline levels after the withdrawal of the intervention used. The authors acknowledge that future research should included a control group that receives the same incentives independent of CO status to reduce the likelihood that external variables caused the change in the dependent variable. Duker & Van Lent (1991) observed maintained levels of gesture requests after withdrawal of the differential reinforcement procedure used in individuals with mental retardation. The authors explain that short-term use of the intervention used has lasting effects on the dependent variable. Kohler & Fowler (1985) observed the maintenance of certain play behaviors after a social skills training package was withdrawn in three typically developing children. Those behaviors that were more likely to be

reciprocated (e.g. social invitations) compared to those that were not (e.g. social amenities) were more likely to show maintenance in the absence of the treatment. The authors assert that reciprocal use of social behavior by peers may contribute to the maintenance of social behavior. For the current study, it is possible that this response type has a high resistance to extinction, and that extending the reversal condition may result in a return to baseline levels, or a substantially lower number of novel activity selections than in the treatment condition. For Zeke, returning to the baseline condition after treating the generalization activities did result in a return to baseline rates of novel selection of generalization activities. One may question why the condition reversal resulted in response reversal for the generalization activities, but not for the training activities. Among the variables affecting the resistance to extinction is the number of reinforcers that are presented contingent on the behavior (Cooper, Heron, and Heward, 1987). Behavior that has a longer history of reinforcement will show higher resistance to extinction. In Zeke's case, the training activities were exposed to 8 trials per session for 13 sessions, as opposed to 4 trials per session for 8 sessions for the generalization activities. Thus, the number of opportunities for novel activity selection to be reinforced was considerably higher for training activities than generalization activities.

The effect of the intervention on novel activity selection was less clear for Andrew than it was for Zeke and Howie. It is possible that the reinforcer identified for Andrew by the staff under the RAISD procedure may not have been as sufficiently strong to compete with the reinforcers resulting from repeated activity selection. The RAISD has been used in a number of studies to identify potential reinforcers for participants (Bowman, Piazza, Fisher, Hagopian, & Kogan, 1997; Higbee, Carr, & Harrison, 2000; and Rush, Kurtz, Lieblein, & Chin, 2005). Given its ease of implementation and the short time required to administer the survey, it was used in the

current study rather than a reinforcer that would have produced a higher level of acquisition for Andrew.

There was some evidence of response chaining by Zeke, as shown by the conditional probabilities in Table 5. The conditional probability of selecting the fishing game followed by piano was .61 in post-baseline conditions. Response chaining may be a possible strategy in meeting the variability requirement. However, because Zeke always chained these two responses for the first and second trials and responded variably for the remaining 6 trials, it is unlikely that this was the case. An alternate possibility is that the response chain was the product of higher order stereotypy. There were some sessions during which Zeke chose activities that were adjacent to each other, but this did not persist. There was no evidence of any other existing strategy, such as responding based on position.

Activity engagement for the participants started off high and remained throughout the study. This was an important variable to assess because, had activity engagement been at low rates during treatment, it may have indicated that the individual was not interested in the activities, and was varying selection as a result of the contingency alone. The participants did show high rates of engagement and did appear interested in the activities, which may be a contributing factor as to why high rates of novel selection were maintained in the absence of extrinsic reinforcement. It is also important to note that the reinforcement presented for ancillary behaviors (e.g. following directions and playing nicely) may have influenced rates of engagement throughout the study. Additionally, the close proximity of the researcher to the participant may have contributed to the high level of activity engagement.

The trials on which each activity was chosen, as well as the frequency of activity selection, were measured. Both of these measures indicated a possible preference for one

activity in baseline for each of the three participants: Zeke selected the fishing game with the highest frequency, and also chose this activity on the first trial throughout baseline. Howie selected dinosaurs with the highest frequency, and chose dinosaurs on the first trial on 80% of the baseline sessions. Andrew selected the piano with the highest frequency in baseline, and chose the piano on the first trial on 67% of the baseline sessions. One might conclude that these activities were the most preferred for the participants. For Zeke, the first activity chosen (fishing) did not change with condition. Although the frequency with which this activity was selected decreased after the baseline condition, it remained high relative to most other activities. Howie began selecting dinosaurs later in the session toward the end of the study, though he continued to select dinosaurs in every session. One interpretation of this shift is that other activities that were chosen on the initial trials instead of dinosaurs became more preferred than dinosaurs. However, because there was variability in the activities chosen on the initial trials, this may not have been the case. A second possible interpretation is that Howie 'reserved' dinosaurs for later in each session. Despite that these activities remained highly preferred for Zeke and Howie throughout the study, they continued to respond in accord with the contingency during the reversal, when reinforcement for novel selection was not delivered. Andrew selected the piano with the highest frequency in both the baseline and the treatment condition. The piano was often chosen on the first trial, but this was concentrated between the 10th and 23rd session. After the 23rd trial, piano was chosen on the first trial sporadically. As such, interpretations of possible preferences are difficult to make.

Similar results were shown for Zeke and Howie when these two measures were conducted on the generalization activities. Both Zeke and Howie chose the bubbles with the highest frequency throughout the study. Zeke chose the bubbles first on every session. Howie

chose bubbles first on over half of the sessions. As with the training activities, then, the bubbles appeared to begin, and remain as, a highly preferred activity. Because of the communication difficulties with students with autism, activity preferences can often only be assumed based on properties of selection behavior. Measuring both properties decreases the likelihood of making false conclusions about preference. Additional research is needed to isolate this measure as a true dependent variable in order to make more definitive conclusions.

The effects of the treatment package were confined to the training activities, and did not generalize to the generalization activities. The failure of treatment effects in individuals with autism to generalize across different settings, people, and materials is not an unusual finding (McGee, Sulzer-Azaroff, & Feldman, 1992; Petursodittir, McComas, McMaster, & Horner, K., 2007; and Valdimarsdóttir, Halldórsdóttir, & Sigurðardóttir, 2010), and it is often the case that skills require direct training in order to be demonstrated with other individuals, materials, and in different settings. It is possible that the systematic difference that exists between responding with the training set versus the generalization set is due to the nonrandom assignment of the activities to each of these sets. This may have contributed to the lack of generalization observed across activity sets. The activity with which the participants selected in the generalization set may have been more preferred than the reinforcer which was presented for selecting novel training activities. Fuure research in this area should ensure the random assignment of activities to training and generalization sets. Another possibility for the lack of generalization observed is that the prompts used with the training activities may have established these activities alone as discriminative stimuli for novel activity selection. Generalization of the effect to the generalization activities might not have occurred because the prompts had not yet been associated with this set of activities, and had not yet established the activities as discriminative

stimuli for novel activity selection. It is possible that specifically programming for generalization would have resulted in the transfer of the skill to the untrained activities. For example, Stokes & Baer (1977) discuss the importance of training sufficient exemplars and use of indiscriminable contingencies in the generalization of skills from trained to untrained stimuli. Had additional sets of activities been trained, it is more likely that novel activity selection would have transferred to the untrained set of activities. Additionally, the current procedure made use of a continuous schedule of reinforcement. Had this schedule been systematically faded into a less dense and predictable schedule, it may be possible that such strict stimulus control shown by the set of activities would not have been seen. The lack of observed generalization does compromise the external validity of these findings. It is less likely that this behavior will occur outside of the experimental environment, where different activities are available for selection.

In the current study, the researcher placed the sticker prompt on the laminated activity picture (Howie and Andrew) or beneath the actual activity (Zeke), rather than teaching the participants to complete this step. Teaching the participants this skill may be beneficial in increasing their independence and possibly increase the likelihood that novel activity selection is maintained in the absence of reinforcement. Additionally, it would help to prevent the researcher or teacher from being too heavily embedded in the treatment procedure, which may ultimately influence the performance of the participants. Similarly, the researcher was always in relatively close proximity (within 10 feet) to the participants throughout the session. This may limit the extent to which the effects of the treatment package generalize outside of the experimental environment, where a teacher or adult may not be in close proximity to the participant. Future research should consider fading or varying the physical proximity of the researcher to increase the likelihood of generalization.

Another consideration is the use of the auditory timer and the laminated activity pictures on the choice board. These materials were used for Howie and Andrew, but not for Zeke. The efficacy of the treatment package on novel activity selection was demonstrated for Zeke, even though these materials were not used. Implementing the treatment package using a more natural procedure, such as having the participant select among the actual activities and using verbal, instead of auditory prompts, may increase the likelihood that generalization across different settings, people, and activities will occur.

These findings provide support for a procedure that teaches the participant to engage in novel activity selection, where control has transferred from sticker prompts to the participant's previously emitted responses. Response restriction, via the removal of previously selected items, does not teach the participant to avoid the previously selected items. Through the use of these procedures in the current study, the participants did acquire an avoidance response to previously selected, though still available, activities. Further, this procedure lends itself well to classroom implementation. The procedure is relatively easy to implement, and because the sources of stimulus control are subtle, the likelihood of generalizing across teachers, or in the absence of a teacher, is greater. Additional strength of this procedure is demonstrated by the inclusion of activities with which the participants truly selected repeatedly.

A limitation of the current study is that it evaluates the efficacy of a treatment package that contains two components: prompt fading and differential reinforcement. A component analysis was not conducted to determine if one component is sufficient in treating repetitive activity selection without the presence of the other. Future research may be aimed at isolating these effects. The study was also limited in that normative data were not collected to determine the base rates of novel activity selection in typically developing students. Normative data may

help to provide a level of varied responding that is desirable for students who engage in repetitive responding to attain. While it is clear why low levels of varied responding can be problematic, it may also be the case that engaging in very high levels of varied responding is not desirable. The latter may imply that the student has difficulty sustaining attention toward and engagement with one activity. Alternatively, normative data may indicate that typically developing peers show differential levels of varied responding depending on the response type. In such a case, different criteria for mastery may be developed depending on response type. Another limitation of the current study is that follow-up maintenance sessions could not be conducted due to the change in placement of the participants. Collecting maintenance data may help to indicate whether novel activity selection is a response type that has long-lasting effects, which would yield additional information about the utility of the procedure in an instructional setting.

The results of the social validity assessment indicate that the observers viewed the way in which the participants selected activities to be more appropriate during treatment than in baseline. They also indicated that the educational staff members believe that the procedure can be implemented relatively easily, and that both they and two participants' parents believe they are likely to praise novel activity selection by the participant in the future. The feasibility of the procedure is of crucial import in applying it to the classroom. Educational staff members may be more likely to address response repetition because this procedure is not a difficult one to implement. It is important to note that the wording of the statements may have been leading, such that the respondents were more likely to assign higher ratings to the statements. Had the statements been more neutrally worded, ratings to the statements may not have been so high. Additionally, it is possible that the parent respondents may not have been blind to the identity of

the baseline versus treatment session, as there may have been some identifying factors in the videos (such as haircut or clothing) that informed the parent as to which session type they were viewing. Increasing the number of session types that each respondent viewed would have decreased the likelihood of this possibility. Social validity data were collected from a small sample of individuals who were familiar with each participant – either an educational staff member on his team, or his parent. Collecting data from such a limited sample may limit the generality of these findings. Individuals close to the participant may be more likely to see positive behavioral changes that do not exist. As such, increasing the sample size of social validity respondents to include individuals who have no relation to the experimental participant, and moreover, who do not necessarily have direct experience with students with autism, may increase the external validity of the social validity assessment.

Increasing novel activity selection through direct differential reinforcement and prompt fading is different from other procedures aimed at increasing novel activity selection (such as the use of activity schedules) in that it teaches the individuals to ultimately select different activities without the use of prompts. Activity schedules often increase novel activity selection through the use of prompts that are not faded (numerous pages depicting different activities through which the participant cycles). As a result, the skill of choosing different activities independently is not taught and instead, may remain under the stimulus control of the schedule. In the current procedure, the source of stimulus control for novel selection is the participant's *own behavior*. Previously selected activities serve as S^{Δ}'s for selection, while activities not yet selected serve an S^{D} function. Using such subtle sources of stimulus control decreases the likelihood of the student's behavior appearing trained and unnatural, thereby decreasing the likelihood of a stigma being attached to the behavior and the student. Increasing the use of procedures that use more

subtle sources of stimulus control may aid in reaching a common goal among teachers and clinicians: increasing the overall independence of students with autism.

Table 1

Training and Generalization Activities, listed in alphabetical order, for Zeke, Howie, and Andrew.

Zeke:	Howie:	Andrew:
Training Activities	**Training Activities**	**Training Activities**
Cars	*Cars* Book	*Cars* Book
Cars Book	Construction Kit	Construction Kit
Construction Kit	Dinosaurs	Fusion
Fusion	Fusion	Legos
Legos	Legos	Magna Doodle
Magna Doodle	Magna Doodle	Magnet Town
Magnet Town	Magnet Town	Mr. Potato Head
Mr. Potato Head	Mr. Potato Head	Penguin Fishing
Penguin Fishing	Penguin Fishing	Piano
Piano	Piano	Play-Doh
Play-Doh	Play-Doh	Recorder
Recorder	Recorder	Star Wars
Generalization Activities	**Generalization Activities**	**Generalization Activities**
Balloon	Balloon	Balloon
Bubbles	Bubbles	Bubbles
Harmonica	Harmonica	Coloring Book
Koosh	Koosh	Harmonica
Magnet School	Magnet School	Koosh
Moon Sand	Moon Sand	Magnet School
Pin Tray	Pin Tray	Pin Tray
Silly Putty	Puzzles	Silly Putty
Sparkle Ball	Silly Putty	Sparkle Ball
Toys Book	Sparkle Ball	*Toys* Book
Trucks	*Toys* Book	Velcro Catch
Velcro Catch	Velcro Catch	Voice Recorder

Note: Most activities were presented to 2 or 3 participants. Deviations were based on including activities with which each individual participant reportedly perseverated, and excluding activities with which participants engaged inappropriately.

Table 2

Inter-observer Agreement on Novel Activity Selection and Activity Engagement for all participants.

	% Agreement											
	Novel Activity Selection						Activity Engagement					
Condition:	1	2	3	4	5	6	1	2	3	4	5	6
Zeke	100	100	100	100	100	100	98	100	96	97	98	97
Howie	100	100	100	100	100		97	99	99	97	98	
Andrew	100	100					99	99				

Note. Condition 1 = Baseline 1, 2 = Treatment 1, 3 = Baseline 2, 4 = Treatment of Generalization Activities, 5 = Baseline of Generalization Activities 1, 6 = Treatment of Generalization Activities 2.

Table 3

Explanation for breaks in data path in Figure 1.

Session #	Trial Type	Participant(s)	Explanation
13	Both	Zeke	1
22	Both	Zeke	1
38	Both	Zeke	1
2	Generalization	Howie	1
7	Both	Howie	1
15	Both	Howie	1
25	Both	Howie	1
9	Both	Andrew	1
13	Both	Andrew	1
25	Both	Andrew	2
28	Generalization	Andrew	3
34	Generalization	Andrew	1
40	Generalization	Andrew	3
43	Generalization	Andrew	3

Note. 1 indicates the unavailability of the participant (due either to absence from school or a schedule change), 2 indicates that the session was terminated early due to challenging behavior from the participant, and 3 indicates that the session was terminated early due to time constraints. Trial type refers to whether the trials missed were training trials, generalization trials, or both.

Table 4

Mean Number of Novel Selections Across Experimental Conditions for Training Activities.

	Baseline 1	**Treatment 1**	**Baseline 2**
Zeke	1.4	8	8
Howie	5.6	7.8	8
Andrew	2.1	3.5	

Table 5

Conditional probabilities of choosing one activity after another activity for post-baseline conditions for Zeke.

Response	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12
A1	0	.13	.07	0	.20	0	.13	.13	.13	0	0	.20
A2	.10	0	.20	0	.20	.20	.10	0	0	0	.10	.10
A3	.13	.08	0	.04	0	.04	.21	.17	.04	0	.13	.17
A4	.14	0	0	0	.43	.14	.14	0	.14	0	0	0
A5	.08	0	.15	.08	0	0	.15	0	.23	0	.15	.15
A6	0	.25	0	0	.25	0	0	0	.25	0	.25	0
A7	.04	.18	.04	.04	.18	.04	0	0	.21	0	.18	.11
A8	.10	0	.13	0	0	.03	.13	.10	.28	0	.13	.10
A9	.14	.03	.14	.03	.28	0	.10	.03	0	0	.03	.21
A10	.02	0	.10	0	0	0	0	.61	.02	.25	0	0
A11	.15	.10	.10	.10	0	0	.10	0	.25	0	0	.20
A12	.04	.08	.17	.04	0	.04	.38	0	.04	0	.21	0

Table 6

Conditional probabilities of choosing one activity after another activity for post-baseline conditions for Howie.

Response	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12
A1	0	.9	.25	.09	.34	0	0	.06	0	.09	0	.06
A2	.15	0	.06	.15	.06	.03	.09	.03	.03	.21	0	.18
A3	.17	.07	.03	.07	.07	.03	.10	.07	.03	.27	0	.10
A4	.04	.18	.18	0	.4	0	.18	.04	.04	.14	.04	.14
A5	.14	.11	.29	.17	0	0	.06	0	0	.14	0	.09
A6	0	0	0	0	1	0	0	0	0	0	0	0
A7	.11	.11	0	.22	0	0	0	.11	.33	0	0	.11
A8	.09	.27	0	.09	.09	0	.09	0	0	.18	.09	.09
A9	0	0	.50	.50	0	0	0	0	0	0	0	0
A10	.10	.13	.10	.03	.13	.03	.07	.07	0	0	.07	.27
A11	.0	0	0	0	0	0	0	0	0	0	0	1
A12	0	.19	.03	.23	.16	0	.13	.10	.10	.06	0	0

Table 7

Conditional probabilities of choosing one activity after another activity for post-baseline conditions for Andrew.

Response	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12
A1	.83	0	0	0	.03	.03	0	.08	0	0	.03	0
A2	0	0	0	0	0	0	0	0	0	0	0	0
A3	0	0	0	0	0	0	0	0	.5	0	0	.5
A4	.11	0	0	.44	.33	0	0	0	0	0	0	.11
A5	0	0	.11	.11	.11	0	.11	.22	.11	0	0	.22
A6	0	0	0	0	0	.75	0	0	0	0	0	.25
A7	.0	0	0	0	0	0	0	1	0	0	0	0
A8	..07	0	0	.07	.04	0	.02	.61	.04	.02	0	.14
A9	.13	0	0	.13	.13	0	0	.38	.25	0	0	0
A10	0	0	0	.10	0	0	0	.10	0	.8	0	0
A11	0	0	0	0	0	0	0	0	0	0	0	1
A12	.09	0	.06	0	.03	0	0	.2	.06	.03	0	.54

Table 8

Social validity data obtained from participants' parents and educational staff members.

Educational Staff Members:						
Statement:	Zeke:		Howie:		Andrew:	
	Baseline	Treatment	Baseline	Treatment	Baseline	Treatment
"I believe the participant is choosing activities appropriately."	1	5	2	4	2	3
"I believe the procedure can be implemented relatively easily."	5	4	4	4	5	5
"I would praise this participant for choosing different activities in an every day setting"	5		4		4	
Parent:						
Statement:	Zeke:		Howie:			
	Baseline	Treatment	Baseline	Treatment		
"I believe the participant is choosing activities appropriately."	2	5	3	5		
"I would praise this participant for choosing different activities in an every day setting"	5		5			

Note: Likert-Scale used where 1 = "Strongly Disagree" and 5 = "Strongly Agree"

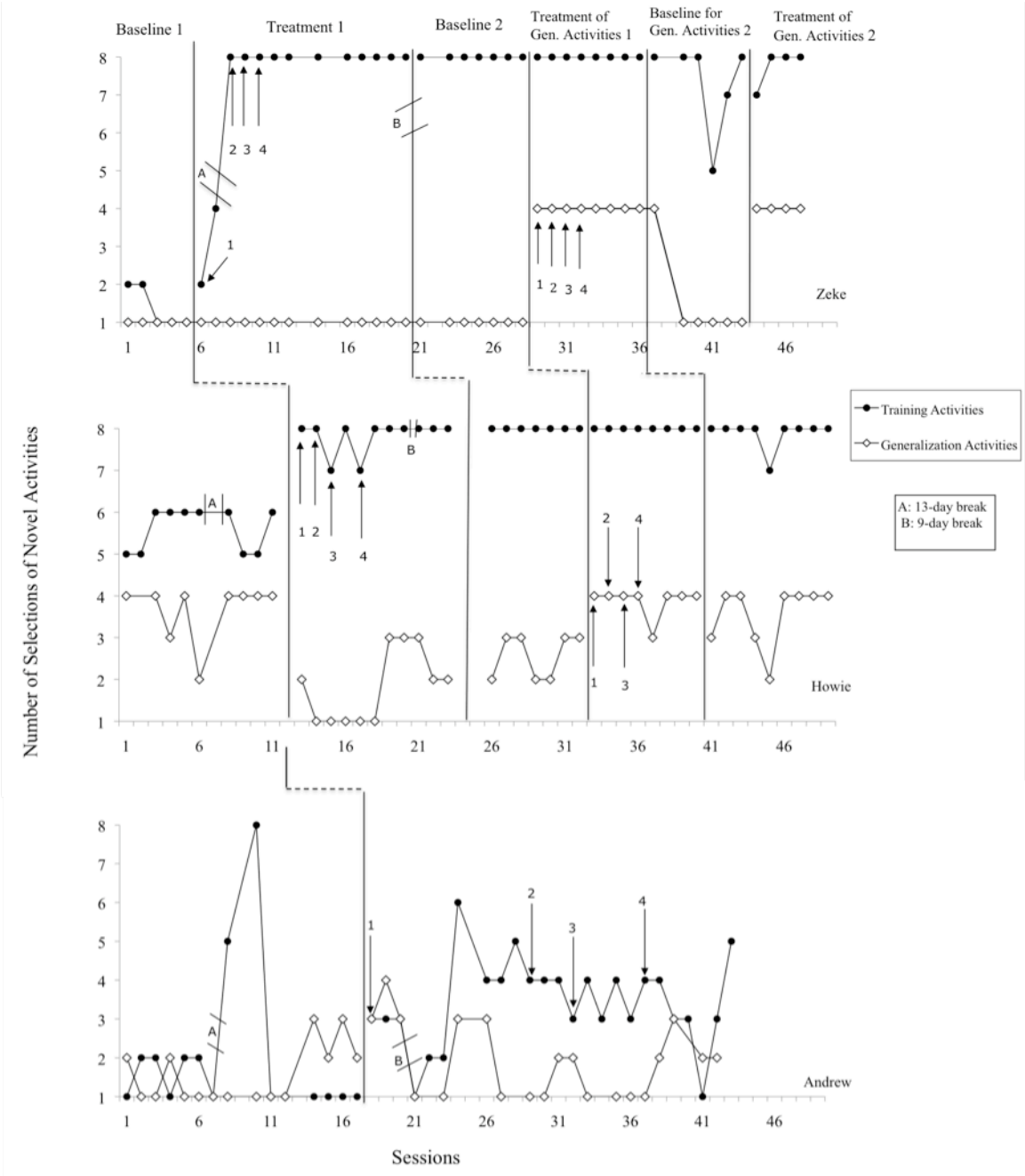

Figure 1. The number of novel training and generalization activity selections per session for each experimental condition for Zeke (top panel), Howie (middle panel), and Andrew (bottom panel). The A and B symbols denote a 13- and 9-day break from school, respectively. Prompt fading levels are indicated by the numbered arrows, where 1, 2, 3, and 4 correspond to the entire sticker prompt, half of the sticker prompt, ¼ of the stick prompt, and no sticker prompt, respectively. Novel selections on training trials are indicated by the solid circles, and data for generalization trials are indicated by the open diamonds.

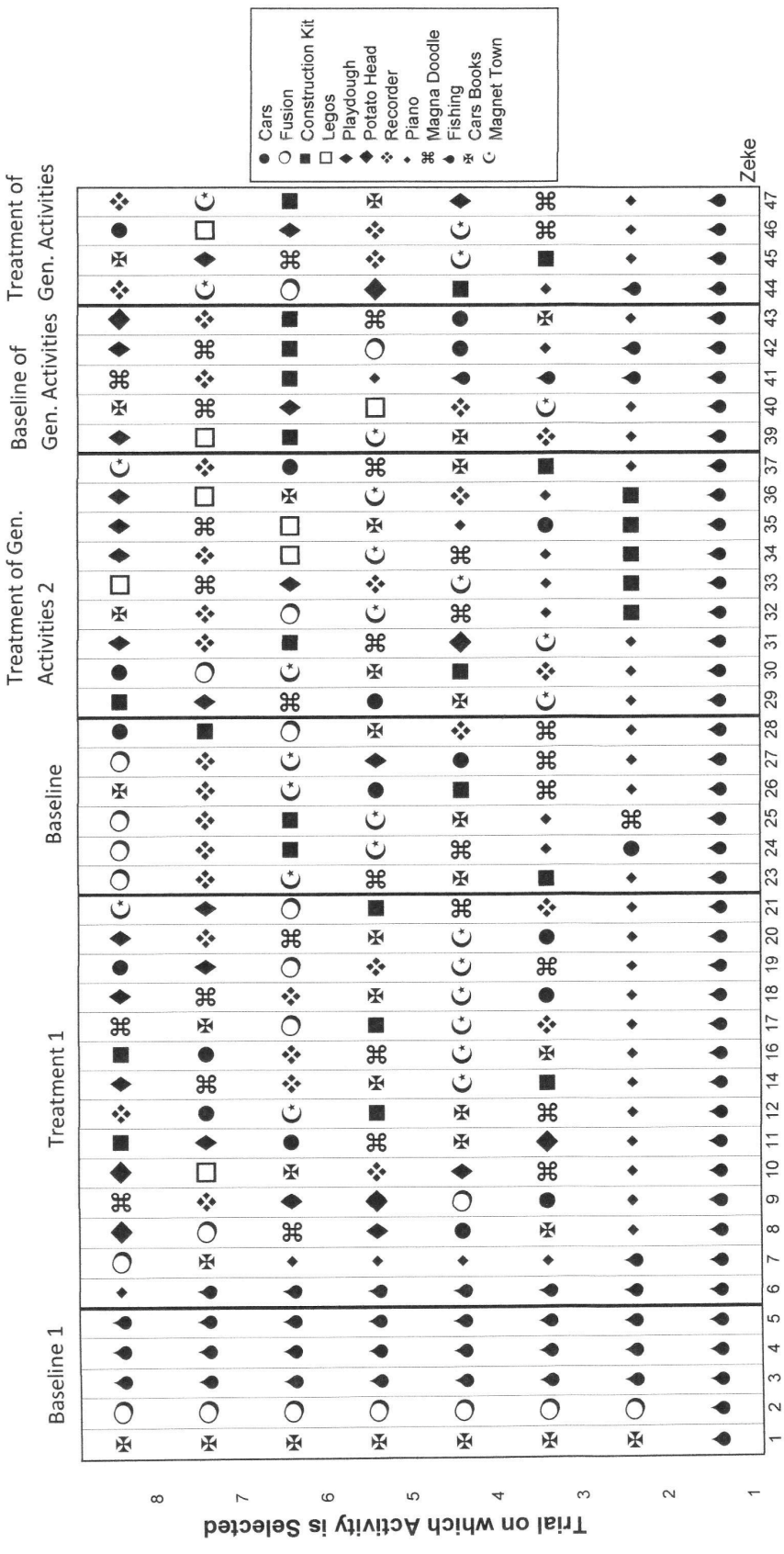

Figure 2. The trials during which each training activity was chosen on each session by Zeke under each condition.

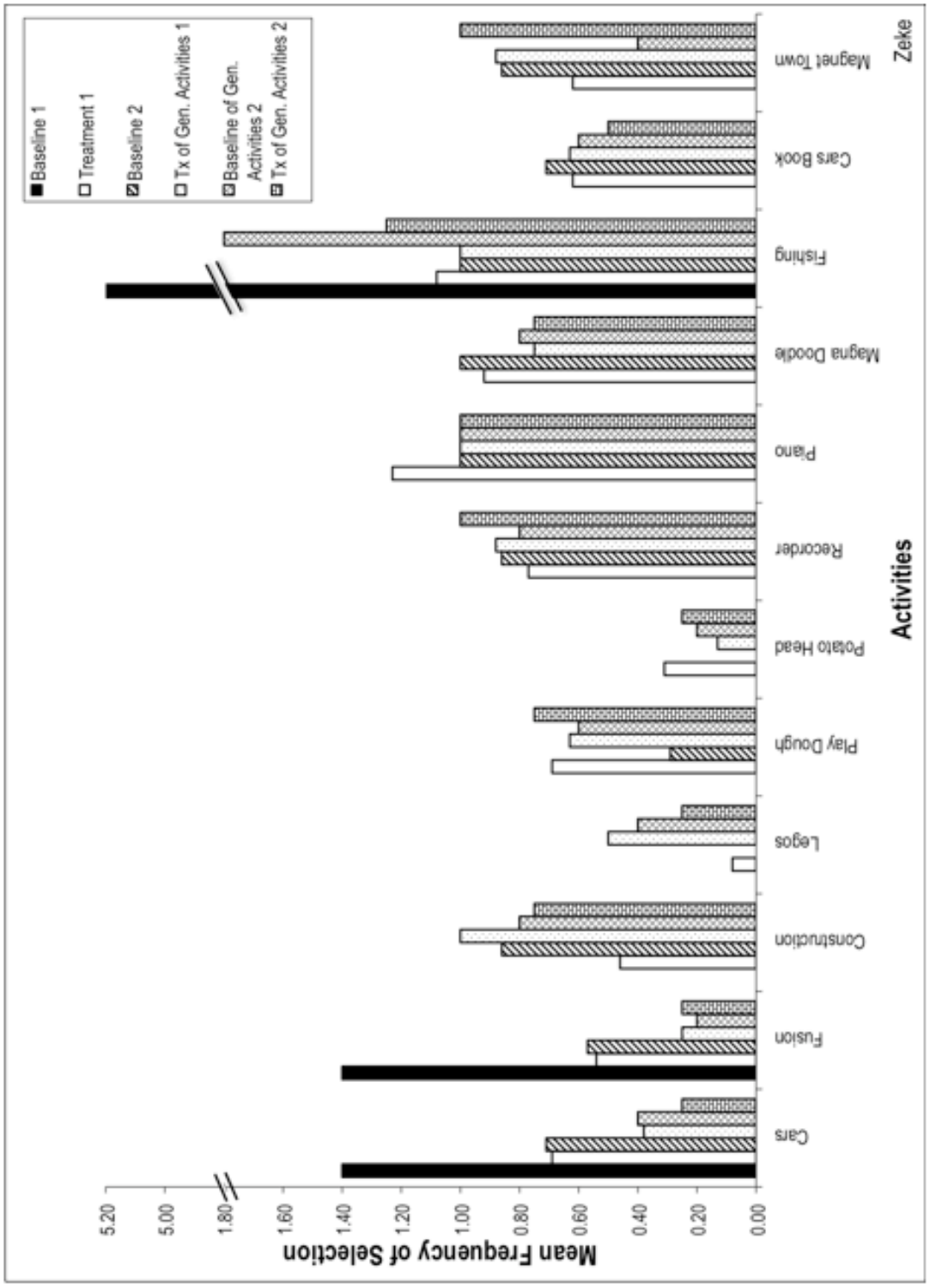

Figure 3. The frequency of selecting each training activity for each condition for Zeke.

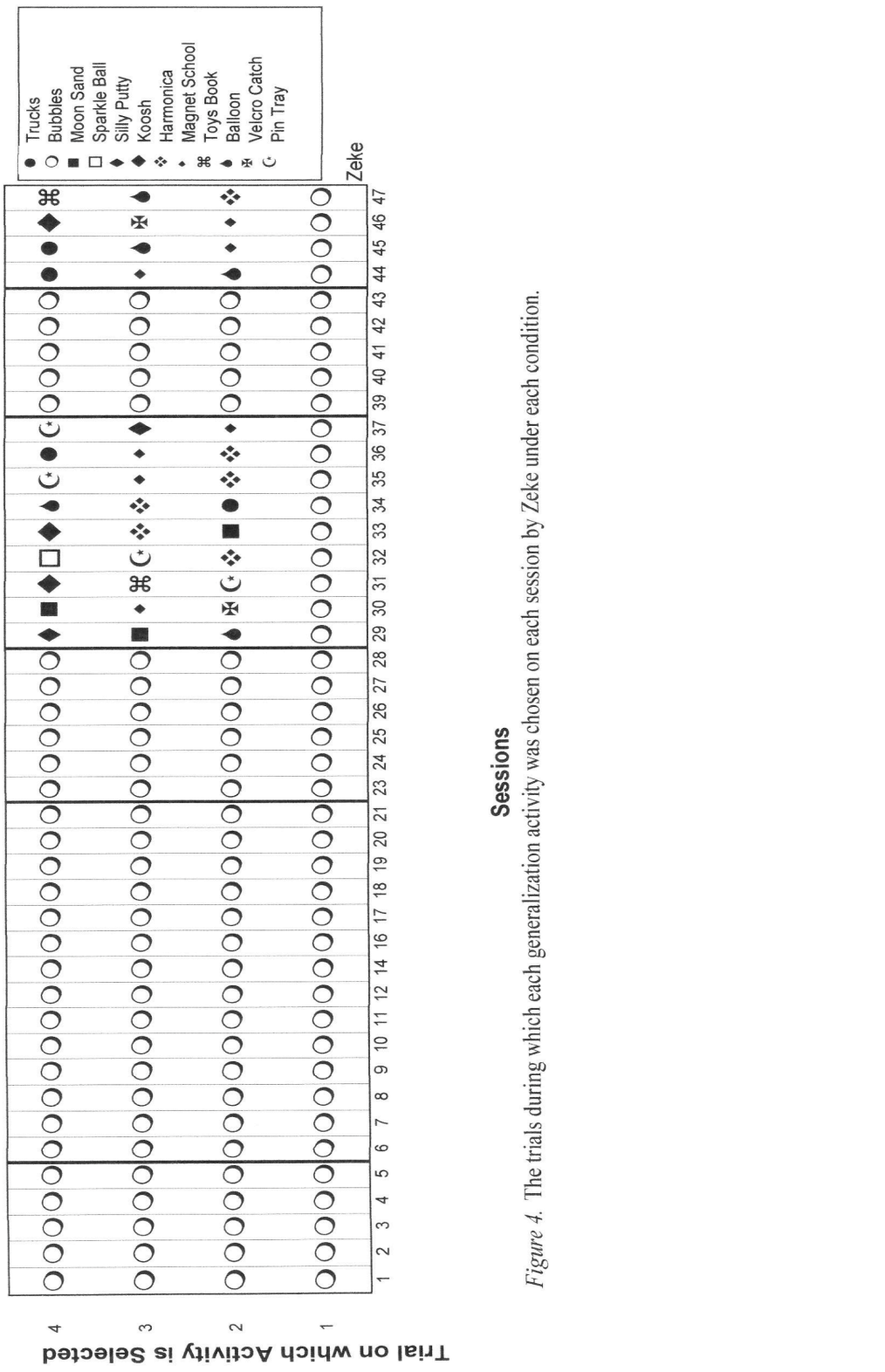

Figure 4. The trials during which each generalization activity was chosen on each session by Zeke under each condition.

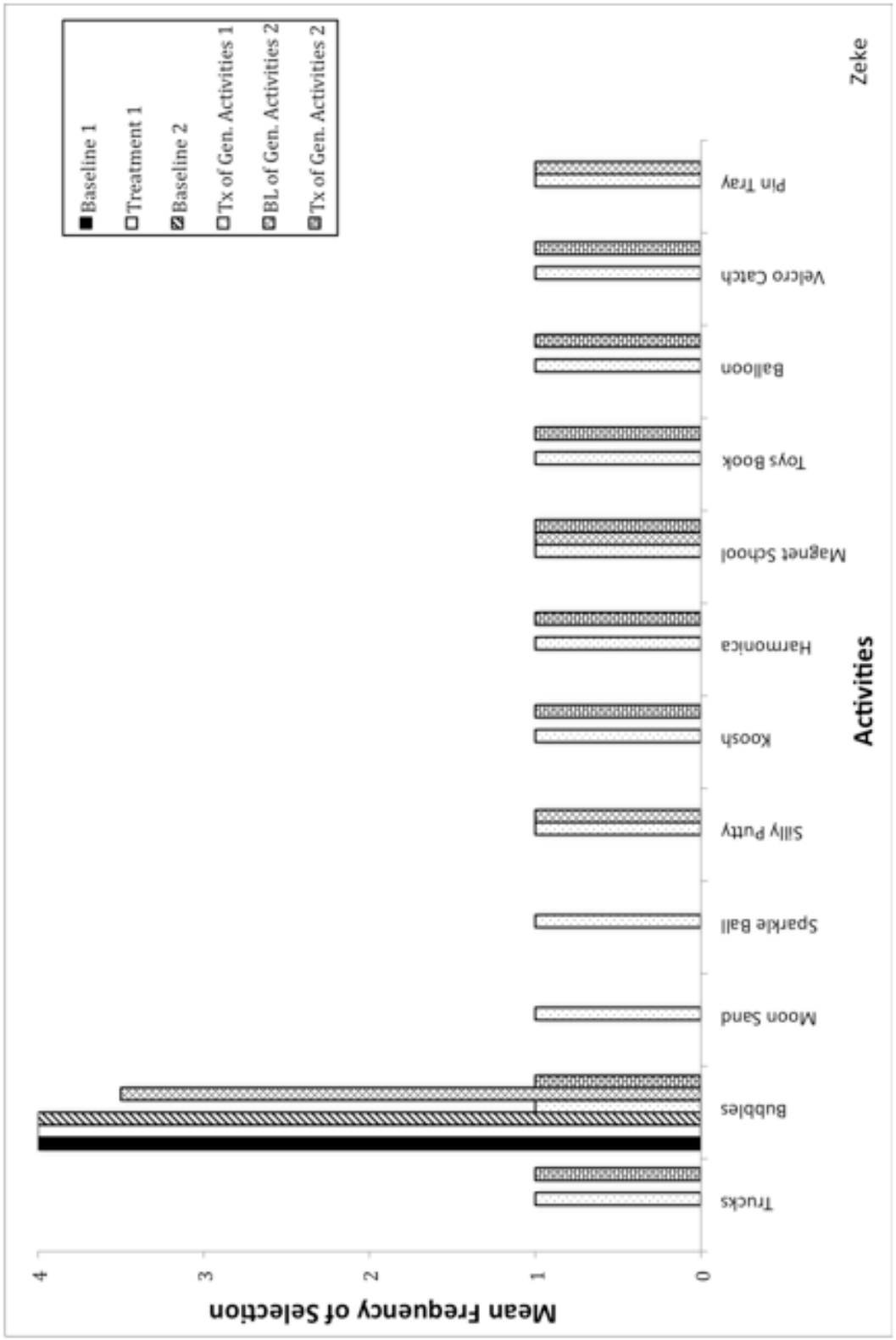

Figure 5. The frequency of selecting each generalization activity selection for each condition for Zeke.

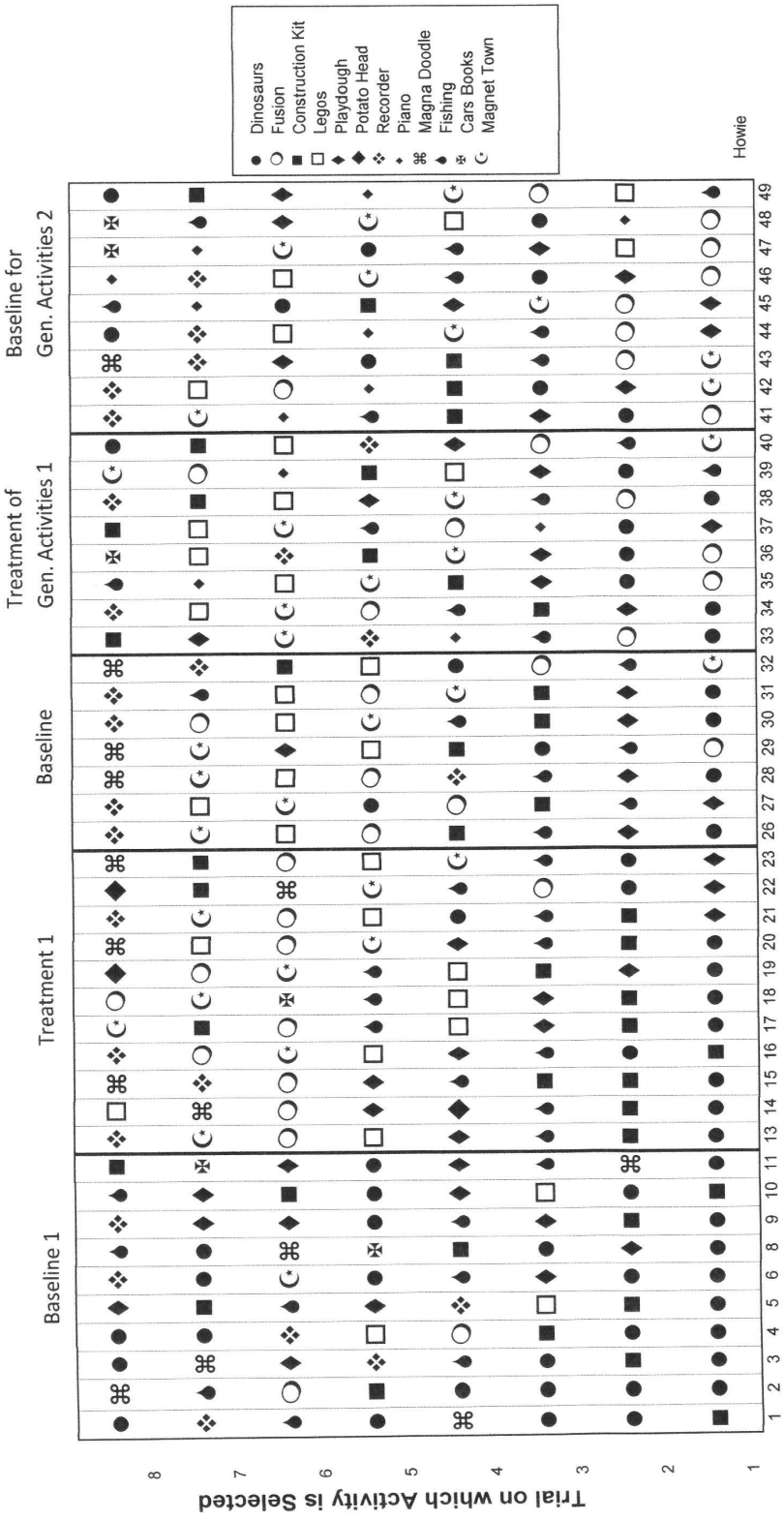

Figure 6. The trials during which each training activity was chosen on each session by Howie under each condition.

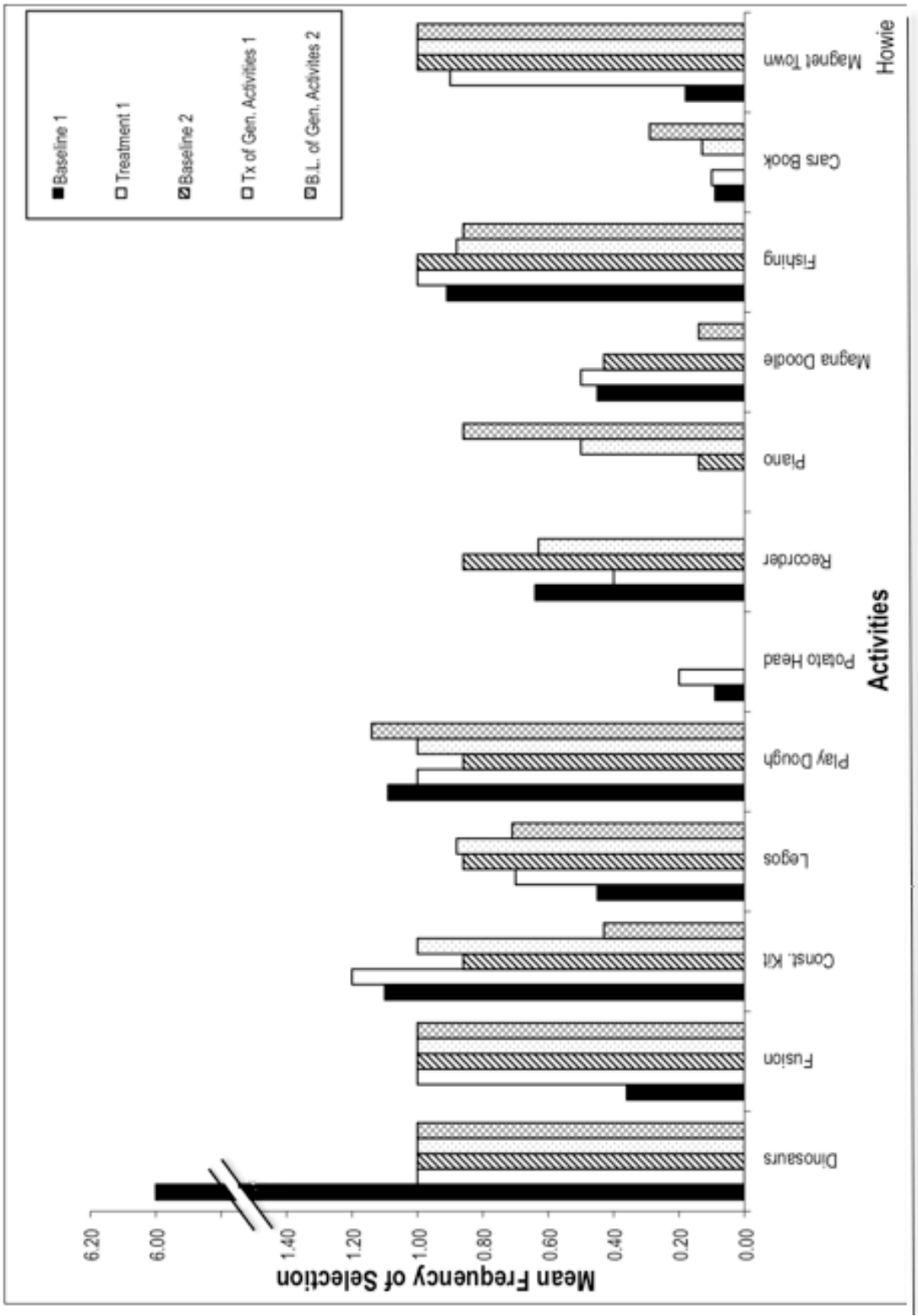

Figure 7. The frequency of selecting each training activity for each condition for Howie.

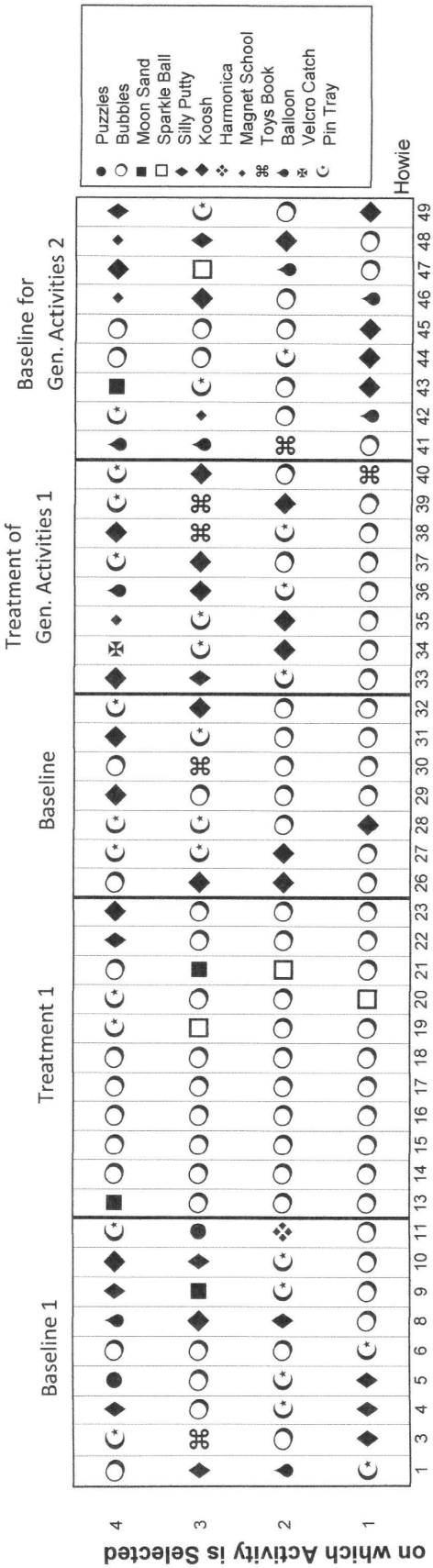

Figure 8. The trials during which each generalization activity was chosen on each session by Howie under each condition.

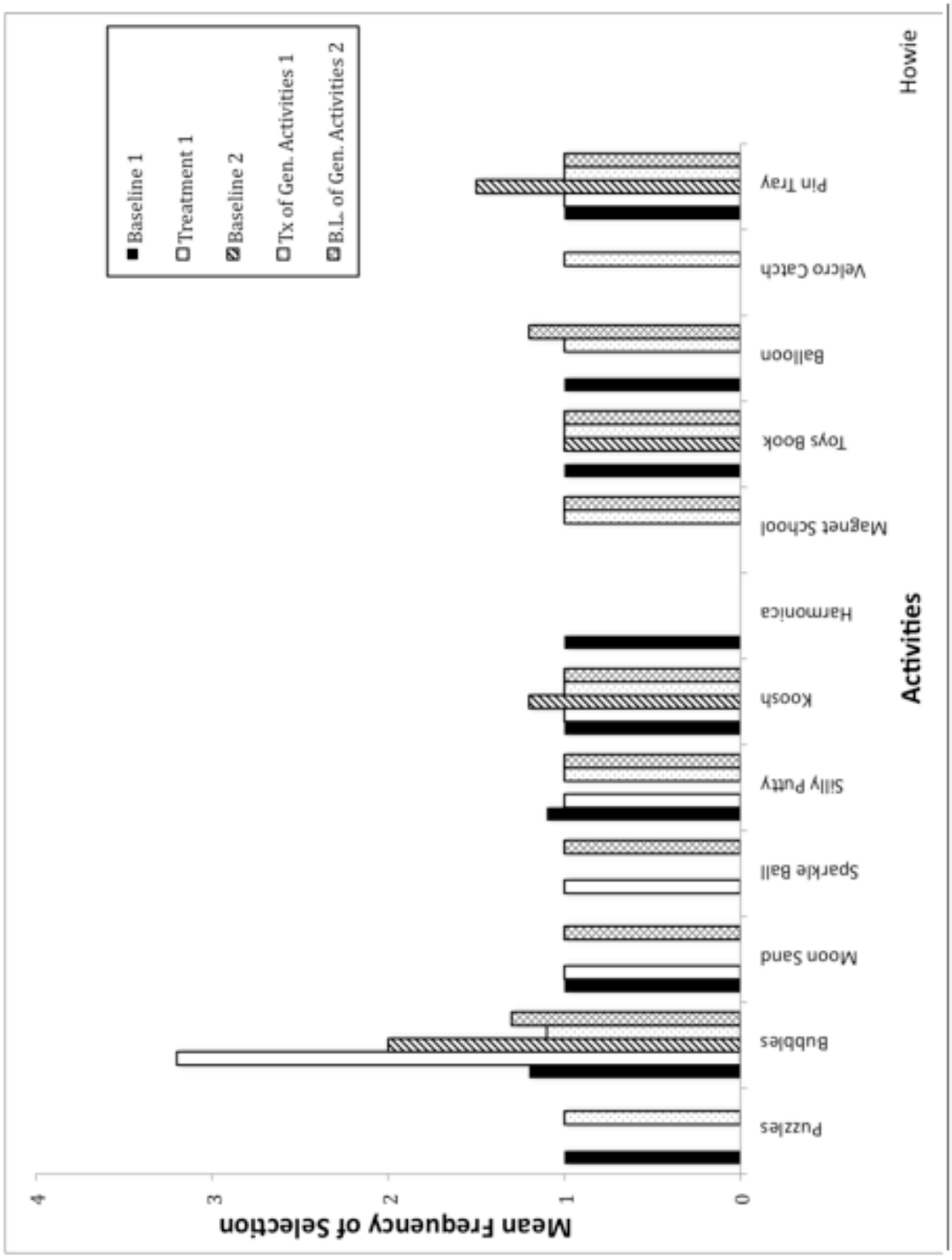

Figure 9. The frequency of selecting each generalization activity selection for each condition for Howie.

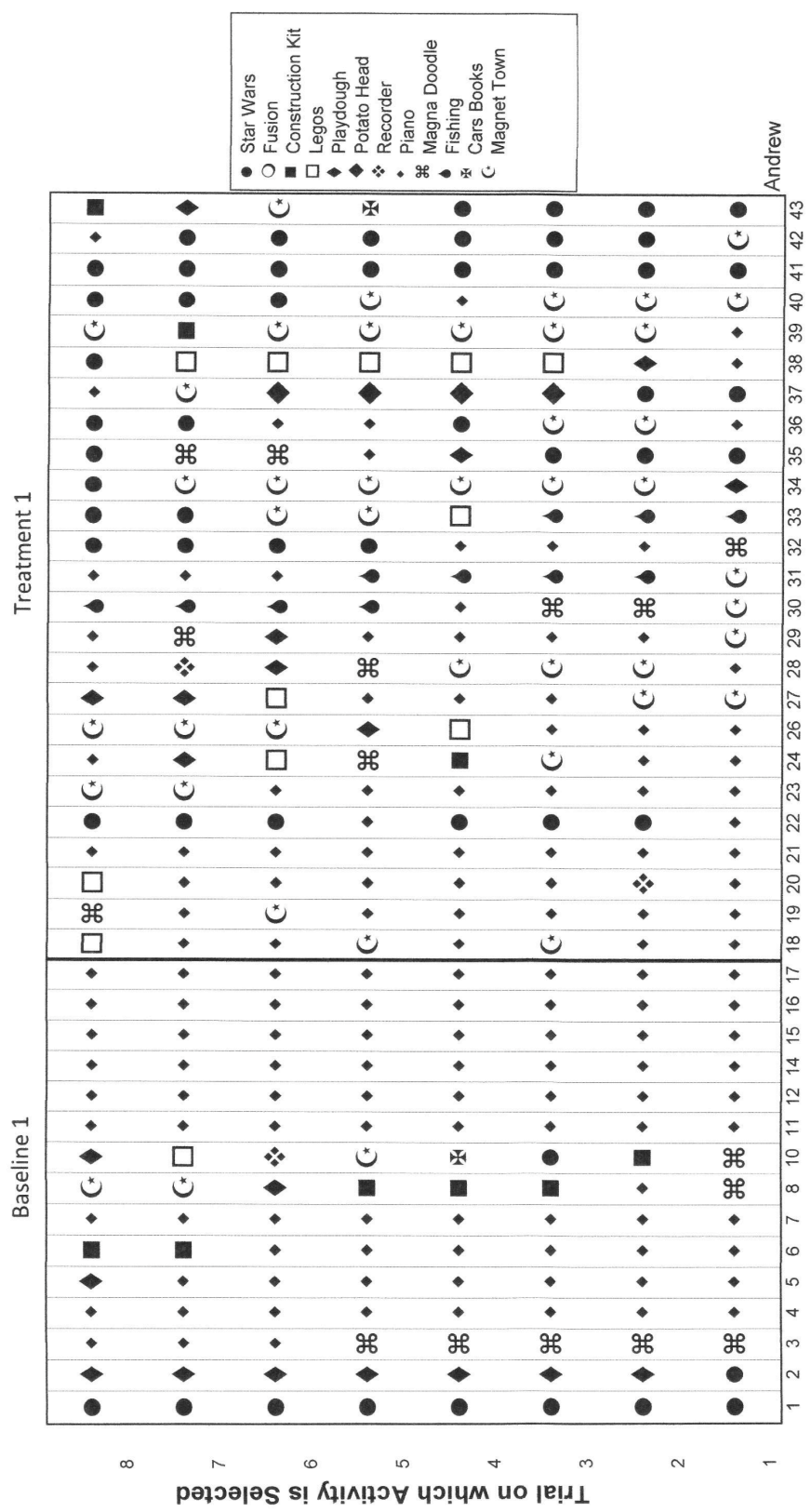

Figure 10. The trials during which each training activity was chosen on each session by Andrew under each condition.

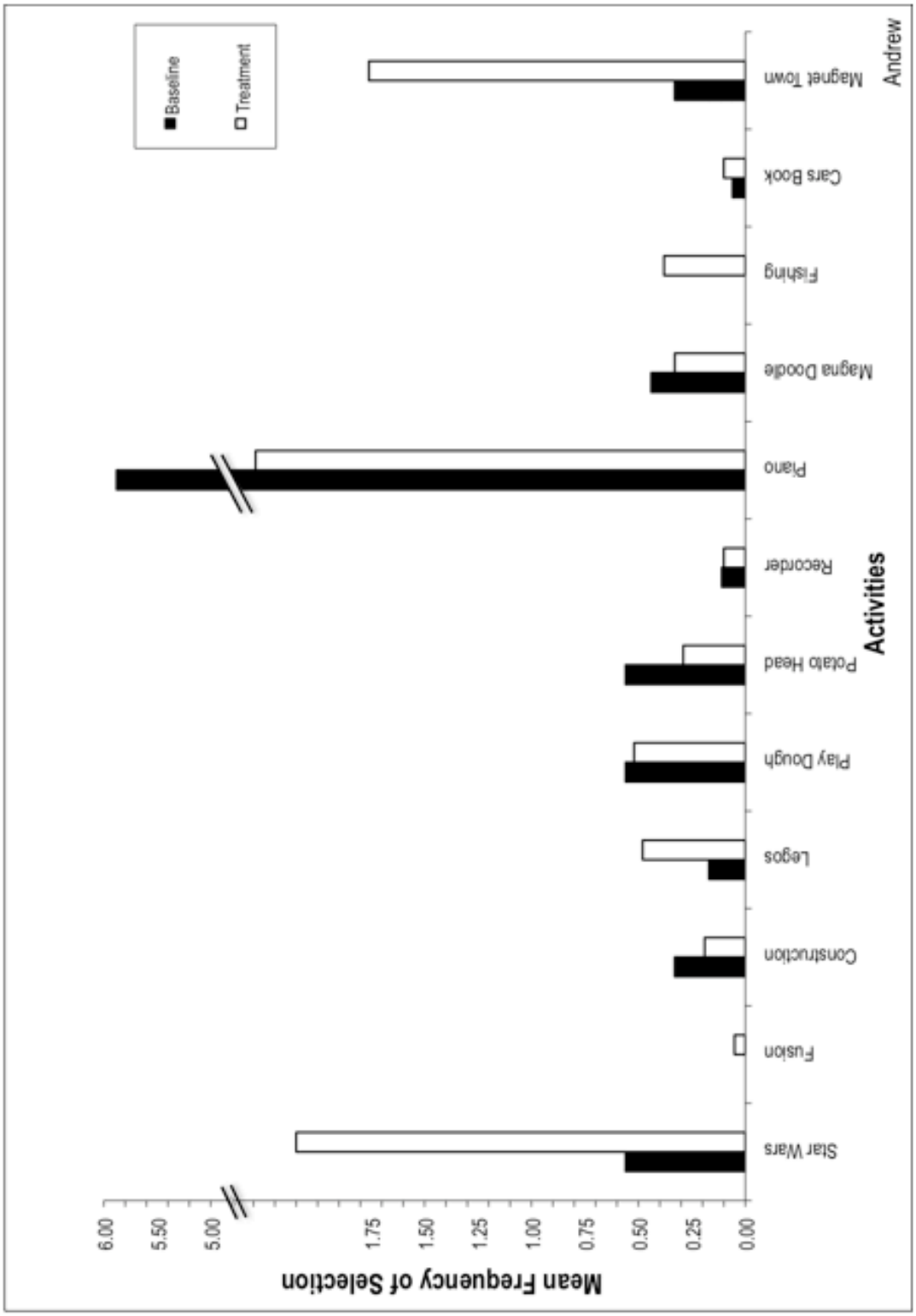

Figure 11. The frequency of selecting each training activity selection for each condition for Andrew.

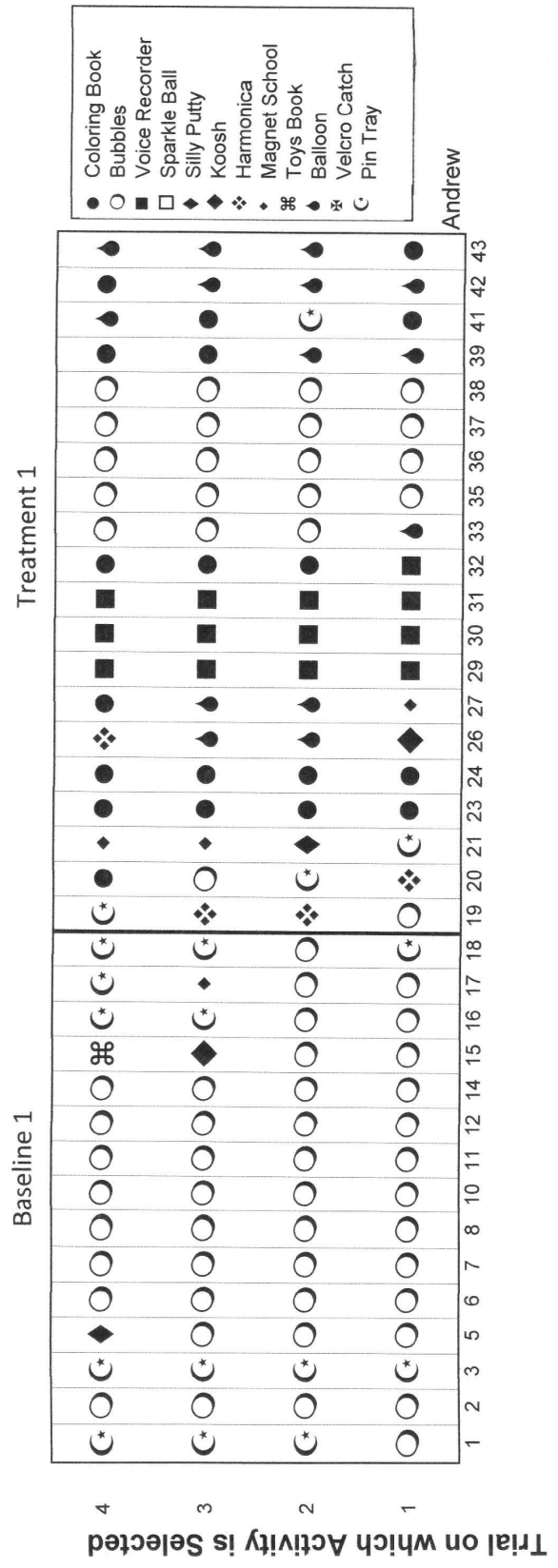

Figure 12. The trials during which each generalization activity was chosen on each session by Andrew under each condition.

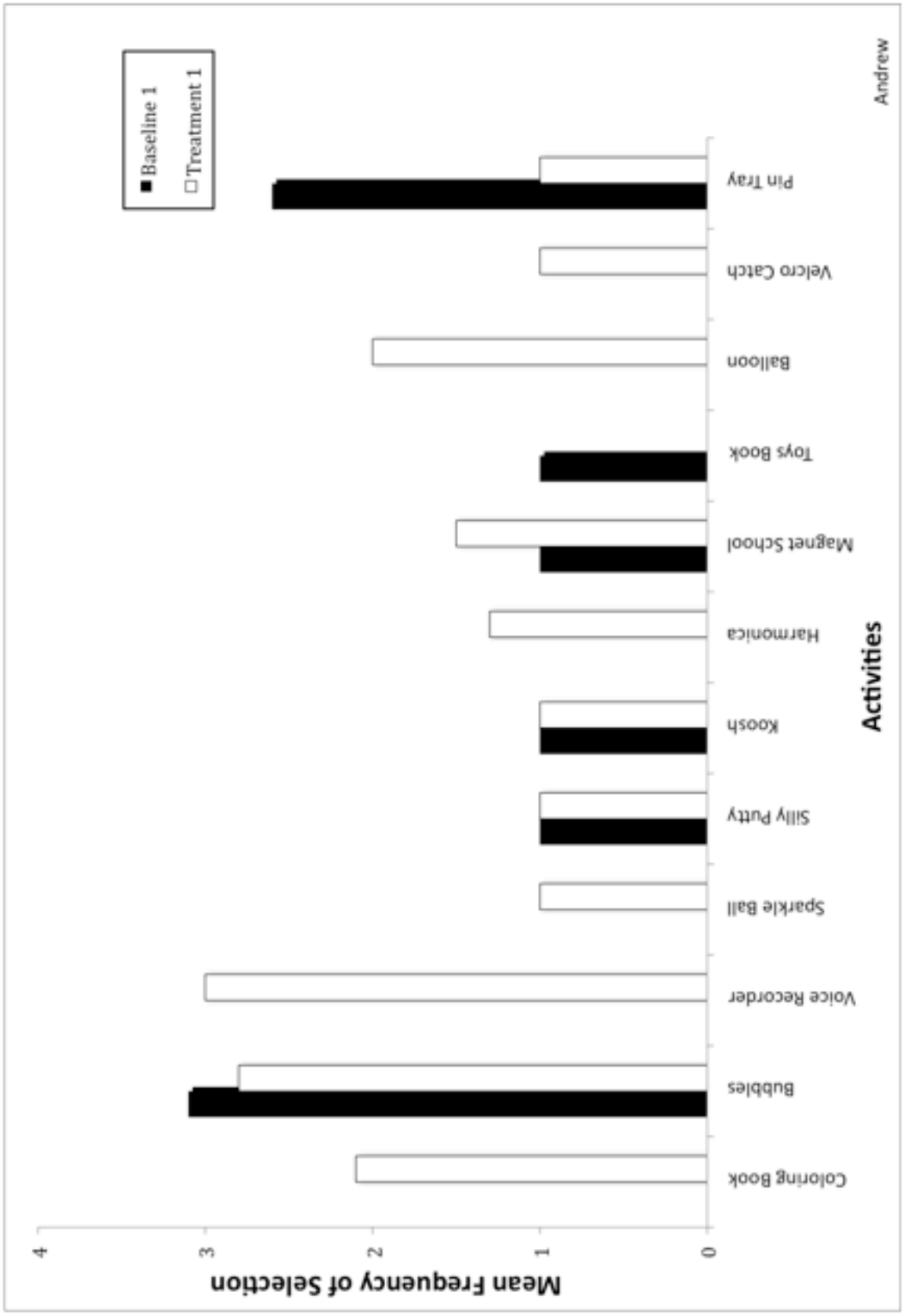

Figure 13. The frequency of selecting each generalization activity selection for each condition for Andrew.

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