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## The effects of "restricted interests" on caregiver presentation of items

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**The Effects of “Restricted Interests” on Caregiver Presentation of Items**

**A Thesis Presented**

**by**

**Corey Scot Stocco**

Bouvé College of Health Sciences Graduate School

In partial fulfillment of the requirements

For the degree of

**Master of Science**

**in the field of**

**Applied Behavior Analysis**

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Running head: THE EFFECTS OF “RESTRICTED INTERESTS”

**The Effects of “Restricted Interests” on Caregiver Presentation of Items**

by

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Submitted in partial fulfillment of the requirements for the degree of  
Master of Science in Applied Behavior Analysis  
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## Abstract

Restricted and repetitive behavior (RRB) is more pervasive, prevalent, frequent, and severe in individuals with autism spectrum disorders (ASDs), relative to their typical peers. One subtype of RRB is restricted interests in items or activities, which is evident in the manner in which individuals engage with items (e.g., repetitious wheel spinning), the types of items or activities they select (e.g., preoccupation with a phone book), or the range of items or activities they select (i.e., narrow range of items). Restricted interests may limit sources of stimulation, and interruption of engagement with restricted interests may evoke problem behavior (Charlop-Christy & Haymes, 1996; Hanley et al., 2003). Additionally, individuals with restricted interests may respond differentially to an array of items—positively toward preferred items and negatively toward nonpreferred items—potentially affecting the array of items presented to these individuals. The purpose of the present study was to use procedures similar to Carr and colleagues (1991) to evaluate the effects of the behavior of those with ASDs on caregiver presentation of items. Results show that caregiver presentation of items corresponds with differential responses provided by individuals with ASD, and those with restricted preferences experienced a narrower array of items. Caregiver sensitivity to student behavior is discussed in terms of expanding preferences.

### The Effect of “Restricted Interests” on Caregiver Presentation of Items

Restricted and repetitive behavior (RRB) is a defining characteristic of autism spectrum disorders (ASDs; American Psychiatric Association, 2000; Lord, Rutter, & Le Couteur, 1994). Although, RRB is also common in the other populations (e.g., typically developing children between the ages of 2 and 4; Evans et al., 1997), RRB is more pervasive and prevalent in those with ASDs relative to their typical peers (Berkson & Tupa, 2000; Honey, Leekman, Turner, & McConachie, 2007). Furthermore, RRB is more frequent and severe in those with ASDs, relative to those with mental retardation (Bodfish, Symons, Parker, & Lewis, 2000).

One subtype of RRB is restricted interests in items or activities. Restricted interests may describe the manner in which individuals perform activities, the types of activities individuals prefer, or the range of activities individuals prefer. Individuals with autism engage in more repetitive toy play, compared to both typical peers and peers diagnosed with mental retardation (Tilton & Ottinger, 1964). For example, when playing with a toy car, an individual with autism may repetitively spin the wheels. Additionally, individuals with ASDs may prefer socially unacceptable items or activities. Charlop, Kurtz, and Casey (1990) described one individual who preferred to flip through phonebooks. Finally, individuals may prefer a narrow range of items or activities, or an exclusive item or activity. For example, one individual’s interest in maps was exclusive to the point that his sister reported it didn’t allow them to “talk about anything else” (Mercier et al., 2000, p. 414).

Restricted interests may lead to limited sources of stimulation and present barriers to achieving social, communicative, and educational goals. It can be difficult to identify effective and socially acceptable reinforcers for people with ASDs, leading some researchers to examine the use of items of preoccupation (e.g., a telephone book; Charlop et al., 1990) in reinforcement-based interventions (Boyd, Conroy, Mancil, Nakao, & Alter, 2007; Charlop-Christy & Haymes, 1998; Charlop-Christy & Haymes, 1996; Charlop et al.). Restricted interests have the potential to

limit learning opportunities as well as opportunities to interact with peers who have a broader range of interests; therefore, inhibiting an individual’s repertoire and range of experiences. Additionally, interrupting an individual’s engagement with restricted items, or contexts in which the restricted interest item is not available, may evoke more severe topographies of problem behavior (Adelinis & Hagopian, 1999).

If one adopts Bannerman, Sheldon, Sherman, and Harchik’s (1990) position that it is one’s right to exercise choice, restricted interests should be accepted and we should not attempt to alter an individual’s preferences. In fact, a great deal of behavior analytic research has been dedicated to the systematic identification of preferences so that participant’s preferences can be incorporated into programming. However, in an attempt to accommodate the narrow or idiosyncratic preferences of some individuals with ASD, caregivers, teachers, and professionals may inadvertently restrict the individual’s range of experiences (e.g., activities). That is, adults interacting with children with ASD may tend to present those activities that the child already prefers, thus minimizing opportunities to expand preferences.

In some cases, those caring for individuals with ASDs may present already preferred items according to a specified behavior program designed to incorporate the participant’s preferences. In other cases, consequences provided directly by the individual with an ASD might promote this caregiver behavior. Bates (1978) discussed how child behavior may influence adult behavior, which, in turn, may influence child behavior. Bates’ discussion is the theoretical basis for an area of research referred to as *child effects* research. A number of child effects studies have examined the influence of behavior of typically developing children on adult behavior (Bohannon & Marquis, 1977; Fagot, 1984; Murray, 1979).

Bates’ notion of *child effects* may be relevant to the establishment and maintenance of restricted preferences in those with ASDs. When caregivers present an initially preferred stimulus, these presentations are likely to be reinforced by positive reactions from the child. By

contrast, presentation of an unfamiliar or nonpreferred stimulus may be met with a neutral or negative reaction from the child. In this way, child responses may differentially reinforce the continued presentation of a stimulus or class of stimuli that is preferred, resulting in an apparent magnification of the initial preference. No study to date has examined this relation.

However, a study by Carr, Taylor, and Robinson (1991) captured the effects of child problem behavior on teachers' presentation of instructions. Twelve undergraduate students were asked to present discrete trials to pairs of preschool students; one student in each pair typically exhibited problem behavior in instructional settings and the other student was typically compliant with instructions. Over the course of the observation, teachers presented fewer trials to the students who engaged in problem behavior, relative to the compliant children, and avoided those specific tasks that evoked problem behavior.

In the current study, we used procedures similar to those described by Carr and colleagues (1991) to examine the effects of the behavior of those with autism on caregiver presentation of items. Specifically, we were interested in describing how teachers' leisure item presentation was influenced by the consequences provided by individuals with autism.

## **Method**

### **Student Participants**

Four students (10-19 years-old) participated in the study. All students were male and diagnosed with an autism spectrum disorder and received educational and clinical services in a residential setting. Caregivers referred students who were considered to have restricted preferences and individuals who interacted similarly with a broad range of leisure items (hereafter called distributed preferences). All students who were referred by teachers participated in both phases of the study. All students responded to “yes/no” questions vocally or by nodding or shaking their heads accordingly. Caregivers of student participants reported that none of the student participants received leisure skills training during the course of the study.

**Participants with restricted interests.** Steve (19-years-old) was reported to carry a Fisher-Price Elmo Phone<sup>®</sup> with him across the day. It was reported that removal of this item or presentation of other leisure items typically resulted in Steve engaging in problem behavior. Steve had a history of engaging in aggression and self-injury. Steve did not have a vocal mand repertoire, but he frequently pointed to items.

Wayne (10-years-old) was reported to have a strong preference for pictures of roller coasters. It was reported that removal of this item or presentation of other leisure items typically resulted in problem behavior. Wayne had a history of engaging in self-injury and had a vocal mand repertoire.

**Distributed interest participants.** Nick (17-years-old) reportedly engaged with a variety of leisure items across the day and did not engage in problem behavior in the context of item presentation or removal. Nick had a history of engaging in hand mouthing. Nick did not have a vocal mand repertoire.

Mark (10-years-old) reportedly engaged with a variety of leisure items across the day and did not engage in problem behavior in the context of item presentation or removal. Mark had a history of hand mouthing and biting others. Mark had a vocal manding repertoire and a picture exchange communication system present during sessions.

### **Teacher Participants**

Five teachers at a residential program for people diagnosed with an autism spectrum disorder participated: 4 female (23- to 30-years-old) and 1 male (25-years-old). Four teachers were currently pursuing master’s degrees (3 in Special Education; 1 in Applied Behavior Analysis). One teacher had obtained a master’s degree in special education. Teachers did not have a history of working with the student participants. Teachers received 2 hours of training, unrelated to this project, on topics such as discrete-trial teaching and reinforcement.

## Setting

Sessions were conducted in a separate research room at the participants’ school. Rooms contained desks, chairs, cabinets, shelves, and materials for academic programming. An experimenter was present for, and used a camcorder to record, each session.

## Response Measurement and IOA

Observers viewed recorded sessions and used IPAQ handheld computers to record the item presented and student behavior that occurred while each item was present. Item presentation included the teacher placing the item on the student’s desk, in the student’s hands, or vocally presenting the item (e.g., “Do you want the ball?”). We recorded item removal, which included the teacher physically removing the item from the student’s desk or hands. Additionally, observers recorded teacher removal attempts, which may not have corresponded with item removal. Teacher removal attempts included verbally requesting the student give the item back to the teacher (e.g., gesturing to hand the item to the teacher or saying, “Give me the ball”). Observers also recorded duration of presentation for each item. The onset of presentation was recorded when the participant placed an item on the desktop, on the student’s lap, or in the student’s hands. The termination of presentation was recorded when the participant removed an item from a student’s possession or from the desktop.

Student behavior was recorded and coded in two categories: positive behavior and negative behavior. *Positive behavior* included positive vocalizations and approach responses. *Positive vocalizations* included laughing, smiling, requests for item, and requests for teacher interaction. *Approach responses* included the student touching or grabbing the item presented. *Negative behavior* included problem behavior, negative vocalizations, and avoidance responses. *Problem behavior* included self-injury and aggression. *Negative vocalizations* included requests for removal of item, screaming, crying, cursing, yelling or negative vocalizations, such as, “No,” “Go away,” or “Stop.” *Avoidance responses* included turning head or body away, using hands or

body to block presentation of the item. *Resistance to item removal* was also recorded and defined as holding onto to the item or moving the item away from the teacher when the teacher is attempting to remove the item. Frequency measures were used to record positive/negative vocalizations, problem behavior, and approach/avoidance responses. Frequency measures were converted to rate for each item by dividing the total frequency for a given behavior by the duration an item was presented. Duration measures were used to record item presentation and item engagement. Observers recorded the immediate onset of presentation and engagement and the immediate offset of item presentation. The offset of item engagement was recorded when engagement ceased for 2 s. We included a 2-s delay in an attempt to capture appropriate interaction with items that involved brief pauses (e.g., bouncing a ball). Percentage of item presentation was calculated by dividing the duration of item presentation by the total duration of the session. Percentage of item engagement was calculated by dividing the duration of engagement with an item by the duration of presentation for that specific item.

**Interobserver agreement.** A secondary observer scored an average of 43.2% (range, 33% to 50%) of the sessions across all student participants. Each session was divided into 10-s intervals. Partial agreement was calculated by dividing the smaller number (or duration) of recorded events by the larger across observers, averaging these scores across the session, and converting them to a percentage. Mean agreement for all teacher behavior was 95.8% (range, 82% to 100%). Mean agreement for all student behavior was 97.7% (range, 71.7% to 100%).

### **Procedures and Data Analysis**

**Phase 1.** The overall purpose of the study was to describe how teachers' leisure item presentation was influenced by the differential consequences provided by individuals with autism. Phase 1 was conducted to inform the items used in Phase 2 in attempt to arrange differential consequences across students and items for teacher behavior. Specifically, we sought to identify (a) items that would produce differentiated responding for restricted interest

participants and (b) items that would produce undifferentiated responding for distributed interest participants.

Experimenters selected items for Phase 1 that were similar to items found in the participants’ natural environment, or items included in previous preference assessments. We chose not to include the Fisher-Price Elmo Phone<sup>®</sup> that Steve carried throughout the day because we were concerned that item presentation of teacher participants who had seen Steve around the school might be influenced by this extra-experimental history. The experimenter conducted 3 to 5 sessions with each participant, depending on the stability and clarity of the data, to assess student behavior evoked or occasioned by the presentation of each item. Each session consisted of one presentation of each item, for a total of 3 to 5 presentations per item. Each item was presented for 30 s and removed after 30 s, independent of student behavior. No programmed consequences were provided contingent on positive or negative behavior exhibited by the students during Phase 1. We used the results of Phase 1 to identify four items per student to be used in Phase 2 of the study. For participants with restricted interests, we selected two items that produced high levels of positive behavior (putative reinforcers for teacher presentation of an item) and low levels of negative behavior and two items that produced low levels of positive behavior and high levels of negative behavior (putative punishers for teacher presentation of an item). For participants with distributed interests, we selected four items that each produced relatively similar levels of positive behavior and no negative behavior.

**Phase 2.** Student participants were grouped in dyads that included one participant with restricted interests and one participant with distributed interests. Each teacher participant presented items to each member of a dyad in separate 10-min sessions. The sessions conducted with the participant with *restricted interests* provided an opportunity to observe teacher behavior that occurred when a student participant responded differentially to presentation of various items. Teacher behavior during these sessions was then compared with teacher behavior during sessions

involving the participant with *distributed interests*, who was less likely to provide differential responding for teacher presentation of various leisure items. At the start of the first session, the experimenter informed the teacher that he was interested in the student’s interaction with the teacher and leisure materials. It was explained to the teacher that a debriefing of the study would take place after the completion of the study. If a teacher asked the experimenter questions about the study, the teacher was reminded of the debriefing after the completion of the study. The teacher was given a box containing the items identified in Phase 1. The teacher was instructed to present one item at a time and remove the previous item before presenting the next item (so that student responses could be attributed to a single item during data analysis). The teacher was also told that statements such as, “Do you want the ball?” were considered presentations and teachers were reminded to avoid statements that offered two items simultaneously to the student (e.g., “Do you want the ball or the car?”). The teacher was not instructed to present every item or to present items at a specific rate. Additionally, the teacher was not instructed to keep the student seated at the desk.

## Results

**Phase 1.** Figure 1 illustrates the results from Phase 1 for each of the student participants. Items selected for inclusion in Phase 2 are indicated with an asterisk. Items were selected for participants with restricted interests in an attempt to program differential consequences for teacher presentation of the items in Phase 2. Items were selected for participants with distributed interests in an attempt to program similar consequences for teacher presentation of the items in Phase 2.

For Steve, the Playskool™ Palm Top and Slinky were selected to determine whether Steve’s high levels of engagement would reinforce teacher presentation of these items. The Jumping Frogs and Egg Shaker were selected to determine whether his negative responses to the

presentation of these items and lack of engagement would decrease teacher presentation of these items.

Items for Nick were selected to determine whether Nick’s relatively similar responding to the presentation of these items would correspond with relatively undifferentiated presentation of these items, relative to Steve. Therefore, we selected the Egg Shaker, Playskool™ Palm Top, Googly Ball, and Slinky.

The Roller Coaster Book and Slinky were selected based on Wayne’s high levels of engagement with those items. The Bear Book and Animals (i.e., animal figurines) were items were selected because they produced frequent negative responses and low levels of engagement. The Playskool™ Palm Top, Legos®, Potato Head, and Piano produced similar responding and were selected for inclusion in Phase 2 with Mark.

**Phase 2.** Figures 2-4 depict the results for the three teachers who were observed interacting with Steve and Nick. Figures 5 and 6 depict the results for the two teachers who presented items to Wayne and Mark.

Results for Erica, our first teacher participant, are depicted in Figure 2. Data on Erica’s item presentation appear in the top panels, and data on student participants’ responses during item presentation are in the bottom panels. Erica presented the Playskool™ Palm Top to Steve for differentially longer durations, relative to the other items. Presentation of the Playskool™ Palm Top corresponded with high levels of engagement and low rates of negative responses. Erica presented the Egg Shaker, Frogs, and Slinky for shorter durations, relative to the Playskool™ Palm Top; those three items corresponded with low levels of engagement and high rates of negative responses. Erica’s presentation behavior with Nick was more evenly distributed across items, although the Googly Ball and Playskool™ Palm Top were presented for the longest and shortest durations, respectively. Presentation of all items to Nick corresponded with similar levels of engagement, relative to Steve, and no negative responses.

Results were replicated across the four remaining teacher participants and second pair of student participants. Differentiated responding across items was captured for student participants with restricted interests, whereas student participants with distributed interests responded relatively similarly across items. Teacher participants presented one item for differentially longer durations to the students with restricted interests. Teachers presented the Playskool™ Palm Top for longer durations to Steve, and the Roller Coaster Book for longer durations to Wayne. Items presented to participants with restricted interests for differentially longer durations corresponded with high levels of engagement and low rates of negative responses; items presented for shorter durations corresponded with low levels of engagement and high rates of negative responses. Items were presented relatively evenly to student participants with distributed interests. Relatively even presentation of items to participants with distributed interests corresponded with similar levels of engagement and low rates of negative responses.

Although the aforementioned pattern was observed across all teachers and student pairs, informal observations by experimenters indicated that the interactions between Amy and Wayne (left panel of Figure 6) were strikingly different. Amy commonly blocked negative responses such as throwing items and kept items present until negative responses were absent for a period of time. Amy was the only teacher observed to prompt appropriate engagement with the items. It is interesting that, under these conditions, Wayne engaged with the bear book and had relatively fewer negative responses compared with the sessions conducted by Carol and those in Phase 1. Amy was the only teacher participant enrolled in a Masters program in Applied Behavior Analysis at the time of the study, and one would expect this history to influence her interactions with the student participants.

Figures 7 and 8 are event diagrams illustrating within-session data for Steve and Wayne with different teacher participants and are included to highlight the immediate consequences for teacher presentation of items. These graphs depict teacher presentation and removal of items and

contiguous student participant engagement and negative responses. At the beginning of Session 1, Lisa presented the Frogs, Egg Shaker, and Slinky and Steve engaged in low levels of item engagement and high rates of negative responses. Lisa then presented the Playskool™ Palm Top, and Steve, engaged with the toy without negative responses for the remainder of the session. Figure 8 illustrates similar within-session data with Carol and Wayne. Again, this figure illustrates the differential consequences that were likely responsible for teacher presentation of the Roller Coaster Book, which was the only item in this session that produced consistent engagement and no negative responses.

### **Discussion**

These findings add to the literature examining the effects of child behavior on caregiver behavior. Previous studies have reported the likely negative reinforcement contingencies of child problem behavior that may influence caregiver presentation of demands (Addison & Lerman, 2009; Carr et al., 1991; Sloman et al., 2005). The current study captured the likely influence of the behavior of students with autism on teacher presentation of materials. Student participants with restricted interests responded differentially during presentations of different items, and teachers presented one item for differentially longer durations. By contrast, students with distributed interests responded relatively similarly during presentation of different items and teachers presented items more evenly to these individuals. Generally, items correlated with higher percentages of engagement were presented for longer durations, and items correlated with higher rates of negative responses were presented for shorter durations.

Given that this is a descriptive study, no statements about functional relations can be made; however, results suggest teachers' behavioral sensitivity to the consequences provided by individuals with restricted interests. These data suggest that differential responding across items provided differential consequences for teacher presentation behavior. A combination of

differential reinforcement and punishment likely influenced item presentation to students with restricted interests, resulting in a narrower range of experiences with the array of items.

In many ways, the performance of the teacher participants is highly desirable. Teachers demonstrated individualized interactions with student participants and led unstructured play sessions according to participant preferences. Generally, teachers presented leisure items in a manner that appeared to minimize undesirable behavior and maximize engagement. Yet, this same approach resulted in students with restricted preferences experiencing more limited exposure to the full array of leisure items. The current study does not demonstrate the effects of exposure on participant preferences, but it seems likely that presentation of a narrow array would limit expansion of preferences. Therefore, teacher performance may have been consistent with some behavioral goals (e.g., promoting engagement in general) but counter-therapeutic with respect to expanding restricted preferences. Future research should examine the effects of common educational and clinical practices on RRB among individuals with autism. For example, intervention components, such as picture schedules, aimed at improving on-task behavior (MacDuff, Krantz, & McClannahan, 1993) may inadvertently contribute to the rigidity in routines that is common among individuals with autism (Bartak & Rutter, 1976; Lord & Pickles, 1996).

The current results highlight the need for behavioral programs aimed at expanding the preferences of individuals with autism and restricted interests. In addition to the obvious need for exposure to a variety of stimuli, teachers should be trained to arrange conditions to promote engagement with a wider array of items so that individuals with restricted preferences may contact sources of reinforcement for engaging with these stimuli. Research suggests that engagement in initially nonpreferred activities may be promoted through prompting (Duffy & Nietupski, 1985, Schleien, Wehman, & Kiernan, 1981), restriction of the array of available stimuli (Hanley, Iwata, Roscoe, Thompson, & Lindberg, 2003), reinforcement of engagement

(Hanley et al.), conditioning (i.e., simultaneous access to preferred and non-preferred activities; Hanley et al.; Hanley et al., 2006), and embedded reinforcement (Hanley et al.; Hanley, Tiger, Ingvarsson, & Cammilleri, 2009; Hoch, McComas, Johnson, Faranda, & Guenther, 2002). Additionally, lag schedules of reinforcement have increased children’s selections of novel classroom activities (Cammilleri & Hanley, 2005).

This study describes some natural relations that may contribute to RRB in individuals with ASDs and adds to the literature investigating contingencies that affect caregiver behavior (Carr et al., 1991; Sloman et al., 2005). An understanding of the variables influencing caregiver behavior is essential to a full understanding of the development and maintenance of problematic behavior. Further, an understanding of variables controlling caregiver behavior should inform the development of training programs that must be designed to promote adherence to effective programs despite a history of caregiver-child interactions that might otherwise perpetuate the problem.

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## Figure Captions

*Figure 1.* Results from Phase 1 are depicted for student participants. Items are listed across the x-axis. Percentage of engagement is plotted on the primary y-axis. Frequency of positive responses is upward on the secondary y-axis. Frequency of negative responses is plotted downward on the secondary y-axis.

*Figure 2.* Results for teacher participant Erica. The left panel depicts results for Erica’s presentation of items to Steve; the right panel depicts results for Erica’s presentation of items to Nick. The top panel depicts total duration of item presentation across sessions for each item. The bottom panel depicts aggregate data for each item. Teacher presentation and student engagement is plotted on the primary axis. Student rate of positive responses and negative responses is plotted on the secondary y-axis.

*Figure 3.* Results for teacher participant Lisa. The left panel depicts results for Lisa’s presentation of items to Steve; the right panel depicts results for Lisa’s presentation of items to Nick. The top panel depicts total duration of item presentation across sessions for each item. The bottom panel depicts aggregate data for each item. Teacher presentation and student engagement is plotted on the primary axis. Student rate of positive responses and negative responses is plotted on the secondary y-axis.

*Figure 4.* Results for teacher participant Matt. The left panel depicts results for Matt’s presentation of items to Steve; the right panel depicts results for Matt’s presentation of items to Nick. The top panel depicts total duration of item presentation across sessions for each item. The bottom panel depicts aggregate data for each item. Teacher presentation and student engagement is plotted on the primary axis. Student rate of positive responses and negative responses is plotted on the secondary y-axis.

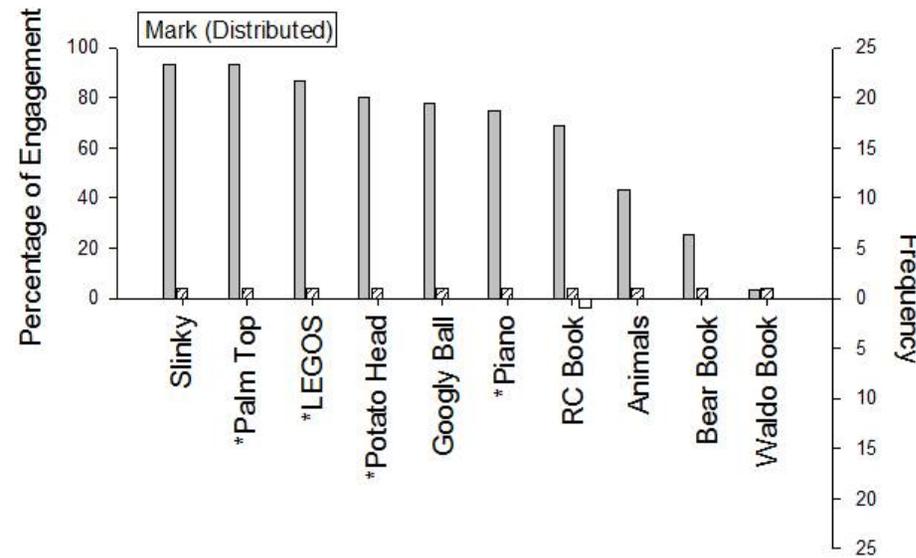
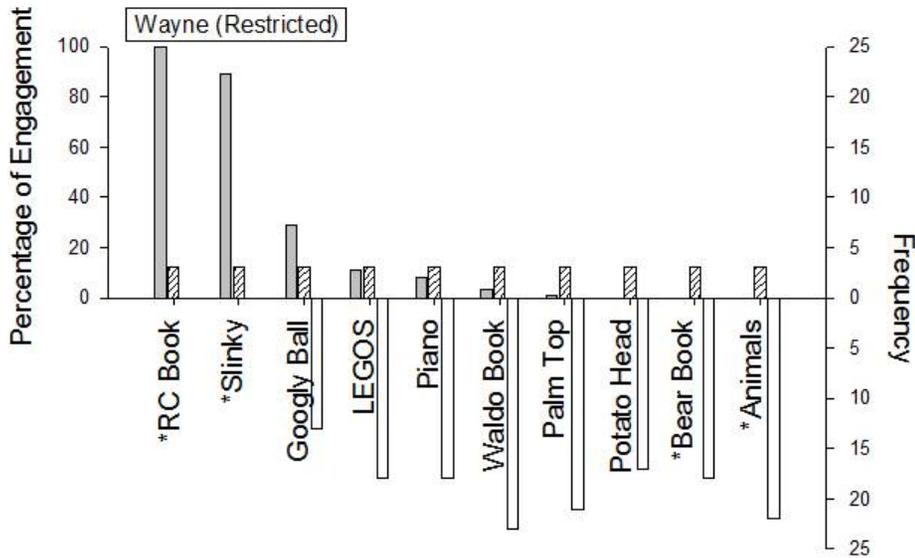
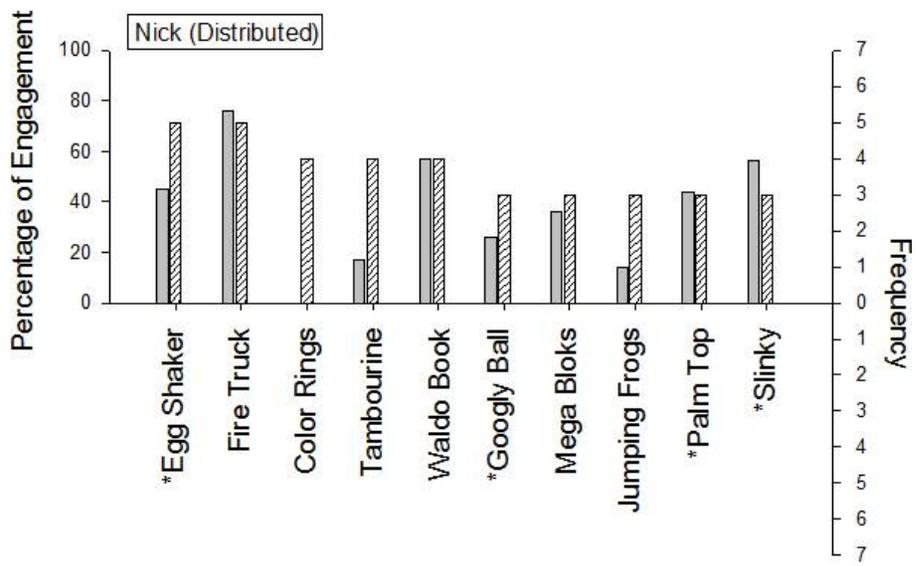
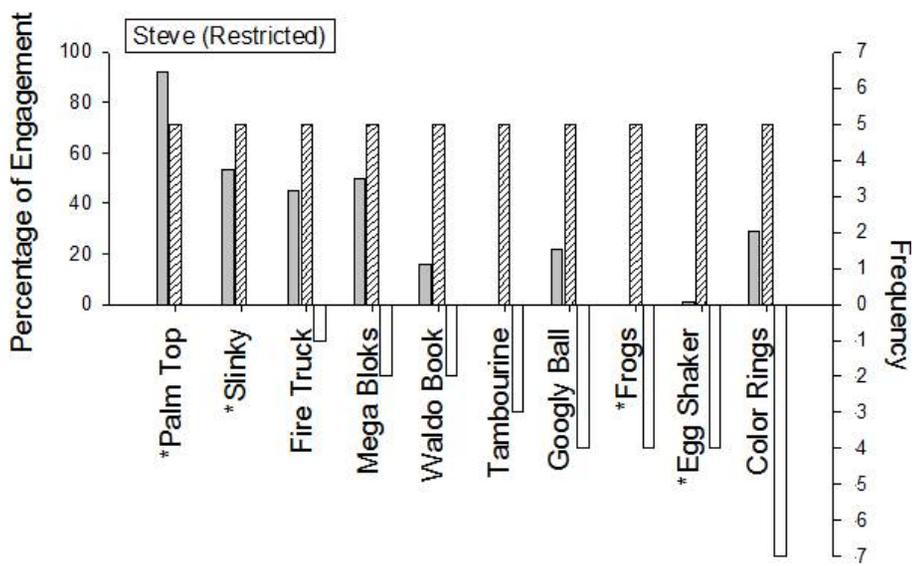
*Figure 5.* Results for teacher participant Carol. The left panel depicts results for Carol’s presentation of items to Wayne; the right panel depicts results for Carol’s presentation of items

to Mark. The top panel depicts total duration of item presentation across sessions for each item. The bottom panel depicts aggregate data for each item. Teacher presentation and student engagement are plotted on the primary axis. Rates of student positive responses and negative responses are plotted on the secondary y-axis.

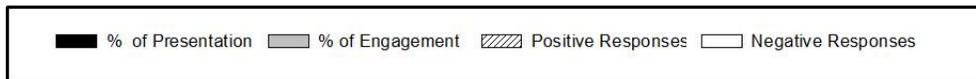
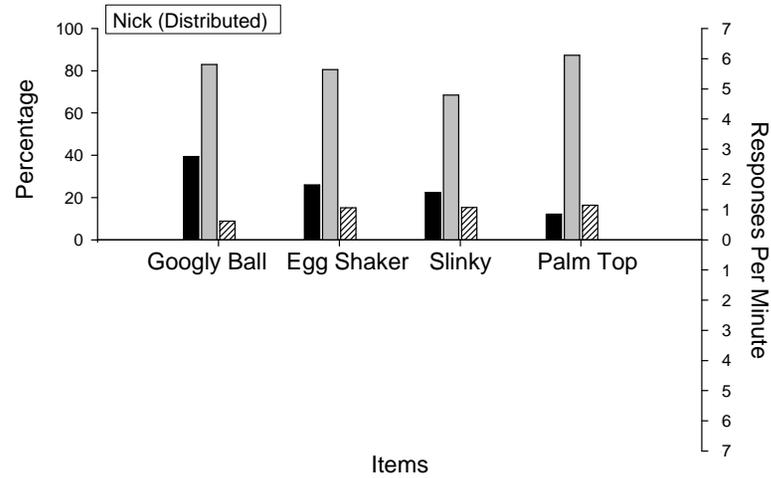
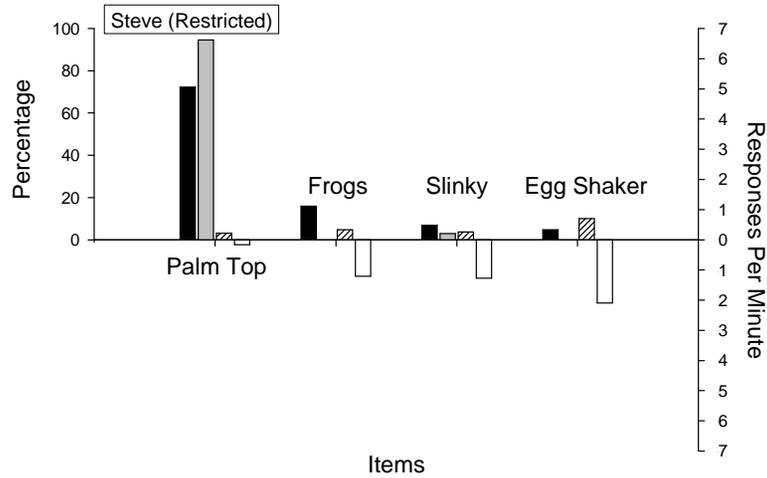
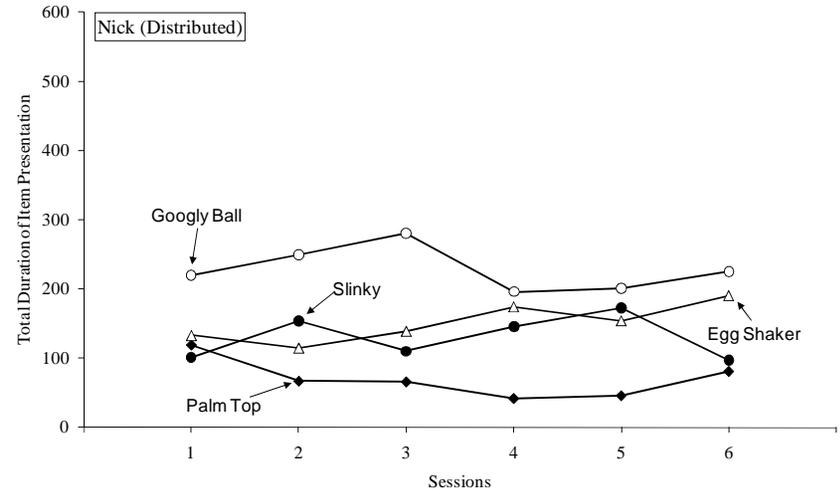
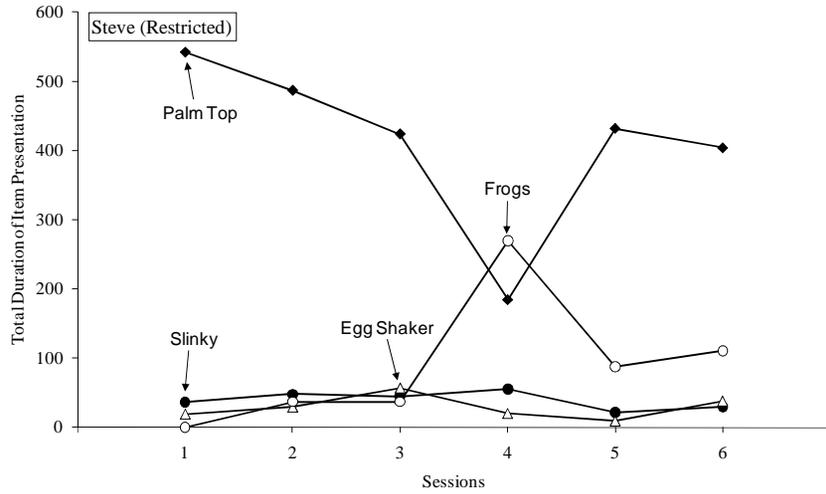
*Figure 6.* Results for teacher participant Amy. The left panel depicts results for Amy’s presentation of items to Wayne; the right panel depicts results for Amy’s presentation of items to Mark. The top panel depicts total duration of item presentation across sessions for each item. The bottom panel depicts aggregate data for each item. Teacher presentation and student engagement are plotted on the primary axis. Rates of student positive responses and negative responses are plotted on the secondary y-axis.

*Figure 7.* Event diagram of session 1 for teacher participant Lisa with student participant Steve. Within-session data depicting teacher presentation of items, student engagement, and student negative responses. Presentation of an item is noted by blips in the corresponding data path. Student engagement is noted by segmented lines above presentation blips. Negative responses are noted by tics on the top row.

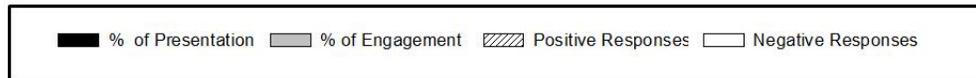
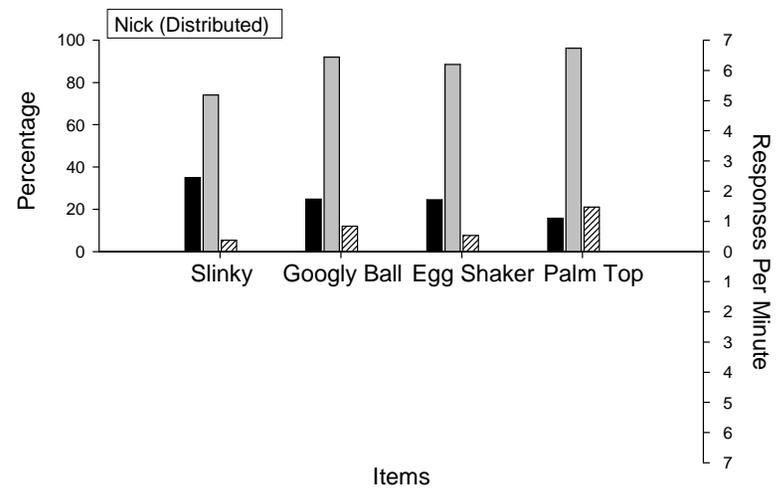
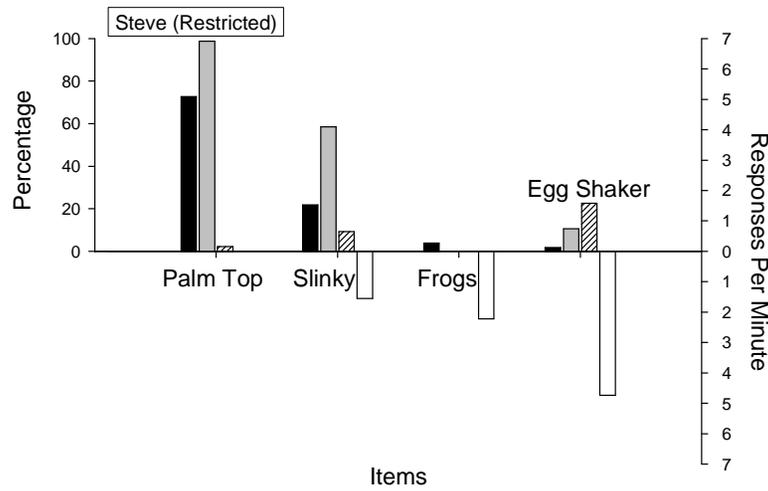
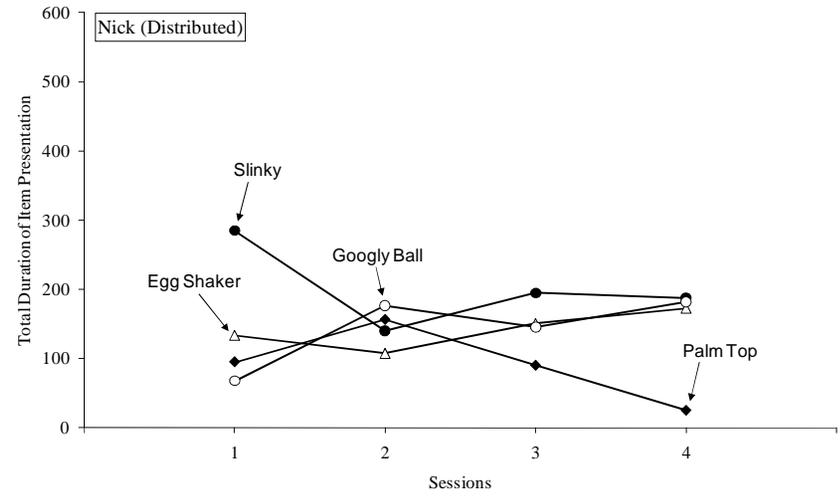
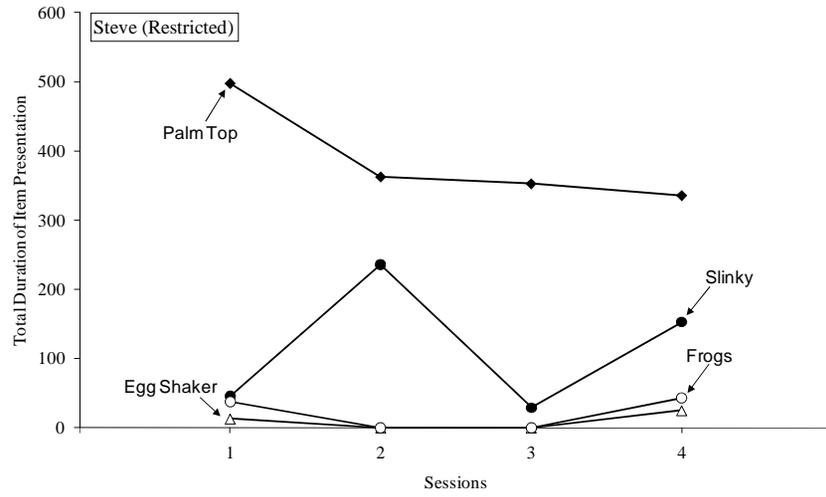
*Figure 8.* Event diagram of session 2 for teacher participant Carol with student participant Wayne. Within-session data depicting teacher presentation of items, student engagement, and student negative responses. Presentation of an item is noted by blips in the corresponding data path. Student engagement is noted by segmented lines above presentation blips. Negative responses are noted by tics on the top row.



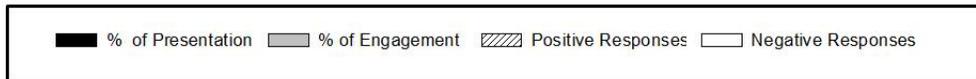
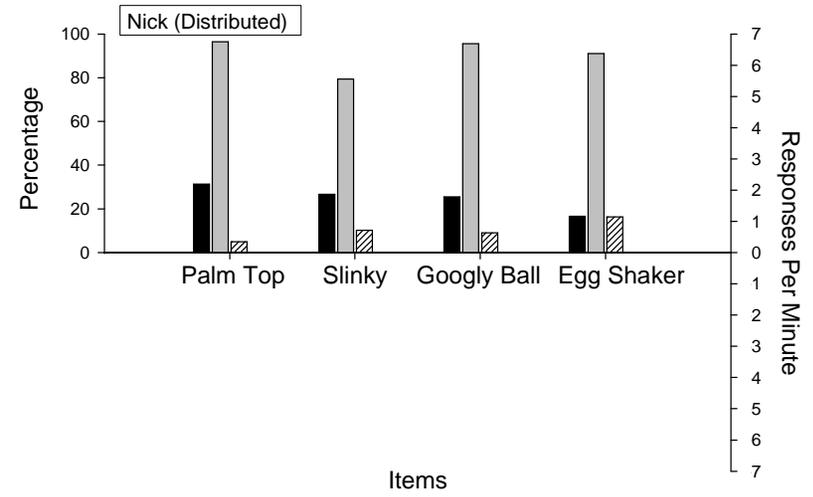
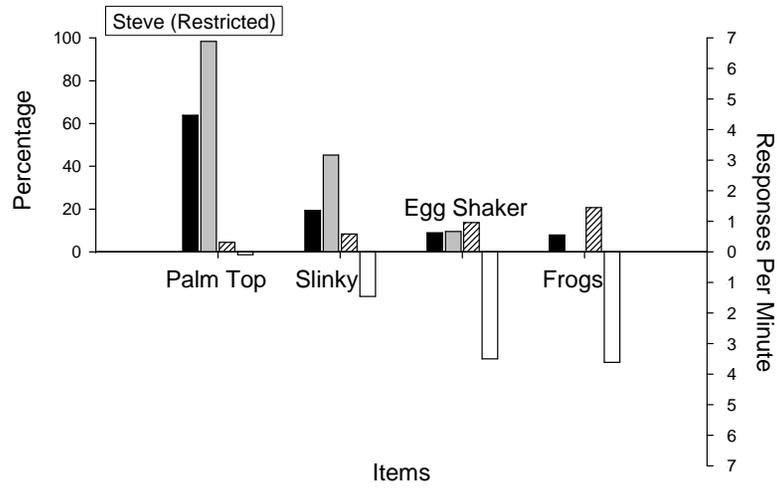
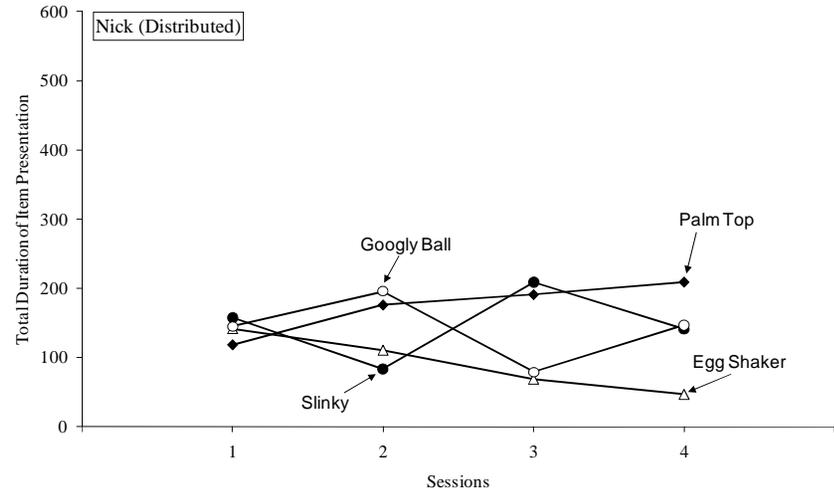
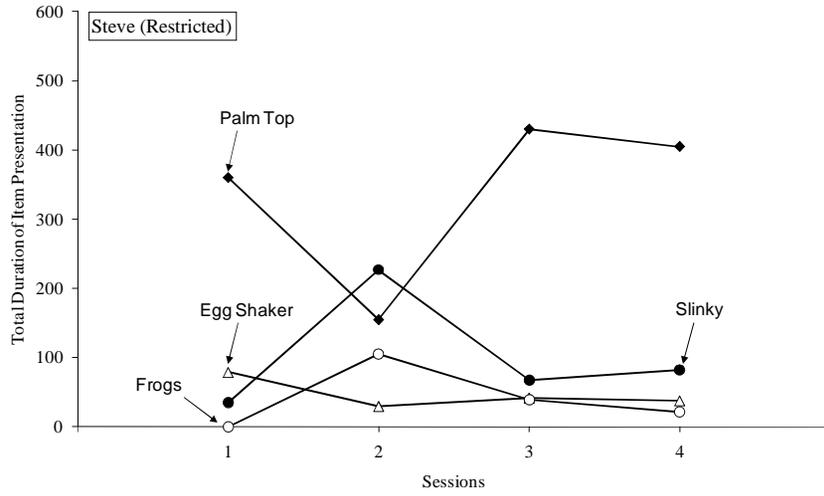
# Erica



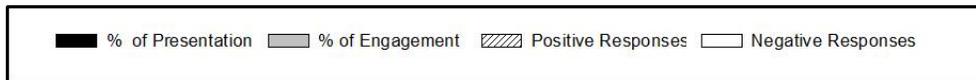
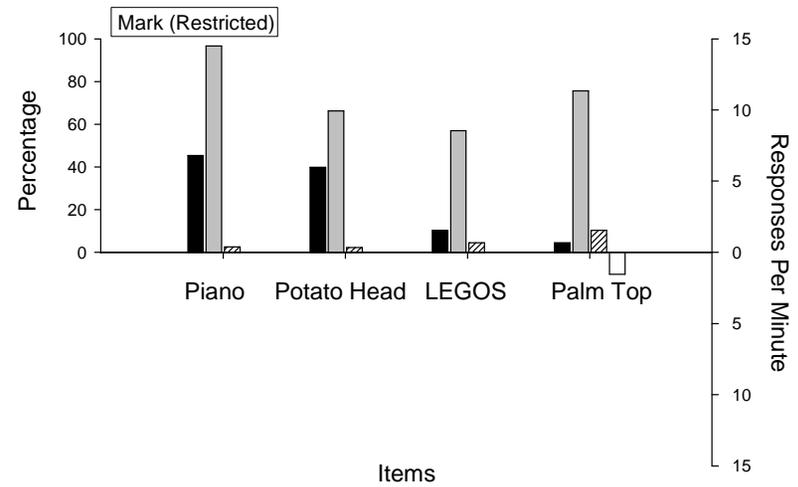
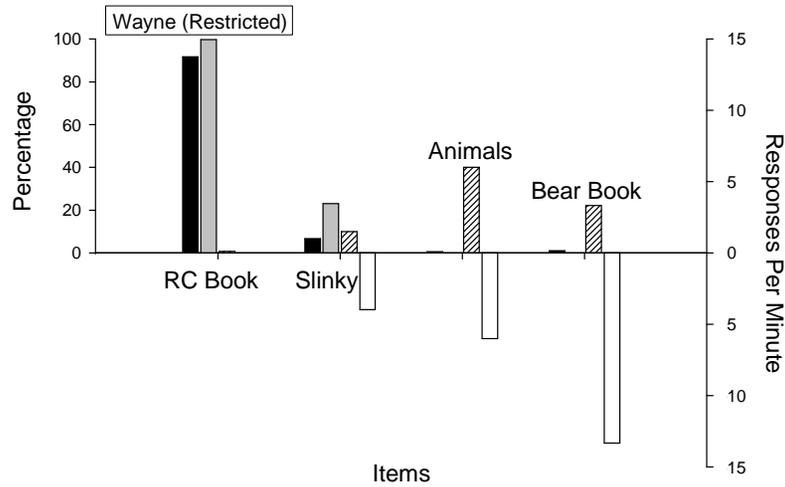
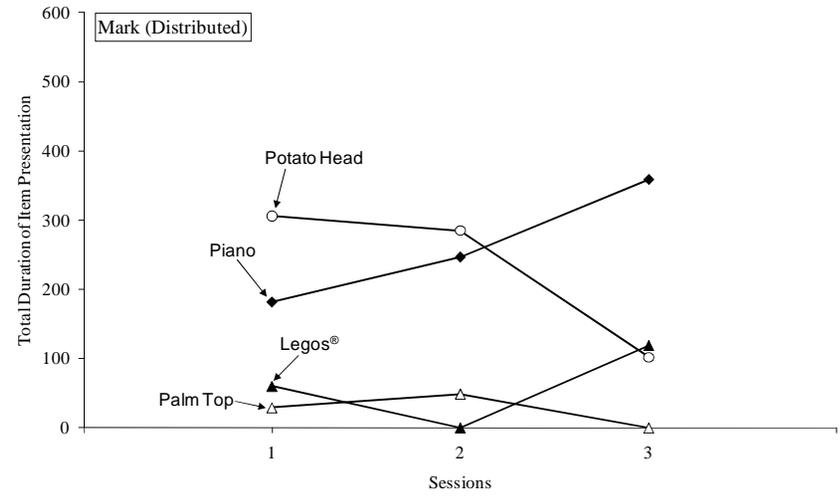
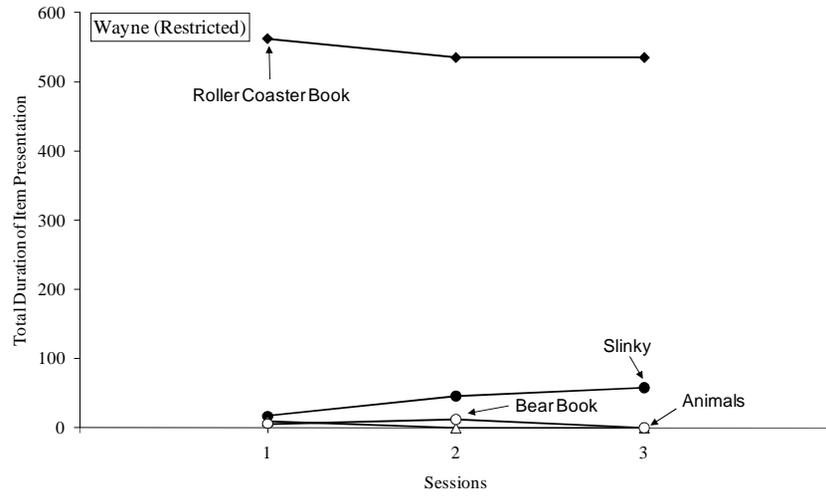
# Lisa



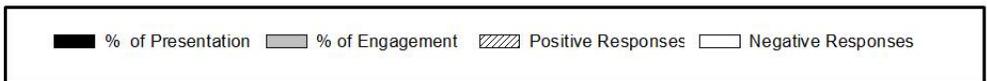
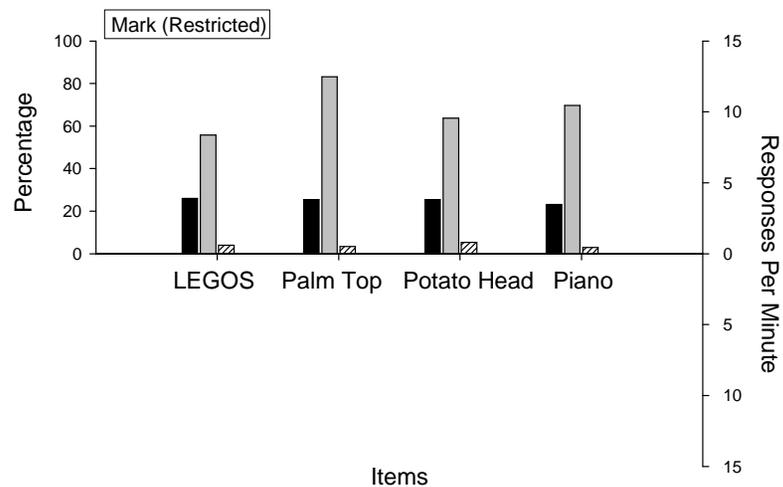
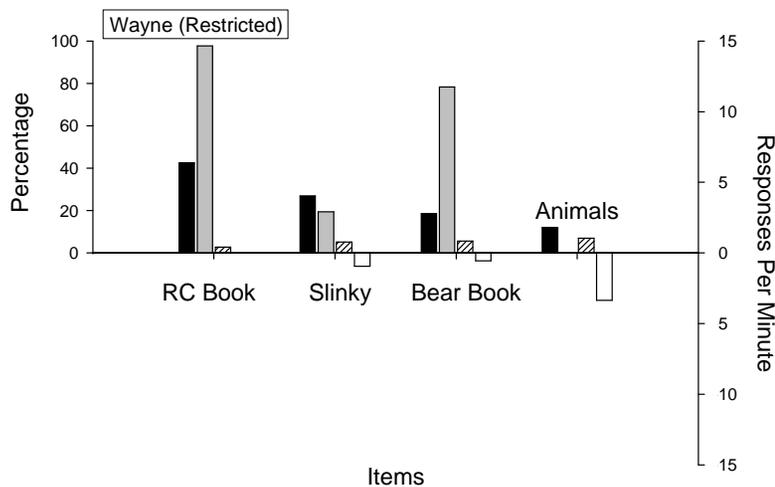
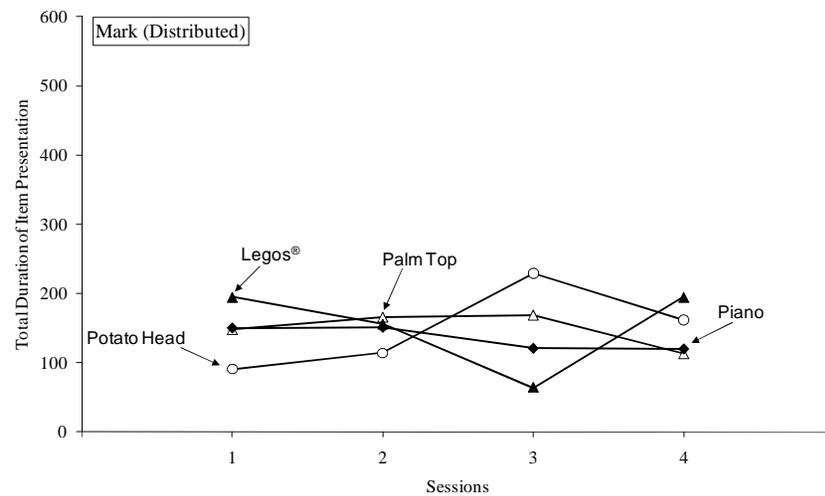
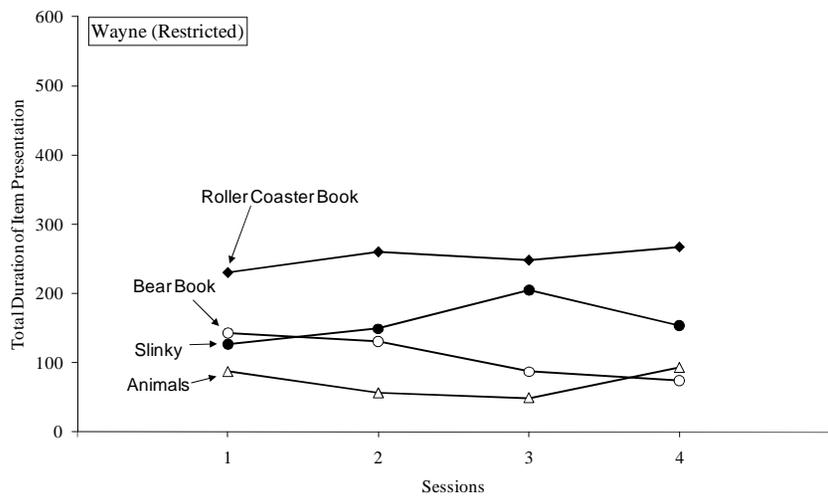
# Matt



# Carol



# Amy



Neg.  
Responses



Jumping  
Frogs



Egg Shaker



Slinky



Palm Top



0 50 100 150 200 250 300 350 400 450 500 550 600  
Seconds

Neg.  
Responses



Safari  
Animals



Bear Book



Slinky



Roller  
Coaster  
Book



0 50 100 150 200 250 300 350 400 450 500 550 600  
Seconds