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Comparison of Direct and Indirect Reinforcement Contingencies on Task Acquisition

A Thesis Presented

By

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Abstract

In order to effectively teach new skills, it is important to identify ways in which to reinforce the behavior. One important aspect of reinforcement is the way in which the reinforcer is delivered upon the completion of the task. Direct and indirect reinforcement are examples of two different contingencies of reinforcement, each associated with different stimulus arrangements. Direct reinforcement refers to arrangements in which the reinforcer is obtained through the completion of the task. Indirect reinforcement refers to arrangements in which the reinforcer is delivered through social mediation upon the completion of the task. Previous research conducted by Thompson and Iwata (2000), has found direct reinforcement to be more effective than indirect reinforcement in skill acquisition. The purpose of this study was to attempt to replicate the research of Thompson and Iwata (2000), and determine whether similar results would be found in a population of individuals with autism who have had a history with socially mediated reinforcement.

Comparison of direct and indirect reinforcement contingencies on task acquisition

When teaching a new skill, it is important to consider which stimuli will be delivered to reinforce the target response. In order to identify items that may be preferred by the individual, a variety of preference assessments may be conducted. One preference assessment to consider is the forced choice assessment proposed by Fisher, Piazza, Bowman, Hagopian, Owens, and Slevin (1992). In this study, a stimulus preference assessment and a forced choice assessment was conducted with 16 different stimuli with 4 participants with mental retardation. In stimulus preference sessions, the 16 stimuli were presented individually 10 times over 8 sessions. In each session, 4 stimuli were presented 5 times, and approach to a stimulus resulted in 5s of access to the item. In the forced choice assessment, each of the 16 items was paired once with each of the other stimuli. These stimuli were paired in a randomized order, for a total of 120 paired stimulus presentations. If the participant approached one of the items within 5s, they were granted access to the item for 5s and the other item was removed. The stimuli used in these assessments were then grouped based on the results as: high-high (approached at least 80% of the time on both assessments), SP high (approached at least 80% of the time in the stimulus preference assessment and less than 60% of the time in the forced choice assessment) or FC high (approached at least 80% of the time in the forced choice assessment and less than 60% of the time in the stimulus preference assessment). When multiple stimuli met criteria for a high-high stimulus, the 2 stimuli with the greatest agreement across both assessments were chosen. Conversely, when multiple stimuli met criteria for a SP-high stimulus, the 2 with the greatest disagreement between both assessments were chosen. These selected reinforcers were then placed in one of two squares or chairs, and the individual could then gain access to the reinforcer for 10s by completing independent in seat work. Results indicated that the stimuli identified as

high-high stimuli were associated with significantly higher durations of in-seat behavior. These results suggest that the forced choice assessment could be more effective in identifying potential reinforcers than just conducting a stimulus preference assessment alone.

Another method of identifying preferred items is the multiple-stimulus preference assessment presented by DeLeon and Iwata (1996). In this study, a multiple stimulus without replacement (MSWO), a paired stimulus (PS) and a multiple stimulus with replacement (MS) were conducted with 7 participants. In the MSWO assessment all of the items were laid out on the table, and after an item was chosen it was immediately removed from the area. The MS procedures were identical to those in the MSWO except for the fact that when an item was selected, it was replaced prior to the following session. Results indicated that there were stimuli that were identified as preferred in the MSWO and PS procedures that did not appear to be in the MS procedure. The effectiveness of these stimuli was assessed in a second experiment in order to determine if they supported levels of responding above baseline. The stimuli selected from the PS and MSWO procedures were implemented to reinforce a target response on an FR 1 schedules. Results indicated that the stimuli that were never selected during the MS procedure but selected during the MSWO and PS procedures increased responding. These results indicate that the MSWO and PS procedures identified more potential reinforcers than the MS procedure. The studies conducted by Fisher et al. (1992) and DeLeon and Iwata (1996) showed that direct assessment of preference is the most effective way to identify potential reinforcers.

Stimuli that are found to be preferred through these assessments can then be delivered contingent upon desired behaviors in order to increase the frequency at which they occur. Once preferred stimuli are identified, it is also important to determine the contingencies under which

the reinforcer will be delivered. Koegel and Williams (1980) compared direct and indirect response reinforcer relationships in teaching new behaviors. The purpose of this study was to examine differences between responding when the response was directly related to reinforcement, and when the response was not directly related to reinforcement and required social mediation to receive reinforcement. Direct response-reinforcer relationship was defined as one in which the target behavior is a direct part of a response chain required to produce a reinforcer (e.g., opening a container and retrieving a piece of food from inside the container). An indirect response-reinforcer relationship was defined as one in which the target behavior is an indirect part of the chain (e.g., a therapist delivers a piece of food contingent upon opening a container). Tasks were arbitrarily selected and included; saying “wh”, clapping, touching a book, discriminating white from green, discriminating between a square and a circle, and handing the therapist their own printed name. Results indicated that acquisition was met at a faster rate across participants and tasks when the target response was directly related to the response chain. The indirect condition was associated with low to high variable levels of correct responding, while the direct condition was associated with fast acquisition and high levels of correct responding in fewer trials.

Williams, Koegel, and Egel (1981), also compared the effects of direct and indirect reinforcement contingencies on acquisition, however, in this study the authors referred to direct as functional and indirect as arbitrary. Functional reinforcement was defined as reinforcement that was directly related to the response, while arbitrary reinforcement was defined as reinforcement that was not directly related and required social mediation. The purpose of this study was to determine if arbitrary stimuli can improve learning by being arranged so that they become functionally related to the target response. Furthermore, the authors were interested in

observing whether or not the performance achieved under functional reinforcement would be maintained if arbitrary reinforcers were introduced. Simple tasks were taught for each participant, for example; bending over, touching one's head, and reaching out one's hand. These tasks were observed under both the arbitrary and functional reinforcement conditions. In the arbitrary condition, touching one's head was reinforced by placing a reinforcer in the child's hand upon completion of the task, while in the functional condition the reinforcer was placed on the child's head, resulting in immediate reinforcement for head touching. Results showed low levels of responding in the initial arbitrary condition. Subsequent functional reinforcement sessions resulted in an immediate increase in acquisition for all of the participants. Furthermore, all of the children rapidly achieved high levels of correct responding between 5 and 25 trials. Maintenance was observed when the arbitrary condition was reinstated.

The effectiveness of these contingencies was also shown in a study conducted by Thompson and Iwata (2000) in which acquisition was observed under both direct (functional) and indirect (arbitrary) contingencies of reinforcement. The purpose of this study was to compare the effects of direct and indirect contingencies on individual performance, and to take data on reaching behavior under the indirect condition to observe whether the behavior may interfere with the target response. The effects of the direct and indirect contingencies were assessed on acquisition of opening clear plastic containers. Data were taken on correct independent responding, prompted correct responding, and reaching (observed only in the indirect condition). Reaching was defined as the participant trying to take the reinforcer from the therapist instead of engaging in the target response. Effects of these conditions were assessed under a multi-element design in which baseline, indirect, and direct contingencies were alternated. For all the other participants, results indicated that the direct condition was correlated with more rapid acquisition

than in the indirect condition. Response acquisition was observed in both conditions for 4 of the participants: however, 3 of these participants had a higher percentage of correct responding in the direct reinforcement condition. The indirect reinforcement condition was also found to be ineffective for 2 of the participants in that the response was not acquired in this condition. These results supported the hypothesis made by the authors who stated that the direct condition would be more effective in teaching acquisition, and that reaching may have inhibited responding in the indirect condition.

The purpose of the current study was to replicate the procedures of the research conducted by Thompson and Iwata (2000), in order to determine whether the results obtained are similar to those produced by Thompson and Iwata (2000), which indicated that direct contingencies were more effective than indirect contingencies in teaching new skills.

Methods

Participants and Setting

Six participants with autism spectrum disorder were selected to participate in this study because they were recommended by their teachers as not already having these skills in their repertoire. Alex, an 11 yr-old boy diagnosed with autism who has adequate fine motor skills and was able to print, eat, and dress himself with his dominant hand. He also had the ability to attend to verbal and model prompts. Sessions were conducted at his residential home in a room in which other teachers and students weren't present, typically the kitchen or living room. These sessions were conducted once or twice per week with 2 sessions conducted per work day. Ricky, a 12 yr-old boy diagnosed with autism who has limited fine motor skills, as he has low muscle tone in his hands. At times, his ability to complete fine motor tasks was also limited due to lack

of attending. He also engages in frequent problem behavior, such as climbing and grabbing.

Sessions were conducted in his residential group home twice a week, with 3 sessions conducted per work day. These sessions were conducted in a quiet room with only relevant task materials, reinforcers, and his primary teacher present. Ethan, an 8 yr-old boy diagnosed with autism who has very limited fine motor skills and may require assistance completing simple tasks, such as opening a box of cereal. Sessions were conducted 3 days a week, with 3 sessions conducted per work day at his residential group home in a quiet room with only relevant materials present.

Matt, a 9 yr-old boy diagnosed with autism who also has very limited fine motor skills and may require assistance completing simple tasks. This individual also has poor in-session behavior, meaning he has trouble attending, is easily distracted, may attempt to bolt, or will flop on the ground for extended periods of time. His sessions were conducted in a cubby area designated for him at his school. This cubby consisted of a desk with 2 chairs, and a curtain in order to block the view of others walking by. Sessions were conducted 2 days per week and 2 – 4 sessions were conducted per work day.

Procedure

To determine which containers would be selected, pre-session assessments were conducted to identify appropriate materials for each student. If the participant could independently open the container more than a couple of times, that session was discontinued and a different session began with new materials. Once an appropriate container was selected, a paired stimulus preference assessment was conducted with each participant to identify a preferred edible to use for the reinforcement conditions.

In baseline and reinforcement sessions, the participant was given the verbal prompt “open”, and was then given 5 seconds to open the container. If the participant did not open the container within the initial 5 seconds, the experimenter either modeled the correct response (Alex and Ryan) or manually guided the participant to complete it (Ethan and Matt), and repeated the verbal prompt “open”. The participant was then given an additional 30 seconds to open the container. If the participant opened the container during the additional 30 seconds, it was considered a correct prompted response. If the participant was unable to open the container during the additional 30-s, it was considered to be an incorrect response. Baseline, direct, and indirect conditions were alternated in a multi-element design for one participant and a multiple baseline design for all others until mastery criteria was met in one of the conditions (9/10 correct independent responding for 3 consecutive sessions).

In baseline sessions, there was no consequence for correct or incorrect responding. If the participant emitted the target response, there was a 15-s delay before the initiation of the next trial. In the direct condition, procedures were similar to those described in baseline; however, preferred edible reinforcers were placed inside the clear container. In this condition, correct responding resulted in direct reinforcement as the participant was able to retrieve the edible without social mediation. The indirect condition procedures were also similar to baseline, however, in the indirect condition the experimenter held out a preferred edible approximate 12 inches away from the participant so that it was in their view. Correct responding resulted in the delivery of the edible by the experimenter. Instances of reaching in indirect sessions were ignored and the trial continued, however, the experimenter attempted to prevent the participant from obtaining the edible.

Dependent Variables

The dependent variables in this study are correct responding, reaching and problem behavior. Correct responding was defined as opening the container enough so that the participant could reach inside. If the participant opened the container with-in the additional 30-s, it was considered to be a correct prompted response. Reaching was defined as instances in which the participant reached out for an edible held with-in eye sight, which interfered with the completion of the target response. Problem behavior was defined as any undesirable behavior, such as; aggression, flopping, climbing, or self-injury.

Measurement and Interobserver Agreement

During pre-sessions and training sessions, data were taken with pen and paper by the instructor conducting the sessions. Data were collected in 10 trial sessions, in which data was taken after each trial. For each trial, the participant could have emitted a correct response, a correct prompted response, or an incorrect response. Data were also taken on interfering behavior that occurred in the indirect condition only which was referred to as reaching. Occurrences of reaching behavior were tallied after each trial to determine if it may have been related to the participant's performance in the indirect condition. Other forms of problem behaviors (e.g. aggression, flopping, climbing, or self-injurious behavior) were also recorded.

Interobserver agreement (IOA) was conducted by training a graduate level student to score data from previously videotaped sessions. Percentage of agreement was calculated by dividing the number of sessions with agreement by the number of sessions with agreement and disagreement.

IOA was collected for 26% of all sessions for Alex, with a mean agreement of 98% (range 90%-100%), and a mean agreement of 100% for reaching. IOA was collected for 38% of all sessions for Ricky, with a mean agreement of 98% (range 90% - 100%) for correct responding, a mean agreement of 100% for reaching, and a mean agreement of 82% (range 80% -90%) for problem behavior. IOA was collected for 29% of all sessions for Matt, with a mean agreement of 100% for correct responding, and a mean agreement of 97% (range of 90% - 100%) for reaching. IOA was collected for 15% of sessions for Ethan with a mean agreement of 97% (range 90% - 100%) for correct responding, and a mean agreement of 100% for reaching.

Results

Results from this study are shown in figures 1-4. Results for Alex, shown in figure 2, indicate that both the direct and indirect contingencies were equally effective in teaching the target response. Initial baseline sessions resulted in no correct responding, prompted or independent, for 2 consecutive sessions. However, once the reinforcement contingencies were implemented, correct responding was observed in 100% of opportunities in the initial indirect session and each of the subsequent indirect or direct sessions. While levels of correct responding were high in the indirect conditions, little to no instances of reaching were observed. An increasing trend of correct responding was also observed across baseline.

Results for Ricky indicate that both reinforcement contingencies were effective in teaching the target response. Initial baseline sessions produced no correct responding, prompted or independent. An immediate increase in correct responding was observed once reinforcement conditions were implemented. While performance appeared to be slightly better in the initial direct sessions, both conditions produced high stable levels of correct responding and were

effective in teaching the task. Levels of reaching in indirect conditions were low and stable, as only 1 instance occurred in the 4th session. Problem behavior was also measured for Ryan as it was observed in each of the conditions. Levels of problem behavior were the highest in the baseline sessions, ranging from low to high levels (3 – 7 instances per session). Problem behavior was observed at low undifferentiated levels in the direct and indirect conditions.

Results for Matt indicate that both reinforcement contingencies were effective in teaching the target response. Initial baseline sessions produced no correct responding. In both the direct and indirect condition, the first sessions produced no correct responding. Subsequent sessions were then conducted in a cubby at his school. After the relocation, an immediate increase was observed in both the indirect and direct conditions and remained stable for each remaining session. Reaching occurred at very low levels and was only observed once during the 7th session.

Results for Ethan indicate that both direct and indirect reinforcement were equally effective in teaching the target skill. Initial baseline sessions produced no correct responding, prompted or independent. The initial direct and indirect conditions also produced no correct responses, as a result the prompting procedure was changed as it was determined that a model prompt was not sufficient. As a result a physical prompt was utilized as it was believed to be more appropriate for this individual as he had no history with model prompts. The first session with the physical prompt was an indirect session which produced no correct responses. However, on the subsequent direct session, a high level of correct responses was observed. Each session after that produced 100% correct responding in both the direct and indirect conditions. Reaching occurred at moderate levels in the first indirect session, however, as Ethan acquired the task levels of reaching decreased and remained stable.

Discussion

Results from the current study did not replicate the results of previous research that found direct contingencies to be more effective in teaching than indirect contingencies. While the results that were observed were unexpected, there are several reasons why this may have occurred. First, the majority of the participants in this study have a long history with socially mediated contingencies of reinforcement. As a result, the difference between direct and indirect reinforcement may not have been as significant for these participants. The availability of reinforcement in this case seemed to function as enough of a reinforcer that the arrangement did not have a significant impact on its effectiveness.

Another possible explanation for the results is that work itself may have been reinforcing. Since these participants have had such a long history with reinforcement for following instructions, the presentation of a verbal prompt may function as a discriminative stimulus, and completion of the task is automatically reinforced. This could explain the increasing levels of correct responding observed with Alex during baseline.

Finally, the simplicity of the tasks taught could explain why similar results were observed. While the individuals who participated in this study couldn't initially complete the task, rapid acquisition was observed across participants under both the direct and indirect conditions. Since this was the case, the participants may have consistently emitted the correct response because of the simplicity of the task and reinforcement delivered or obtained upon completion.

In the present study there are a number of potential limitations. First, each of the participants that took part in the study had some sort of history of reinforcement for correctly responding to

verbal prompts. Therefore, the presentation of work may have been reinforcing itself, as it may have signaled that reinforcement would be delivered. This could possibly explain why both the direct and indirect contingencies were equally effective in teaching the tasks presented. Different results may have been observed if participants with no history of socially mediated reinforcement were included in this study.

Second, a change was made in the prompting procedure used for Ethan during the reinforcement sessions. This was done because it was determined that a model prompt was not appropriate for this individual as he had no history with that type of prompt, and did not have the skills in his repertoire to attend to a model prompt. Therefore, a physical prompt was implemented as the researcher believed it would give Ethan the opportunity to acquire the task, and possibly still allow for some difference in the reinforcement contingencies to be shown. While this prompt proved to be sufficient in teaching the task, no difference was noted between the reinforcement contingencies. Therefore, it is difficult to determine whether the prompting procedure or the reinforcement contingencies were responsible for teaching the task, or to what extent each teaching method had on acquisition.

Future research should examine the effectiveness of direct and indirect contingencies of reinforcement on individuals who have had no history with socially mediated reinforcement and those who have to determine whether a history of this type of reinforcement contingency has an effect on performance. Results could then be compared to see if it is the presentation of the task itself which is reinforcing or whether it is certain aspects of the direct and indirect contingencies. More complex skills could also possibly be taught under these contingencies in order to determine whether or not one is more effective than the other. More complex tasks may take

more time for the participant to acquire the skill and may allow for some differentiation to be observed between the direct and indirect contingencies. More complex tasks may also result in longer session length which might evoke problem behaviors such as reaching or other problem behaviors which could influence performance under each condition.

Future research should also examine whether or not socially mediated reinforcement necessary to teach new skills. If reinforcement is necessary, to what extent do you need to utilize it in order to effectively teach? And if reinforcement is not necessary, to what extent can it be removed. Work itself may be reinforcing for some individual's with a history of reinforcement for following instructions, but if a particular response is put on extinction, how long would the individual continue to emit that response?

Finally, future research should continue to compare these contingencies, and if differences in their effectiveness are observed, sources of stimulus control that may enhance or hinder these contingencies should be examined. In doing so, we could then apply the findings to further improve methods of reinforcement by limiting possible inhibiting properties of indirect contingencies and by utilizing the possible enhancing properties of direct contingencies.

References

- DeLeon, I.G. & Iwata, B.A. (1996). Evaluation of a multiple-stimulus presentation format for assessing reinforcer preferences. *Journal of Applied Behavior Analysis*, 29, 519-533.
- Fisher, W., Piazza, C.C., Bowman, L.G., Hagopian, L.P., Owens, J.C., & Slevin, I. (1992). A comparison of two approaches for identifying reinforcers for persons with severe and profound disabilities. *Journal of Applied Behavior Analysis*, 25, 491-498.
- Koegel, R.L., & Williams, J.A. (1980). Direct versus indirect response-reinforcer relationships in teaching autistic children. *Journal of Abnormal Psychology*, 8, 537-547.
- Thompson, R.H., & Iwata, B.A. (2000). Response acquisition under direct and indirect contingencies of reinforcement. *Journal of Applied Behavior Analysis*, 33, 1-11.
- Williams, J.A., Koegel, R.L., & Egel, A.L. (1981). Response-reinforcer relationships and improved learning in autistic children. *Journal of Applied Behavior Analysis*, 14, 53-60.

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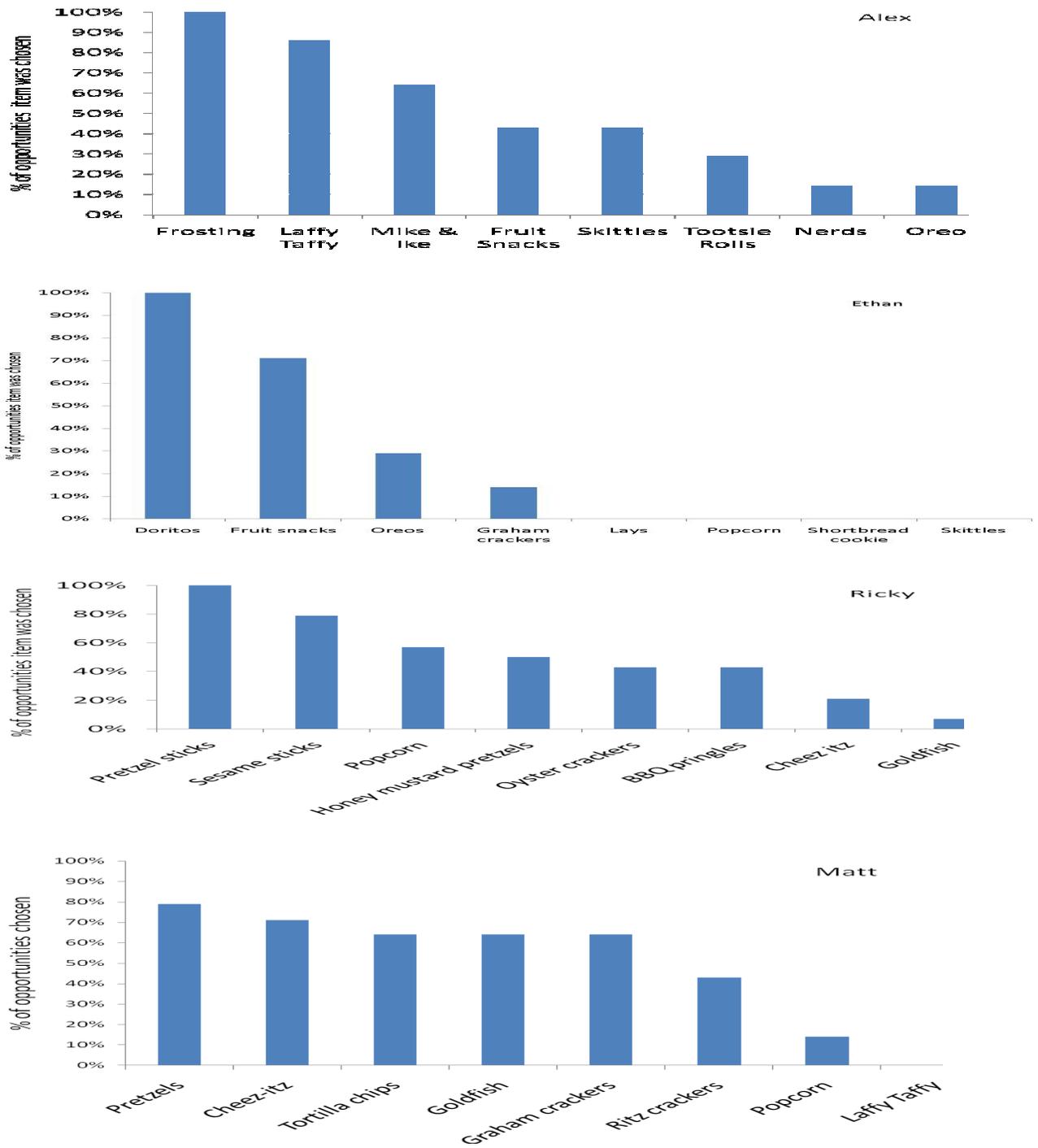


Figure 1. Results from the paired stimulus preference assessments conducted with all 4 participants before sessions began.

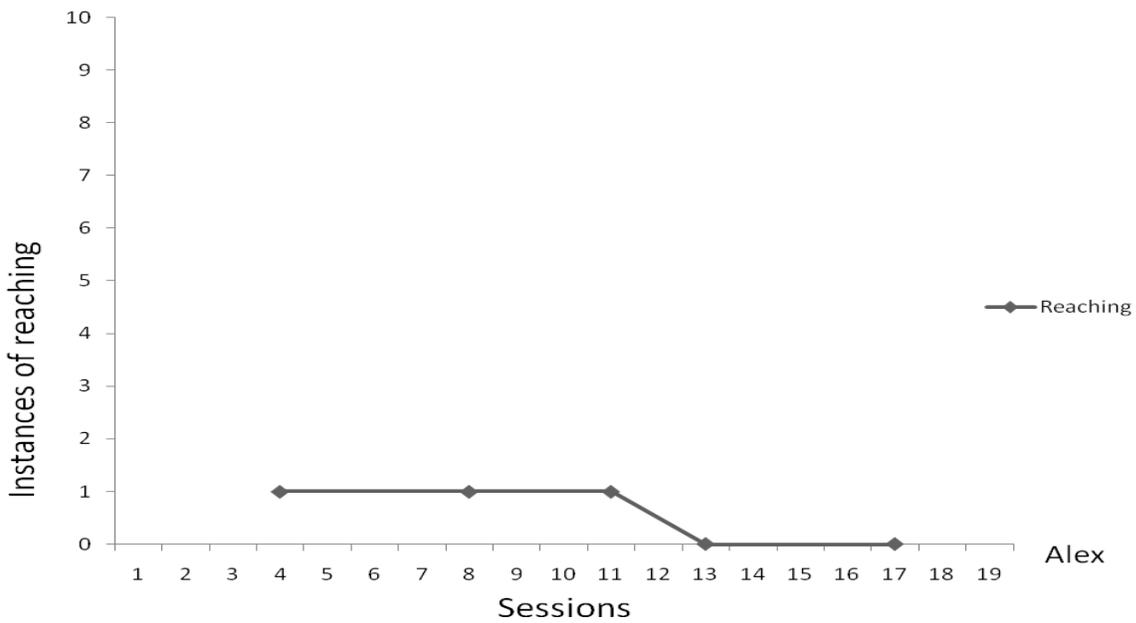
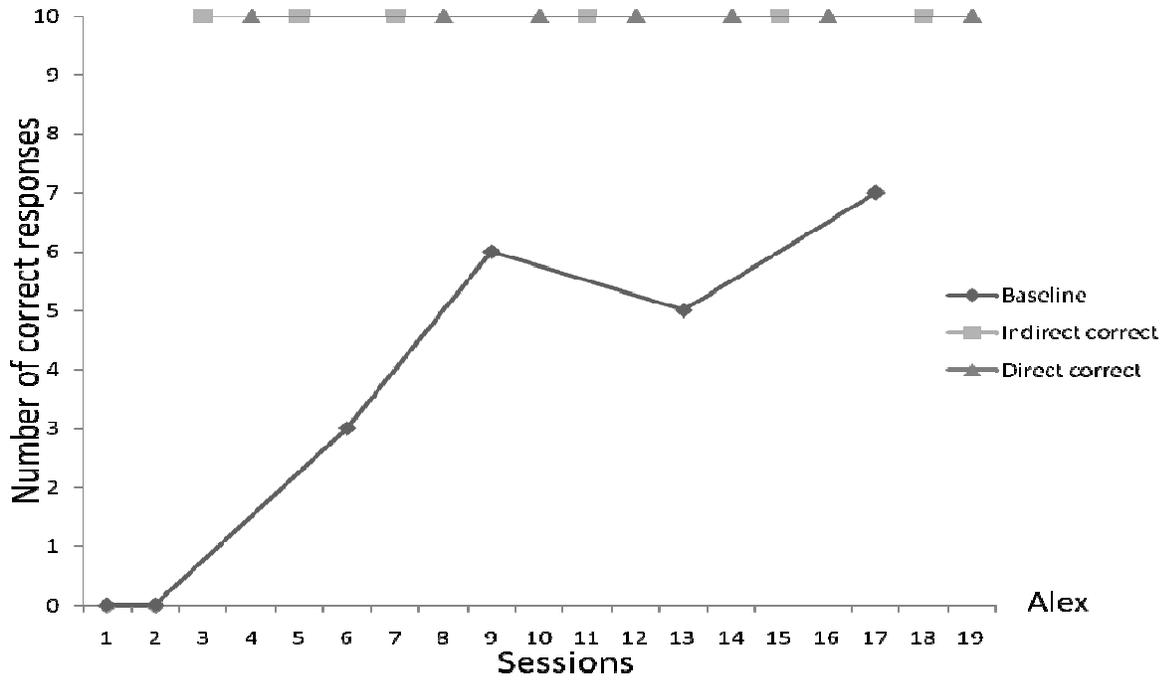


Figure 2. Results from the multi-element design conducted with Alex only. Top graph depicts the total number of correct responding, both prompted and unprompted, in all conditions. Bottom graph depicts instances of reaching behavior.

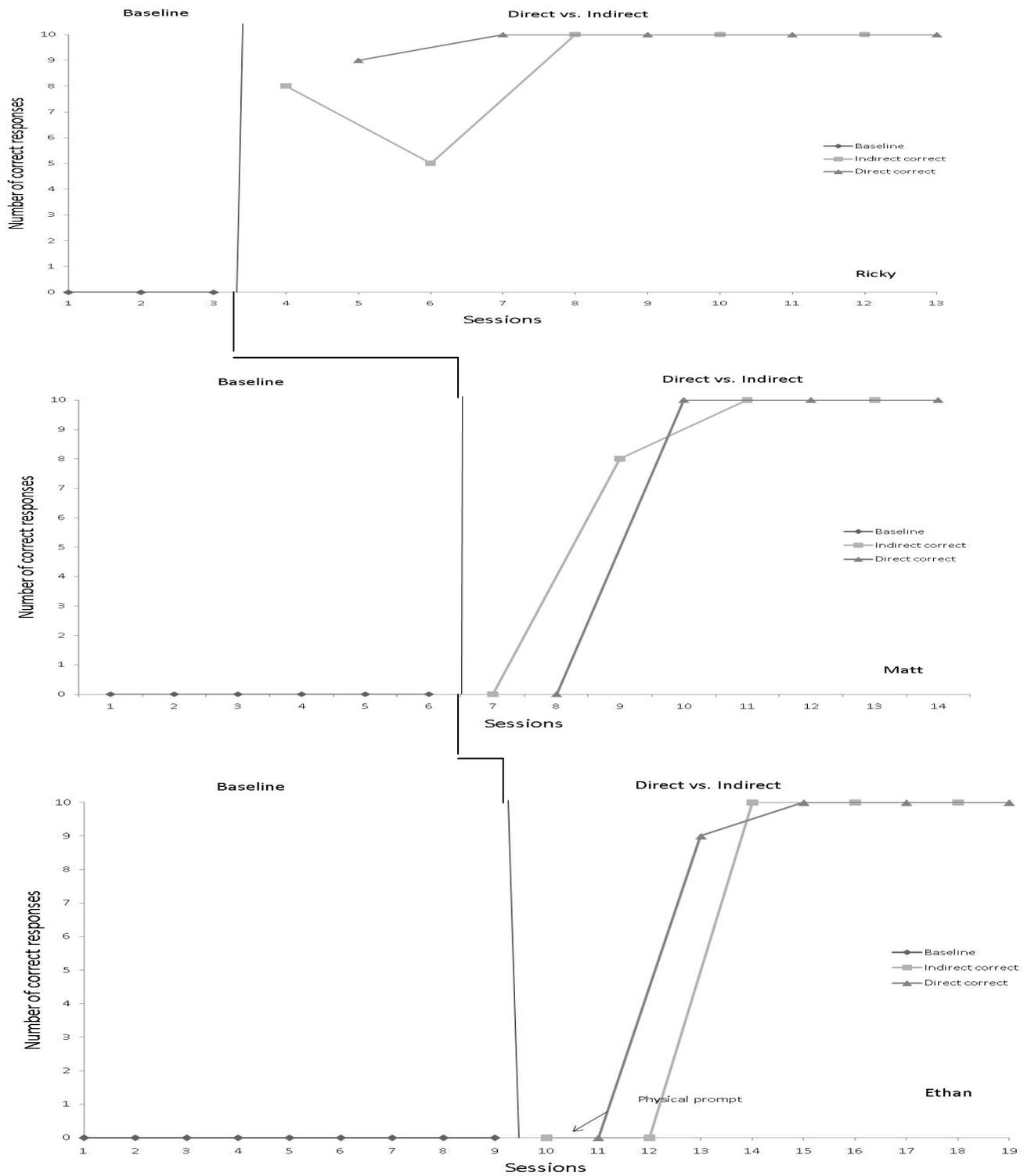


Figure 3. Results for Ricky, Matt, and Ethan, shown in a multiple baseline design, showing the total number of correct responses in baseline, and direct and indirect conditions.

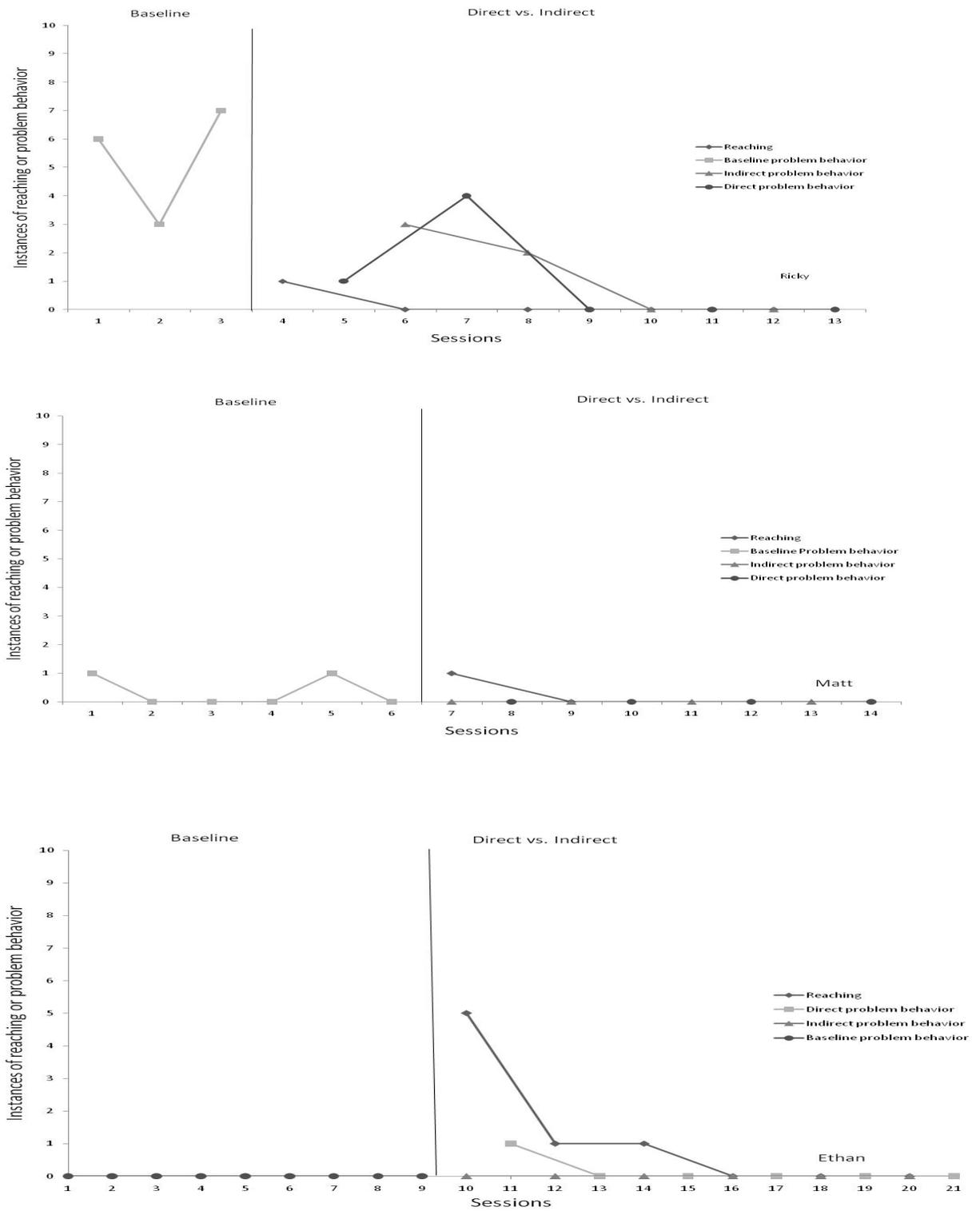


Figure 4. Data representing instances of reaching for Ricky, Matt and Ethan, and problem behavior.