THE EFFECTS OF DIFFERENT IMMEDIATE HISTORIES OF REINFORCEMENT ON SUBSEQUENT RESPONDING IN YOUNG CHILDREN

BY

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Abstract

Previous research has shown that providing continuous access to a stimulus decreases subsequent responding for that stimulus, and restricted access (i.e., no access) to a stimulus increases subsequent responding for that stimulus. An important implication of these findings is that certain immediate histories of reinforcement may affect whether certain stimuli may subsequently be used as reinforcers for effective teaching. Although previous research has shown that continuous and restricted access to reinforcers affect subsequent responding, little is known about the effect other immediate histories of reinforcement may have on subsequent responding to access those reinforcers. Therefore, the purpose of the current study was to replicate and extend previous research by evaluating the effects of four different immediate histories of reinforcement on subsequent responding on a pre-academic task to access that reinforcer and other concurrently available stimuli.

The Effects of Different Immediate Histories of Reinforcement on Subsequent Responding in Young Children

Previous research has shown that contingent delivery of stimuli such as edibles, attention, and access to preferred items/activities can be used to increase the occurrence of socially desirable behavior across various populations and in numerous contexts (e.g., Adelinis, Piazza, & Goh, 2001; Baer & Sherman, 1964; Brackbill, 1958; Buell, Stoddard, Harris, & Baer, 1968; Hart & Risley, 1995; Lancioni, 1982; Milby, 1970; Rheingold, Gewirtz, & Ross, 1959; Thomas, Becker, & Armstrong, 1968). Various factors may influence the degree to which these and other stimuli function as a reinforcer including (a) type or quality of the stimulus (e.g., Fisher, Ninness, & Piazza, 1996; Kazdin & Klock, 1973; Neef, Mace, Shea, & Shade, 1992; Piazza et al., 1999); (b) magnitude of the stimulus (e.g., Trossclaire-Lassere, Lerman, Call, Addison, & Kodak, 2008); (c) immediacy of stimulus delivery (Bijou, 1995; Hanley, Iwata, & Thompson, 2001); (d) schedule of stimulus delivery (Gable & Shores, 1980); (e) motivating operations (e.g., Gewirtz & Baer, 1958a; Gewirtz & Baer, 1958b; Vollmer & Iwata, 1991); and (f) conditioning history (Baer, 1962; Bijou & Baer, 1965).

As mentioned, one important factor that may influence the effectiveness of a stimulus as a reinforcer is motivating operations (MO; Laraway, Snycerski, Michael, & Poling, 2003). Motivating operations are antecedent events that momentarily alter the effectiveness (value) of a reinforcer and the frequency of responding associated with obtaining that reinforcer. One type of MO establishes or increases the effectiveness of a reinforcer and increases responding associated with obtaining that reinforcer. Another type of MO abolishes or decreases effectiveness of a reinforcer and decreases responding

associated with obtaining that reinforcer. For example, food *deprivation* is a type of MO termed an establishing operation (EO) that increases the efficacy of food as a reinforcer and increases the occurrence of behavior that has resulted in obtaining food in the past. Food *satiation* is a type of MO termed an abolishing operation (AO) that decreases the efficacy of food as a reinforcer and decreases the occurrence of behavior that results in access to food. Thus, the availability of a particular reinforcer in an individual's recent history may affect the frequency of responding for that reinforcer.

Numerous studies have shown that response acquisition and maintenance of behavior may be momentarily affected by motivating operations (i.e., a recent history of reinforcer availability). That is, exposure to or restriction from a particular stimulus has been shown to affect responding in subsequent situations including preference and reinforcer assessments (e.g., Gewirtz & Baer, 1958a, 1958b; Gottschalk, Libby, & Graff, 2000; McAdam et al., 2005; North & Iwata, 2005; Sy & Borrero, 2009; Vollmer & Iwata, 1991; Zhou, Iwata, & Shore, 2002), engagement in preferred activities (e.g., Klatt, Sherman & Sheldon, 2000), academic tasks (e.g., Martens et al., 2003), and functional analyses (e.g., Berg et al., 2000; McComas, Thompson, & Johnson, 2003; O'Reilly, 1999; Iwata, Duncan, Zarcone, Lerman, & Shore, 1994;).

Most studies on the effects of immediate histories of reinforcement on subsequent responding have evaluated the effects of prior restricted access (no access) or continuous access to a particular stimulus on subsequent responding for that stimulus. For example, in two early studies, Gewirtz and Baer (1958a, 1958b) found that (a) no access (deprivation period) to attention resulted in an increase in subsequent responding for

attention and (b) continuous access (a satiation period) to attention resulted in a decrease in subsequent responding for that stimulus.

In the first study, Gewirtz and Baer (1958a) evaluated participants's responding on a marble-dropping task with and without presession social deprivation. In the social-deprivation condition, the participant were told that the experimenter needed to go find something and were left alone in a room with access to toys for 20 min. After the 20-min period, the experimenter returned and conducted a 10-min session in which praise was delivered for placing a marble in a pre-specified hole. In the control condition, presession social deprivation was not conducted. That is, the participant was immediately taken to a room, and the 10-min session in which praise was delivered for correct responding to the marble-dropping task was conducted. Results showed that higher levels of correct responding to the marble-dropping task occurred during sessions that were conducted after the social-deprivation period. Although the participant was left alone during the social-deprivation period, the experimenters suggested that social deprivation may be implemented in which the experimenter is present but very low levels of attention are delivered.

In a follow-up study, Gewirtz and Baer (1958b) extended the study conducted by Gewirtz and Baer (1958a) by comparing the effects of social deprivation and social satiation on subsequent responding. The social-deprivation condition was identical to the one conducted in Gewirtz and Baer (1958a). In the social-satiation condition, the experimenter brought the participant to the room and provided continuous social interaction for 20 min. After this 20-mini period, the 10-min session in which praise was delivered for correct responding on the marble-dropping task was conducted. Results

showed that higher levels of correct responding on the marble-dropping task occurred after periods of social deprivation as compared to periods of social satiation.

Vollmer and Iwata (1991) extended the studies by Gewirtz and Baer by evaluating the effects of presession periods of deprivation and satiation with various stimuli (i.e., edibles, social interaction/praise, and music). Presession periods involved 10 min (edibles), 15 min (social interaction/praise), or 30 min (music) of either no access (deprivation) or continuous access (satiation) to the stimulus. Following deprivation and satiation periods, a "test session" was conducted in which the stimulus was provided contingent upon responding on a block-placement or switch-closure task. Similar to the results of the Gewirtz and Baer studies, results showed that the mean response rate on these tasks was higher after periods of deprivation as compared to satiation for both edibles and social interaction/praise. Furthermore, after two satiation periods in the social interaction/praise condition, one participant began to move and run away from the experimenter who was delivering social interaction/praise in the presession satiation period. This anecdotal information suggests that praise not only lost its reinforcing efficacy but it may have become aversive.

More recently, a few studies have involved a comparison of the effects of different periods of restricted access (deprivation; e.g., Klatt et al., 2000) and continuous access (satiation; Sy & Borrero, 2009). Klatt et al. compared the effects of 15 min, 2 hr, and 1 to 4 days of deprivation from a high-preference activity on subsequent engagement with that activity. The results showed that the amount of subsequent engagement with an activity was directly related to the amount of deprivation from the activity. In fact, little engagement occurred after the 15-min deprivation period as compared to engagement

following the longer deprivation periods. Sy & Borrero (2009) compared the effects of different durations of satiation (i.e., short, medium, and long durations of presession access) of a particular stimulus (i.e., edibles and leisure items) on subsequent responding for that stimulus. Results were idiosyncratic across participants. With respect to edible reinforcers, one participant displayed similar decreasing and low levels of responding (as compared to baseline) after all three satiation periods. For another participant, moderate levels of responding occurred after all three satiation periods, with somewhat higher levels occurring after small and medium satiation periods. For another participant, the level of responding was associated with the duration of the satiation period. That is, the highest level of responding occurred after a short duration, a moderate level of responding occurred after a medium duration, and the lowest level of responding occurred after a long duration. With respect to leisure items, responding was similar to baseline levels following all satiation periods.

The implications of the above-mentioned studies are that if a particular stimulus is to be used as a reinforcer for acquisition and maintenance programs, then it might be beneficial to provide a period of deprivation from the stimulus prior to teaching or training situations. For example, teachers may find it useful to program periods of individual work time or quiet reading time in which certain stimuli (e.g., attention, access to preferred items) are not provided continuously (or on a dense schedule) prior to teaching periods in which those stimuli will be delivered for correct responding in acquisition or maintenance programs. This modification might make teaching situations more productive.

Although the effects of deprivation (no access) and satiation (continuous access) on subsequent responding have been replicated in multiple studies across various stimuli, it is less clear whether immediate histories of reinforcement may affect subsequent responding. For example, it is unknown whether an immediate history of contingent or noncontingent reinforcement might affect subsequent responding for a particular stimulus.

Although little is known about the effects of prior access to noncontingent reinforcement (NCR) on subsequent responding, several studies have evaluated the effects of NCR schedules on responding within session. For example, numerous studies have shown that providing a functional reinforcer for problem behavior on an NCR schedule results in a decrease in the occurrence of problem behavior within that session. Goh, Iwata, & DeLeon (2000) showed that the delivery of stimuli shown to maintain problem behavior displayed by two participants (i.e., edibles for one participant, and attention for the other participant) on an NCR (fixed time [FT]) schedule resulted in a decrease in problem behavior. Interestingly, the FT schedule was coupled with differential reinforcement of alternative behavior (DRA) for increasing an appropriate, alternative response for the problem behavior, and the initial relatively dense FT schedule interfered with acquisition of the alternative response. In another study by Martens et al. (2003), the experimenter provided tangible items (i.e., edibles and prizes) on an FT schedule prior to academic tasks. Although response maintenance occurred after the FT schedule, the experimenters found that more mistakes or "careless" errors were made following the FT schedule. Together, results from these studies are consistent with the satiation hypothesis of NCR schedules (Goh et al., 2000) which suggests that the delivery

of reinforcers on an NCR schedule results in a decrement in responding to access that reinforcer within session and possibly in subsequent sessions.

In addition to research showing a decrement in responding with the implementation of NCR schedules, North and Iwata (2005) showed a decrement in responding with contingent reinforcement schedules. North and Iwata examined the effect of contingent edible reinforcement on responding across repeated sessions in a repeated-reinforcement condition. The repeated-reinforcement condition involved seven consecutive 5-min sessions with 5-min breaks between each session. During each session, an edible was delivered on an fixed-ratio 1 (FR 1) schedule for responding on a micro-switch panel. Results showed that for seven of nine participants, responding decreased within and across the 5-min sessions of the repeated-reinforcement condition. The general results of these studies on within-session and across-session effects of noncontingent and contingent reinforcement suggest that these schedules of reinforcement provided prior to a teaching session might also affect subsequent responding.

The purpose of the current study was to delve further into the question of the effects of prior access to reinforcers on the response allocation and rate of responding to access those and other reinforcers in subsequent learning situations. Specifically, we attempted to replicate results of previous research by comparing the effect of presession no reinforcement (deprivation) and continuous delivery (satiation) of a stimulus on responding during subsequent pre-academic task situations. An additional purpose was to extend previous research by comparing the effect of presession contingent and noncontingent delivery of a stimulus on response allocation and rate of responding during

subsequent pre-academic task situations. Results of this study may allow us to gain additional information about the conditions under which stimuli (i.e., edibles and attention) are most effective as a reinforcer for skill acquisition/maintenance programs.

Study 1 (Edibles vs. Preferred Attention)

The purpose of study 1 was to determine the effects of different immediate reinforcement histories (i.e., presession schedules of reinforcer delivery; no access, continuous access, contingent reinforcement, noncontingent reinforcement) on subsequent responding to access that reinforcer and another preferred stimulus. Study 1 extends previous research in several ways. First, the type of attention that was used in this study was determined using a systematic attention assessment (see below). Second, in the comparison of different presession schedules on subsequent responding, both the stimulus presented during presession (e.g., edibles) and another preferred stimulus (e.g., praise) were subsequently available to determine not only the level of responding for the particular stimulus provided during presession but also to determine whether, and to what extent, responding would occur to access the other available stimulus. Third, in addition to a replication of previous research comparing the effects of presession no access and continuous access on subsequent responding, for some participants, the effects of presession contingent and noncontingent reinforcement on subsequent responding were compared.

Method

Participants and setting. Six typically developing participants, ranging in age from 2 to 5 years, participated. Sessions were conducted in a session room equipped with

a table, chairs, and relevant session stimuli. Sessions were conducted 1 to 2 times per day (with at least 20 min between sessions), 3 to 5 days per week.

Dependent variable, data collection, and interobserver agreement. Trained observers recorded participant behavior using handheld computers. During attention assessment sessions, the dependent variable was the frequency of picture touches to each of three pictures depicting three different types of attention (i.e., praise, physical attention, and conversation), which was converted to a rate measure. A picture touch was defined as the participant placing his or her hand on a particular picture. During the immediate-history evaluation, two types of sessions were conducted (i.e., presession and baseline/test sessions). During presession, the dependent variable was the frequency of correct, independent responses on one match-to-sample task. Correct, independent responses were defined as placing a card depicting a sample stimulus on top of a card depicting the correct comparison stimulus. Data were also collected on incorrect responses, which were defined as placing a card depicting the sample stimulus on top of a card depicting the incorrect comparison stimulus. During all baseline and test sessions, the dependent variable was also the frequency of correct, independent responses on the same match-to-sample task; however, data were collected on the frequency of this response on three concurrently available (and identical) tasks. During all sessions, data were collected on the frequency of therapist behavior. That is, the delivery of the different types of attention and edible items were recorded.

Interobserver agreement was assessed by having a second observer independently collect data during a minimum of 30% of all sessions across all phases of the study. Observers' records were divided into 10-s intervals and compared on an interval-by-

interval basis. Interobserver agreement was calculated by dividing the smaller number of responses by the larger number of responses recorded in each interval, summing these quotients, dividing this number by the total number of intervals, and converting this ratio to a percentage. For Ali, the mean agreement coefficient for the attention assessment was 94% (range, 75%-100%), and the mean agreement coefficient for the history effects evaluation was 98% (range, 80%-100%). For Grace, the mean agreement coefficient for the attention assessment was 97% (range, 91%-100%), and the mean agreement coefficient for the history effects evaluation was 96% (range, 85%-100%). For Erin, the mean agreement coefficient for the attention assessment was 98% (range, 83%-100%), and the mean agreement coefficient for the history effects evaluation was 94% (range, 78%-100%). For Leif, the mean agreement coefficient for the attention assessment was 99% (range, 91%-100%), and the mean agreement coefficient for the history effects evaluation was 98% (range, 86%-100%). For Timmy, the mean agreement coefficient for the attention assessment was 96% (range, 83%-100%), and the mean agreement coefficient for the history effects evaluation was 98% (range, 82%-100%). For Brody, the mean agreement coefficient for the attention assessment was 97% (range, 87%-100%), and the mean agreement coefficient for the history effects evaluation was 98% (range, 67%-100%).

Attention assessment. The purpose of the attention assessment was to determine the most preferred type of attention (i.e., praise, physical attention, or conversation) for each participant to be used in the subsequent immediate-history evaluation. *Praise* was defined as any general statement referring to a positive aspect of the participant (e.g., "You're awesome," "You are such a good friend") delivered by the therapist to the

participant. *Physical attention* was defined as tickles, high-fives, and hugs delivered by the therapist to the participant. Physical attention was accompanied by vocalizations by the therapist (e.g., "I got ya," "High five!," "Squeeze"). *Conversation* was defined as statements by the therapist about activities and interests related to the participant's classroom (e.g., "I saw that it is Zoo theme week this week. My favorite zoo animal is the monkey."). Prior to each attention-assessment session, three different pictures of the therapist and participant (each associated with one of the three different types of attention) were placed in front of the participant, equidistant from the other two pictures. Rules and pre-session exposure trials were provided prior to each session. That is, the therapist told the participant the type of attention each picture depicted and that he or she could touch any of the pictures at any time to get that type of attention. In addition, the therapist had the participant touch each of the pictures and delivered the corresponding type of attention.

At the start of attention-assessment sessions, all three picture cards were concurrently available, and picture touches to a particular card resulted in the therapist delivering that type of attention for 5-10 s. During all sessions, the therapist attempted to control for the quality of attention (i.e., voice inflection and facial expression). Attention assessment sessions were 2 min in length, and a concurrent-operants arrangement was used for experimental control. The type of attention for which the participant responded at the highest level was then used in the immediate-history evaluation (see below).

Immediate-history evaluation. The purpose of the immediate-history evaluation was to determine whether different presession periods involving withholding or delivering a stimulus would affect subsequent responding for a particular stimulus. In

particular, whether (a) responding for a highly preferred stimulus would increase or decrease after a particular immediate presession history of reinforcement with that stimulus and (b) responding would switch to another preferred stimulus after a particular immediate presession history of reinforcement with another stimulus.

Prior to the immediate-history evaluation, a paired stimulus preference assessment (Fisher et al., 1992) was conducted to determine highly preferred edible items to be used in the immediate-history evaluation. Next, baseline sessions were conducted to determine whether preferred edibles or preferred attention resulted in higher levels of responding. The stimulus that resulted in the highest level of responding during baseline was then withheld or delivered during *presession* periods of the immediate-history evaluation. After each presession period, a test *session* was conducted in an identical manner to baseline to evaluate the effects of the different presession histories of stimulus availability on responding to the stimulus used in presession and the other available preferred stimulus.

During all sessions including baseline, presession, and test sessions, at least one match-to-sample task was presented to the participant. The match-to-sample task was either color matching or a combination of color and shape matching. For the color-matching task, two colored buckets (e.g., one yellow and one blue) were present and a pile of blue or yellow, letters and numbers was placed in front of the participant. The task involved matching the colored letters and numbers by placing them into the correct bucket. For the color- and shape-matching task, two sample stimuli (one shape card and one color card) were present and a stack of shape cards and color cards was placed in

front of the participant. The task involved matching the cards in the stack of cards to the correct sample stimulus.

Baseline. Baseline sessions were 5 min in length. During baseline sessions, three concurrently available and identical match-to-sample tasks were presented to the participant. One concurrently available task was associated with the most preferred type of attention (as determined by the attention assessment). Another concurrently available task was associated with a highly preferred edible. To determine which highly preferred edible would be used on a particular day, the participant was given the choice of the top three edibles (as determined by the paired stimulus preference assessment) prior to the start of the first session of the day. The final concurrently available task was associated with no programmed reinforcement (control task). Different stimuli were used to aid in discrimination of the contingencies associated with each of the match-to-sample tasks. That is, each task was associated with a particular color and other stimuli. The match-to-sample task associated with preferred attention was placed in front of a blue card, and a picture depicting the therapist delivering that type of attention was placed behind the task. The match-to-sample task associated with preferred edibles was placed in front of a red card, and a plate containing those preferred edibles was placed behind the task. The match-to-sample task associated with no programmed reinforcers was placed in front of a white card, and no additional stimuli were associated with this task.

Prior to the start of each baseline session, the therapist reminded the participant of the contingencies associated with matching to each of the different match-to-sample tasks. Also, the therapist prompted the participant to respond once on each of the match-to-sample tasks and delivered the corresponding stimulus (attention, edible, or no

reinforcer). At the beginning of the session, the therapist told the participant that he or she could match to any of the tasks and switch at any time. During the session, responding on a particular match-to-sample task resulted in the delivery of the stimulus associated with that task. Responding on the task associated with preferred attention resulted in the delivery of that preferred attention (for 5-10 s) on a fixed-ratio 1 (FR1) schedule of reinforcement. Responding on the task associated with preferred edibles resulted in the delivery of an edible on an FR1 schedule of reinforcement. Responding on the control task resulted in no programmed reinforcers. The stimulus (attention or edible) that produced the highest level of correct, match-to-sample responding was then delivered during presession periods (see below).

Presession. Presession periods were 10 min in length. During all presession periods, one match-to-sample task (identical to those presented in baseline) and an alternative task were available. The alternative task was an item typically provided in the participant's classroom (e.g., a book or a block-building game). Prior to all presession periods, the participant was told that he or she could match or play with the alternative task, and rules were provided regarding the contingencies in place for each presession period. After a presession period was conducted, a test session (see below) was immediately conducted.

Presession no access (NA). Prior to each presession NA period, the participant was told that the preferred stimulus (i.e., preferred edibles or preferred attention, depending upon the outcome of the baseline phase) would not be delivered. During presession NA periods, no attention or edibles were delivered.

Presession continuous access (CA). Prior to each presession CA period, the participant was told that the preferred stimulus would be provided throughout the whole session regardless of whether he or she engaged in the matching task. During presession CA periods, attention or edibles (depending upon the outcome of the baseline phase) were available continuously.

Presession contingent reinforcement (CR). Prior to each presession CR period, the participant was told that the preferred stimulus would be delivered for each correct matching response. During presession CR periods, attention or edibles were delivered on an FR1 schedule for correct matching.

Presession NCR (FT). Prior to each presession NCR period, the participant was told that sometimes the preferred stimulus would be delivered regardless of whether he or she matched. During presession NCR periods, attention or edibles was delivered on an FT schedule. The FT schedule was yoked to the rate of reinforcer delivery in the previous presession CR period. For example, if 20 reinforcers were delivered during the previous presession CR period, then the rate of reinforcement (20 reinforcers divided by 10 min) was 2. Therefore, the schedule of stimulus delivery during the subsequent presession NCR period was FT 30 s.

Test session. Test sessions were identical to baseline sessions; however, unlike baseline sessions, each test session was conducted immediately following one of the presession periods described above.

Experimental Design. A concurrent-operants arrangement and multielement design were used for experimental control for all participants. That is, during baseline and test sessions, three concurrently available tasks (each associated with a different

contingency) were present and levels of responding to each task (including a control task that resulted in no programmed reinforcers) was measured. In addition, different presession periods were rapidly alternated to determine the effects of different presession schedules on subsequent responding during test sessions. Finally, a reversal design was used to replicate results with one participant (Ali).

Results

Figures 1-6 show results for the six participants in study 1. The top graph of Figure 1 shows the results of the attention assessment for Ali. Ali responded at a higher rate to access conversation (*M*=3.3) as compared to praise (*M*=.7) and physical attention (*M*=.7). Based on these results, conversation was used as the preferred attention in the immediate-history evaluation. The bottom graph (including four panels) of Figure 1 shows the results of the immediate-history evaluation for Ali. During baseline, Ali responded at a higher rate for preferred edibles (*M*=5.4) as compared to preferred attention (*M*=.7) and no reinforcement (*M*=0). Based on these results, edibles were used during presession periods in the subsequent phases. After baseline, we compared the effects of presession NA (edibles) and presession CA (edibles) on subsequent responding during test sessions. During presession NA and presession CA periods (bottom panel), responding occurred at low levels. During test sessions, Ali engaged in somewhat higher levels of responding to access edibles following presession NA (*M*=5.5) as compared to presession CA (*M*=2.1). In addition, somewhat higher levels of responding during test sessions occurred to access preferred attention (conversation) following presession CA (*M*=1.1) as compared to presession NA (*M*=.3). Because we saw different patterns of responding based on the presession periods in this phase, we then compared the effects of

presession periods of contingent reinforcement presession CR and noncontingent reinforcement presession NCR to determine whether these schedules would affect responding during subsequent test sessions. During presession CR (edibles) and presession NCR (edibles) periods (bottom panel) of this phase, different patterns of responding occurred. Presession CR resulted in high and stable levels of responding, and presession NCR resulted in low levels of responding. During test sessions, Ali engaged in similar levels of responding to access edibles following presession CR (*M*= 2.9) and presession NCR (*M*=2.8); however, responding was somewhat more stable after presession NCR as compared to presession CR. In the final phase, when presession NA and presession CA were again compared, responding occurred at high levels in the presession CA period, and low levels of responding occurred in the presession NA period (bottom panel). In addition, during test sessions, Ali again engaged in higher levels of responding to access edibles following presession NA as compared to presession CA. Finally, Ali engaged in higher levels of responding to access preferred attention following presession NA as compared to presession CA.

The top graph of Figure 2 shows the results of the attention assessment for Grace. Grace responded at a higher rate to access physical attention (*M*=3.1) as compared to praise (*M*=1) and conversation (*M*=.3). Based on these results, physical attention was used as the preferred attention in the immediate-history evaluation. The bottom graph of Figure 2 shows the results of the immediate-history evaluation for Grace. During baseline, Grace only responded for preferred edibles (*M*=4.1). Based on these results, edibles were used during the presession periods in the subsequent phases. After baseline, we compared the effects of presession NA (edibles) and presession CA (edibles) on

subsequent responding during test sessions. During presession NA and presession CA periods (bottom panel), responding occurred at low levels. During test sessions, Grace engaged in somewhat higher and more stable levels of responding during test sessions to access edibles following presession NA (*M*=4.5) as compared to presession CA (*M*=3.7). In addition, low levels of responding during test sessions occurred to access physical attention following both presession NA (*M*=.4) and presession CA (*M*=.7;). Finally, some responding occurred to the task associated with no reinforcement after both types of presession periods. Because we saw different patterns of responding based on the presession periods in this phase, we then compared the effects of presession presession CR (edibles) and presession NCR (edibles) on subsequent responding during test sessions. During presession periods (bottom panel), higher levels of responding occurred during presession CR periods as compared to presession NCR periods. During test sessions, Grace engaged in relatively similar levels of responding to access edibles during test sessions following presession CR (*M*= 3.2) and presession NCR (*M*=2.8). In addition, initially somewhat higher levels of responding occurred to access physical attention following presession NCR as compared to presession CR; however, over time, responding decreased and was similar regardless of the type of presession.

The top graph of Figure 3 shows the results of the attention assessment for Erin. Erin responded at a somewhat higher rate to access conversation (*M*=1.1) as compared to praise (*M*=.7) and physical attention (*M*=.85). Based on these results, conversation was used as the preferred attention in the immediate-history evaluation. The bottom graph of Figure 3 shows the results of the immediate-history evaluation for Erin. During baseline, Erin responded at a higher rate for preferred edibles (*M*=4.1) as compared to preferred

attention (*M*=1.4) and no reinforcement (*M*=.15). Based on these results, edibles were used during presession periods in the subsequent phases. After baseline, we compared the effects of presession NA (edibles) and presession CA (edibles) on subsequent responding during test sessions. During presession NA and presession CA periods (bottom panel), responding occurred at low levels. During test sessions, Erin engaged in similar levels of responding during test sessions to access edibles following presession NA (*M*=6.1) and presession CA (*M*=6.2). In addition, similar levels of responding during test sessions occurred to access preferred attention (conversation) following presession CA (*M*=1.1) and presession NA (*M*=.92). Because we did not see different patterns of responding based on the presession periods in this phase, we did not compare the effects of presession CR and presession NCR on responding during test sessions.

The top graph of Figure 4 shows the results of the attention assessment for Leif. Leif responded at a higher rate to access conversation (*M*=2.9) as compared to praise (*M*=1.2) and physical attention (*M*=2.4). Based on these results, conversation was used as the preferred attention in the immediate-history evaluation. The bottom graph of Figure 4 shows the results of the immediate-history evaluation for Leif. During baseline, Leif responded at a higher rate for preferred edibles (*M*=2.1) as compared to preferred attention (*M*=.5) and no reinforcement (*M*=.2). Based on these results, edibles were used in the presession periods in the subsequent phases. After baseline, we compared the effects of presession NA (edibles) and presession CA (edibles) on subsequent responding during test sessions. During presession NA and presession CA periods (bottom panel), responding occurred at low levels. During test sessions, Leif engaged in somewhat similar mean levels of responding to access edibles following presession NA (*M*=5.03)

and presession CA (*M*=5.52). However, levels of responding were more variable following presession CA as compared to presession NA. In addition, during three sessions, elevated levels of responding occurred to access preferred attention (conversation) following presession CA. Because we saw slightly different patterns of responding based on the presession periods in this phase, we then compared the effects of presession CR (edibles) and presession NCR (edibles) on responding during subsequent test sessions. Presession CR resulted in high and stable levels of responding, and presession NCR resulted in low levels of responding. During test sessions, Leif engaged in similar levels of responding to access edibles during test sessions following presession CR (*M*= 3.2) and presession NCR (*M*=3.2).

The top graph of Figure 5 shows the results of the attention assessment for Timmy. Timmy responded at a higher rate to access physical attention (*M*=2.5) as compared to praise (*M*=.38) and conversation (*M*=2). Based on these results, physical attention was used as the preferred attention in the immediate-history evaluation. The bottom graph of Figure 5 shows the results of the immediate-history evaluation for Timmy. During baseline, Timmy responded at a higher rate for preferred edibles (*M*=4.32) as compared to preferred attention (*M*=.12) and no reinforcement (*M*=0). Based on these results, edibles were used in the presession periods in the subsequent phases. After baseline, we compared the effects of presession NA (edibles) and presession CA (edibles) on subsequent responding during test sessions. During presession NA and presession CA periods (bottom panel), responding occur at low levels. During test sessions, Timmy engaged in similar levels of responding to access edibles following presession NA (*M*=4.8) as compared to presession CA (*M*=3.82). In addition,

responding occurred initially to access preferred attention and to the task associated with no reinforcement following presession CA. We did not compare the effects of presession CR and presession NCR on responding during subsequent test sessions.

The top graph of Figure 6 shows the results of the attention assessment for Brody. Brody responded at a higher rate to access conversation (*M*=5.9) as compared to praise (*M*=.3) and physical attention (*M*=.4). Based on these results, conversation was used as the preferred attention in the immediate-history evaluation. The bottom graph of Figure 6 show the results of the immediate-history evaluation for Brody. During baseline, Brody responded at a higher rate for preferred attention (conversation) (*M*=3.5) as compared to preferred edibles (*M*=.7) and no reinforcement (*M*=0). Based on these results, preferred attention (conversation) was used in the presession periods in the subsequent phases. After baseline, we compared the effects of presession NA (conversation) and presession CA (conversation) on subsequent responding during test sessions. During presession periods, responding occurred at high levels during some presession NA periods and at low levels during presession CA periods. During test sessions, Brody engaged in similar levels of responding to access conversation following presession NA (*M*=2.2;) and presession CA (*M*=2.7). In addition, similar levels of responding during test sessions occurred to access edibles following presession NA (*M*=5) and presession CA (*M*=3.9). We did not compare the effects of presession CR and presession NCR on subsequent responding during test sessions.

Study 2 (Attention)

The purpose of study 2 was to replicate the immediate-history evaluation in study 1 with the three different types of attention (i.e., praise, physical attention, and

conversation) used in the attention assessment in study 1. No attention assessment was conducted in study 2. In the comparison of different presession schedules on subsequent responding, the type of attention presented during presession (as determined by baseline levels of responding) and the other two types of attention were subsequently available to determine not only the level of responding for the type of attention presented during presession but also to determine whether, and to what extent, responding would occur to access the other two types of attention.

Method

Participants and setting. Three typically developing participants, ranging in age from 2 to 5 years, participated. Sessions were conducted in a session room equipped with a table, chairs, and relevant session stimuli. Sessions were conducted 1 to 2 times per day (with at least 20 min between sessions), 3 to 5 days per week.

Dependent variable, data collection, and interobserver agreement. Trained observers recorded participant and therapist behavior using handheld computers. The dependent variable was the same as in the immediate-history evaluation of study 1. In addition, during all sessions, data were collected on the frequency of therapist delivery of the different types of attention (as defined in study 1).

Interobserver agreement was assessed by having a second observer independently collect data during a minimum of 30% of sessions across all phases of the study. Observers' records were divided into 10-s intervals and compared on an interval-by-interval basis. Interobserver agreement was calculated by dividing the smaller number of responses by the larger number of responses recorded in each interval, summing these quotients, dividing this number by the total number of intervals, and converting this ratio

to a percentage. For Colin, the mean agreement coefficient was 98% (range, 90%-100%). For Maggie, the mean agreement coefficient was 98% (range, 83%-100%). For Aubry, the mean agreement coefficient was 95% (range, 78%-100%).

Procedures. Baseline, presession, and test sessions were similar to those conducted in study 1. Baseline sessions were similar to those in study 1; however, the three concurrently available stimuli were the three types of attention. The type of attention that resulted in the highest level of responding during baseline was then delivered or withheld during presession periods. Presession periods were similar to those conducted in study 1. After each *presession* period, a test *session* was conducted in an identical manner to baseline to evaluate the effects of different presession histories of stimulus delivery on responding to the stimulus used in presession and the other two available stimuli. The same experimental design was used in study 2 as in study 1.

Experimental Design. A concurrent-operants arrangement and multielement design were used for experimental control for all participants.

Results

Figures 7-9 show results for the three participants in study 2. Figure 7 shows results of the immediate-history evaluation for Colin. During baseline, Colin responded at a higher rate for conversation (M=4.0) as compared to physical attention (M=0) and praise (M=.1). Based on these results, conversation was used during the presession periods in the subsequent phase. After baseline, we compared the effects of presession NA (conversation) and presession CA (conversation) on subsequent responding during test sessions. During presession NA and presession CA periods (bottom panel), responding occurred at low levels. During test sessions, Colin engaged in similar levels

of responding to access conversation following presession NA (*M*=2.2) and presession CA (*M*=2.25). In addition, very low levels of responding during test sessions occurred to access physical attention and praise following presession NA and presession CA. Because we did not see different patterns of responding based on the presession periods in this phase, we did not compare the effects of presession CR and presession NCR on responding during subsequent test sessions.

Figure 8 shows results of the immediate-history evaluation for Maggie. During baseline, Maggie responded at a higher rate for conversation (*M*=2.3) as compared to physical attention (*M*=.7) and praise (*M*=.6). Based on these results, conversation was used during the presession periods in the subsequent phase. After baseline, we compared the effects of presession NA (conversation) and presession CA (conversation) on subsequent responding during test sessions. During both types of presession periods, responding occurred at low levels. During test sessions, Maggie engaged in similar levels of responding during test sessions to access conversation following presession NA (*M*=4.1) and presession CA (*M*=4.2). In addition, very low levels of responding during test sessions occurred to access physical attention or praise following presession NA and presession CA. We did not compare the effects of presession CR and presession NCR on responding during subsequent test sessions.

Figure 9 shows results of the immediate-history evaluation for Aubry. During baseline, Aubry responded at a higher rate for conversation (*M*=2.1) as compared to physical attention (*M*=1) and praise (*M*=.14). Based on these results, conversation was used during the presession periods in the subsequent phase. After baseline, we compared the effects of presession NA (conversation) and presession CA (conversation) on

subsequent responding during test sessions. During both types of presession periods, responding (except during two presession CA periods) occurred at low levels. During test sessions, Aubry engaged in similar levels of responding to access conversation following presession NA (*M*=34) and presession CA (*M*=3.0). In addition, very low levels of responding during test sessions occurred to access physical attention or praise following either type of presession period. We did not compare the effects of presession CR and presession NCR on responding during subsequent test sessions.

General Discussion

Several interesting findings were observed in study 1. Overall the results of the attention assessment of study 1 suggest that more participants preferred conversation than physical attention or praise. In addition, participants in study 1 responded more in baseline for edibles than the preferred type of attention. Finally, responding during the immediate-history evaluation showed idiosyncratic effects across participants. That is, some participant's subsequent responding was differentially affected by presession periods, whereas other participant's subsequent responding was not. The overall results of study 2 suggest that all participants responded more in baseline for conversation than the other two types of attention, and no difference in subsequent responding occurred following continuous and no access to the preferred type of attention.

Results of the attention assessments in study 1 showed that four out of six participants preferred conversation, the other two preferred physical attention, and no participants preferred praise. These results are interesting given (a) the ubiquity of praise in early childhood classrooms, (b) the suggestion found in many education and psychology books that the use of praise in the classroom is best practice, and (c) that

praise was a type of attention that was often used in previous research on the effects of satiation and deprivation on subsequent responding for attention. Future researchers may want to determine the variables that may result in conversation being more preferred than the other two common types of attention. It may be that conversation was more preferred in the current study because the topics of conversation were those that were preferred by the participants. In addition, it may be that conversation was more preferred (and therefore occurred at higher rates) because the continuous occurrence (or dense schedule) of conversation is more naturalistic than continuous delivery of physical attention or praise. Finally, it may be that conversation was more preferred because it is a more variable form of attention as compared to physical attention or praise.

Another interesting finding of study 1 was that the results of the baselines during the immediate-history evaluation of study 1 showed that edibles resulted in higher levels of responding than preferred attention for five out of six participants. This finding is not surprising given the delivery of stimuli in the preschool classroom in which the participants were enrolled (and in which they were engaged prior to each baseline session). That is, the types of edibles used in the current study (e.g., chocolate treats and gummy candies) were rarely available throughout the day in the classroom, and teachers were trained to provide dense schedules of attention (i.e., every 3-5 min). Thus, it is likely that higher levels of responding occurred for edibles as compared to attention because of the availability of these items prior to and after sessions.

Several different findings were observed during the immediate-history evaluation of study 1. During the comparison between presession no access and continuous access on subsequent responding, we found idiosyncratic results. That is, (a) two participants

(Ali and Grace) displayed higher levels of responding for the preferred stimulus (edibles) following no access as compared to continuous access, (b) one participant (Leif) displayed more stable responding for the preferred stimulus (edibles) following no access as compared to continuous access, and (c) three participants (Erin, Timmy, and Brody) showed no difference in responding for the preferred stimulus following no access and continuous access. With respect to responding toward the other concurrently available tasks, one participant (Ali) began responding at higher levels toward the task associated with the other preferred stimulus (conversation) after continuous access compared to no access, and another participant (Grace) began responding at somewhat higher levels toward the task associated with no reinforcement after continuous access compared to no access. Interestingly, another participant (Brody) began responding at higher levels toward the task associated with the other preferred stimulus (edibles) following both no access and continuous access. Finally, results of the comparison between presession contingent and noncontingent reinforcement on subsequent responding showed that all three participants engaged in similar, high levels of responding for the preferred stimulus (edibles) following either presession schedule, and only one participant (Grace) responded at somewhat higher levels (at least initially) following noncontingent as compared to contingent presession schedules.

The results of the immediate-history evaluation of study 2 are similar across all three participants. That is, all three participants (a) responded at higher levels to access conversation as compared to the other two types of attention during baseline, (b) responded at high and similar levels to access conversation following no access and

continuous access, and (c) did not engage in much responding for the other types of attention following either presession period.

One interesting aspect of the current study was the use of a concurrent-operants arrangement during the test session for the purpose of not only determining whether responding to the stimulus that was withheld or provided during presession would be affected but also whether responding might be allocated to different preferred stimuli. Although we saw some responding to access the other preferred stimulus or no reinforcement for a few participants, following particular presession schedules, the results were not robust. Future researchers might consider evaluating the possible influence of the availability of other stimuli on whether presession schedules affect subsequent responding.

For some participants in study 1 and for all participants in study 2, we did not replicate the results found in previous research on the effects of deprivation and satiation periods on subsequent responding. There are several reasons why this may have occurred. First, as mentioned above, edibles were not freely available in the classroom, whereas attention was freely and frequently available. The availability of these stimuli in the classroom may have influenced responding during baseline and test sessions during study 1. Second, it is possible that the lengths of presession periods (i.e., 10 min) were too short to have an effect on subsequent responding. However, Sy & Borrero (2009) found satiation effects for presession periods as short as 2 to 9 min. Third, it is possible that the length of our test sessions were too short to observe a change in responding. Therefore, future researchers might also conduct a parametric analysis of test-session length to determine overall patterns as well as within-session patterns of responding

following different presession schedules. It is important to note that we did not increase our presession duration above 10 min because the participants in our study were young participants, and we did not feel it was ethical to deprive them of attention for more than 10 min or provide continuous access to edibles for more than 10 min.

For some participants, different patterns of responding were found following no access as compared to continuous access; however, different patterns of responding were not found following contingent as compared to noncontingent access. It is possible that continuous access to a stimulus reduces subsequent responding because of the amount of the stimulus consumed (i.e., a general satiation effect); however, it is also possible that continuous access to a stimulus reduces subsequent responding because the noncontingent delivery of the stimulus devalues the stimulus as a reinforcer (DeLeon, Williams, Gregory, & Hagopian, 2005). That is, a stimulus that is delivered freely (i.e., a stimulus for which one does not have to work) may become less valuable. We attempted to answer this question by conducting the comparison of the effects of presession contingent and noncontingent reinforcement on subsequent responding. Therefore, we yoked the number of reinforcers delivered (consumed) across the two presession conditions, such that the only variable that was different was the contingency, to determine whether changes in subsequent responding might be due to the presession contingency rather than overall number of stimuli consumed. The results of study 1 suggest that a decrement in responding is most likely due to a general satiation effect (i.e., the amount of stimulus provided) rather than the contingency in place for delivery. However, our results are preliminary, and future researchers should continue to evaluate the effects of different presession schedules on subsequent responding.

These results provide preliminary information for teachers, clinicians, and caregivers for creating the best environment for enhancing the reinforcing effects of a particular stimulus prior to teaching situations (e.g., learning trials). Given our findings, it is likely that edibles are a potent reinforcer for acquisition and maintenance during teaching situations; however, it is unlikely that edibles are feasible (or preferred by teachers or caregivers) in all learning environments. Our results also suggest that conversation is a preferred type of attention that may be a relatively potent reinforcer for typically developing preschool-aged participants. Therefore, conversation could possibly be used as a reinforcer for acquisition and maintenance tasks with this population. Finally, our results suggest that delivery of large amounts of a preferred stimulus (e.g., continuous access to a preferred edible) might decrease the reinforcing efficacy of that stimulus, and therefore, result in less than optimal learning during teaching situations/learning trials.

Future researchers should consider extending the current study by evaluating the effects of naturally occurring deprivation and satiation periods that occur in the classroom and determine the effects of those periods on subsequent responding to access different types of classroom reinforcers during teaching and play situations. In addition, future researchers should consider evaluating whether periods of quiet time or independent work time as compared to continuous 1:1 interaction and access to preferred classroom toys might affect subsequent responding for those stimuli during teaching and play situations in a classroom environment.

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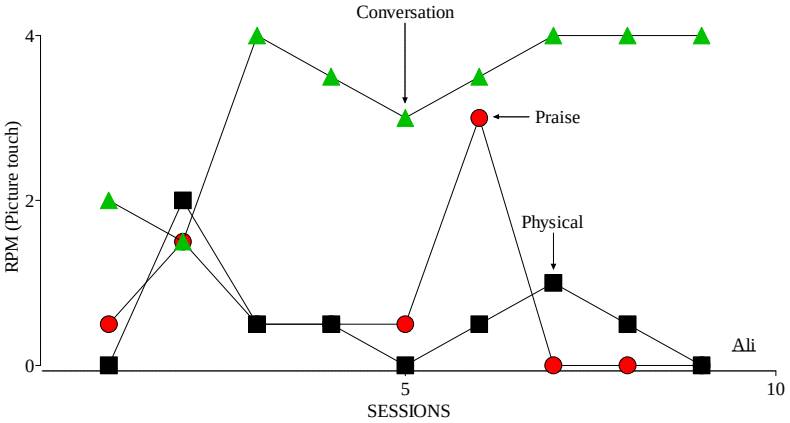
Figure 1. The top graph depicts the results of the attention assessment (i.e., the rate of picture touches to access praise, physical attention, and conversation) for Ali. The bottom graph depicts the results of the immediate-history evaluation. The top three panels depict the rate of responding during baseline and test sessions for preferred attention (top panel), preferred edible (second panel), and no reinforcement (third panel) after particular presession periods. The bottom panel depicts the rate of responding during the various presession periods.



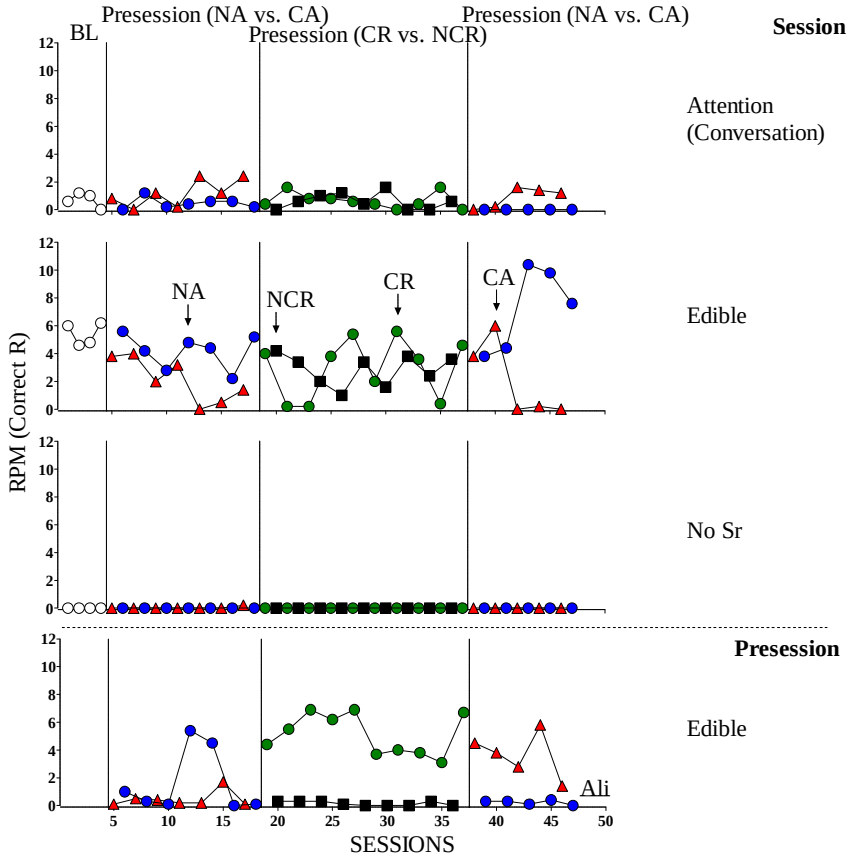
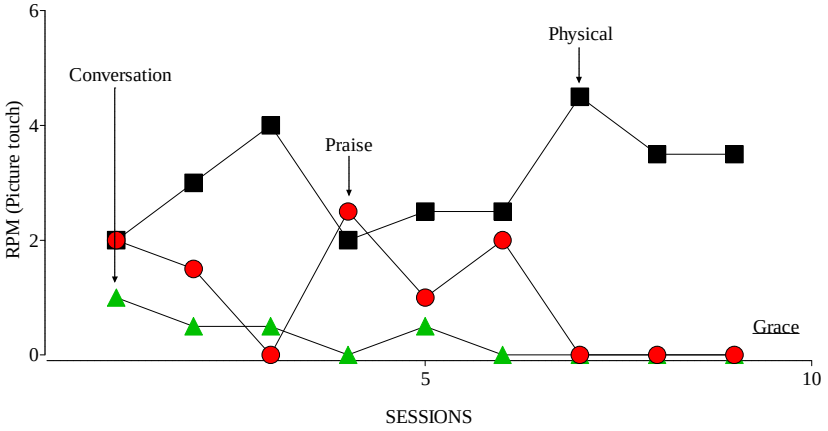


Figure 2. The top graph depicts the results of the attention assessment (i.e., the rate of picture touches to access praise, physical attention, and conversation) for Grace. The bottom graph depicts the results of the immediate-history evaluation. The top three panels depict the rate of responding during baseline and test sessions for preferred attention (top panel), preferred edible (second panel), and no reinforcement (third panel) after particular presession periods. The bottom panel depicts the rate of responding during the various presession periods.



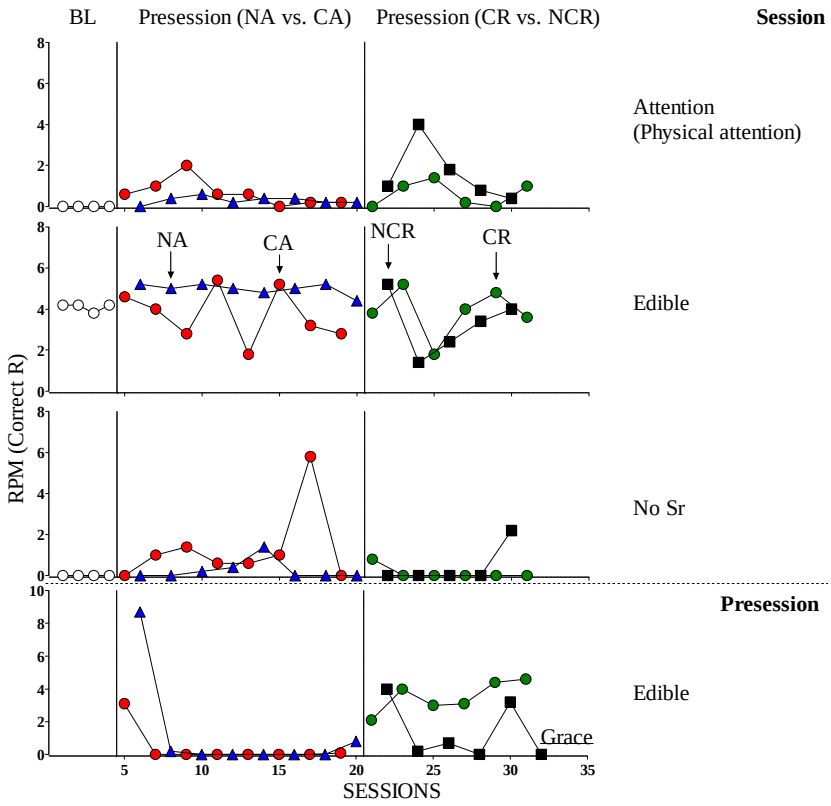
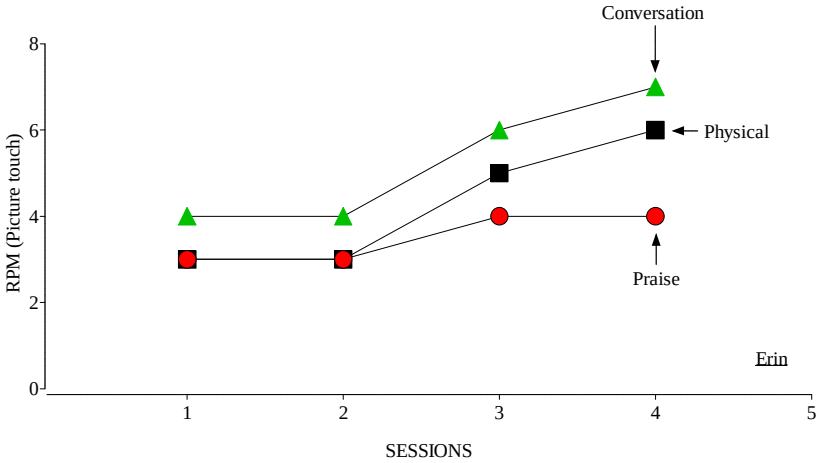


Figure 3. The top graph depicts the results of the attention assessment (i.e., the rate of picture touches to access praise, physical attention, and conversation) for Erin. The bottom graph depicts the results of the immediate-history evaluation. The top three panels depict the rate of responding during baseline and test sessions for preferred attention (top panel), preferred edible (second panel), and no reinforcement (third panel) after particular presession periods. The bottom panel depicts the rate of responding during the various presession periods.



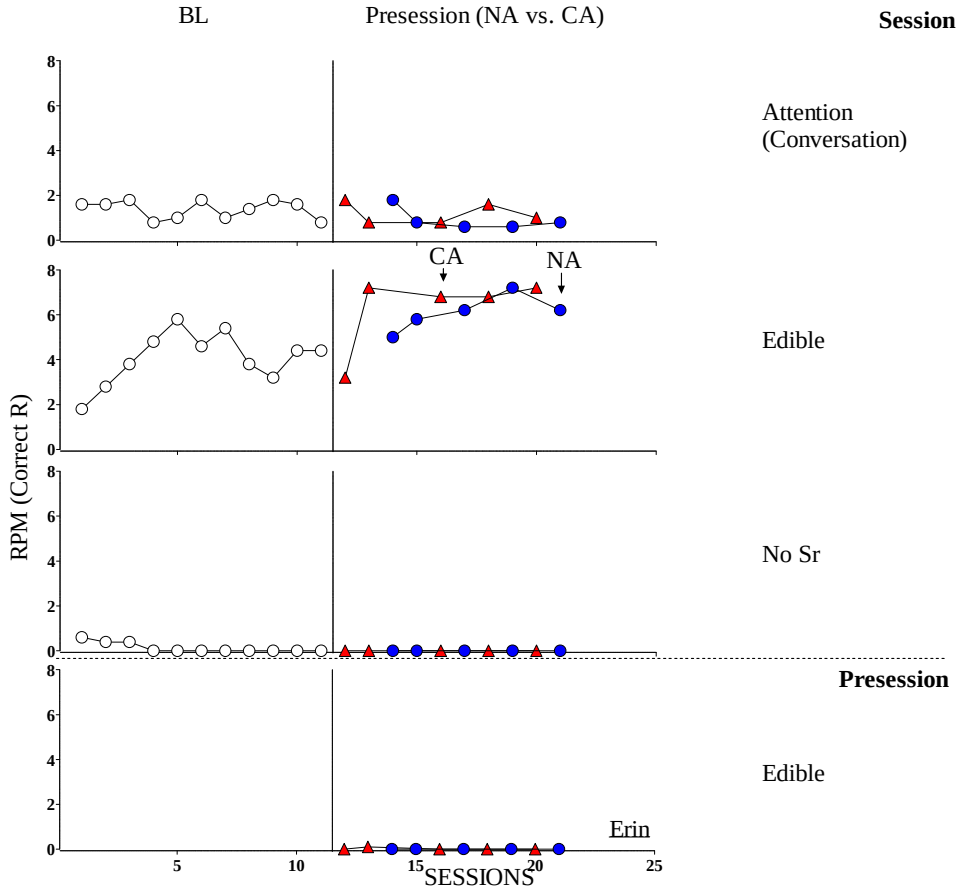
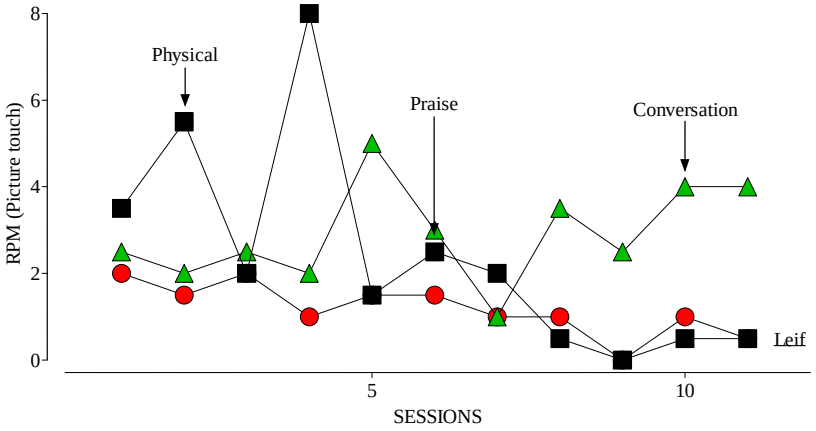


Figure 4. The top graph depicts the results of the attention assessment (i.e., the rate of picture touches to access praise, physical attention, and conversation) for Leif. The bottom graph depicts the results of the immediate-history evaluation. The top three panels depict the rate of responding during baseline and test sessions for preferred attention (top panel), preferred edible (second panel), and no reinforcement (third panel) after particular presession periods. The bottom panel depicts the rate of responding during the various presession periods.



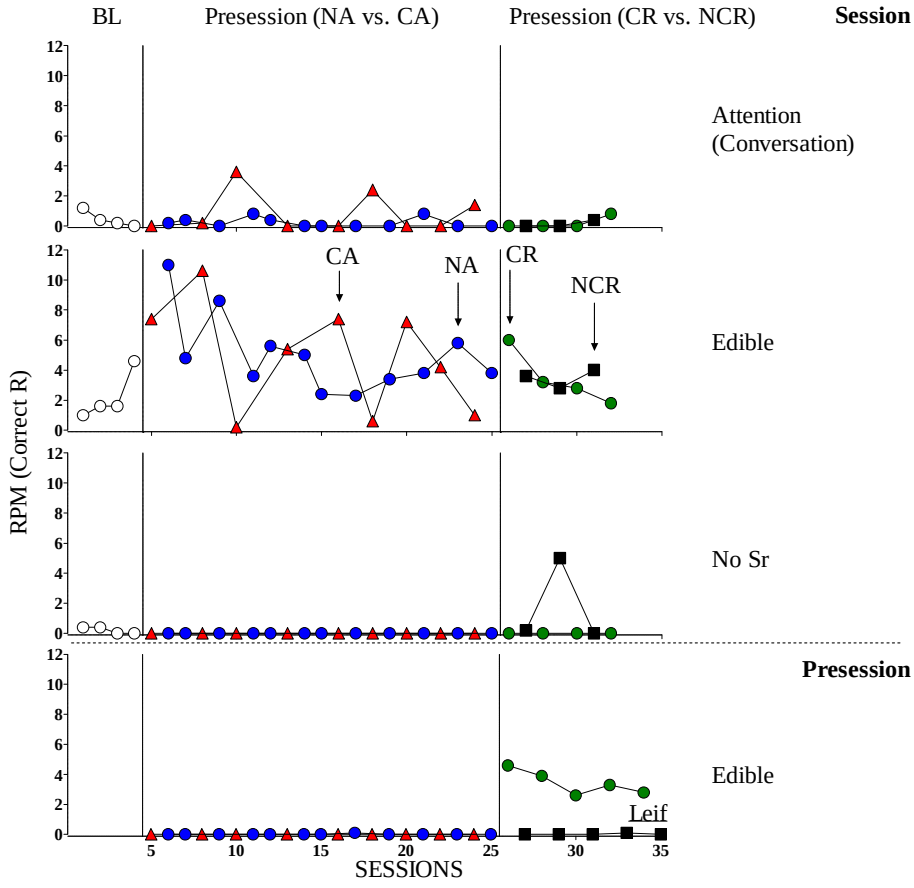
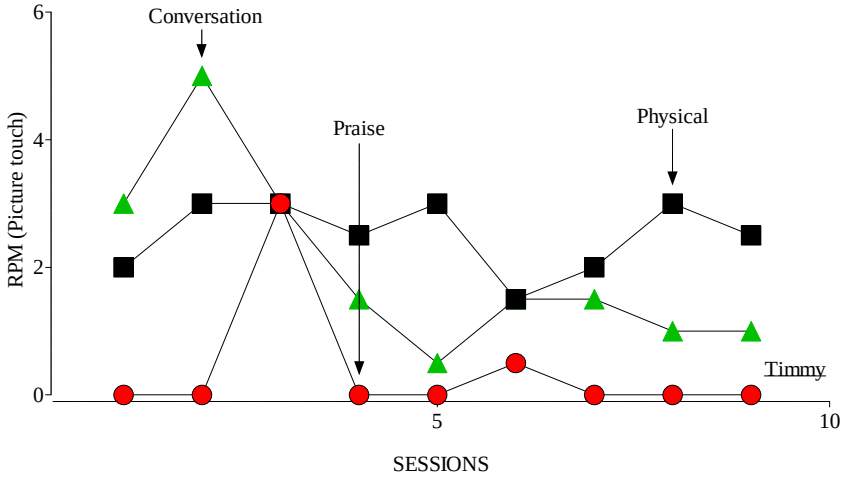


Figure 5. The top graph depicts the results of the attention assessment (i.e., the rate of picture touches to access praise, physical attention, and conversation) for Timmy. The bottom graph depicts the results of the immediate-history evaluation. The top three panels depict the rate of responding during baseline and test sessions for preferred attention (top panel), preferred edible (second panel), and no reinforcement (third panel) after particular presession periods. The bottom panel depicts the rate of responding during the various presession periods.



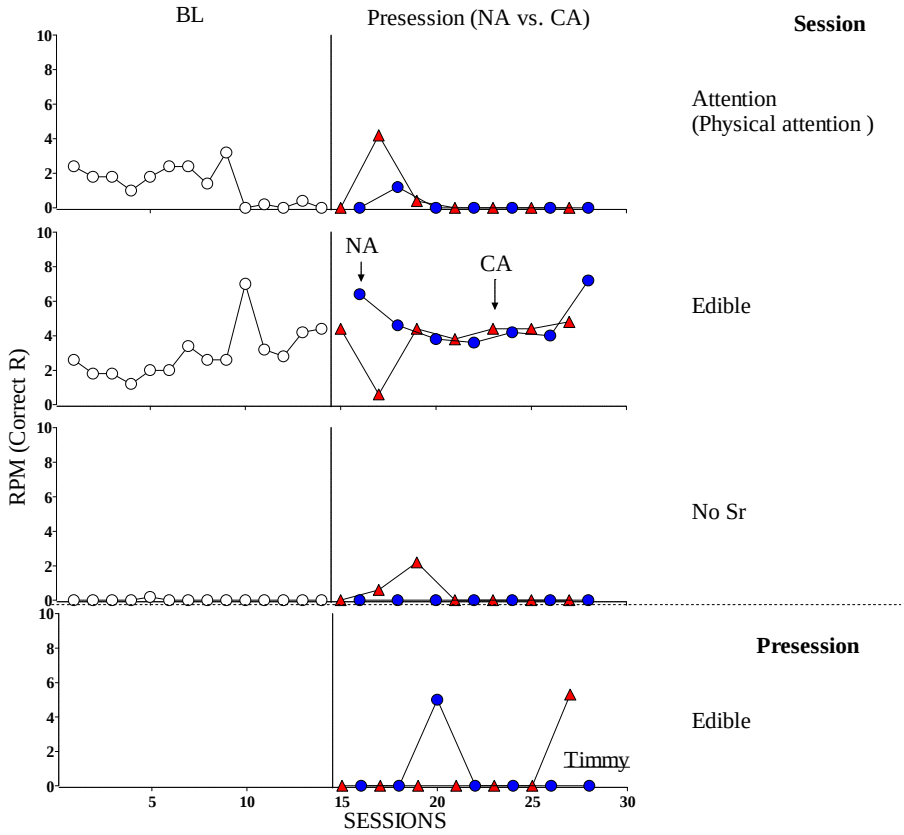
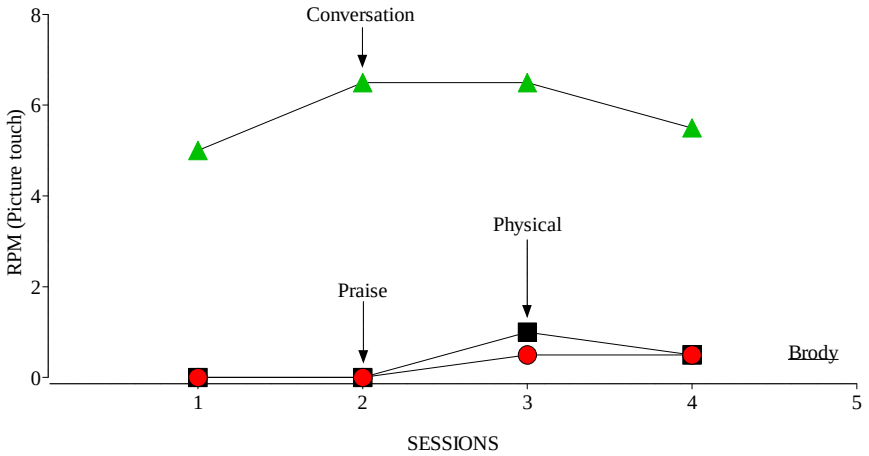


Figure 6. The top graph depicts the results of the attention assessment (i.e., the rate of picture touches to access praise, physical attention, and conversation) for Brody. The bottom graph depicts the results of the immediate-history evaluation. The top three panels depict the rate of responding during baseline and test sessions for preferred attention (top panel), preferred edible (second panel), and no reinforcement (third panel) after particular presession periods. The bottom panel depicts the rate of responding during the various presession periods.



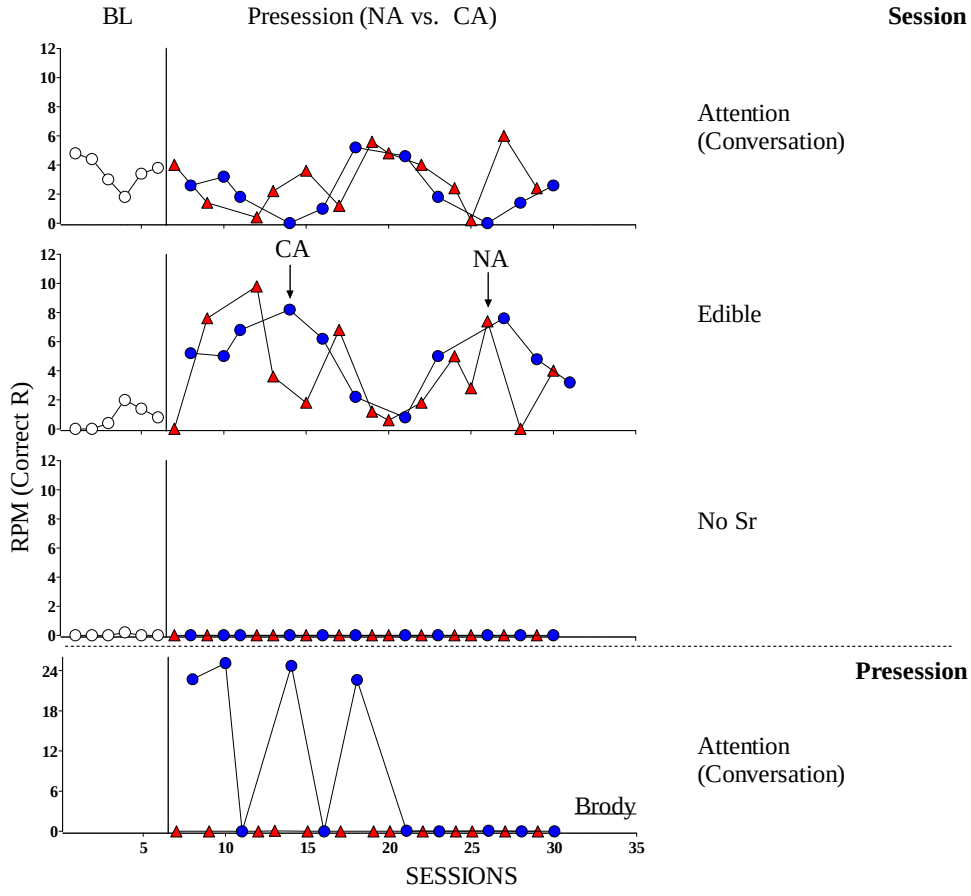


Figure 7. This figure depicts the results of the immediate-history evaluation for Colin. The top three panels depict the rate of responding during baseline and test sessions for conversation (top panel), physical attention (second panel), and praise (third panel) after particular presession periods. The bottom panel depicts the rate of responding during the two presession periods.

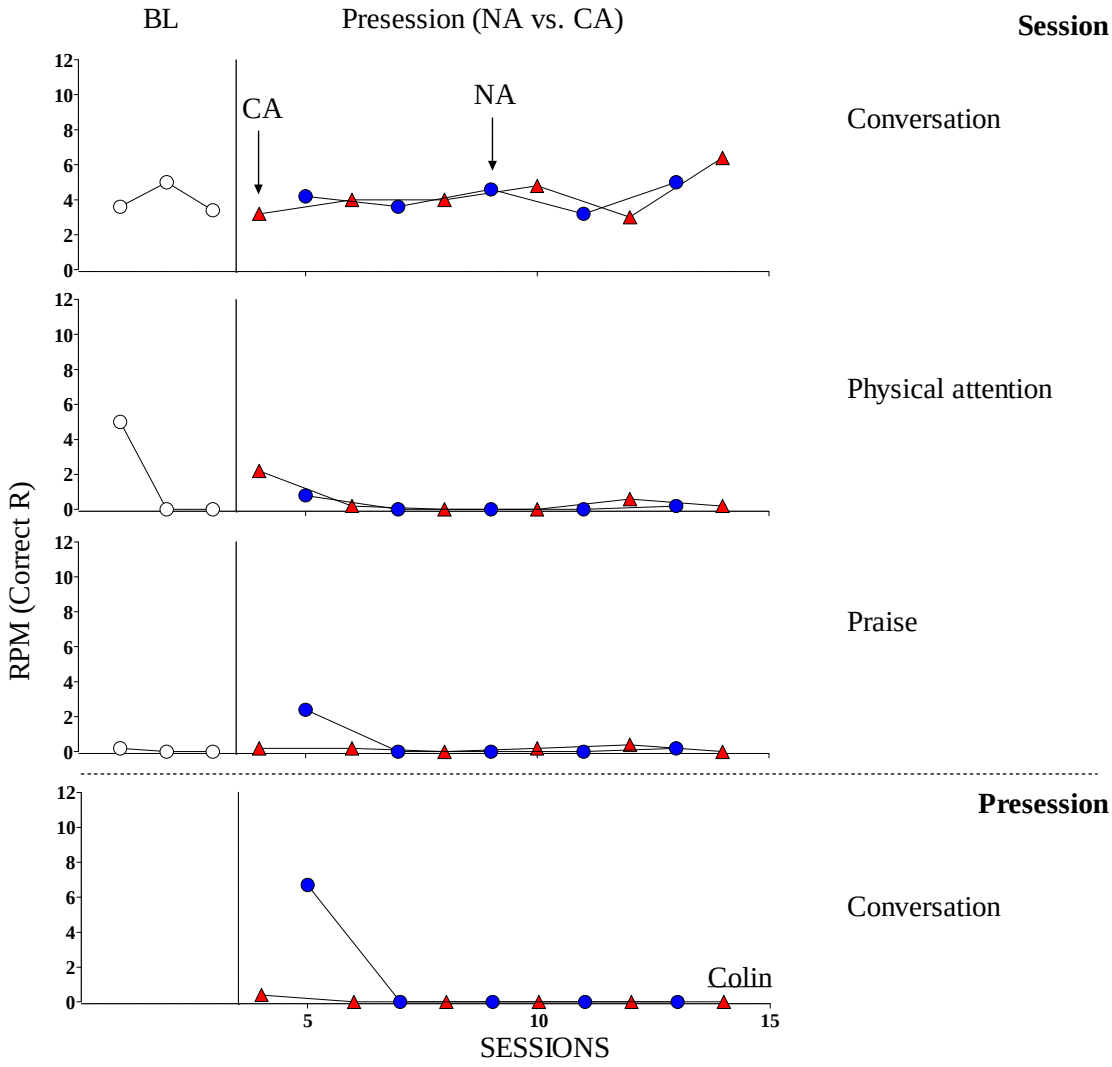


Figure 8. This figure depicts the results of the immediate-history evaluation for Maggie. The top three panels depict the rate of responding during baseline and test sessions for conversation (top panel), physical attention (second panel), and praise (third panel) after particular presession periods. The bottom panel depicts the rate of responding during the two presession periods.

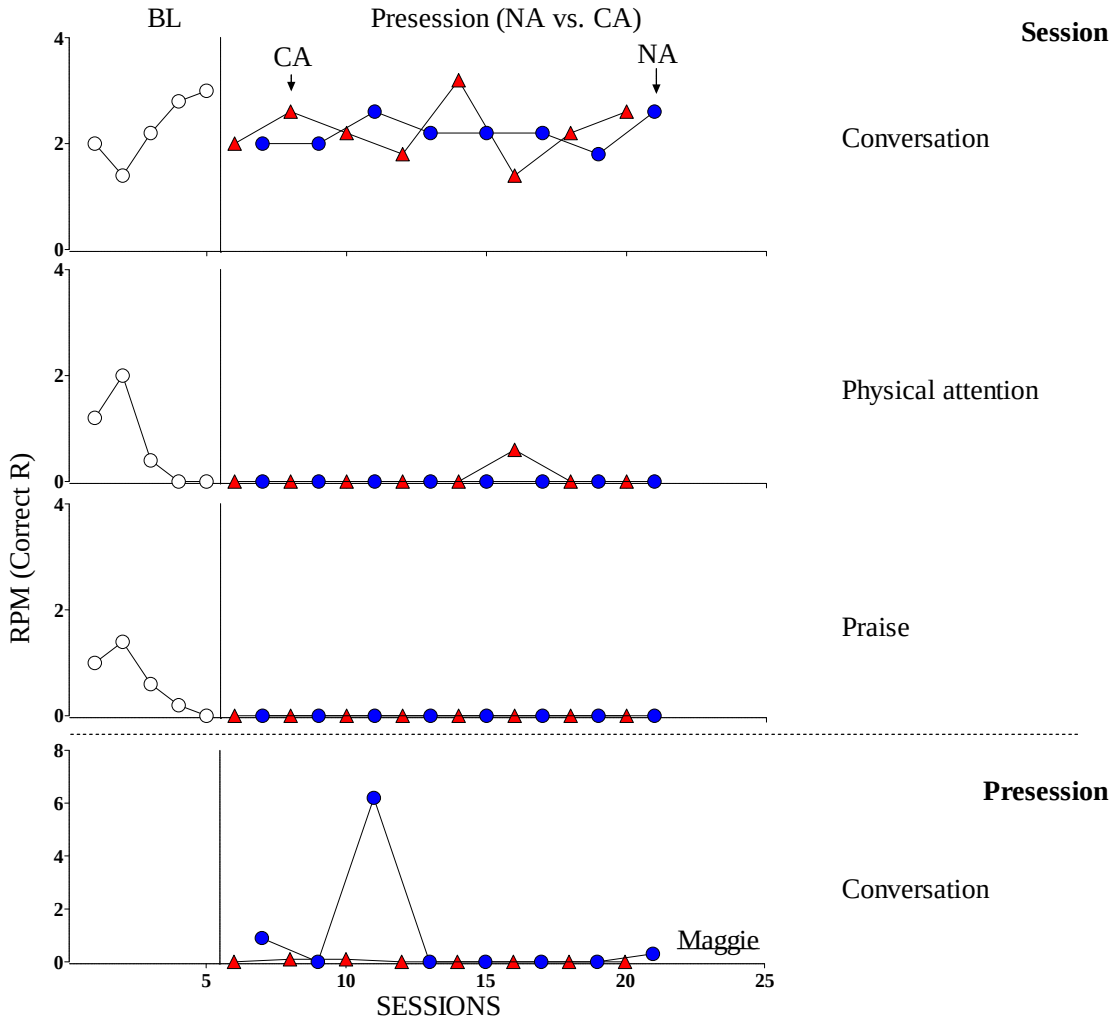


Figure 9. This figure depicts the results of the immediate-history evaluation for Aubry. The top three panels depict the rate of responding during baseline and test sessions for conversation (top panel), physical attention (second panel), and praise (third panel) after particular presession periods. The bottom panel depicts the rate of responding during the two presession periods.