A Thesis Presented

by

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Table of Contents

Abstract

The effectiveness of discrete-trial training of an alternative response to decrease pica was examined with two 9-year-old boys. Before training was implemented, a series of preference assessments was conducted to determine the relative preference of edible and pica items. A functional analysis of pica was also conducted prior to the start of training. The training consisted of reinforcing an alternative behavior and blocking pica. The participants were taught to come and find a therapist when they found pica items in their environment. In exchange for pointing to the pica item in the environment, the participants received a highly-preferred edible. Results indicate that differential reinforcement of an alternate response was effective in decreasing pica even when the distance between the therapist and participants was increased.

Using Differential Reinforcement of Alternative Behavior to Decrease Pica with Decreased Therapist Proximity

The DSM-IV defines pica as meeting one of the following criteria (1) the persistent eating of non-nutritive substances for a period of at least one month, (2) the eating of non-nutritive substances is inappropriate to the developmental age, (3) the eating behavior is not part of a culturally sanctioned practice, and (4) if the eating behavior occurs exclusively during the course of another mental disorder, it is sufficiently severe to warrant clinical attention. In the literature, pica is typically defined as the placing of any nonfood object past the lips (Hagopian & Adelinis, 2001; Piazza et al., 1998; Piazza, Roane, Keeny, Boney & Abt, 2002), as ingestion of any non-food items (Piazza et al., 1998; Winton & Singh, 1983; Piazza et al., 2002), or as ingestion of food items off of the floor (Johnson, Hunt & Siebert, 1994; Winton & Singh, 1983). However, the definition sometimes includes a behavior that precedes pica or an attempt to engage in pica behavior (Hagopian & Adelenis, 2001; Mace & Knight, 1986; Rojahn, McGonigle, Curcio & Dixon, 1987). Approximately 25.8% of persons diagnosed with mental retardation who live in a residential placement engage in pica (Danford & Huber, 1982). Engaging in this behavior poses a serious health risk. Some of the consequences include, but are not limited to, lead poisoning, dental trauma, parasitic infection, intestinal blockage, and death (Piazza et al., 1998; Rojahn et al., 1987; Stiegler, 2005).

Various approaches to the treatment of pica have been evaluated. These include punishment procedures involving the presentation of aversive consequences such as a water mist to the face, physical restraint, response blocking, or overcorrection (Hagopian & Adelenis, 2001; Rojahn et al., 1987; Matson, Stevens & Smith, 1978; Singh & Winton,

1985; Winton & Singh, 1983; Ausman, Ball & Alexander, 1974). Non-contingent reinforcement has also been used; for example, Mace and Knight (1998) and Piazza et al. (1998) showed that access to non-contingent food can result in lower rates of pica. Donnelly and Olczak (1990) showed that differential reinforcement of incompatible behavior (DRI) can reduce cigarette pica. During treatment, participants were given a stick of gum to chew and instructed to abstain from engaging in pica. Coffee and praise were delivered contingent on the absence of cigarette pica and on gum being present in the participant's mouth. Other treatment options that have been evaluated include manipulation of response effort, discrimination training, and treatment packages that use a combination of reinforcement and punishment procedures (Piazza et al., 2000; Johnson, Hunt & Siebert, 1994; Ausman, Ball, & Alexander, 1974; Paniagua, Braverman, & Capriotti, 1996).

McAdam et al. (2004) noted that only 4 of 26 studies on pica included a functional analysis. Results of these functional analyses indicate that pica is not always maintained by automatic reinforcement, although treatments are often based on this assumption (McAdam et al.). Mace and Knight (1986) conducted a functional analysis of pica with a 19-year-old male whose pica was maintained by attention. Piazza et al. (1998) conducted functional analyses on the pica of three participants. Results of these analyses indicated that for one participant pica was maintained by automatic reinforcement, and for two participants pica was maintained by both automatic and social reinforcement. Based on these results, different treatment packages were used with the three participants. For the two participants whose pica was maintained by automatic and social reinforcement, the treatment included non-contingent attention as well as either

free access to items that provided oral stimulation or food items. In another study on the pica of cigarette butts, a functional analysis indicated that pica was maintained by the properties of nicotine (Piazza et al., 1996).

Goh, Iwata, and Kahng (1999) compared the effects of two treatments—NCR (non-contingent reinforcement) & DRA (differential reinforcement of an alternative behavior) plus response interruption—on rates of pica. Prior to treatment, various preference assessments were conducted to identify the specific stimulus characteristic of a cigarette that maintained pica. A functional analysis was not conducted because it was assumed that the pica was maintained by automatic reinforcement. During the DRA sessions, the therapist placed a cigarette on the table and extended their hand with their palm facing upwards a few inches above the cigarette. The participant was instructed to hand the cigarette to the therapist in exchange for an edible item. If the participant did not comply within 10 s, the therapist repeated the instruction and modeled the response. If the participant did not comply within 10 s of the model, the therapist then provided physical guidance for them to comply but did not provide an edible. During the NCR condition, edibles were delivered on an FT 10 s schedule. Results indicated that DRA was a more effective treatment in reducing rates of pica. One limitation of this study noted by the authors was that the initial component of the chain leading to pica (picking up the item) was still intact.

In a later study, the parameters of response-blocking in relation to the distance between the therapist and the participant and also in relation to when in the chain the response (pica) was blocked were examined (McCord, Grosser, Iwata, & Powers, 2005). The effectiveness of response blocking was evaluated with three participants who

engaged in pica. Rates of pica were measured across four conditions: alone, no-blocking, block-ingest, and block-touch. There was no consequence for pica during the alone and no-blocking conditions. During the block-ingest condition, the therapist remained 3.1 m from the pica item, which was located on a laminated square on the floor, and attempted to block pica attempts when the participant held the pica item a distance of 0.3 m from their mouth. The therapist blocked pica by stopping the participant from moving their hand closer to their mouth. The therapist also took the item and placed it back on the laminated square. Even though pica was being blocked, the participants were sometimes able to engage in pica before the attempt could be successfully blocked during these conditions. During the block-touch condition, the pica was stopped as soon as the participant touched the pica item. Participants had near zero rates of successful pica (ingested items) during these sessions. Results indicated that response blocking may only be effective if it is implemented early in the chain (as soon as the item is touched) since pica is more consistently interrupted.

The purpose of this study was to extend the findings of the Goh et al. (1999) study methodologically and in treating different forms of pica. Prior to training, a series of preference assessments and a functional analysis was conducted. Training, as in the Goh et al. study included differentially reinforcing an alternative response and response blocking. However, instead of picking up the pica item, the participants were taught to point to it, therefore breaking the initial component of the chain leading to ingestion of a pica item. In addition, the degree to which the response would maintain with faded therapist proximity was evaluated. As discussed by McCord et al. (2005), this can be important to the efficacy of the treatment. If the therapist is further away and unable to

block the pica attempts, or interrupt the chain as soon as possible, then the effectiveness of the treatment could be compromised.

Method

Participant and Setting

Cody was a 9-year-old boy diagnosed with autism and mental retardation. Cody was ambulatory, followed simple directions and communicated mostly with a picture exchange communication system (PECS; Bondy & Frost, 1993). His medications at the time of the study included risperdal and clonipin. His current placement was at a residential facility for children with autism. He had been there for 3 years. It was reported by staff that Cody would ingest non-edible items such as lotion, glue, and soap. Harold was an 11-year-old diagnosed with autism and mental retardation. He was ambulatory, followed simple directions and communicated mostly with simple sign language and a few words. His medications at the time of the study were risperdal and depakote. His current placement was also at a residential facility for children with autism. He had been there for 5 years. Harold did not ingest non-edible items but frequently ate food items off of the floor.

All functional analysis sessions were conducted in a small room containing a table and two chairs. For Cody, training sessions were conducted in his bedroom, which contained one window, a bed, a desk and chair, and a shelving unit. Harold's training sessions were conducted in a small room that contained a small table and two chairs. Materials consisted of a timer, clipboard, pen and paper, data sheets, edibles (used during the preference assessment and training), and a variety of pica items. The pica items selected for Cody were lotion, aquaphor, deodorant, and a glue stick. The lids to all of

these inedible items were glued shut to prevent the participant from opening and obtaining the item. Additionally, the contents of all of the containers were removed and replaced with an alternative, edible item that was similar in texture (Crisco for aquaphor, glue, and deodorant, and jelly for lotion) to the actual item to give the container weight. This also provided a safeguard to prevent against consumption of inedible items in the event that the participant was able to open the container. Four food items (turkey, skittles, cheese crackers, and a breakfast bar) were used during Harold's training. These items were placed on a napkin on the floor or chair in the room.

Response Measurement and Interobserver Agreement

Stimulus preference assessments. The dependent variable was a pointing response. Data on item selection were scored on a trial-by-trial basis. Percentage of trials with selection was calculated by dividing the number of times the item was selected by the number of times it was presented across all trials then multiplying by 100. First selection data were also calculated for Cody due to possible non-selection of pica items subsequent to the first time they were selected as these items were not delivered to the participant. These data were calculated by eliminating all of the trials in which the pica item was presented after it was first selected. Interobserver agreement (IOA) was collected during 100% of trials and averaged 97%. The range was 95% to 98%.

For Harold, the dependent variable was a pointing response. Data on item selection was scored on a trial-by-trial basis. Percentage of trials with selection was calculated by dividing the number of times the item was selected by the number of times it was presented across all trials then multiplying by 100. IOA was collected during 84% of trials and averaged 100%.

Functional analysis. The dependent variable, attempted pica, was defined as the participant's hand making any contact with the pica item. For example, if the participant put their hand on the container, a pica attempt was scored. Frequency of attempts for Cody was calculated for all sessions and was converted to a rate by dividing the number of occurrences of pica by the duration of the session in min. IOA was collected during 58% of sessions and averaged 97%. The range was 90% to 100%.

As there was no harm to Harold in ingesting food items off of a napkin on the floor, the dependent variable, pica, was defined as the participant placing food into his mouth. Frequency of pica was calculated for all sessions and was converted to a rate by dividing the number of occurrences of pica by the duration of the session in min. IOA was collected during 62% of sessions and averaged 91%. The range was 82% to 97%.

Training. The dependent variables during the training were attempted incorrect responses (pica), incorrect prompted responses (pica that occurred after the therapist prompted the participant to point to the item), correct independent responses (pointing to the pica item), and correct prompted responses. Each training session was composed of 10 trials. Responses were scored on a trial-by-trial basis. The percentage of trials with occurrence for each response was calculated. This was done by adding the total number of times that each response occurred and dividing by the total number of trials. IOA was scored during 49% of sessions and averaged 99%. The range was 86% to 100%. For Harold, IOA was scored during 27% of sessions and averaged 99%. The range was 90% to 100%.

Procedure

Preference assessment. A series of paired stimulus preference assessments (Fisher et al., 1992) was conducted to identify an edible item that was more preferred than the targeted, non-edible items for Cody. Pica items were selected for inclusion in the preference assessment based on staff and teacher reports of what non-edible items the participant typically ingested. Edible items were selected for inclusion based on results of previous preference assessments and also on teacher reports of what the participants' preferences were. A paired stimulus preference assessment with eight edible items was conducted first. The four most highly preferred edibles from this initial preference assessment were selected for inclusion in the second preference assessment. The second preference assessment included the four most highly preferred edibles from the initial preference assessment and four pica items. Only one paired stimulus preference assessment, with edible items, was conducted with Harold. For all preference assessments, each item was presented in a counterbalanced order and was paired with all other items twice for a total of 56 trials.

Functional analysis. The participant was exposed to an experimental functional analysis of pica. The conditions were similar to those described by Iwata, Dorsey, Silfer, Bauman and Richman (1982/1994). During the demand condition, the participant was instructed to complete academic tasks that were not included on their IEP. A three-step prompting hierarchy was used (verbal, model, and manual guidance). Prompts were delivered every 5 s. Contingent on the attempted occurrence of pica, the therapist removed the pica item as neutrally as possible, stated "Okay, you don't have to," and removed materials/turned away from the participant for 15 s. During the social attention

condition, the therapist told the student, “Play with your toys. I will be here doing work.” Contingent on attempted pica the therapist removed the pica item as neutrally as possible and stated, “Don’t do that. It’s not safe.” During the play condition, the participant had access to highly preferred toys. Praise was delivered on a fixed-time 15 s schedule. If attempted pica occurred, the therapist removed the item as neutrally as possible and withheld praise until the participant was 5 s free of pica attempts. During the no-interaction condition, the therapist was in the room with the participant, no toys were available, and contingent on pica, the therapist removed the item as neutrally as possible.

Harold was exposed to the same analysis with a few exceptions. During the social attention condition, the participant was told, “I will be here doing work.” No toys were present. Contingent on pica the therapist stated, “Don’t eat that, it’s dirty.” Throughout all conditions, Harold was allowed to consume items that he picked up off of the floor. The therapist then replaced these items with new ones.

DRA and response blocking. During the DRA treatment, the participants were taught to gain the therapist’s attention and to point to the pica items found in their environment. Each session consisted of 10 trials. Training trials and probe trials were interspersed so there were five training trials and five probe trials per session. During the training trials the participant and the therapist were a distance of 5 cm from one another. During probe trials, the therapist stood outside of the room. Before the onset of each session, the participant’s bedroom was baited with four different containers of pica items. The cue, “Go hang out in your room/classroom” was delivered at the start of each trial. During training trials, the participant and the therapist walked into the room together. Cody receive an isolatdible reinforcer and Harold received an edible reinforcer of his

choice that was twice the size of the item on the floor for gaining the therapist's attention (by tapping their shoulder) and pointing to the pica item. If the participant did not do this within 5 s of entering the room, the therapist manually guided the correct response and then provided edible reinforcement. During probe trials, the same cue, "Go hang out in your room/classroom" was delivered. The therapist remained outside of the room. If the participant came out of the room to get the therapist's attention, the therapist entered the room. If the participant pointed to the item within 5 s of the therapist entering the room, an edible reinforcer was delivered. Otherwise, the therapist left the room again. For Cody, probe trials were terminated if he touched the pica items or if 1 min elapsed without him either touching the item or getting the therapist's attention. Probe trials were terminated for Harold if he consumed one of the pica items or if 1 min elapsed without him either consuming the item or getting the therapist's attention. Across all trials for Cody, if he touched the pica item, consumption was blocked and the trial was repeated. Across all trials for Harold, if he consumed the pica item, the food was replaced on the floor and the trial repeated. After a number of treatment sessions, a change was made to the procedure for Harold and his attempts to engage in pica were blocked as soon as he touched the pica item also. The correct response was immediately manually guided and edible reinforcement delivered.

Results

Preference Assessment

Two preference assessments were conducted for Cody. The results from the initial preference assessment, with edibles only, are depicted in Figure 1. Peppermint patties, selected in 86% of trials, were the most highly preferred. Percentage of trials

with selection of other items is as follows: tortilla chips were selected in 79% of trials, cheese crackers in 64% of trials, chips in 57% of trials, pretzels in 50% of trials, gummy candy in 43% of trials, jelly beans in 14% of trials, and caramels in 7% of trials. The four most highly preferred edibles—peppermint patties, tortilla chips, cheese crackers, and chips were selected for inclusion in the second preference assessment. Results from the second preference assessment, with edibles and pica items, are presented in Figure 1. These are first selection data. Peppermint patties and glue stick were the most highly preferred; both items were selected in 100% of trials. Percentage of trials with selection of other items is as follows: Chips were selected in 66% of trials, cheese crackers in 63% of trials, aquaphor in 50% of trials, deodorant in 30% of trials, tortilla chip in 25% of trials, and lotion in 0% of trials. Therefore, peppermint patties were selected for the treatment phase. First selection data were taken because edible items were always chosen over the pica item after the pica item was presented a few times, as consumption of these items was not allowed.

One preference assessment was conducted with Harold. These results are depicted in Figure 1. Chips, the most highly preferred edible, were selected in 79% of trials. Toaster pastries, turkey and candy-coated fruit chews were all selected in 71% of trials. Cheese crackers were selected in 43% of trials, fruit snacks in 29% of trials, chocolate in 22% of trials, and soft mints in 14% of trials. Toaster pastries, turkey, candy-coated fruit chews and cheese crackers were selected for use in the functional analysis and treatment sessions.

Functional Analysis

Data from Cody's functional analysis are depicted in Figure 2. Initially, there were undifferentiated rates of responding across all conditions. Responding remained high and variable across the no interaction condition. Pica occurred at low variable rates during the demand condition. Although pica was high for the first session of both the play and attention conditions, responding decreased to and remained at zero for the remainder of the functional analysis. These data suggested that Cody's pica was maintained by automatic reinforcement.

Data from Harold's functional analysis are also depicted in Figure 2. The rate of pica was high across all conditions. Initially, low rates were exhibited during the demand condition. However, these rates increased and remained high for the remainder of the functional analysis. These data indicated that Harold's pica was also maintained by automatic reinforcement.

DRA and Response Blocking

Training trials and probe trials are displayed on two separate graphs. Data collected during training trials for Cody are depicted in Figure 3 and data collected during the probe trials are depicted in Figure 4. Baseline data are the same across both graphs. During baseline sessions, pica occurred during 80% of the trials for one session and 100% of the trials for all other baseline sessions. There was a marked decrease in pica as soon as the treatment began. The percentage of correct prompted responses per session was high and steady until the fifteenth treatment session when rates of unprompted correct responses began to increase. Correct unprompted responses remained high throughout the treatment. Pica rarely occurred during the training trials. However,

during probe trials, pica initially occurred during almost all trials. The percentage of trials with pica per session began to decrease and the percentage of trials with correct unprompted responses per session began to increase after session 25 but was highly variable. Training was terminated after correct unprompted responses during probe trials stabilized. At the end of the training, correct unprompted responses occurred during 100% of both training and probe trials.

Data collected during Harold's training trials are depicted in Figure 3 and data collected during the probe trials are depicted in Figure 4. Baseline data are the same across both graphs. During baseline sessions, pica occurred during 100% of the trials for all baseline sessions. There was a decrease in pica as soon as the treatment trials began. Fifteen sessions were conducted without blocking pica attempts. During these sessions, there was a high percentage of prompted responses but a low percentage of independent responses during treatment trials. During probe trials, there were no independent responses. Once blocking pica was added to the procedure, there was an immediate increase in the percentage of independent responses during the training trials. During probe trials, there was a slight decrease in pica and a slight increase in independent responses. Independent responses continued to increase and stabilized at 100% during the probe sessions.

Discussion

This study extended the findings of Goh et al. (1999). In the Goh et al. study, four participants were treated for cigarette pica. A functional analysis was not conducted in the Goh et al. study; instead, treatment was based on the assumption that cigarette pica was maintained by automatic reinforcement and a specific component of the cigarette. In

the current study, a functional analysis on pica was conducted to rule out other possible maintaining variables, as the treatment may not have been effective with a participant whose pica was maintained by attention. As in the Goh et al. study, an alternative response to pica was taught. Participants in the Goh et al. study were taught to pick up cigarette butts and hand them to a therapist who was standing within a close proximity in exchange for a preferred edible. Therapist proximity was, however, not decreased. The current study extended these methods. Instead of engaging in pica, two participants were taught to gain a therapist's attention and point to pica items in their environment. This behavior was reinforced with a highly preferred edible. In addition, therapist proximity was decreased such that at the end of the treatment, the therapist was standing at the door with their back turned away from the participant. Therapist proximity was discussed by McCord et al. (2005). The effect of blocking pica at two different points in the response chain was evaluated. Two response-blocking conditions were examined. In one condition, the therapist blocked pica after the item had been picked up off of the floor and in another condition the therapist blocked pica immediately when the participant touched the pica item. Blocking was more effective when the therapist stood closer to the participant during the trials in which pica was blocked immediately.. This implies that treatment can be impacted by therapist proximity. If the therapist is closer to the participant, they can interrupt the chain sooner than they would be able to if they were standing further away.

Although the current treatment was successful and both participants began to point to pica items rather than consume them, there are some limitations to the study. All of the training trials were conducted with the same four pica items and in the same

location. It is possible that if the participants were to find other pica items in their environment, they would consume them rather than pointing to them. This should be explicitly tested in future studies.

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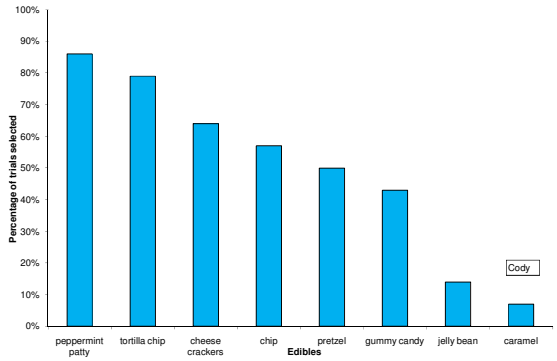
Figure Captions

Figure 1. Percentage of trials with selection of edibles during the initial preference assessment for Cody and Harold. First selection data; percentage of trials with selection of edibles and pica items during the second preference assessment with Cody.

Figure 2. Responses per minute of pica during functional analysis conditions for Cody and Harold. Closed squares represent the play condition, closed triangles represent the demand condition, open diamonds represent the no interaction condition, closed circles represent the attention condition.

Figure 3. Percentage of trials per session with pica (closed squares), correct independent responses (open circles), correct prompted responses (open diamonds), incorrect prompted responses (asterix), and no responses (closed triangles) during training trials for Cody and Harold.

Figure 4. Percentage of trials per session with pica (closed squares), correct independent responses (open circles), and no responses (closed triangles) during probe trials for Cody and Harold.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10%
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Percentage of trials selected
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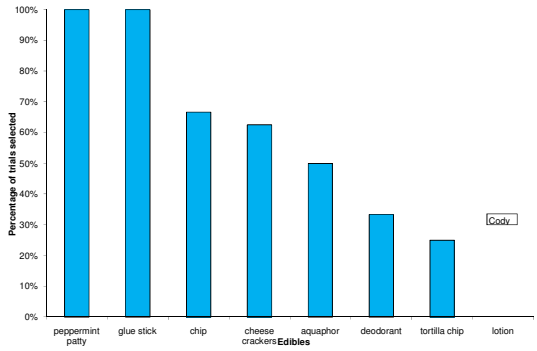
cheese crackers
chip
pretzel
gummy candy
jelly bean
caramel
Edibles
Cody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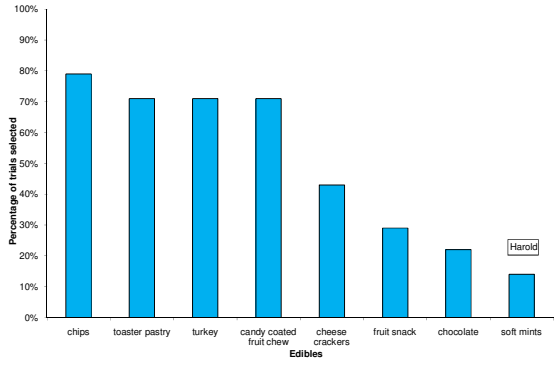
aquaphor
deodorant
tortilla chip
lotion
Edibles
Cody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Percentage of trials selected
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toaster pastry
turkey
candy coated fruit chew
cheese crackers
fruit snack
chocolate
soft mints
Edibles
Harold

Figure 1.

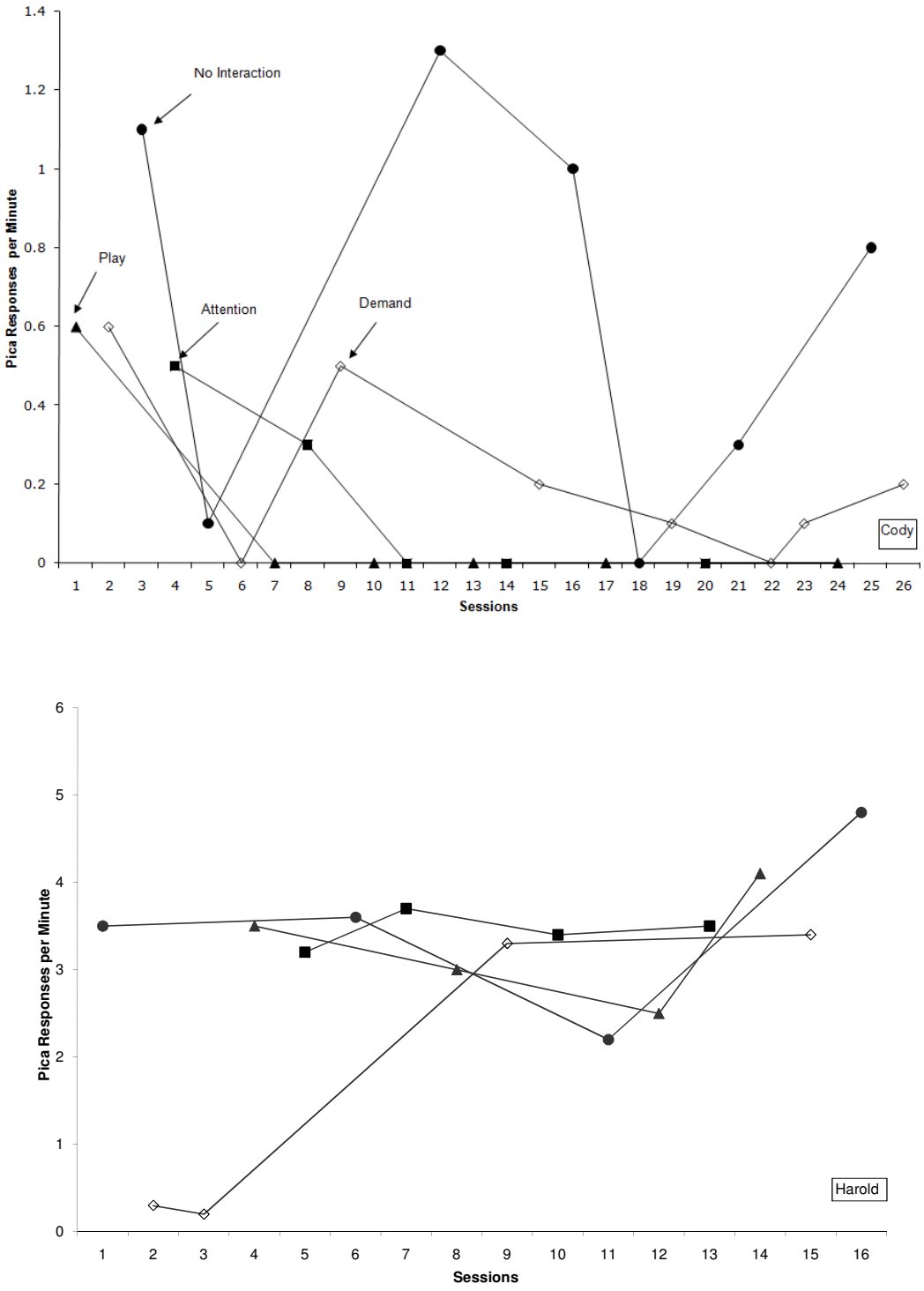
Pica Responses per Minute
Sessions
No Interaction
Play
Attention
Demand
Cody
Harold

Figure 2.

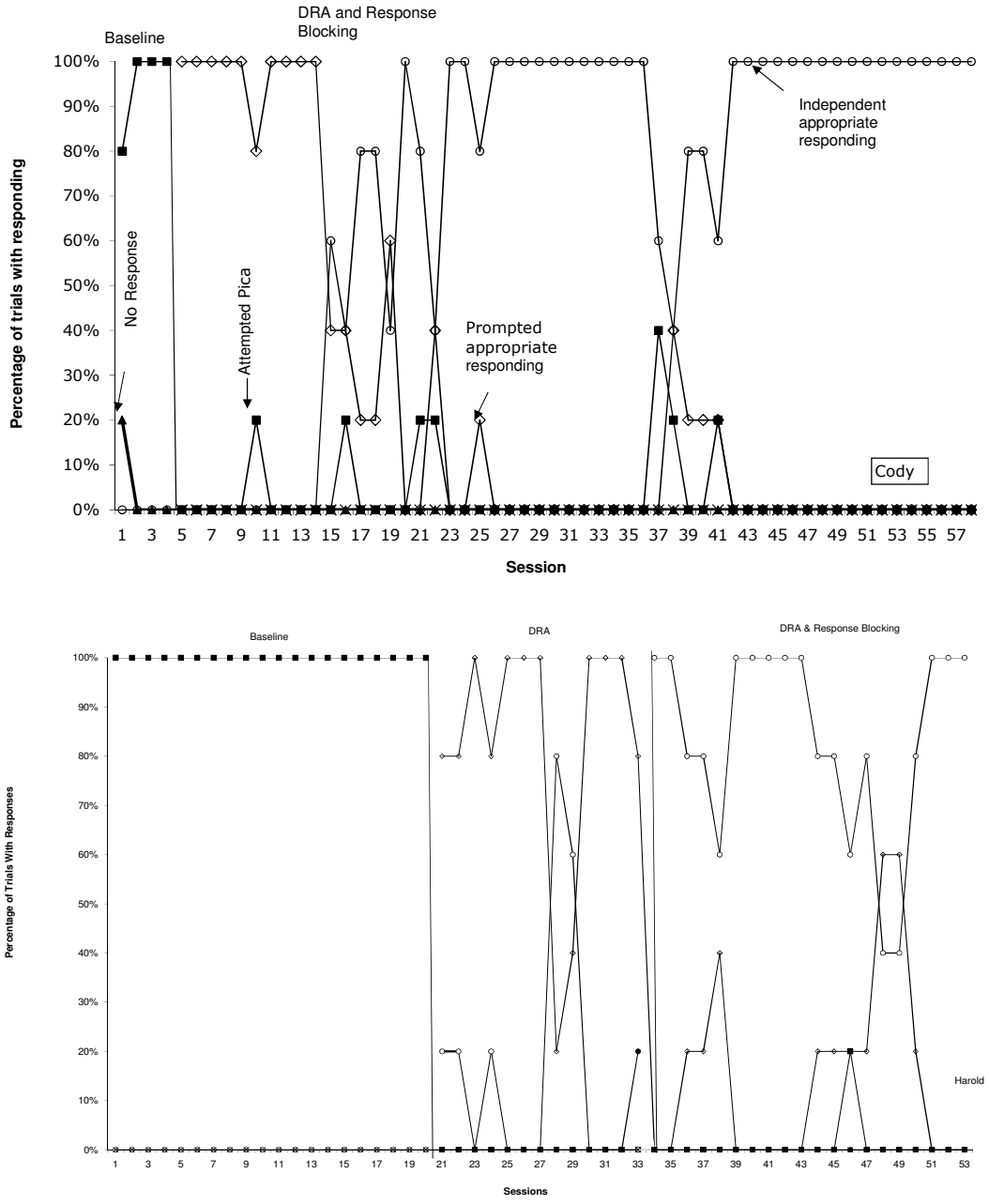
Baseline
DRA and Response Blocking
Percentage of trials with responding
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
No Response
Attempted Pica
Prompted appropriate responding
Independent appropriate responding
Cody
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47 49 51 53 55 57
Session
Baseline
DRA
DRA & Response Blocking
Percentage of Trials With Responses
Harold
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47 49 51 53
Sessions

Figure 3.

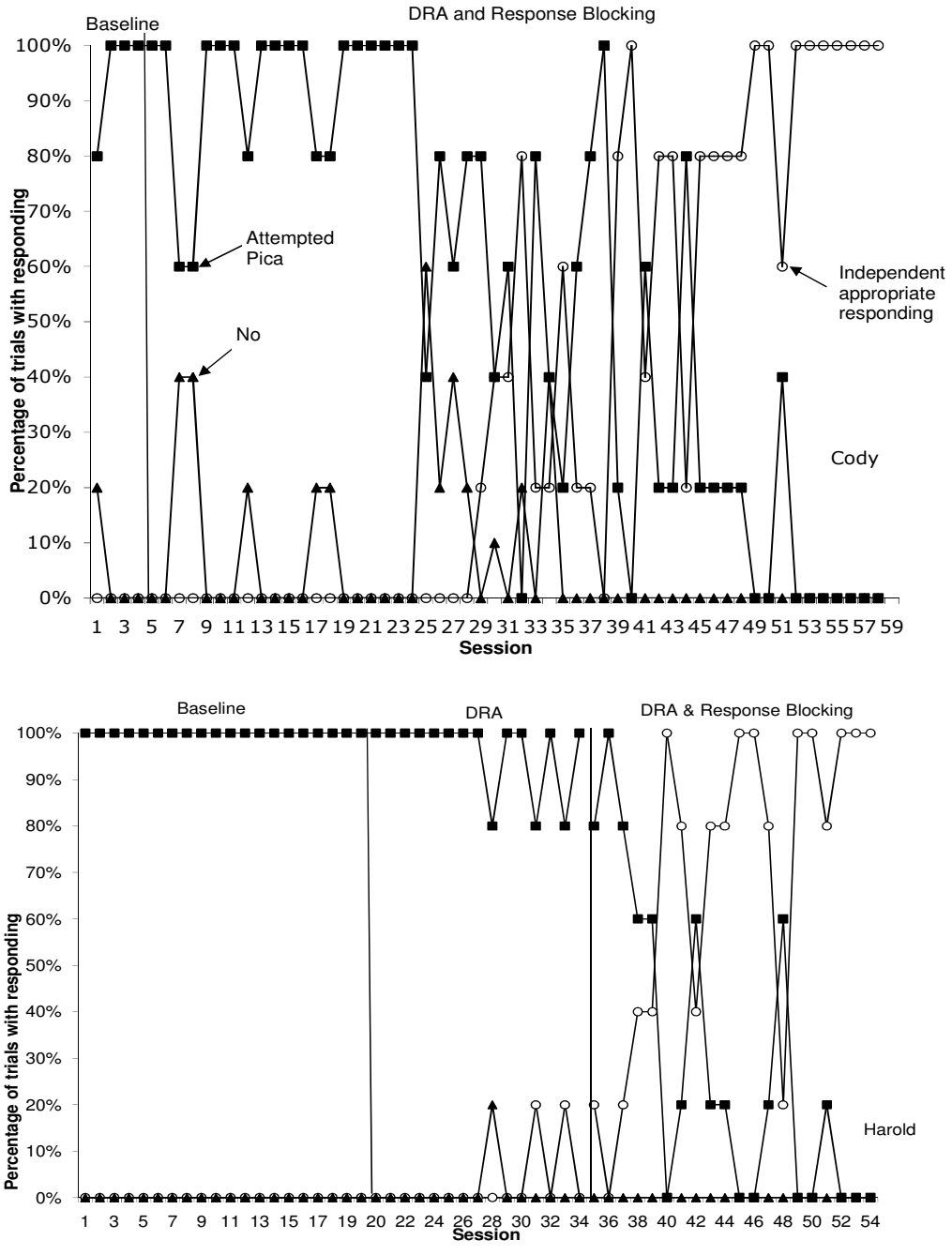
Baseline
DRA and Response Blocking
Attempted Pica
No
Independent appropriate responding
Cody
Percentage of trials with responding
Session
Baseline
DRA
DRA & Response Blocking
Harold
Percentage of trials with responding
Session

Figure 4.