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Reinforcing effects of social stimuli on responding after implementation of a pairing procedure

Amanda J. Murray
Northeastern University

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**Reinforcing Effects of Social Stimuli on Responding After
Implementation of A Pairing Procedure**

A Thesis Presented

by

Amanda J. Murray

The Department of Counseling and Applied Educational Psychology

In partial fulfillment of the requirements

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Author: Amanda Murray

Department: Counseling and Applied Educational Psychology

Approved for Thesis Requirements of Master of Science Degree

Julie Weiss Date

Paula Braga-Kenyon Date

Karen Gould Date

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by

Amanda J. Murray

B.S., Pennsylvania State University

Submitted In partial fulfillment of the requirements for the degree of
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Abstract

The current study was conducted to assess the reinforcing effects of social stimuli on responding, and through the use of a pairing procedure, establish previously neutral social stimuli as reinforcers. An edible reinforcer was identified through a preference assessment and was validated through a reinforcer assessment. Two social stimuli, vocal praise and back pats, were also assessed to detect any pre-pairing procedure effects of these stimuli on responding. A pairing procedure was then implemented with the social stimuli to determine if either stimulus could be conditioned to serve as an effective social reinforcer. One child, diagnosed with an Autism Spectrum Disorder (ASD), participated in the current study. The social stimuli were not effective reinforcers prior to the pairing procedure, but both stimuli were conditioned as effective reinforcers for responding after pairing procedures were implemented. The implications of the current study's results and directions for future research are discussed, such as new methods for establishing conditioned reinforcers and the number of pairings required to condition reinforcers.

Reinforcing Effects of Social Stimuli on Responding After Implementation of Pairing Procedure

“Reinforcement is the most important principle of behavior and a key element of most behavior change programs designed by behavior analysts.” (Cooper, Heron & Heward, 2007, p. 36) Reinforcement is defined by the relationship between a behavior, a consequence and an increased probability of future occurrence of the behavior. Most behavior change programs include the use of reinforcers to increase rates of behavior. Much research has been devoted to the identification, assessment and effectiveness of these reinforcing stimuli used in behavioral programming (DeLeon & Iwata, 1996; Pace, Ivancic, Edwards, Iwata, & Page, 1985; Fisher et al., 1992). The identification of an effective reinforcer is an essential component of behavior programming for individuals with developmental disabilities. Often times, effective reinforcers for responding are not easily identified for these individuals due to decreased spontaneous play, lack of vocal communication, or limited motor ability. The process of identification of effective reinforcers is often taken for granted (Pace et al., 1985).

A reinforcer is “a stimulus change that increases the future frequency of behavior that immediately precedes it” (Cooper et al., 2007, p.702). According to this definition, a stimulus cannot be identified as a reinforcer until the effect on the response has been examined. Many studies fail to effectively identify and/or assess a stimulus as a reinforcer prior to inclusion in behavior programming. This may lead clinicians to assume a behavior program is ineffective when in fact, the stimulus presumed as a reinforcer is ineffective. One solution to this problem is to formally identify stimuli as reinforcers before including them in behavior programming (Pace et al., 1985).

There have been many studies devoted to procedures for identification of preferred stimuli. A procedure to identify preferred stimuli for individuals with developmental disabilities

was developed by Pace et al. (1985). The authors presented stimuli one at a time to a participant and recorded approach responses. Those stimuli with higher percentages of approach were considered to be preferred stimuli and those with low percentages of approaches were not. The preferred stimuli were then assessed as reinforcers through the contingent presentation on a response. The reinforcing effectiveness was determined through the effects on rates of responding. This study was one of the first whose purpose was to design a way of identifying reinforcers. There are some limitations to the results of the study such as a lack of preference hierarchy and a lengthy assessment procedure.

The consideration of these limitations led to a more effective procedure for the identification of reinforcing stimuli for individuals with developmental disabilities. This procedure was developed by Fisher et al. (1992). The authors compared the results of the single stimulus procedure to the results of a paired stimulus method. In the paired stimulus method, stimuli were presented in pairs to an individual, the individual selected one stimulus, the stimulus was delivered, and selections were recorded. By presenting the stimuli in pairs, the experimenters were able to compile a preference hierarchy of the stimuli using percentage of selections. All stimuli identified as “high preference” on their paired stimulus procedure were also identified as such on the single stimulus procedure, but not vice versa (i.e. the single stimulus procedure gave some false positive results). Although it is important to identify stimuli as preferred, it is also important to test their reinforcing effectiveness in a reinforcer assessment before including them in a behavior program.

A reinforcer assessment is a test of preferred stimuli. If preferred stimuli function as reinforcers, then there should be an increase in response rates when these stimuli are presented contingent on that response. During a reinforcer assessment, preferred stimuli are presented

contingent on a response and rate of responding is measured to determine if the stimuli serves as a reinforcer. After both of these assessments have been conducted, a preferred stimulus can be identified as a reinforcer for that individual's responding. This is of practical use to clinicians because they can then include this reinforcer in behavior programming to increase target behavior.

The studies mentioned involved identification of preferred stimuli for individuals, however, there are many caveats associated with the use of unconditioned reinforcers in behavioral programming. These drawbacks include the difficulty of presentation of the stimulus, satiation effects, reduced effectiveness due to delay in presentation and detrimental health effects (Cooper et al., 2007). Also, it may be difficult to use primary reinforcers in natural or classroom environments; therefore, it is important to investigate conditioned reinforcers. Conditioned reinforcers are stimuli that function as reinforcers due to prior pairing with one or more other reinforcers (Cooper et al.).

Literature on the use of conditioned reinforcement for individuals with developmental disabilities states a variety of advantages for doing so. Kazdin and Bootzin (1972) noted:

...there are a number of advantages in using generalized conditioned reinforcers.

Specifically, conditioned reinforcers: (1) bridge the delay between the target responses and back-up reinforcement; (2) permit the reinforcement of a response at any time; (3) may be used to maintain performance over extended periods of time when the back-up reinforcer cannot be parceled out; (4) allow sequences of responses to be reinforced without interruption; (5) maintain their reinforcing properties because of their relative independence of deprivation states; (6) are less subject to satiation effects; (7) provide the same reinforcement for individuals who have different preferences in back-up

reinforcers; and (8) may take on greater incentive value than a single primary reinforcer...
(p.343)

There may also be some advantages to using concrete, tangible conditioned reinforcers, for example tokens, rather than something ephemeral, such as praise (Ayllon & Azrin, 1968). The number of tokens delivered can be related to the amount of reinforcement available, for example, 10 tokens can be exchanged for candy, but 50 tokens can be exchanged for a bag of candy. The use of tokens allows the participant to observe the delivery, accumulation and exchange of the stimuli. These are all characteristic of token economies, but not of reinforcers such as praise. This visual aspect may increase the saliency and/or reinforcing effectiveness of the stimuli.

Although there is much research on the use of conditioned reinforcers, there is little applied research on ways to establish stimuli as conditioned reinforcers or to continue to assess their potency throughout behavioral programming. There are a variety of factors that may influence the effectiveness of conditioned reinforcers and therefore, modify the durability of the stimulus as a reinforcer (Kelleher & Gollub, 1962). According to Kelleher and Gollub:

...amount of primary reinforcement, and frequency or probability of primary reinforcement are effective in determining conditioned reinforcement strength. In addition to these variables, number of pairings of and duration of interval between conditioned and primary reinforcers affect the potency of a conditioned reinforcer.
(p.593)

One study examined the number of pairings between types of reinforcers necessary to effectively condition social stimuli as reinforcers (Dozier, Iwata, Thomason & Wilson, 2007). In the study, the authors compared three pairing procedures for conditioning reinforcers. The first

pairing procedure involved contingent delivery of an edible plus praise on a novel response. The second procedure was identical to the first but stimuli were presented contingent on an established response. The third procedure, the established response procedure with schedule thinning, was identical to the second with the addition of schedule thinning of the edible stimulus. The third procedure was the most effective of the three at increasing participants' responding and maintaining it even after schedule thinning (of the primary reinforcement). The results of this study led to implications for future research designed to examine the number of pairings necessary to effectively condition reinforcers.

One study examined the reinforcing value of tokens after a pairing procedure and the minimal number of pairings between the primary reinforcer and neutral stimulus required to establish a conditioned reinforcer (Moher, Gould, Hegg, and Mahoney, 2008). The authors found that the essential number of pairings to establish a neutral stimulus as a conditioned reinforcer varied among the participants. The procedure implemented in the study, alternating pairing sessions with preference probes, is one way to determine this critical number for an individual.

Although there are many reasons why it is beneficial to establish and maintain effective conditioned reinforcers with individuals with developmental disabilities, there are also advantages for using a more socially-accepted reinforcer, such as praise or a pat on the back. When the individual is in an inclusion setting, it may be stigmatizing to use a conditioned reinforcer, such as a token. Social reinforcers may be less salient to typically-developing peers and social reinforcers are often naturally-occurring in the environment, so the individual may have more sources from which to access reinforcement.

Gibson (2009) extended the results of the study conducted by Moher et al. (2008) by examining the reinforcing value of a social stimulus after a pairing procedure with a primary

reinforcer. The study assessed the reinforcing effects of two social stimuli prior to and after pairing these stimuli with an identified primary reinforcer and then examined the effects of another stimulus already being used in a participant's behavior program outside of their sessions, but which had not been formally assessed. The results indicated that the pairing procedure was effective at conditioning social stimuli as reinforcers, but that these effects did not generalize when probed later in the study.

The purpose of the current study was to replicate the pairing procedures of Gibson (2009). The purposes included: assessing the reinforcing value of social stimuli for an individual diagnosed with an Autism Spectrum Disorder (ASD), establishing one or more social stimuli as conditioned reinforcers through a multiple pairing procedure, and comparing the reinforcing effects of the pairing procedure with the effects of an existing conditioned reinforcer used in the individual's daily behavior programming. The current study also examined the efficacy of pairing a neutral stimulus with a conditioned reinforcer.

Method

Participant

Harry was an 8-year-old male diagnosed with an Autism Spectrum Disorder (ASD). He lived at home with his family and attended a private school with typically-developing peers at the time of the study. He had previous exposure to a token economy used in his daily behavior program and in differential reinforcement procedures. At the time of the study, his behavior program included delivery of tokens contingent on correct responses in the classroom. These tokens were exchanged for an edible on a fixed ratio 8 (FR8) schedule of reinforcement.

Harry presented delays in social skills, as compared to his typically-developing peers. He communicated vocally and performed at or above academic levels when compared to children of

his age. He was selected for this study due to the need to identify and/or establish social reinforcers to include in his behavior programming. Social reinforcers would be less stigmatizing than his tokens and more likely to be delivered by other adults within the school.

Setting and Materials

All sessions were conducted in the child's classroom at his home. This area was a large room (approximately 6m x 8m) in a part of the home in which he received tutoring and completed homework. The room contained a play area (approx. 4m x 6m) with bins of toys, bookshelves, a computer, and a variety of puzzles, games, etc. as well as a work area (approx. 2m x 2m) that was partitioned off in one corner of the room. This area contained a table/chairs, whiteboard, shelving, and a variety of school supplies such as markers, paper, rulers, etc. During the sessions, a clipboard, timer, watch, video recorder, and pencil/paper were also present. Session materials included edible stimuli in a small plastic bag and the Connect 4 game board/chips. The same tokens and token board (handwritten stars on a printed 8-block grid) that were used in the participant's daily programming were used in the reinforcer assessment.

Dependent Variable and Response Definition

The dependent variable during the edible preference assessment was a selection response, defined as touching a picture card of the edible stimulus with any finger on either hand. Items were delivered contingent on selection.

The dependent variable during all reinforcer assessments was inserting one chip (small plastic disk, either yellow or green) into any slot of the Connect 4 board game from the top with any hand and releasing the chip. If two chips were inserted at approximately the same time, two responses were recorded. Chip insertion was defined as picking up a chip from the table with fingers and releasing it over a slot in the game board, causing the chip to fall through the slot.

Number of chips displayed in the board at the end of the session duration equaled the number of responses emitted.

Social stimuli used in the study were vocal praise and back pats. Vocal praise was delivered by the experimenter orienting face toward the participant and saying aloud, in moderate volume and with normal inflection, “good job” or “good work.” Back pats were delivered by the experimenter orienting face toward the participant and patting near top of his back twice with open hand for approximately 1 second.

Measurement Method and Inter-Observer Agreement (IOA)

The experimenter was present and recorded all data for all sessions. During preference assessment sessions, the experimenter recorded selection data on each trial. The data sheets consisted of information about the stimulus, the selection response and a final summary of the stimuli listed in a hierarchical order (i.e. highest to lowest) based on point values assigned according to order selected.

During reinforcement sessions, the experimenter tallied the number of responses or counted number of chips inserted at the end of the session to determine the response frequency. Response rate was calculated by dividing the number of responses by the duration of the session.

Inter-observer reliability was collected for a minimum of 30% of sessions in each condition across all analyses and mean agreement was always above 85%. Sessions were divided into 30-s intervals and percent agreement was calculated by dividing the number of intervals in agreement by the number of intervals total and multiplying by 100. Inter-observer agreement was collected independently by a second observer.

Procedure

Phase 1. A preference assessment was conducted to identify a high-preference stimulus to be used as an edible reinforcer in subsequent phases throughout the study. The procedures used in this phase closely resembled those developed by DeLeon and Iwata (1996). Prior to the assessment, to decrease the assessment duration and to prevent any satiation effects, the participant was shown a series of eight pictures that represented the edible stimuli. The experimenter instructed the participant to name the stimuli and informed him that these pictures would be used to represent the tangible edible. During this procedure, commonly referred to as a multiple-stimulus without replacement (MSWO) assessment, eight picture stimuli were presented in an array to the participant. The participant was then instructed to select the pictures in order with his “favorite” being selected first. The experimenter recorded the order the stimuli were selected and the stimuli were present until all stimuli were chosen. Selection was defined as described above. The experimenter blocked any attempts to select more than one stimulus per trial. A trial ended after the stimuli were all selected. A new trial with the stimuli presented in a rotated order (i.e. stimulus on right was rotated to the left of the array) was presented. The assessment consisted of seven trials. After the completion of the assessment, scores were assigned to each stimulus based upon the order in which it was selected, from 7 to 0. For example, if a stimulus was chosen 1st during each trial, it would receive a score of 49 (e.g., 7 points awarded for each trial multiplied by 7 trials).

Phase 2a. During this phase, a reinforcer assessment was conducted to determine whether the stimulus with the highest score from the previous phase (Spicy Cheeto crisp) did in fact function as a reinforcer for responding. The response, chip insertion, was defined previously and was used throughout all phases of the assessment. The two conditions during this phase were FR1 (crisp) and extinction. During the FR1 condition, the ‘high-preference’ edible (Spicy Cheeto

crisp) was delivered contingent upon the chip insertion response. The experimenter delivered the crisp onto a paper napkin in front of the participant. During the extinction session, no consequence occurred following a chip insertion response. Prior to each session, the experimenter provided an instruction (i.e., “during this session, you will receive a Cheeto for each chip you put in” or “during this session, you won’t receive anything for putting chips in”). All sessions in this and subsequent phases were 2 minutes in duration. Sessions were alternated and continued until there was stable rate of responding or differential rate of responding between the conditions.

Phase 2b. During this phase, a reinforcer assessment was conducted to assess whether the social stimuli, provided contingent on responding, would function as reinforcers prior to any pairing sessions. The conditions in this phase included the FR1-edible, extinction, vocal praise, and back pats. The extinction, vocal praise, and back pats conditions were alternated in a multi-element design in quasi-random order and continued until there was stable rate of responding. Edible and extinction conditions were identical to those in Phase 2a. Contingencies during the vocal praise and back pats sessions were implemented as described in the dependent variables section described above. Instructions were delivered prior to each session similar to those described in Phase 2a. After stable rate of responding was achieved, the FR1-edible condition was re-introduced to indicate differential rate of responding between conditions and to demonstrate that the edible stimulus still held reinforcing value, when the social stimuli did not.

Phase 3. During this phase, pairing was implemented in an attempt to establish the previously-neutral social stimuli as conditioned reinforcers. The procedure was similar to that used in Dozier et al. (2007). Each pairing session consisted of 10 pairings between the edible stimulus and a neutral social stimulus. A pairing was the presentation of the social stimulus,

immediately followed by the edible. Four pairing sessions were implemented with each social stimulus in an alternating order, before moving on to the next phase.

Phase 4. This phase consisted of probe sessions, conducted to evaluate the reinforcing effects of the previously-neutral social stimulus. The sessions were identical to those in Phase 2b, with the exception of the ratio of conditions. For every block of 8 sessions, there were 3 praise, 3 back pats, 1 FR-1 edible, and 1 extinction session. Phases 3 and 4 were alternated until stable rate of responding was observed in Phase 4 or until the response rates in Phase 4 matched those of the rates observed in Phase 2a.

Phase 5. In this phase, a reinforcer assessment was conducted with the participant's existing tokens used during daily behavior programming. Sessions were conducted similarly to the procedures in Phase 2a. Contingent on the chip insertion response, the experimenter delivered a token. When 8 tokens had been delivered, the experimenter removed the board and delivered the edible reinforcer.

Phases 6 and 7. These phases were very similar to phases 3 and 4. Phase 6 consisted of 3 pairing sessions with back pats and tokens. Each session was 10 trials. Back pats and tokens were delivered contingent on responding. After 10 pairings, an edible was delivered in exchange for the tokens and the pairing session ended. After the completion of a pairing session, phase 7 was implemented similar to phase 4. Sessions were run in a fixed ratio of 3 back pats, 1 extinction, and 1 token. Prescribed consequences were delivered contingent on responding and sessions were 5 minutes in length. Phases 6 and 7 alternated until stable rates of responding were observed or there was differentiated responding. One probe session of each condition in the study was conducted approximately 3 weeks after the conclusion of the study.

Results

The results for the preference assessment (Phase 1) are shown in Figure 1. Spicy Cheetos receive a summative score of 49 (out of 49) on the MSWO assessment. They were selected first during each trial of the assessment and therefore, selected for inclusion in the subsequent phases of the study.

The results for the reinforcer assessments conducted in Phases 2a and 2b are depicted in Figure 2. In Phase 2a, response rates for the FR1-edible condition were higher than in the extinction (baseline) condition. Mean responding during FR1-edible sessions was 14.38 responses per minute (range 9.0 to 21.5) and the mean response rate during the extinction sessions was 6.5 (range 1.0 to 12.0). The selected edible functioned as a reinforcer for the participant's responding. In Phase 2b, back pats, praise and extinction sessions were implemented. Back pats sessions initially showed differential response rates, but after a session, the rates of responding decreased and were similar to rates of responding in the praise and extinction conditions. Response rates in the three conditions remained stable and low rates, similar to the rate of responding recorded in the extinction condition of Phase 2a. Mean responding during the back pats sessions was 14.25 (range, 6.0 to 21.0), in the praise sessions was 6.37 (range, 4.0 to 8.0), and in the extinction sessions was 6.56 (range, 4.0 to 9.3). When edible stimuli were delivered contingent on responding at the end of Phase 2b, responding increased to 18.17 (range, 17.5 to 19.0), while rates of responding in the other conditions remained low rates. Neither social stimulus maintained responding without prior conditioning and pairing with another reinforcing stimulus.

The results of Phases 3 and 4 are depicted in Figure 3. This phase included 240 pairings of the social stimuli with the unconditioned reinforcer. Mean responding for back pats was 4.83 and remained low throughout the phase, even after the pairing procedure (range, 3.5 to 7.0).

Mean responding in the praise condition was 8.55, and increased to a rate similar to that of the edible condition, after the occurrence of additional pairings between the edible reinforcer and the social stimulus (range, 4.5 to 17.0). The pairing procedures occurred prior to sessions 43, 51, and 59 during this phase and each pairing procedure included 80 pairings of the stimuli. Mean responding during the FR1-edible condition was 14.83 and increased throughout the phase (range, 12.0 to 17.5). Near the end of phase 4, responding in the FR1-edible and praise conditions indicated an increasing trend while responding in the back pats condition indicated a decreasing trend at a level similar to that of the control (extinction). Therefore, one social stimulus, vocal praise, was effectively conditioned as a reinforcer for the participant's responding with the use of the pairing procedure; one social stimulus, back pats, was not effectively conditioned using the same pairing procedure.

Results from Phase 5 are shown in Figure 4. This phase assesses the reinforcing value of tokens currently used in the participant's daily behavior program. Mean responding during the token condition (tokens delivered contingent on responding) was 18.5 and indicated a high response rate with an increasing trend (range, 17.0 to 20.5). This rate was higher than that of the unconditioned stimulus (edible), initially observed in Phase 2a.

Results from Phases 6 and 7 are shown in Figure 5. These phases were similar to Phases 3 and 4. The pairing procedures occurred prior to sessions 74, 79, and 84 during this phase and each pairing procedure included 10 pairings between back pats and tokens (30 pairings in all). Mean responding during the token condition was 17.6 and remained stable throughout the phase (range, 17.2 to 18.0). Mean responding in the back pats condition was 7.0 (range, 3.2 to 12.8), indicating an increasing trend. Therefore, back pats were conditioned as a reinforcing stimulus using the pairing procedure with another conditioned reinforcer.

All assessment data are presented in Figure 6 (Phases 2 to 7). It appears that neither of the social stimuli functioned as unconditioned reinforcers, prior to the implementation of the pairing procedure. Although the rate of responding of the back pats condition was high initially, this rate decreased to a pattern similar to that of extinction. With the use of two different pairing procedures, both social stimuli were conditioned as effective reinforcers for responding.

Discussion

In the current study, praise and back pats were effectively conditioned as reinforcers; however, responding during the token condition was higher, indicating that the token served as a stronger conditioned reinforcer for responding. Another note-worthy observation was the initial burst in responding during the social reinforcer assessment in the back pats condition. One explanation for this initial burst in responding may have been the novelty of the social stimulus. Back pats were not observed outside of sessions and also not observed in the surrounding culture. This may have contributed to the observed effect on responding.

There were some limitations to the current study. One was that only a single type of conditioning procedure was implemented. Future research should aim at the development of additional conditioning procedures. Another possible limitation was that only two social stimuli were assessed. Future research should include a wider range of stimuli in the assessment.

One interesting observation was the responding that occurred during the extinction condition, even when instructions were provided, stating the current condition. Rates of responding during the extinction condition were low; however, they did exist, and implied that

the participant's responding may have been due to behavioral momentum from the previous condition or a high extinction resistance of the edibles.

The inclusion of the tokens raised another interesting question regarding the characteristics of the stimuli used in the study. Obviously, the tokens were tangible and present throughout the accumulation until the exchange occurred. By contrast, the social stimuli did not remain present throughout the condition, and were absent between deliveries. This fundamental difference between the types of stimuli may lead to further research, such as a study examining the effectiveness of a brief, concealed, auditory or visual stimulus (a 'click' or a flash of light) as an unconditioned reinforcer for responding and/or procedures to establish it as a conditioned reinforcer. This could potentially decrease the use of token economies in environments where the use of such could be stigmatizing or distracting to peers.

Other future research directions may include the examination of: the number of pairings required to establish conditioned reinforcers, types of stimuli (e.g. audible, visual) that can function as reinforcers and their ease of delivery in a natural environment, rates of social stimuli occurring in the natural environment by teachers and/or peers, and efficiency/effectiveness of alternative pairing procedures or other methods of establishing social stimuli as conditioned reinforcers. The number of pairings of the primary and conditioned reinforcers is important, because if this number is too low, a conditioned stimulus may lose its reinforcing value (Williams, 1994). Some methods for assessing social consequences as reinforcers and identification of preferences for social stimuli are described by Smaby, MacDonald, Ahearn, and Dube (2007). This study designed a method to quickly assess the reinforcing effectiveness of social stimuli as consequences for target behavior. They discuss the importance of the

conditioning of social stimuli as reinforcers for target behavior such as joint attention, appropriate conversations, and play skills.

It is evident that social stimuli considered as reinforcers for typically developing children, such as praise, eye contact, or back pats, do not function as reinforcers for some children with developmental disabilities. This limits the available opportunities for reinforcement in any natural setting. Thus, it is important to identify an effective conditioning procedure to establish these social stimuli as reinforcers for appropriate, target behaviors. The identification of such a procedure will assist in the development of effective behavioral programming for children with developmental disabilities.

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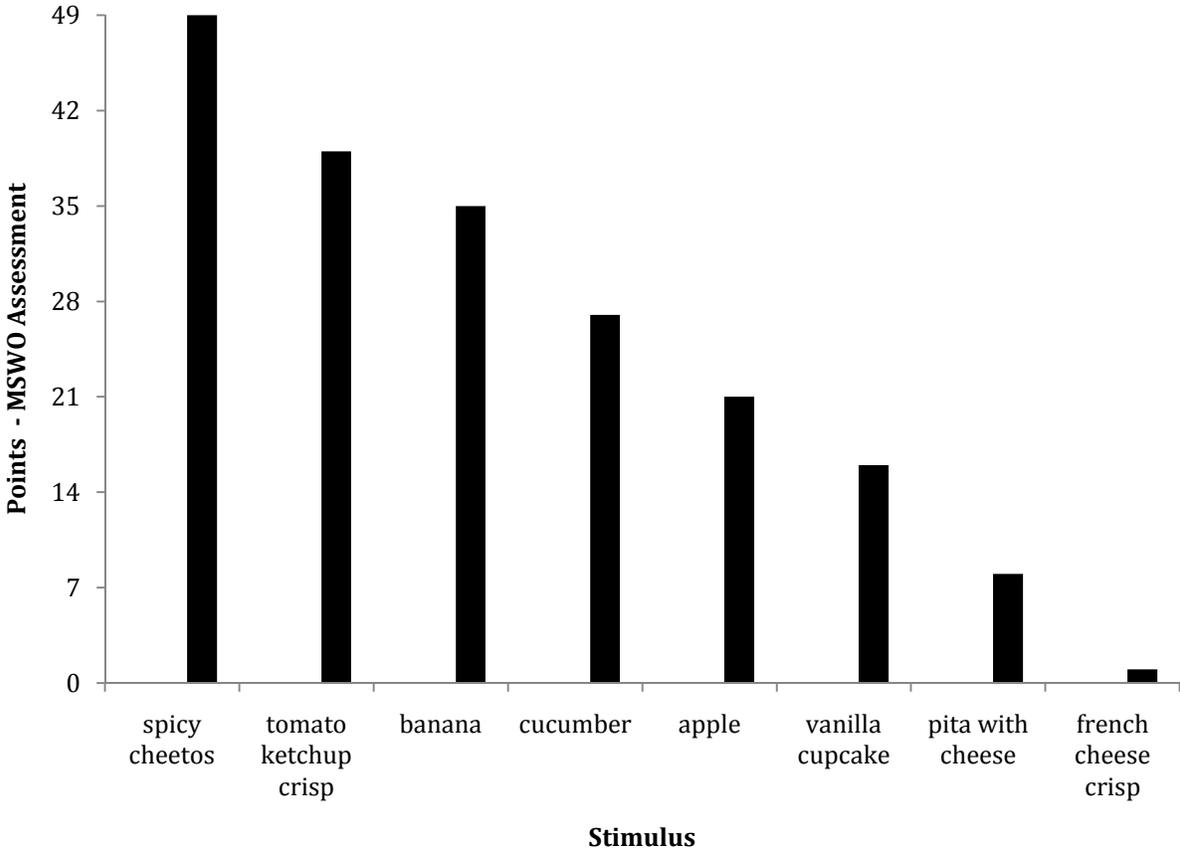


Figure 1. Points allotted to each stimulus included in assessment (MSWO).

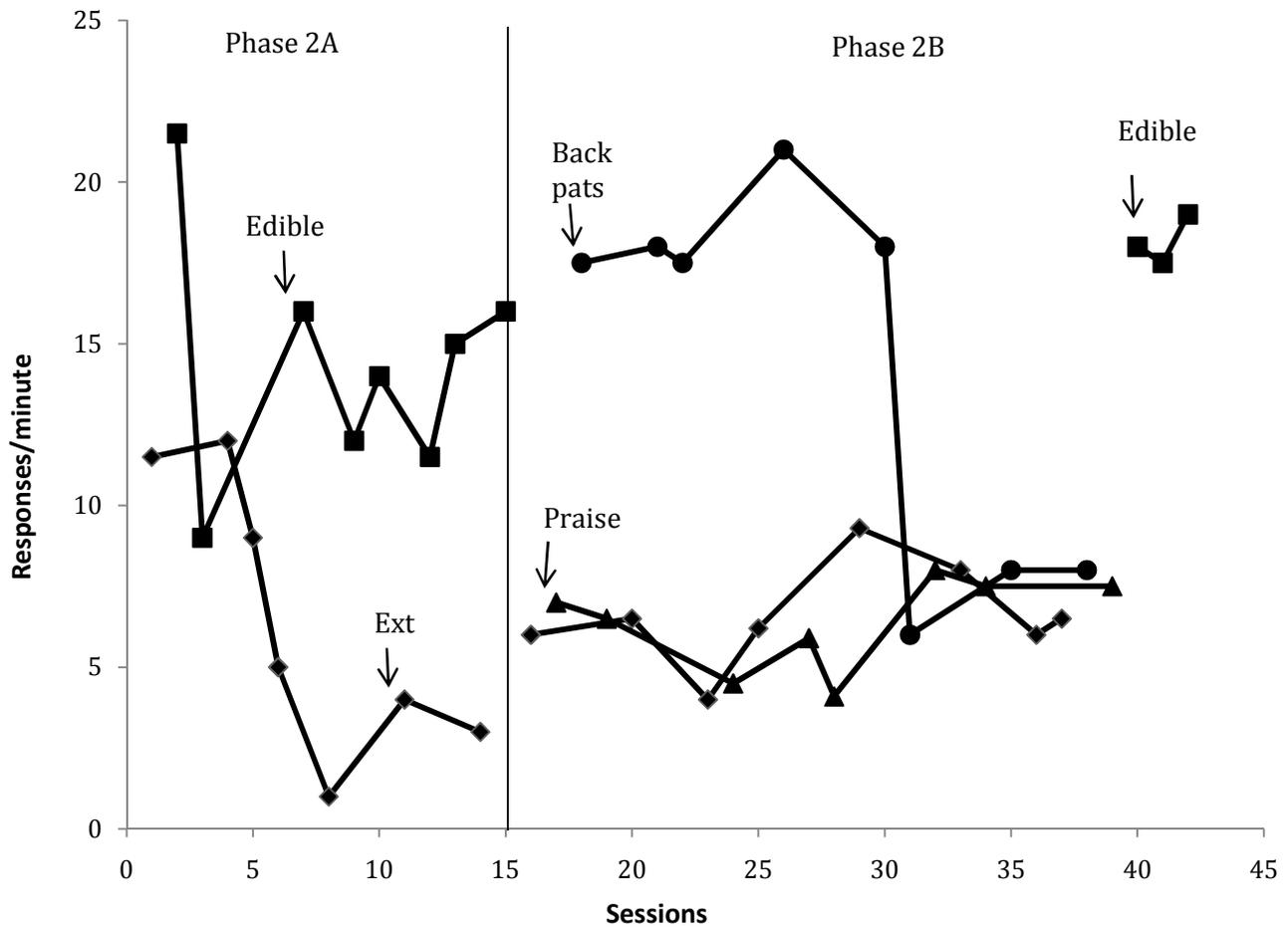


Figure 2. Responding (chip insertion) during reinforcer assessments conducted in Phase 2a and Phase 2b. Stimuli delivered contingent on responding were no programmed consequence (Ext.), crisps (FR1-edible), praise, and back pats.

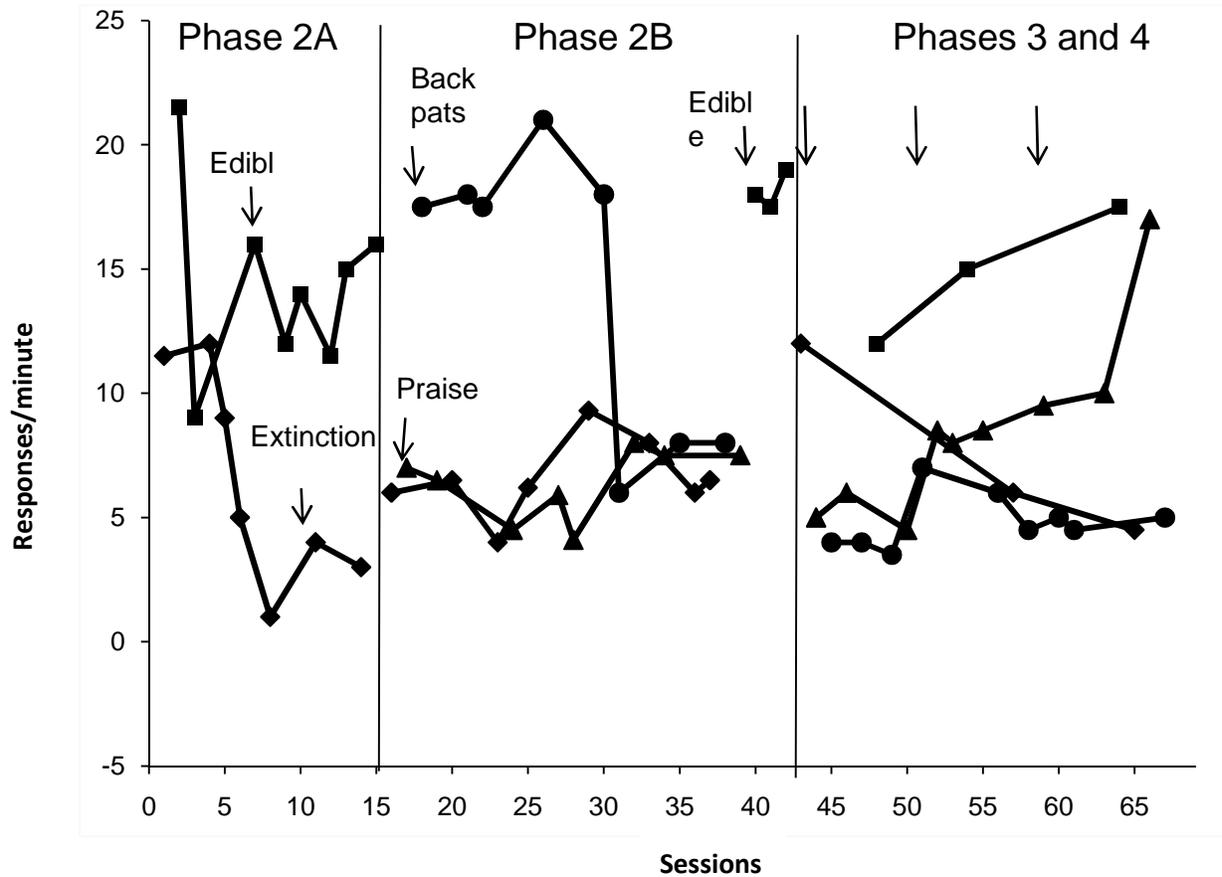


Figure 3. Responding (chip insertion) during reinforcer assessments conducted in Phase 2b through Phase 4. Stimuli delivered contingent on responding were no programmed consequence (Ext.), crisps (FR1-edible), praise, and back pats. Arrows indicate pairing sessions (Phase 3).

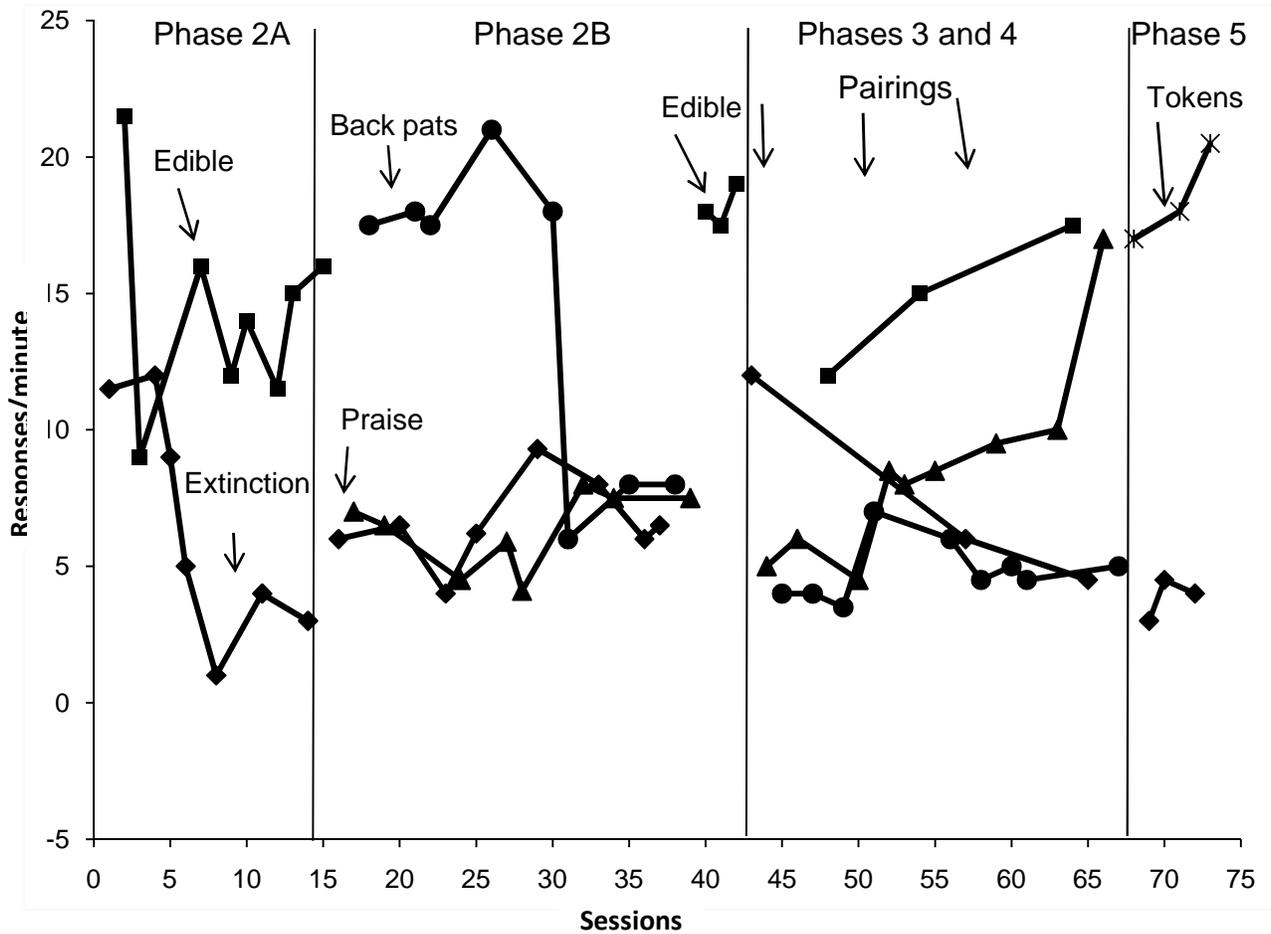


Figure 4. Responding (chip insertion) during reinforcer assessments conducted in Phase 5. Stimuli delivered contingent on responding were no programmed consequence (Ext.), crisps (FR1-edible), praise, back pats, and tokens.

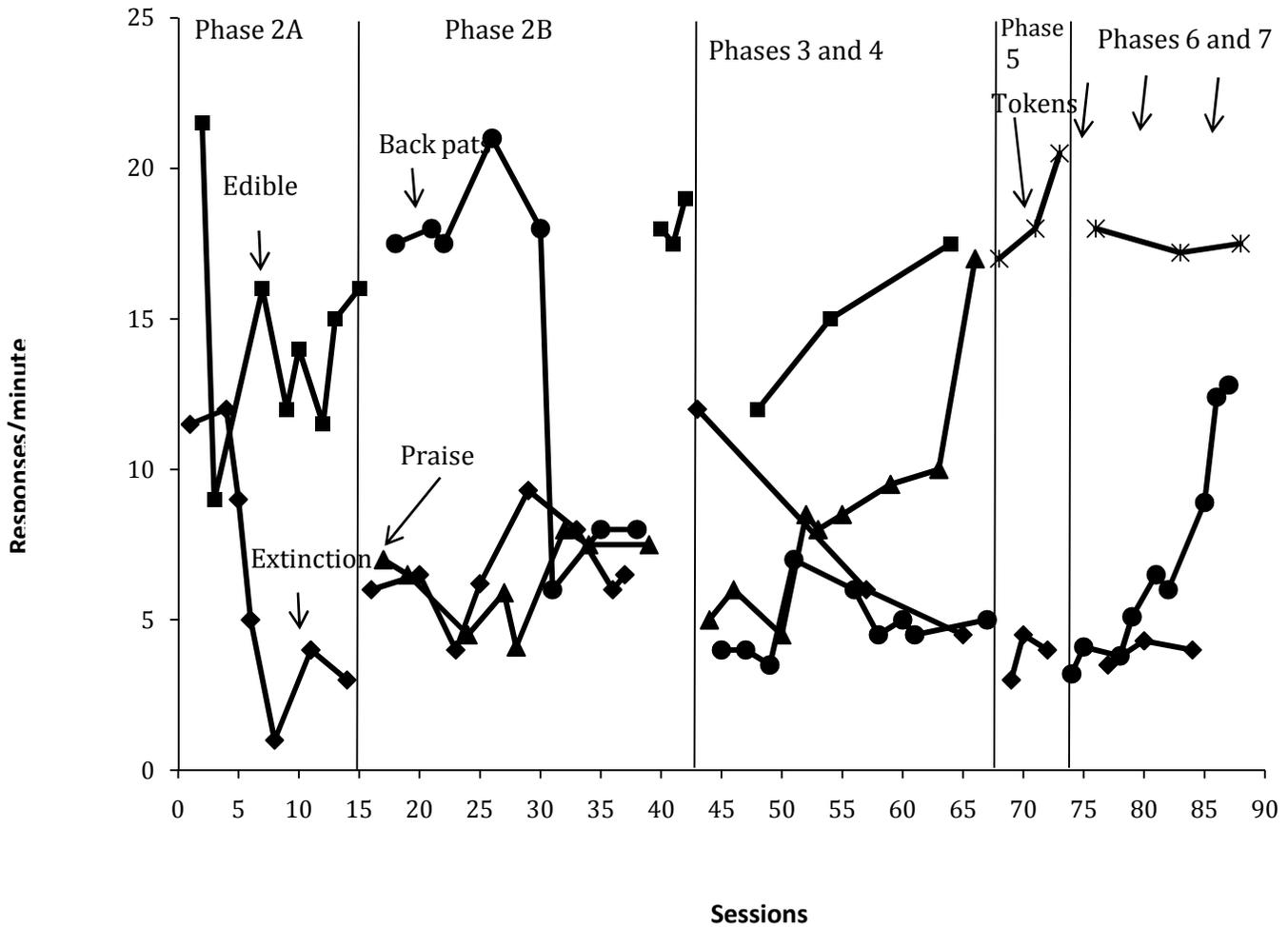


Figure 5. Responding (chip insertion) in Phases 2-7. In Phases 6 and 7, back pats and tokens were delivered contingent on responding. Pairing sessions between back pats and tokens are depicted by arrows.