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A comparison of methods for marking correct responses in matching to sample

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**A Comparison of Methods for Marking Correct Responses
in Matching to Sample**

A Thesis Presented

by

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The Department of Counseling and Applied Educational Psychology

In partial fulfillment of the requirements

for the degree of

Master of Science

in the field of

Applied Behavior Analysis

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in Matching to Sample

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Date

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in Matching to Sample**

by

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B.S., St. Lawrence University

Submitted in partial fulfillment of the requirements for the degree of
Master of Science in Applied Behavior Analysis
in the Bouvé College of Health Sciences Graduate School
of Northeastern University, December 2009

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**A Comparison of Methods for Marking Correct Responses
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ABSTRACT

Recently acoustical markers have been investigated as conditioned reinforcers used in the shaping of appropriate behavior and independent living skills. However, more research on the exact function of the acoustical marker, and its use in modifying human behavior is warranted. The current study attempted to teach 3 participants to match 6 different sets of arbitrary stimuli. Each set correlated with one of three conditions. These conditions included a TAG (a clicking noise) paired with an edible, the spoken word “good” paired with an edible, and edible only. One of these 3 consequences was provided upon a correct matching response. Each of the participants learned the matching tasks in a lower number of sessions when one of the acoustical markers was present. The results of this study suggest that the use of acoustical markers are not necessary for skill acquisition, but may be helpful.

A Comparison of Methods for Marking Correct Responses in Matching to Sample

Reinforcement is an important aspect of most behavioral programs (Cooper, Heron, & Heward, 2007). As a result, much research has focused on the use of both primary and conditioned reinforcers in the clinical and experimental settings. Primary reinforcers are events or stimuli that are of biological significance, such as food, water, and oxygen. As consequences following a response, these stimuli increase the future probability of that response occurring (Cooper et al.). Unfortunately, delivering primary reinforcers may be inconvenient or perhaps not even possible in every setting or at every moment. Additionally problematic is that primary reinforcers are susceptible to satiation effects or may be unethical to use in some situations. Therefore, use of conditioned reinforcers has become an important research topic. Conditioned reinforcers are defined as “initially neutral events that are paired with a primary reinforcer and through this pairing may acquire reinforcing properties” (Cooper et al, p. 269). For example, Kelleher (1958) demonstrated that patterns of responding when conditioned reinforcers (poker chips paired with food) were used in place of food reinforcement were similar to patterns seen under primary reinforcement.

There are several advantages to using conditioned rather than primary reinforcers. Firstly, conditioned reinforcers can be provided when a primary reinforcer cannot be provided. Secondly, a conditioned reinforcer can maintain responding over a long period of time, and under extinction of the response-primary reinforcer contingency. For example, Kelleher (1961) found that a food magazine sound functioned as a conditioned

reinforcer for the key-pecking behavior of pigeons under different schedules of reinforcement (e.g., FR, FI, DRL) and also under long periods of extinction. A third advantage of conditioned reinforcers is that they can be paired with multiple reinforcers. Moher, Gould, Hegg, and Mahoney (2007) found that by pairing a token with two or three different reinforcers they were able to abolish effects of satiation for single reinforcers. A fourth advantage to using conditioned reinforcers is that they can reduce delay between a target response and the delivery of a reinforcer. Reinforcement is most effective when provided immediately following a target response. In chained behavior, the delivery of reinforcement such as an edible may break up the flow or sequence of behavior, and may interrupt learning of the chain of behavior. In chained behavior the previous step functions as the discriminative stimulus for the next step in the chain (Catania, 2007). The delivery of an edible or other primary reinforcer may interrupt this learning process and decrease the relationship between the discriminative stimulus and the following response. However, a conditioned reinforcer such as a sound, or token, may allow this chain of behavior to continue with minimum interruptions (Catania).

When analyzing or using conditioned reinforcers it is important to investigate and consider variables that may alter the effectiveness of a specific conditioned reinforcer. Kelleher and Gollub (1962) identified several variables that can affect conditioned reinforcers. One variable that can alter their effectiveness is the number of pairings that occur between the primary reinforcer and the neutral stimulus. A second variable is the amount of time between the delivery of the conditioned stimulus and that of the primary reinforcer. A long delay between conditioned stimulus and primary reinforcer may decrease the effectiveness of a conditioned reinforcer, especially if the long delay is

present in the initial pairing of the two, or if the interval between the conditioned stimulus and delivery of the primary reinforcer is increased greatly in a short period of time following the initial pairing. However, a short delay between the presence of the conditioned stimulus and the primary reinforcer may increase the effectiveness of the conditioned reinforcer by strengthening the relationship between the conditioned stimulus and primary reinforcer (Kelleher et al, 1962). Another variable is the quality of the primary reinforcer being paired with the neutral stimulus; reinforcer quality may have an effect on the potency of the conditioned reinforcer. If the primary reinforcer being paired with the neutral stimulus is not an effective reinforcer, then the pairing will not produce an effective conditioned reinforcer. Fourthly, once a stimulus is paired with a single primary reinforcer, the effectiveness of that stimulus as a conditioned reinforcer may be susceptible to the state of satiation or deprivation for that particular primary reinforcer. The consistency with which a primary reinforcer follows a conditioned reinforcer may also alter the effectiveness of that conditioned stimulus as a reinforcer for a particular behavior. Though conditioned reinforcement has been demonstrated to maintain behavior under extinction of the primary reinforcer, long periods of denied access to the primary reinforcer may result in decreased levels of responding (Kelleher, 1958). Finally, the initial neutrality of the conditioned stimulus prior to pairing may have an effect on the effectiveness of the stimulus as a conditioned reinforcer. If a subject has a prior positive or negative history with the stimulus being paired, the stimulus is no longer neutral and this history may alter the effectiveness of that stimulus as a conditioned reinforcer.

Recently research has examined the use of conditioned reinforcers in different shaping methods. Shaping is defined as “the differential reinforcement of successive approximations to some performance criteria; each successive response that is reinforced is a closer approximation to the target or terminal behavior-” (Cooper et al, 2007, p. 421). Catania (2007, p. 113-114) suggests that shaping is possible because of the variability of behavior, and that the “reinforcement of one response produces a spectrum of responses...it is then possible to change the spectrum of responses until the one to be shaped occurs”. Since reinforcement cannot occur unless the behavior is already occurring (Pryor, 1999), shaping is an important step. Shaping approximations of the desired target behavior will set the occasion for the organism to emit the target behavior. Once the target behavior is emitted it can be reinforced, increasing the probability that the specific behavior will occur in the future

Cooper et al. (2007) discuss five limitations that can be associated with shaping. Firstly, shaping a new behavior may be time-consuming, especially if the behavior is not in the current repertoire. Secondly, progress towards the terminal behavior may be “erratic”, and multiple approximations of the target behavior may need to be shaped before the target behavior occurs. Thirdly, shaping requires the experimenter to monitor the subject continuously. Fourthly, shaping can be misapplied, and fifth dangerous behavior can be shaped. However, by keeping these limitations in check, an experimenter can successfully shape a behavior.

Cooper et al. (2007) also describe many ways in which shaping can be enhanced. These include pairing a discriminative stimulus with shaping, using physical guidance, or imitative prompts.

Acoustical markers have been investigated as conditioned reinforcers used in the shaping of appropriate behavior and independent living skills. Using an acoustical marker first requires that the sound is paired with a primary reinforcer. Once the sound obtains the reinforcing properties, it can then be used to quickly shape a target behavior (Pryor, 1999).

Ferguson and Rosales-Ruiz (2001) demonstrated the effectiveness of using an acoustical marker to shape behavior, in order to establish a non-aversive procedure for loading a horse into a trailer. Ferguson and Rosales-Ruiz used a shaping procedure involving a red cloth pot holder, which functioned as a “target” in this study and the sound of a clicker. They first established the clicker as a conditioned reinforcer, and then shaped the horse to touch its nose to a target using the clicker. The target was then gradually moved into the trailer. By reinforcing successive approximations to entering the trailer with the clicker, all horses entered the trailer independently.

Pryor (1999) describes the use of acoustical markers such as whistles and clickers with dogs and dolphins. She suggests that the use of these acoustical markers assists in establishing skills and shaping the behavior of these animals. She also reports success in using acoustical markers with athletes such as divers and gymnasts. The acoustical marker was used to mark and reinforce specific body positions and movements of the athlete, increasing their skills.

Zamansky (2001) used an auditory click to increase acquisition of daily living skills of three developmentally disabled children. She combined an auditory click with backward chaining to successfully increase the number of steps in a task analysis that were completed independently. In a related study, Weiss, Libby, Ahearn, Bennett, and

Olsen (2008) used an acoustical marker or “click” to teach two students, who were previously unable to demonstrate imitation skills, to imitate multiple different actions and to generalize these imitation skills with other stimuli.

Using an acoustical marker as a conditioned reinforcer has several benefits. Firstly, the sound can be delivered immediately following the behavior, thus eliminating the delay between target behavior and the delivery of a primary reinforcer (Pryor, 1999). Secondly, the acoustical marker produces a precise and consistent sound, which increases the procedural integrity. For example, if a child is reinforced for completing math problems by one teacher saying “nice job”, and a second teacher says “nice job” with a different tone or accent, the second teacher’s praise may not reinforce the behavior of completing math problems. Thirdly, the use of one sound can be used by multiple trainers and in multiple settings, allowing for generalization to occur. Fourthly, acoustical markers are easy to implement. Finally, the acoustical marker can be paired with multiple other reinforcers which can decrease the effects of satiation (Zamansky, 2001).

Acoustical markers may have other functions besides being conditioned reinforcers. Pryor (1999) discusses several other functions that an acoustical marker may have when used during a shaping procedure. Firstly, the sound may act as a signal to terminate the behavior. For example, if a seal is balancing a ball on its nose, a click may reinforce that behavior, but may also signal the availability of the primary reinforcer and the end of the behavior. When working with children, the same phenomena may be seen when a child lists words that rhyme, for example, with blue. After a few words the teacher may say “nice job” which may not only reinforce the child for saying the words but also may stop the child from providing the list. Secondly, the acoustical marker may

function as a “keep going” signal, similar to the way stimulus change may function in a chain as both a conditioned reinforcer and discriminative stimulus. Finally, it may function as an “event marker”, which marks the exact behavior to be reinforced at the moment it occurs. Unfortunately, these functions are speculative since little systematic research has been conducted to confirm them. With respect to the function of acoustical markers as “event markers”, Pryor (1999) cites Keller Breland’s use of markers during animal training. Breland used a whistle to reinforce jumps made by dolphins. The whistle was sounded when the dolphin jumped in the air. The whistle was hypothesized to mark the behavior of jumping and the dolphin would then swim to the trainer to receive reinforcement. Breland described the whistle as a “bridging stimulus” that bridged the time between the behavior occurring and reinforcement for that behavior. Pryor (1999) hypothesized that an acoustical marker can allow for the precise marking of desired responses. Pryor suggests that verbal instructions or verbal praise may also be interpreted as event markers. Further, Pryor suggests that these markers may be confusing to the trainee or imprecise at marking behavior because of variability in the sound and in the delivery. This raises a question as to the relative effectiveness of a precise acoustical marker – a “clicker” – as compared to more traditional feedback - verbal praise – for marking correct responses.

The purpose of the current study was to compare methods for marking correct performance in the -acquisition of an arbitrary matching task.

Method

Participants and Setting

Participants - were 1 male and 2 females ranging in age from 6-14 years. All were diagnosed with autism, and attended a program for children with autism or related disorders. Participants had previously demonstrated proficiency in picture to picture matching of arbitrary stimuli.

Tim was a 7 year-old boy who was diagnosed with autism. He was able to communicate verbally. Tim attended an academic classroom 5 hours a day in a typical school with an aid. He complied with tasks while sitting at a desk for longer than 10 min, discriminated among stimuli, and scanned an array of items.

Molly was a 14 year-old girl who was diagnosed with autism. She communicated verbally, although she did exhibit vocal stereotypy which included repeated words and word approximations. Molly demonstrated appropriate session behavior, performed basic discriminations, scanned arrays, and matched picture to picture with arbitrary stimuli.

Amanda was a 13 year-old girl, who was diagnosed with Multiplex Developmental Disorder. She communicated verbally; however, occasionally she required prompting to speak clearly-and to use full sentences. Amanda had previously demonstrated appropriate session behavior including scanning and attending. She could also make basic discriminations and match pictures to pictures.

All sessions were conducted in a quiet room in a residential setting. The room included a desk, two chairs, shelves with leisure materials on them, and a computer. A video camera was also present in the room during all sessions.

Materials

Materials included six sets of arbitrary stimuli used in the three-member comparison array, a TAG (acoustical marker that produced a click sound), and highly preferred edibles determined by preference assessments. The arbitrary stimuli were individually printed 2.54 cm x 2.54 cm black ink forms on pieces of 7.62 cm x 12.7 cm pieces of white paper.

Measurement

Data were recorded per opportunity to respond and summarized as percentage correct. A correct response was defined as a participant's point to the sample stimulus, then a point to stimulus correlated with reinforcement (S+) that was presented in a three-member comparison array. The points could be performed either independently or prompted. Picking up the sample stimulus and placing it on top of the stimulus correlated with reinforcement (S+) was also counted as correct. An incorrect response was defined as a participant's point to the sample stimulus, and then a point to a stimulus uncorrelated with reinforcement (S-). No response (NR) was recorded when the participant did not point to the sample stimulus, or, after pointing to the sample, did not point to a comparison stimulus within 10s. A set of stimuli was defined as mastered when the participant independently selected the stimulus correlated with reinforcement on 89% of the choices made during a single session.

Interobserver Agreement

Interobserver agreement data were collected by having two independent observers score dependent variables during 33% of sessions across all conditions. Interobserver agreement was determined by dividing the number of agreements by the number of

agreements plus disagreements and multiplying by 100%. Interobserver agreement ranged from 89%-100% across sessions, with an overall agreement of 97.8 %.

Experimental Design

The experiment was conducted in a multi-element design. Comparisons across three conditions were used to assess the relative effects of event markers paired with primary reinforcement on skill acquisition. Conditions included a TAG (click sound) paired with an edible following a correct response, the spoken word “good” paired with edible following a correct response, and edible only following a correct response. Conditions were counterbalanced across participants and stimulus sets. Sessions consisted of 9 trials and there were at least 5 min between each session.

Procedure

Preference assessment. Paired-stimulus preference assessments were conducted for each participant (Fisher et al.,1992). Two items, placed approximately 20.32 cm in front of the participant and 5.1 cm apart, were presented in a predetermined order. Each item was positioned an equal number of times in the left and right position. At the beginning of each trial, the experimenter stated “choose”, and the participant was allowed to consume the item that was selected. During each session, each item was paired with every other item twice, with position counterbalanced across presentations.

General procedure. A trial began when the experimenter presented a sample stimulus. Once the participant touched the sample, a three-item comparison array was presented. If the participant did not independently touch a comparison stimulus, the experimenter provided a point prompt after a delay of 0 s, 2 s or 5 s, based on the participant’s previous performance. The delay before prompting increased when correct

responding (both prompted and unprompted) occurred in seven or more trials within a session and decreased when the participant responded incorrectly or a NR was recorded in three or more trials within a session. If the participant touched the correct stimulus from the comparison array, a consequence was provided according to the condition. No consequence was provided for an incorrect response.

Baseline. During the baseline condition all stimuli were presented to the participant with a sample stimulus and three-member comparison array. No prompts or consequences were provided.

Experimental conditions. Three conditions were presented in counterbalanced order: (a) a TAG (acoustical marker) paired with an edible, (b) spoken word “good” paired with an edible, and (c) an edible alone. The edible condition served as control condition. During the TAG paired with an edible condition, the experimenter provided a click and an edible immediately following the participant’s correct responses. The edible was the participants most preferred edible according to the preference assessment. During the verbal praise and edible condition, the experimenter immediately followed each correct responses with the spoken the word “good” and an edible, again using the highest preferred edible from preference assessment. During the edible-only condition, correct responses were immediately followed only by delivery of the edible. No correction procedure and no programmed reinforcement followed incorrect responses.

Results

The number of sessions to reach acquisition criterion was used to evaluate the effects of the independent variable. This was a more appropriate measure than errors to criterion because of the use of the delayed-cue prompting procedure. The number of

opportunities for errors cannot be established because on each trial, the participant could respond correctly before the prompt, could respond incorrectly before the prompt, could respond correctly after the prompt, or could respond incorrectly after the prompt. In an analysis of errors to criterion, the prompted correct responses cannot be scored as incorrect, nor should they be scored as correct since they are under the stimulus control of the prompt rather than the target stimuli. Therefore, in this study a better measure of acquisition is the number of sessions to criterion.

Figure 1 summarizes the major finding of this study, the total number of sessions to reach mastery criterion for all participants in the acquisition of stimulus sets 1 and 2. Across participants, the spoken word plus edible condition required the fewest number of sessions to reach acquisition criterion (20). The TAG paired with edible condition required a total of 24 sessions to criterion, while the edible-only condition required the greatest number of sessions to criterion (32). Figure 2 shows the number of sessions to criterion for all participants across stimulus sets. Across all conditions, participants required more sessions to reach acquisition of stimulus set 1 and fewer to reach acquisition for set 2.

Figures 3 and 4 show the number of sessions to criterion for each participant and each condition in the acquisition of stimulus sets 1 and 2. These figures demonstrate that the number of sessions to criterion for set 2 was always less than or equal to the number of sessions to criterion for set 1, and this difference was consistent across conditions.

The same data are summarized in tabular format in Table 1. This shows the results for all participants in all conditions, including the average number of sessions required to reach mastery criterion for each condition across participants. As can be seen

from the table, results varied somewhat across participants. For Molly, the TAG plus edible condition resulted in fastest mastery; for Amanda, the spoken word plus edible condition resulted in the fastest mastery; and for Tim, the TAG plus edible and spoken word plus edible conditions resulted in equally fast mastery. The edible-only condition resulted in the slowest mastery for all participants. Across all participants combined, the spoken word paired with edible condition resulted in the lowest average sessions to mastery (3.3), the TAG paired with edible resulted in the next lowest average (4.0), and the edible-only condition resulted in the greatest average number of sessions to mastery (5.5).

Figure 5 shows the session-by-session percentage of correct and independent responses for Molly across sessions in the acquisition of stimulus sets 1-3. The stimuli in the spoken word paired with edible condition were mastered in 5 sessions. The stimuli in the TAG paired with edible condition were mastered in 6 sessions, and the stimuli in the edible only condition were mastered in 12 sessions. Figure 6 shows the session-by-session percentage of correct and independent responses for Molly across sessions in the acquisition of stimulus sets 4-6. The stimuli in the spoken word paired with edible condition and the edible only condition were mastered in 4 sessions, while the stimuli in the TAG paired with edible condition were mastered in 2 sessions. Figure 7 shows the session-by-session percentage of correct and independent responses for Amanda across sessions in the acquisition of stimulus sets 1-3. The stimuli in the spoken word paired with edible condition were mastered in 3 sessions, while the stimuli in the edible only condition were mastered in 4 sessions. Amanda mastered the stimuli in the TAG paired with edible condition in 6 sessions. Figure 8 displays the session-by-session percentage

of correct and independent responses for Amanda across sessions in the acquisition of stimulus sets 4-6. The stimuli in the spoken word paired with edible condition were mastered in 2 sessions, while the stimuli in the TAG paired with edible and edible only condition were mastered in 4 and 3 sessions respectively. Figure 9 displays the session-by-session percentage of correct and independent responses for Tim across sessions in the acquisition of stimulus sets 1-3. The stimuli in the spoken word paired with edible condition and the TAG paired with edible condition were both mastered in 3 sessions, while the stimuli in the edible only condition were mastered in 6 sessions. Figure 10 shows the session-by-session percentage of correct and independent responses for Tim across sessions in the acquisition of stimulus sets 4-6. The stimuli in the spoken word paired with edible and the TAG paired with edible conditions were both mastered in 3 sessions, while the edible only condition was mastered in 4 sessions.

Table 2 summarizes the errors made until mastery criterion was achieved for all participants in all conditions. For the purpose of this analysis, correct responses that occurred after the prompt were not included as errors; however, as noted above it is not appropriate to consider prompted responses to be the same as correct independent responses. As can be seen from the table errors varied across participants. For Molly, the edible condition resulted in the greatest amount of errors; for Amanda, the TAG plus edible condition resulted in the most errors, and for Tim, the edible condition resulted in the greatest number of errors to mastery criteria. Across all participants the edible condition resulted in the highest average errors occurring until mastery criteria was met (7.2), the TAG plus edible condition resulted in the next highest average errors occurring

to mastery criteria (3.5), and the spoken word plus edible condition resulted in the lowest number of errors occurring to mastery criteria (2.7).

Discussion

In this study, all participants mastered all stimulus sets regardless of the reinforcer delivered. For each participant, stimulus sets were mastered in fewer sessions when one of the acoustical markers, either the spoken word or the TAG, was paired with an edible as compared with the edible only condition. The results show that a marker stimulus paired with an edible may be more effective than providing the edible alone contingent on a correct response.

Overall, the spoken word “good” plus edible condition resulted in the fewest number of sessions to reach mastery criterion. The participant’s past experience with both the spoken word “good” and the TAG or click should be taken into account when interpreting the results. The spoken word “good” is commonly used as a potential reinforcer in educational settings. All participants had experience with the word “good” being used as verbal praise prior to this study. However, none of the participants had experience with the use of the TAG. Thus, the participants’ experience prior to this study may have established the word good as a conditioned reinforcer, however, the TAG had not been established as a conditioned reinforcer prior to the start of this study. Since the use of the TAG plus edible resulted in faster acquisition than the use of an edible alone, it suggests that there may be two effects of marker stimuli: (a) a conditioned reinforcing effect, and (b) a “marking” effect.

It is possible that the TAG acquired conditioned reinforcing effectiveness during the course of the study through pairing with the edible stimulus. However, it is not clear

from the results whether the TAG functioned as a conditioned reinforcer for all participants. For Tim and Molly, the TAG paired with edible condition always resulted in fewer sessions to mastery than the edible-alone condition. This suggests that the TAG functioned as a supplemental reinforcer. However, for Amanda, the TAG paired with edible condition always resulted in a greater number of sessions to mastery as compared with the edible-alone condition. A test of the effectiveness of the TAG alone to establish or maintain an alternative response would allow an independent test of its reinforcing value, and would be an important extension of the present study.

Further research is warranted on the use of acoustical markers. The types of markers used could depend on the preference or past history of the participant with the specific sound used as the event marker. One interesting continuation of this study would be to compare the effectiveness of many different sounds. One of the disadvantages of using a verbal marker as compared to the TAG is that there is the chance that the tone, volume, and pace of the spoken word may differ between experimenters (Pryor, 1999). In the current study both TAG and spoken word “good” were given by one experimenter. Therefore the naturally occurring difference of the word “good” being spoken by different people was not assessed in this study. Further research could use multiple experimenters to assess the efficacy of this specific marker across experimenters and compare its efficacy with that of the TAG. Further research could also focus on the effect of acoustical markers on acquisition of other skills, such as eye contact, occupational therapy skills, physical therapy skills, task analyses or academic tasks. It would also be interesting to assess the tagging procedure when using a free operant rather than a restricted operant as the target behavior. Finally it would be beneficial to

investigate the use of the auditory marker (similar to the TAG) in classrooms, and other settings, to not only study generalization, but to also assess the social validity and consequences that may occur when used in non-experimental settings with humans.

One limitation of this study was that preference assessments were not completed every session. The edible established as highly preferred in the initial preference assessment was used throughout the study. The edible used in the study may have had some effect on the number of errors made within specific sessions as a result of satiation or other motivating operations.

The current study suggests that acoustical markers are not necessary for skill acquisition of an arbitrary matching task, but may be beneficial for some children. More research is warranted in this area in order to develop more effective strategies for marking correct responses in skill acquisition.

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Table 1.

Number of sessions to meet mastery criteria for each participant and each condition.

<u>Participant + Stimuli</u>	<u>Condition</u>		
	<u>Edible + TAG</u>	<u>Edible + Spoken</u>	<u>Edible Alone</u>
Molly set 1 – 3	6	5	12
Molly set 4 – 6	2	4	4
Molly average:	3.0	4.5	8.0
Amanda set 1 – 3	6	3	4
Amanda set 4 – 6	4	2	3
Amanda average:	5.0	2.5	3.5
Tim set 1 – 3	3	3	6
Tim set 4 – 6	3	3	4
Tim average:	3.0	3.0	5.0
All participants average:	4.0	3.3	5.5

Table 2.

Number of errors made until mastery criteria for each participant and each condition.

<u>Participant + Stimuli</u>	<u>Condition</u>		
	<u>Edible + TAG</u>	<u>Edible + Spoken</u>	<u>Edible Alone</u>
Molly set 1 – 3	11	7	23
Molly set 4 – 6	1	2	3
Molly average:	6.0	4.5	13.0
Amanda set 1 – 3	6	2	6
Amanda set 4 – 6	3	2	2
Amanda average:	4.5	2.0	4.0
Tim set 1 – 3	0	2	9
Tim set 4 – 6	0	1	0
Tim average:	0	1.5	4.5
All participants average:	3.5	2.7	7.2

Figure Captions

Figure 1. Total sessions to criterion for all participants for the acquisition of both sets of stimuli.

Figure 2. Number of sessions to criterion for all participants in the acquisition of stimulus sets 1 and 2.

Figure 3. Number of sessions to criterion by participant in the acquisition of stimulus set 1.

Figure 4. Number of sessions to criterion by participant in the acquisition of stimulus set 2.

Figure 5. Percentage of correct and independent responses for Molly in the acquisition of stimulus sets 1-3.

Figure 6. Percentage of correct and independent responses for Molly in the acquisition of stimulus sets 4-6.

Figure 7. Percentage of correct and independent responses for Amanda in the acquisition of stimulus sets 1-3.

Figure 8. Percentage of correct and independent responses for Amanda in the acquisition of stimulus 4-6.

Figure 9. Percentage of correct and independent responses for Tim in the acquisition of stimulus 1-3.

Figure 10. Percentage of correct and independent responses for Tim in the acquisition of stimulus 4-6.

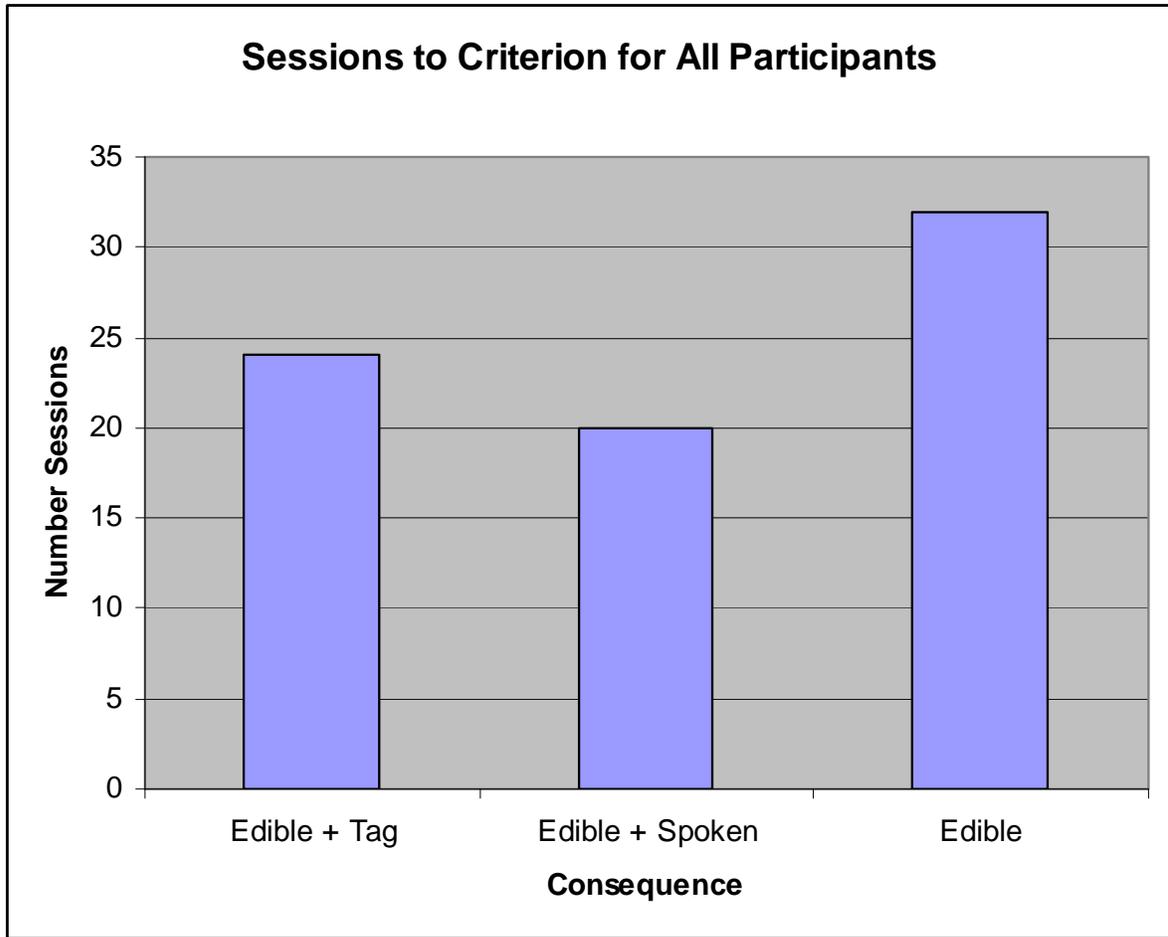


Figure 1

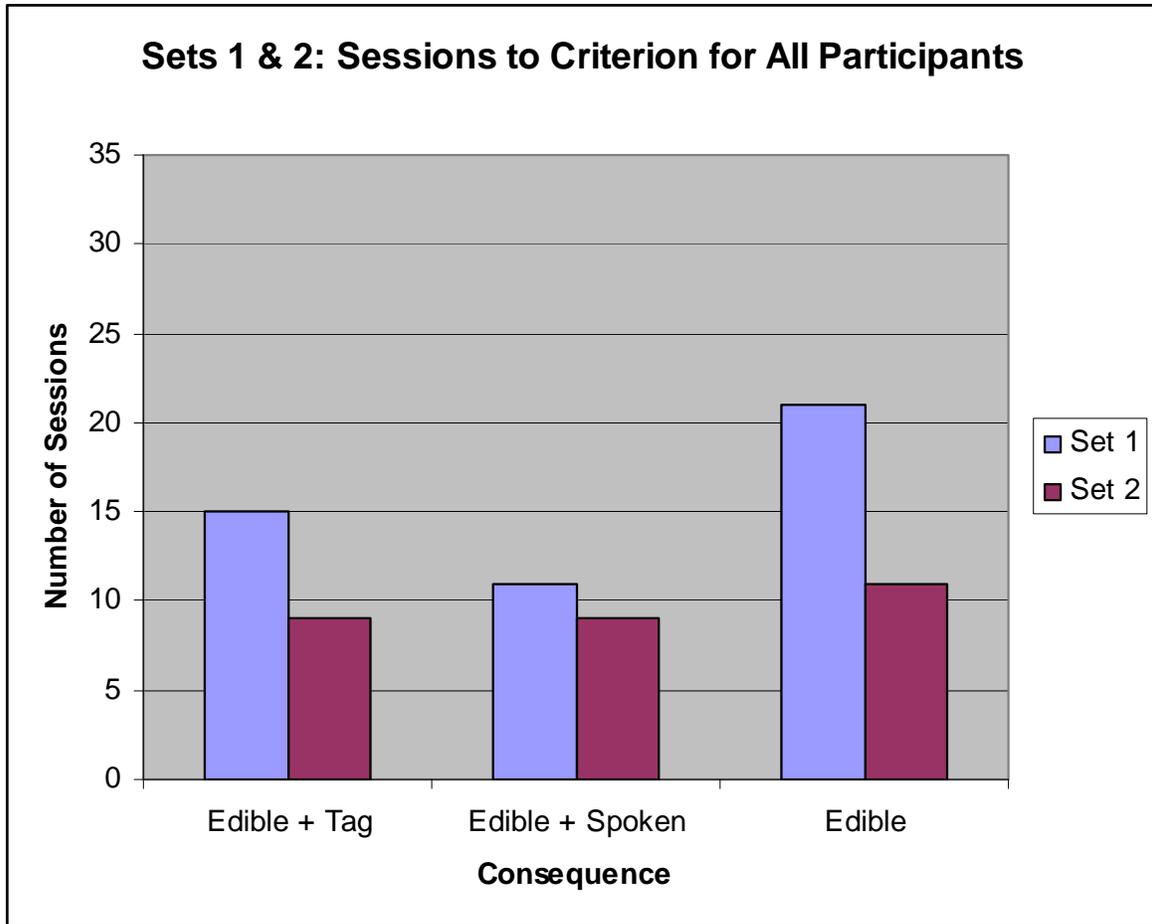


Figure 2

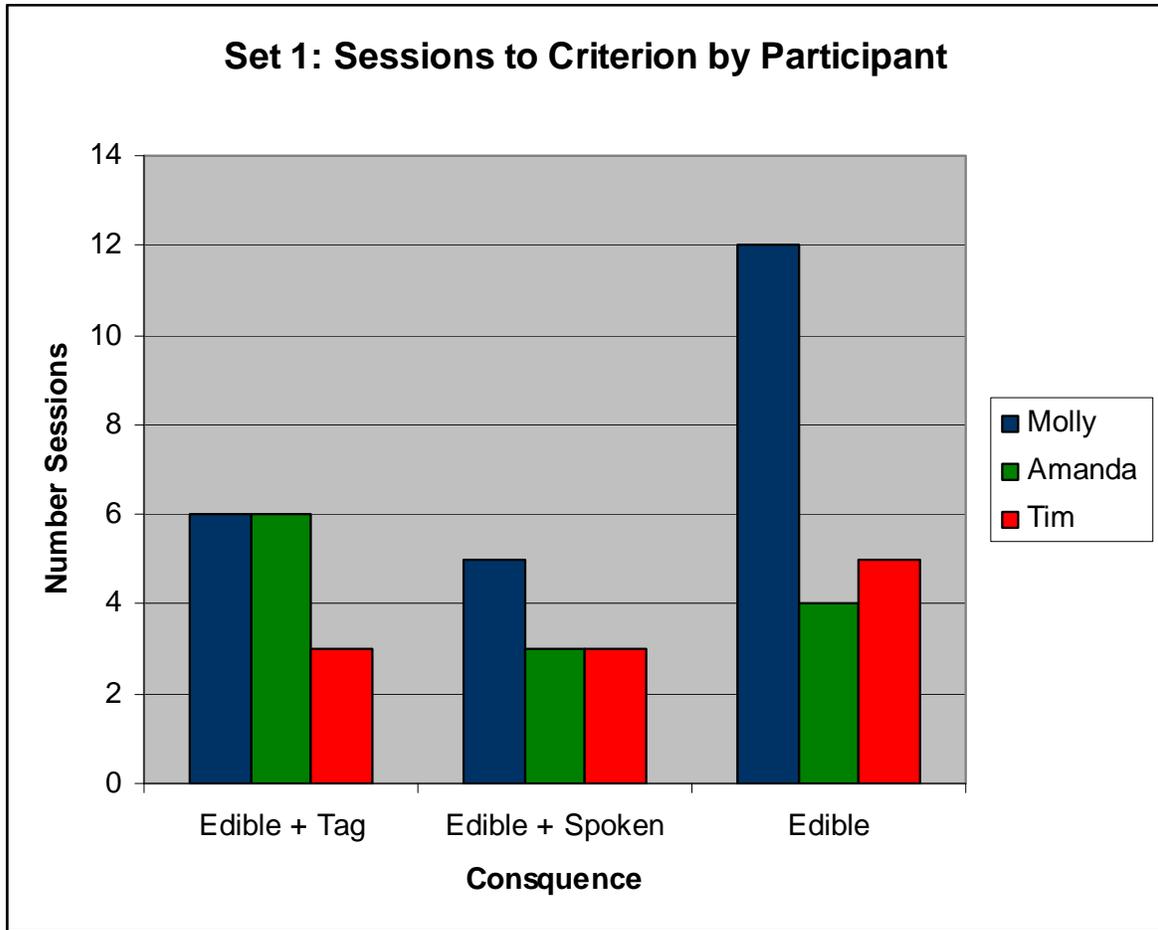


Figure 3

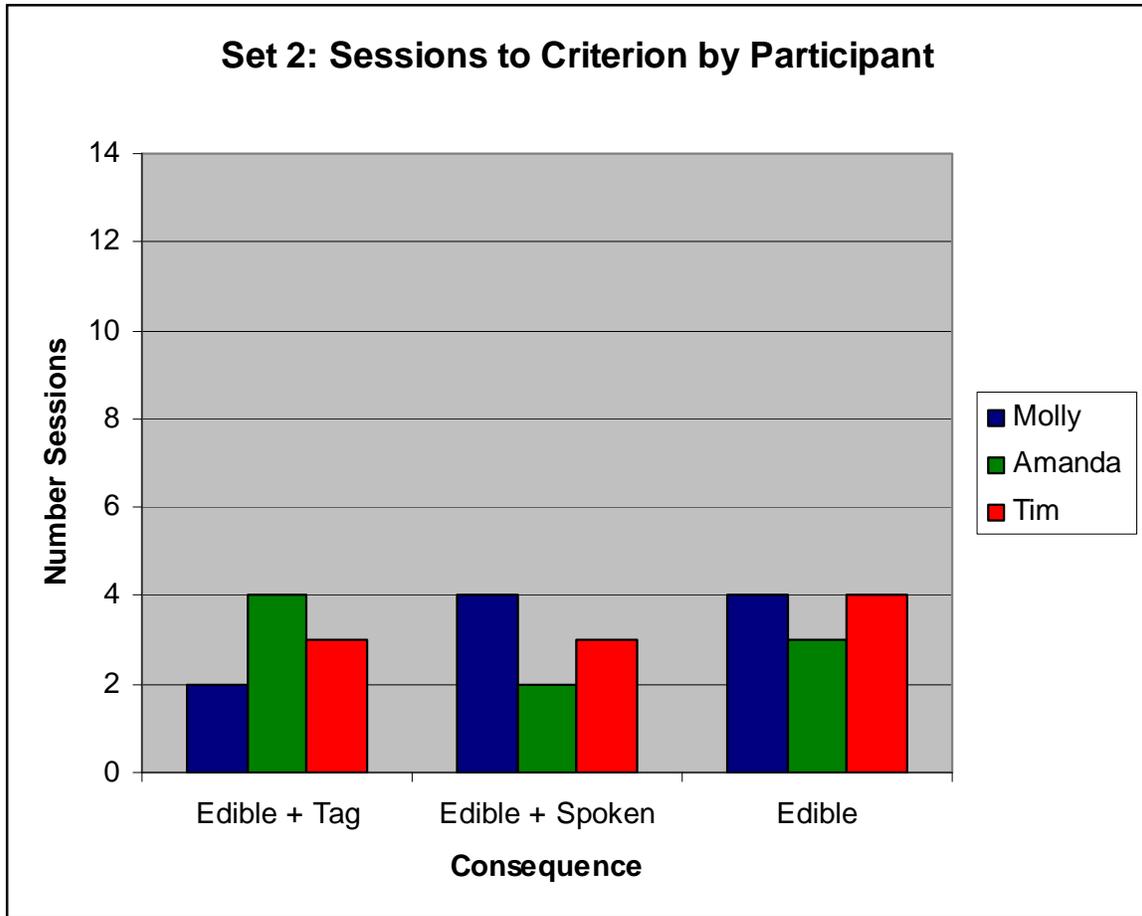


Figure 4

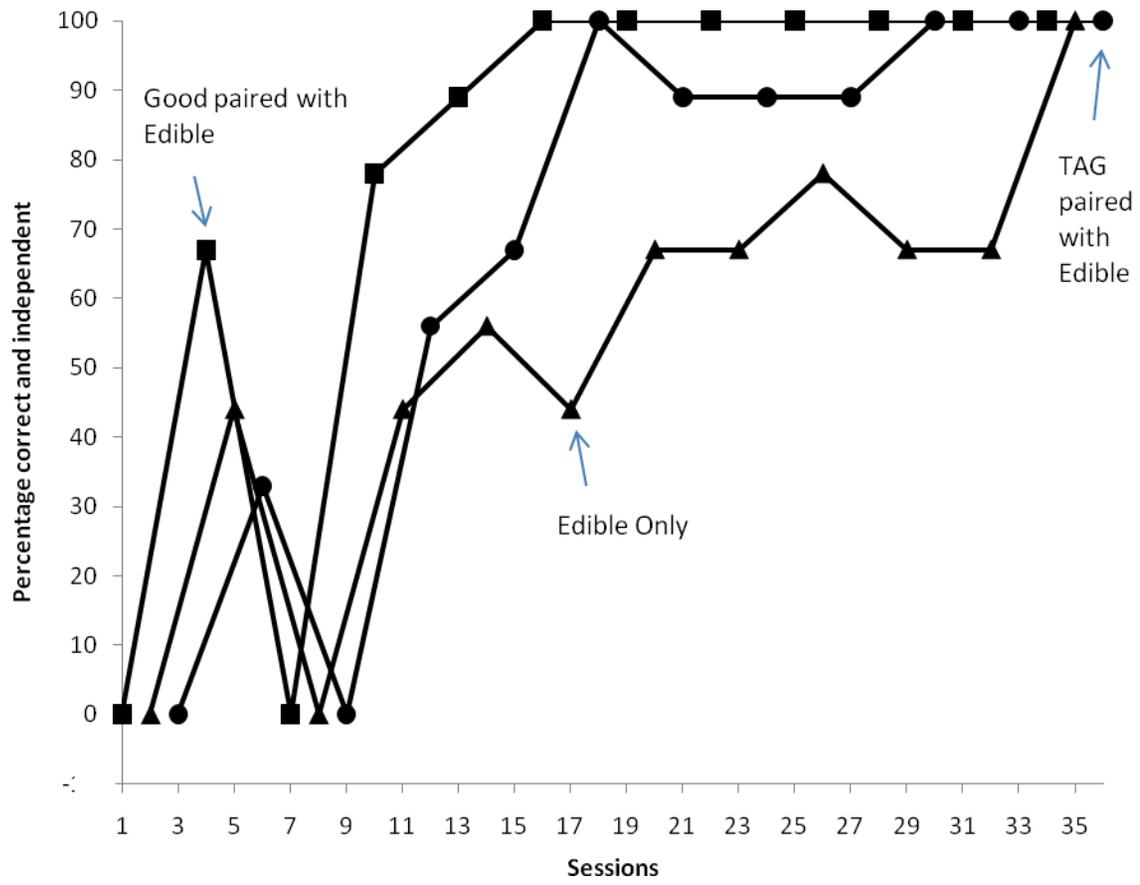


Figure 5

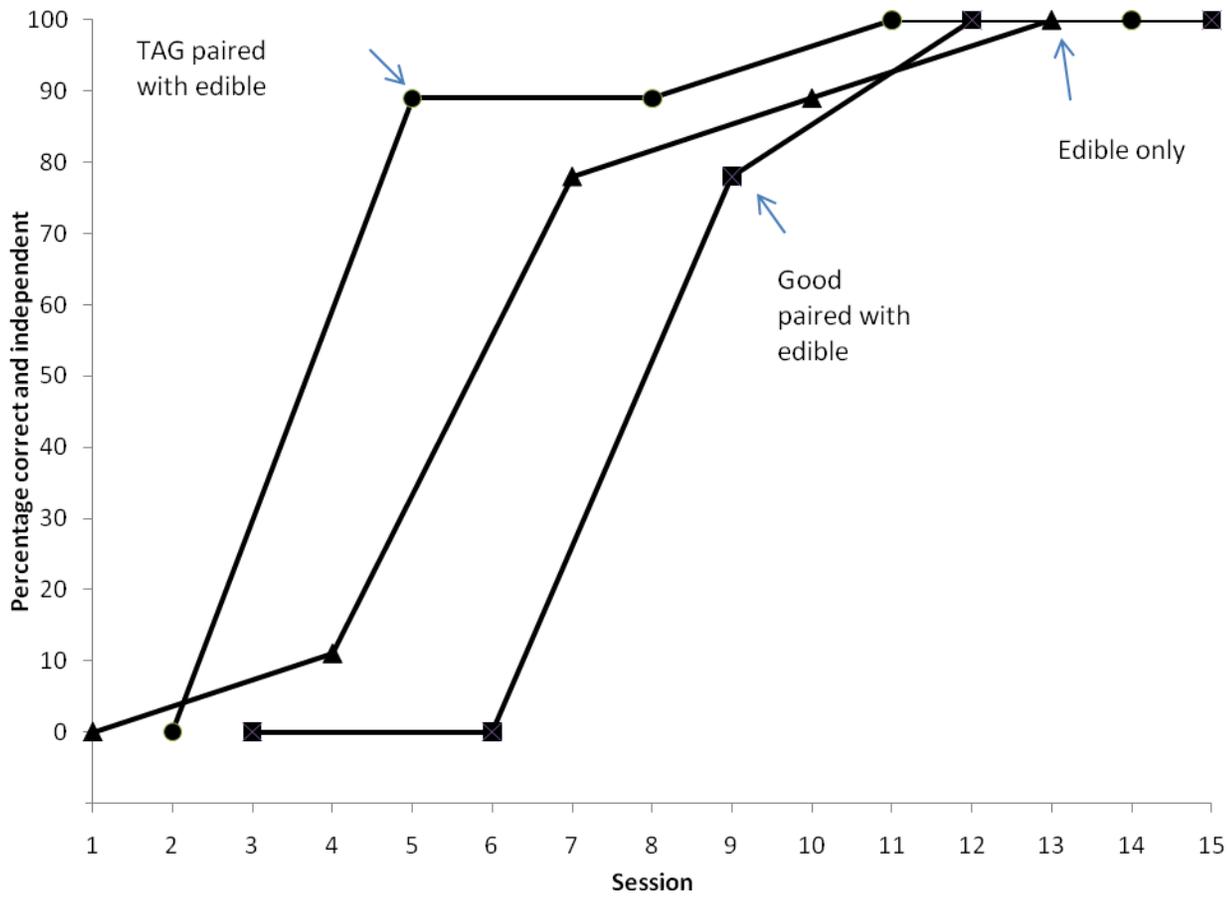


Figure 6

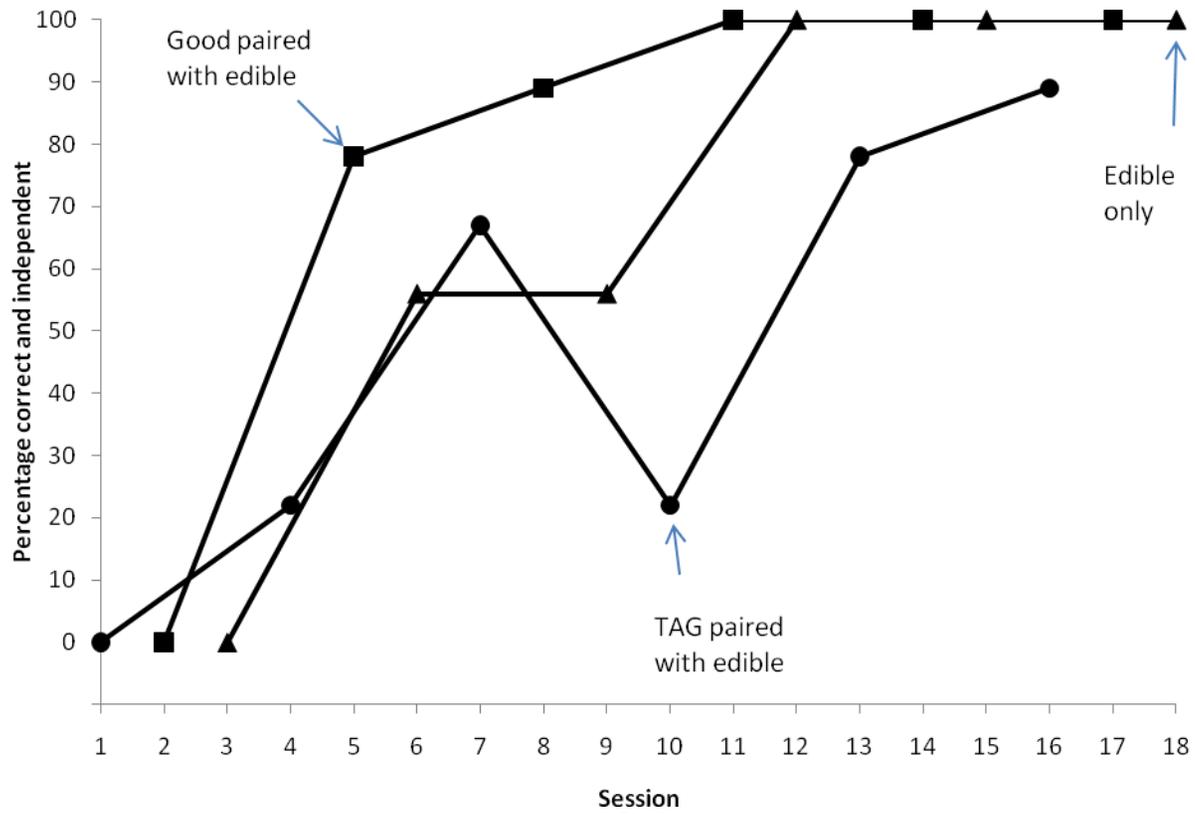


Figure 7

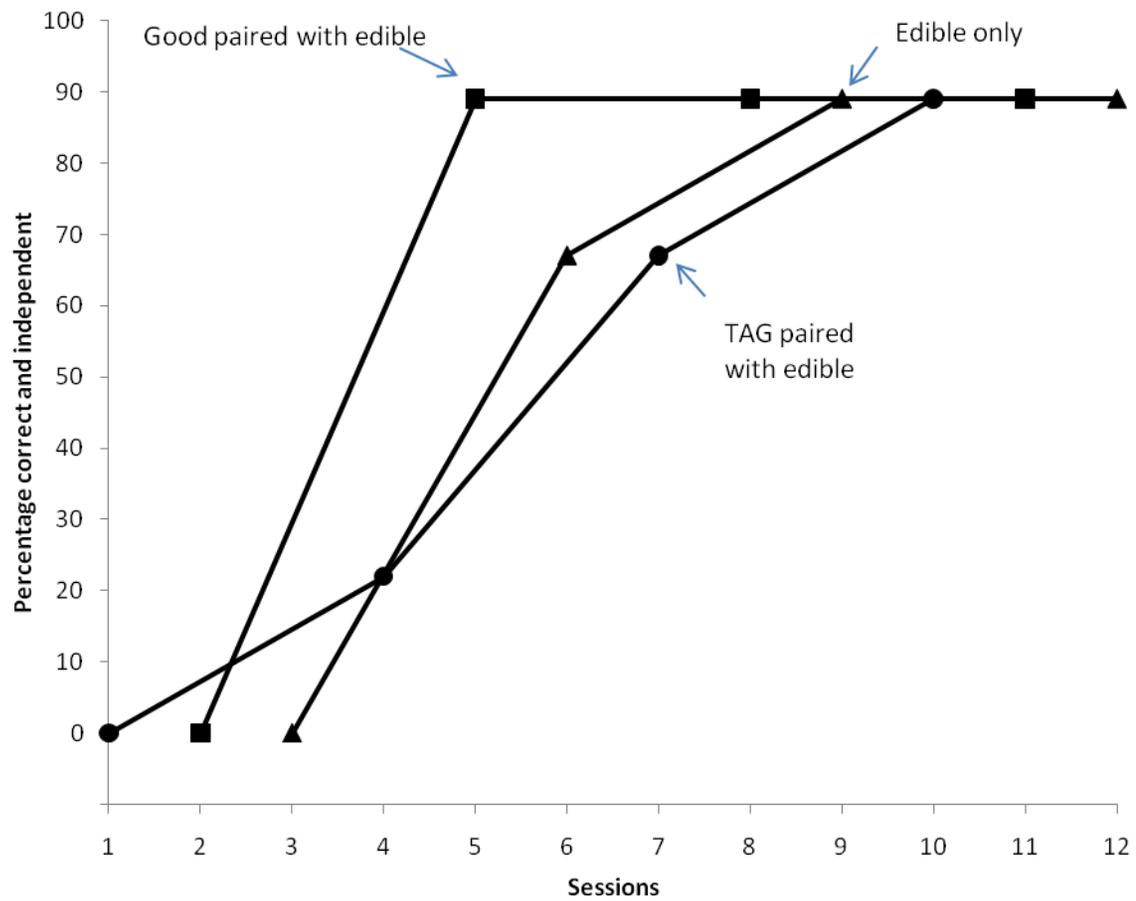


Figure 8

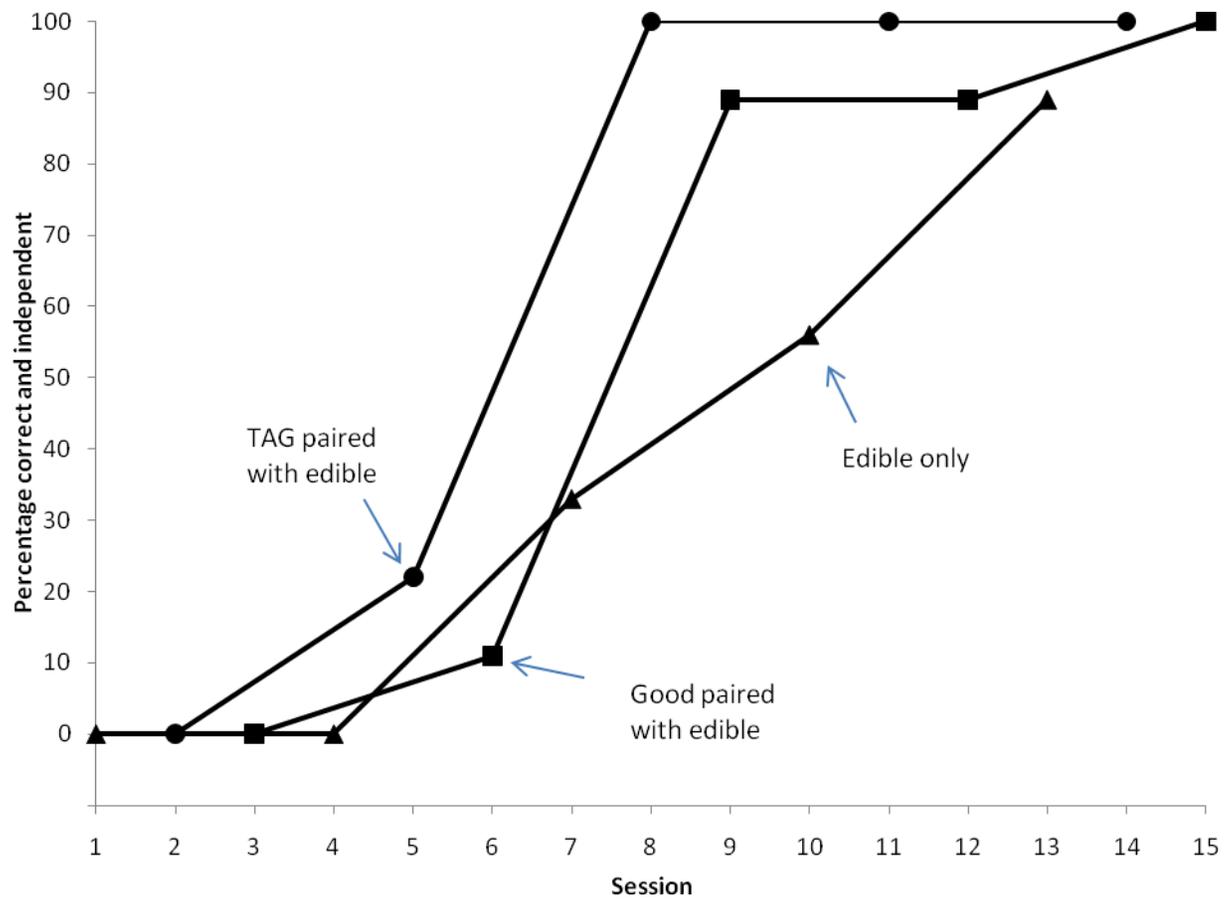


Figure 9

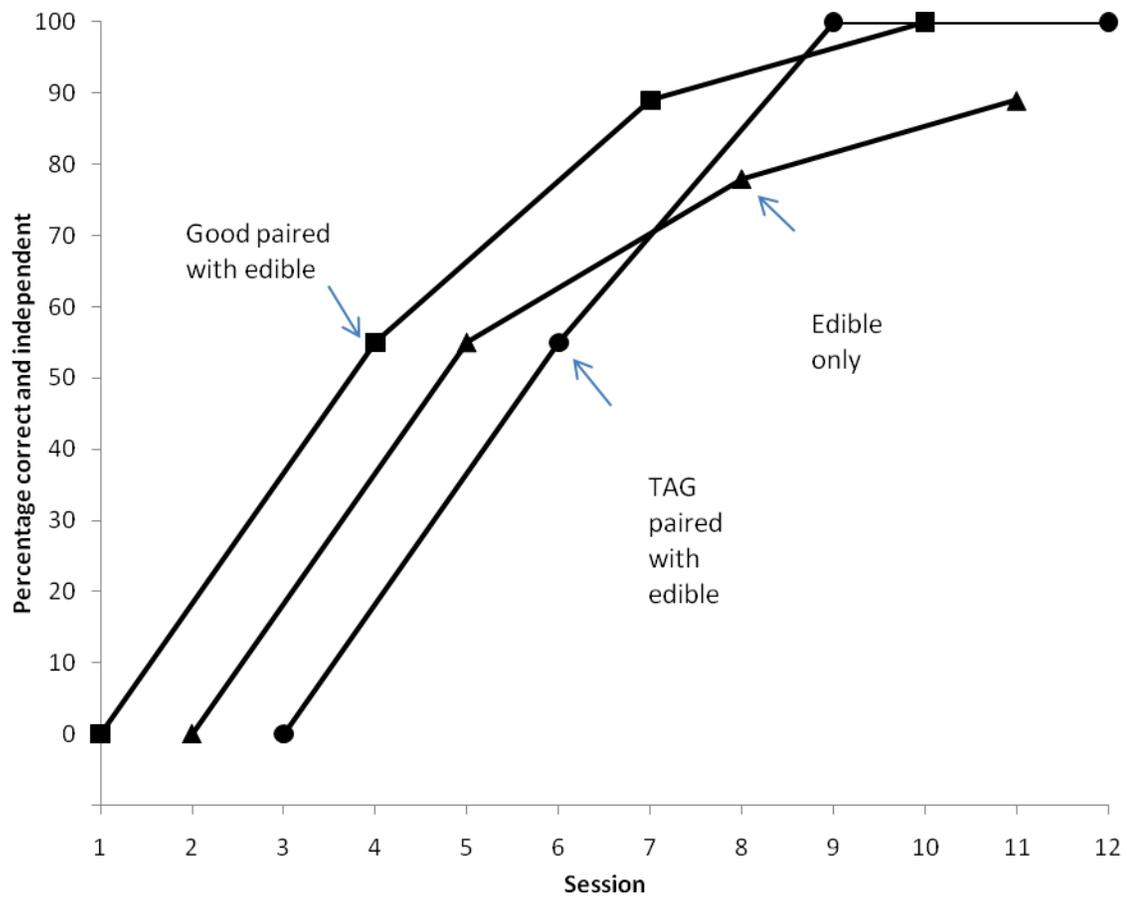


Figure 10