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## Conditioning a novel token as a generalized conditioned reinforcer

Benjamin M. Dawes  
*Northeastern University*

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Conditioning a Novel Token as a Generalized Conditioned Reinforcer

Benjamin M. Dawes

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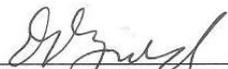
Author: Benjamin M. Dawes

Department: Counseling and Applied Educational Psychology

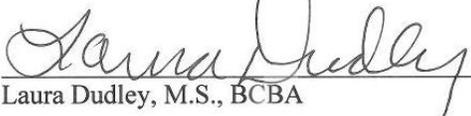
Approval for thesis requirements for the Master of Science Degree

  
\_\_\_\_\_  
Karen E. Gould, Ph.D.

4/18/12

  
\_\_\_\_\_  
D. Daniel Gould, Ph.D. BCBA-D

4/18/12

  
\_\_\_\_\_  
Laura Dudley, M.S., BCBA

4/18/12

**Abstract**

Unconditioned, novel black tokens were systematically conditioned to conditioned, currently utilized tokens in 5 phases for two participants. The unconditioned token resulted in an increased latency from presentation of token to task engagement when first presented. On all subsequent sessions the latency remained at or below baseline levels. The total session time showed a downward trend for both participants, suggesting the unconditioned tokens attained reinforcing properties. A reinforcer assessment indicated that the black tokens served as reinforcers for a novel, untrained task.

### Conditioning Generalized Conditioned Reinforcers Using Generalized Conditioned Reinforcers

Conditioned reinforcers (CRs) are defined as events, objects, or stimuli that are not initially reinforcing, but acquire the properties of reinforcers after frequent pairing or association with other reinforcers (Cooper, 1987, p.487). Generalized conditioned reinforcers (GCRs), are those CRs that have been paired with many different forms of reinforcement and do not depend on specific establishing operations to have reinforcing value (Cooper, 2007).

Kazdin and Bootzin (1972) identified 6 advantages to using GCRs for the reinforcement of behavior. First, GCRs provide a bridge in the delay between a response and a backup reinforcer. Second, reinforcement can be delivered at any time. Third, responding can be maintained over extended periods of time. Fourth, Reinforcement does not have to interrupt a sequence of responses, such as responses that occur in a chain to complete an activity. Fifth, GCRs are less subject to satiation as they are, sixth, not associated with any one specific reinforcer.

Token economies are a frequently used system of GCR that are implemented in applied settings such as work places, schools and prisons (Milan & McKee, 1976; Fox, Hopkins, & Anger 1987; McGinnis, Friman, & Carlyon, 1999). By using GCRs in these widely varied settings, experimenters and administrators are able to control individual and group behaviors across extended periods of time.

Fox, Hopkins, & Anger (1987) instituted a token economy (stamps) at 2 open-pit mining locations. These stamps were provided contingent upon the absence of work place injuries and/or accidents. The data were collected and reported yearly across 15 years. Stamps were earned monthly for individual and group performance and were made unavailable based upon the severity of an injury or accident. The individual reinforcement was yoked to receiving the group benefit, but the group benefit was not yoked to receiving the individual benefit. That is to say, if a person got injured, they would not receive both individual stamps and group stamps for that reinforcement interval, whereas if a person was not injured but a member of their group was, then that person would still receive stamps for individual behavior. These stamps were GCRs in that there were thousands of backup reinforcers available for

redemption and no restriction of saving stamps or trade-in were implemented (aside from the cost of the backup reinforcer). The number of injuries dropped off significantly in the first year at one facility and by the second year in the other facility. Injuries remained well below baseline levels throughout the remainder of the study which saved the mining company hundreds of thousands of dollars each year (despite the capital lost in the trade-in of stamps).

In a study of the effect of token reinforcement on math performance, two middle-school boys, were provided tokens (gold stars) on an FR3 schedule of reinforcement; which was subsequently increased to a FR5 schedule (McGinnis, Friman, & Carlyon, 1999). The response measured was completion of math pages, the accuracy of response, and the amount of time spent working on the math pages. The use of token reinforcement resulted in immediate increase across all response conditions and showed a steady increase in one of the participants. This change in behaviors was maintained as the schedule of reinforcement was thinned and in a later follow-up probe. The participants were allowed to trade their tokens in at the end of a session for a variety of backup reinforcers.

Milan & McKee, (1976) implemented “a simulated checkbook banking system” with male felons in one prison cellblock. In this system, the felons earned points in a manner that was similar to the checkbook banks use outside prisons. Each inmate earned points contingent upon behavior and could write a check to access a preferred reinforcer. This system also incorporated penalties, referred to as response costs, for overdrafts. In a store-like environment, a wide variety of backup reinforcers were available from which the inmates to could choose, including activities, access to events or other areas of the prison, or access to tangibles. Because it was a prison, access to these back-up reinforcers were limited to specific times during the day, but during these times the only limitation was an individual’s account point balance. The independent variables were 4 morning routines; arising on time, bed making, living area neat and clean, and personal appearance.

Milan & McKee (1976) used a multiple reversal design to assess the reinforcing value of the tokens, on the performance of specified morning activities. In baseline, the inmates were informed of the expected behaviors and feedback was given regarding whether their behavior met the performance

criteria. Following baseline 1, there was a short phase in which an officer motivated and harassed the cell block population as he saw fit. This intervention was included because the officer claimed he could better motivate the inmates. Following this intervention, points were given for completion of each morning activity. When an inmate completed this activity he could earn 60-points that could be deposited in a checking account. Initially, the 60 points were delivered non-contingently; in the subsequent condition, however, the 60 points were delivered contingent on successful completion of the individual morning activities.

The authors then increased the point-value of individual task completion to 90 points to determine if the greater value would result in increased morning activity completion. In the 60 points condition, there was an upward trend through the first half (14 days) of the condition after which performance leveled out at 93.3% of all activities completed across all cellblock members. It is interesting that the last 2 datum of the 60 point condition were at 100% task completion. The 90 point condition began with a lower task completion percentage than 11 of the last 13 days in 60 point condition. Performance was then variable, but ultimately showed an upward trend to an average of 89.6% completion. The authors deemed this outcome not to be any different from the terminal performance of the 60 point condition. When a return to the 60 point condition was implemented the percent of task completion was maintained.

Several reversals and comparisons were made through this research and ultimately it was demonstrated that the tokens served as reinforcers for the task completion when delivered contingently. Interestingly, the initial percentage of task completion was lower when the values of the points (tokens) were increased.

Moher, Gould, Hegg, & Mahoney (2008) conducted preference assessments which identified high and low preference edibles, then conditioned tokens by associating them with those edibles. Initially, preference assessments were conducted to identify the highest preferred edible and the lowest preferred edible out of 4 edibles. Following the assessment, novel common items (tokens) were paired with either the HP edible or LP edible in a two-stage procedure. In stage 1, the token was presented within .5 sec of the edible delivery. In stage 2, the participant was required to give the token to the experimenter in order

to access the edible. The number of pairings varied across participants but ranged from 90 to 200 pairings per token. For 2 participants stage 1 included 40 pairings per token, while in stage 2, in which the exchange was necessary, over 100 pairings were needed. For 2 of the 3 participants, probes were conducted in which the 2 tokens were presented and the  $S^D$  “choose one” was given. The backup reinforcer associated with the token selected was then provided. The criterion for terminating conditioning was that the participant selected the HP-token on 90% of the opportunities. The other participant required additional pairing (40 pairing trials) prior to each session in the subsequent phase.

In the next phase of the study, an additional preference assessment was conducted using both the conditioned tokens and moderately preferred edibles. In this phase, 2 of the three participants required “additional token pairing trials” as their responding did not match the previous preference assessment results. The sheer number of trials required to condition these tokens to specific edibles is of interest as it is time consuming and would likely require several days to complete.

Following the conditioning phase, a reinforcer assessment was conducted to both assess the reinforcing value of the edibles and to test the conditioning of the tokens. The response selected was hand raising and the dependent variable was hand-raise per minute (RPM). The phase included 4 conditions; HP-edible, HP-token, LP-edible, & LP-token. In each condition, hand raising was followed by either an edible or token on an FR1 schedule. The edibles and tokens were then placed in a cup and could be accessed at the end of the session. HP-edible resulted in the highest RPM across all participants, followed closely by HP-token, then interestingly LP- token and finally LP-edible.

Moher et al. (2008) study found that the tokens associated with the specific edible were successfully conditioned and that the frequency of subsequent responding to the tokens was similar to the frequency of responding to the edibles. While successful, the token training was very intensive; it required at least 90 pairings before the participants responded to the tokens, and in one case more than 200 pairings were required. Also, each token was only conditioned to one specific edible, so if tokens were to be used for other edibles, another intensive training would have to be conducted. This may well be a good way to shape up the use of tokens and thereby systematically create GCRs.

Sran & Borrero (2010) examined the effects making a variety of edibles available to participants during the token exchange. In the reinforcement phases, three different procedures were compared; a no choice condition in which the participant was provided one highly preferred edible that had been identified in a previous preference assessment, a single-choice condition in which the same highly preferred edible placed on 5 different plates and the participant was allowed to select one of the five edibles with each token earned, and a varied-choice condition in which the participant was presented with “the five most highly preferred items” presented on five plates. The participant earned the tokens, which were provided on a FR5 schedule, for tracing letters. The tokens were then exchanged at the end of a 3 minute work period; each token was exchanged for one edible. Relative to baseline (in which no tokens or edible reinforcement was provided), responding increased across all conditions although response rates varied across conditions.

Each condition described previously was associated with a different colored worksheet. Following the reinforcer assessment, participants were given the opportunity to choose which reinforcer condition under which they would work. The participants made this choice by selecting the colored worksheet associated with that condition prior to beginning a session. While each participant selected each condition a number of times, all participants selected the varied-choice condition across-most frequently. The authors concluded that this preference demonstrated that increased reinforcer choice had greater reinforcing value. The results of Sran and Borrero (2010) established that when tokens become GCRs, such as in the varied-choice condition, that condition is preferred over a condition in which the tokens are associated with little or no choice in back-up reinforcement.

In summary, GCRs show great effectiveness across many environments and their reinforcing efficacy can be maintained regardless of availability of specific reinforcers, value of reinforcers when the tokens are allowed to accumulate (Fox et al., 1987; Milan & McKee, 1976), and when one has greater choice in back-up reinforcer (Sran & Borrero, 2010).

The present research conditioned novel, neutral tokens as GCRs by presenting novel, neutral stimuli in a schedule with tokens that were already established as GCRs. In Experiment 1, the novel

stimuli were imbedded within a 5 token delivery and exchange system. Over successive sessions, the ratio of novel stimuli systematically replaced the existing GCRs until only the novel stimuli were used.

Experiment 2 examined the reinforcing efficacy of the newly conditioned GCRs.

### Method

#### *Participants*

Two pre-school aged males, Ridley and Newton, participated in the study. They were selected because they regularly used a GCR (token) reinforcement system.

Ridley was a 4 year-old male with a diagnosis of pervasive developmental disorder, not otherwise specified (PDD NOS). He had been receiving ABA services in which a token reinforcement was used for approximately 1 year. At the onset of this study, Ridley had emerging verbal skills and was able to communicate simple wants. He could also follow 2 and 3 step instructions reliably.

Newton was a 5 year-old male diagnosed PDD NOS. He had relatively advanced verbal skill and could communicate his wants for specific reinforcers independently. Prior to the onset of this study, he had been using a token reinforcement system for approximately 4 months. Newton could follow 2 and 3 step instructions reliably. Newton was withdrawn from the study before its completion.

#### *Settings and Material*

For both participants, sessions were conducted in their homes at their usual seated work stations during regularly scheduled ABA sessions. Partway through this study, Ridley's sessions took place in an office 2 days a week; therefore, a new work station was established prior to continuing experimental sessions in the new environment.

For both participants, the already established GCRs (tokens) were black and white line-drawing dinosaurs (figure 1), that appeared on squares which were approximately 1 inch by 1 inch in size, made of laminated paper. The type of dinosaurs varied across the tokens; for example, t-rex, brontosaurus, or pterodactyl. Responding remained stable regardless of the specific dinosaur delivered.

Experiment 1 and 2, the novel unconditioned reinforcers (UCR) tokens were black, laminated squares and of similar size to the established GCR (1 inch by 1 inch). These tokens contained no pictures

or other representations. Once delivered, all tokens, both the black squares and dinosaurs, were affixed with Velcro on a board that had spaces for five tokens. The spaces were in a horizontal row and were approximately 1.5 inches apart. For each participant a first work, then break contingency board was also present on the table, positioned so as to not interfere with the maintenance task completion.

In Experiment 1, five maintenance tasks were selected for each participant based upon ease of presentation and completion. The tasks for each participant are listed in table 1. In Experiment 2 the task was putting clothespins on a penny. This was selected because it was a task that was not in the participants' repertoire thereby required training and reinforcement.

An Apple iPad was used to record all sessions and the data were scored post-hoc from the videos using the timer on the video.

#### *Dependent Variable and Operational Definition*

During Experiment 1 the dependent variable was the time in seconds required for the participant to place a token on the board. The experimenter provided an initial S<sup>D</sup> of "It's time to do work". No further prompts were provided unless the participant engaged in stereotypic behavior that interfered with the completion of the maintenance tasks. The time began when the experimenter presented the token and ended when the participant had placed the token on the board and initiated engagement with the next task. Presentation of the token (both dinosaur and black) was defined as the point that the experimenter put token on the table and released it. Engagement in the next task was defined as the initial touch of the materials after placing the token on the token board.

During Experiment 2 the dependent variable was both the length of time to earn five tokens and whether the response was completed independently since the participant occasionally required prompting to complete.

#### *IOA and Procedural Integrity*

The experimenter served as the primary observer for all sessions..

IOA and procedural integrity were conducted on 31% of all sessions. A secondary observer scored the videos on a computer.

In Experiment 1, IOA was assessed on the latency measure which began with the presentation of the token and ended with the engagement in the next activity or, in the case of the fifth token, a request for break. Procedural integrity assessed whether the correct token (black token or dinosaur) was provided at the specified time. IOA was calculated by dividing the number of agreements by the total number of agreements plus disagreements, then multiplying by 100%.

In Experiment 2, IOA data was collected to assess whether the participant completed the task independently and the length of the session. The procedural integrity data was collected to determine if the token was provided following accurate completion of the task.

IOA and procedural integrity were calculated by dividing the number of agreements by the number of agreements and disagreements, then multiplying by 100%.

### *Experiment 1*

Experiment 1 consisted of 6 phases, which are described below. During all phases, standard session procedures were followed. In all sessions, the participant was seated across from the experimenter at a small table. A first work/then break contingency board was placed at the corner of the table, under which the token board was set. Following an attending response, the first of five maintenance tasks was presented with the S<sup>D</sup> “Do your work”. These tasks were presented randomly across all sessions, the order of tasks were not always the same. No further prompts were provided except when the participant engaged in stereotypy that interfered with task completion.

*Baseline.* Phase 1, which was conducted for 3 sessions, the average response latency for token board placement was recorded for all five tokens. A dinosaur token was provided contingent upon the completion of each maintenance task until all five tokens were earned and a break requested. The next task was presented within .5 seconds of the token delivery. No further S<sup>D</sup> was provided to initiate engagement in the next task, or to request a break in following the final task. A prompt to place the token on the token board was provided only if the participant began to engage in the next task without previously placing the token on the token board.

Mastery criterion was for the participant's latency from the presentation of the token to the engagement in the next task to be the same or lower than the average latency established during baseline.

The average response latency was used as a measure of mastery across the next 5 phases.

*Phase 1.* In Phase 1 a neutral black token was introduced. It was delivered for completion of the third task and the participant was required to place it in the third (middle) position of the token board (figure 2). The middle position was selected so the black token was associated with other tokens instead of being immediately associated with the exchange for the backup reinforcer (e.g. the fifth position). Mastery criteria for this and all following phases in Experiment 1 were for three consecutive session in which the response latency for the black token was at or below the average response latency observed during baseline in which only established GCR were provided. Additionally, the participants could not exhibit any extraneous behavior with the novel token, for example, flipping the token backward and forward, making comments regarding the token, etc. If these behaviors occurred, they were ignored.

This procedure remains the same for the following 4 phases.

*Phase 2.* In Phase 2, a second black token was introduced. It was earned when the participant completed the second maintenance task and was placed in the second position on the token board. A black token continued to be presented for completion of the third task and the participant was to place it in the third position continued to be a black token as well (figure 3). This position was selected to maximize the association with the dinosaur tokens and limit association with the backup reinforcer. Mastery criteria remained the same for this condition.

*Phase 3.* In Phase 3, a black token was introduced for completion of the fourth task; when earned it was to placed in the fourth position on the token board. Black tokens were also provided for completion of tasks two and three and the participants were to continue to place them in the trained positions on the token board.

*Phase 4.* In Phase 4, the participant received a fourth black token for completing the fifth task. The participant was required to place this token in the fifth position on the token board; completion of the second, third, and fourth tasks continued to be followed with black tokens (figure 5). At this point, only

completion of the first task was associated with the dinosaur token. However, completion of the final task and delivery of a black token was now directly paired with the token exchange. Mastery criteria remained the same as in previous phases.

*Phase 5.* In Phase 5, A black token followed completion of each of the tasks (figure 6). Mastery criteria remained the same for this condition.

### *Experiment 2*

During Experiment 2, a reinforcer assessment was conducted to determine whether the newly conditioned black tokens had reinforcer efficacy and could be used to train a new task. The task selected was putting clothespins on pennies; this task new to the participant and thus untrained. Ridley was the sole participant in Experiment 2.

*Baseline.* In baseline, Ridley was provided with 5 clothespins and 5 pennies and told, “Put the clips on the pennies.” The experimenter modeled the behavior prior to the beginning of the session; however, there was no further interaction with the participant until he placed all the clothespins on all 5 pennies.

Following baseline, the participant received a black token each time a penny was placed within the clothespin, the clothespin was closed, and the penny did not fall out. A physical prompt was provided when the participant requested help. Prompts were also given to remain on task when stereotypy interfered with task completion. Mastery criteria for this task was achieved when the participant independently placed all 5 pennies individually on a clothespin in below baseline time and maintained response latency at or below that of baseline in Experiment 1. Mastery criteria was set at 100% independent correct responding and in less time than in baseline.

## Results

### *Experiment 1*

IOA and procedural integrity were conducted on 31% of all sessions in Experiment 1. IOA was 93%, procedural integrity was 100%. IOA and procedural integrity were conducted on 40% of sessions in Experiment 2; both were 100%.

Figures 7-10 display the results of Experiment 1 for Ridley and Newton, respectively.

During baseline, the average latency from presentation of token to engagement in the next task was 7.87 seconds for Ridley ranging from 7.6 – 8.2 s and 8.8 seconds for Newton with a ranging from 6.6 – 10 s.

In the first session of Phase 1, Ridley's average response latency when presented with the unconditioned token was 17s while his average response latency when presented the dinosaur was 10s. When first presented with the unconditioned token, Ridley looked the token front and back, placed it down and attempted to engage in the next task. The experimenter then prompted him to place the token on the board. Interestingly, the latency for the next token (token 4) was 14s as Ridley attempted to replace the black token with the dinosaur token. During Phase 1, Session 2, Ridley again looked the black token front and back before placing it on the token board, his average latency was 7.5s, which was below baseline level. In the following three sessions, Ridley's average latencies were 4s, 6s, & 6s, respectively, and Ridley met criteria to begin Phase 2.

Throughout Phase 2 – Phase 5, all of Ridley's average latencies for placing the black tokens were under the 7.87s of baseline. As a result, he met criteria to advance to the next phase in 3 sessions for each phase. He then moved on to the reinforcer assessment.

In the first session of Phase 1, Newton had an average response latency of 22s when he was presented with the unconditioned token. His average latency when he was presented the dinosaur tokens in Phase 1, Session 1 was 6.75s. Newton made 2 comments regarding the black token and required a prompt to place the black token on the token board before engaging in the next task. The average

latencies for token placement in the next 3 sessions of Phase 1 were all below the baseline average of 8.8s; thus Newton advanced to Phase 2.

Newton continued to emit latencies below that of the baseline average in Phase 2 and he met criteria to advance to Phase 3. In Session 9, Newton displayed high levels of stereotypy which increased his latency response when placing the first token. He was also slower in placing one of the dinosaur tokens in its position which resulted in a spike in latency. No further data was collected as Newton was removed from the study at this point.

Ridley's total session time (figure 9), which includes on task time, averaged 462.3 seconds per session ranging from 379s – 569s during baseline. The average session time in Phase 1 was 473s, ranging from 383s – 515s, and the average total session time during Phase 2 was 433.3s, ranging from 404s – 450s. In Phase 3 the average session time was 539.3s with a range of 449s – 569s, and in Phase 4 the average was 486.3s ranging from 471s – 539s. During the final phase, Ridley's average session time was 405s, the lowest across all conditions, with a range of 360s – 451s. Each individual session time across Phase 1- Phase 5 remained within baseline range.

Baseline for Newton's total session time averaged 300.3s with a range of 253s – 327s (figure 10). In Phase 1, the average total session time was 412s, ranging from 254s – 572s, In Phase 2 the average session time was 391s with a range of 345s – 450s.

### *Experiment 2*

Figure 11 displays the results for Experiment 2. In baseline, Ridley required 6'-51" to place 5 clothespins onto 5 pennies. Ridley requested help 2 times during baseline, and the experimenter modeled the target response at these times. In the first session after baseline, Ridley completed the 5 tasks in 2'-12", he completed the tasks with 80% independence, only requiring 1 physical prompt on the first clothespin. In the next three sessions, he responded with 100% independence and the sessions times were 2'-28", 2'-58" and 2'-21" respectively, achieving the mastery criteria.

### Discussion

Both Ridley and Newton took 1 and 2 sessions, respectively, to place the novel token on the board with the same latency as they did the dinosaur tokens. For both participants, the initial presentation of the neutral token resulted in a dramatically higher latency time; 17 seconds for Ridley and 22 seconds for Newton, and both participants required a prompt to place the token onto the token board. For Ridley, there was an associated increase for the average latency of the dinosaur tokens; when that token followed the presentation of the neutral token. In fact, Ridley tried to replace the neutral token he had already placed on the token board with the dinosaur token that he received for completion of the next task. This associated increase did not occur for Newton.

Throughout the introduction of the neutral tokens, Ridley's session times remained below the uppermost range of baseline, although average times showed an increase in Phases 1, 3, & 4. Ridley displayed high amounts of stereotypic throughout his sessions; he often would engage in delayed echolalia while performing the ordering tasks and in between trials during the single digit addition task. The delayed echolalia during the addition task may account for the increase in the average session times that resulted. Had an alternate maintenance task been selected, the total session times may have been much lower. Regardless, the total session times remained below the highest baseline datum, thereby demonstrating that the introduction of the black tokens did not affect the time Ridley spent on task and suggesting that they were equally as reinforcing as the dinosaur tokens.

Following the first session of Phase 1, Newton's latencies remained below baseline for placement of the black tokens. While he did have some variation in his latencies when the dinosaur tokens were presented, his average latencies remained at levels similar to baseline throughout the study. It would have been interesting to probe the Phase 5 condition to measure latencies without having the full systematic phasing in of the black token, and to compare the outcome to Ridley's results. Replication with several participants would be necessary to verify any consistent differences.

It is possible that the behavior the participants displayed in the initial session of Phase 1 was a reaction to the novel stimulus. This assumption is supported by the fact that neither participant showed

increased latencies at the beginning of the remaining phases. Presumably, this was because the black tokens were no longer novel.

It would also have been interesting to probe with reinforcer assessment trials during Experiment 1 to assess if the neutral tokens had acquired sufficient reinforcing value to increase responding on an acquisition task. Circumstances prevented such probes, but a comparison of a full systematic pairing of neutral GCRs with current GCRs to that of 2-3 pairings of the GCRs together would make interesting future research.

Newton's total session times increased to above baseline levels in both Phase 1 and Phase 2; Phase 1 showed steady increases in session time, while Phase 2 showed a more gradual downward trend. A number of times during session, Newton engaged in attention gaining behavior, such as putting the numbers 1-9 in the wrong order deliberately. These behaviors were ignored and put on extinction, which seems to be the case in the downward trend in total session time in Phase 2.

In Phase 1, Ridley required 2 sessions before responding was both below baseline average and no other behaviors associated to the neutral token were observed. Following those 2 sessions, he met criteria to advance in 3 sessions in each phase. In Phase 5 he celebrated that he received all 5 black tokens by saying "We got all 5 black tokens!" before requesting a break. This response suggests that the tokens had reinforcing value to Ridley and a reinforcer assessment confirmed this.

The downward trend in session time noted for both Ridley and Newton may be attributable to the fact that the delivery of the black token was now associated with the token change. This immediate pairing of the delivery of the black token with a demonstrated reinforcer may enhance their reinforcing effect.

In Experiment 2 a reinforcer assessment was conducted with Ridley. In baseline it took him 2'-38" to place the first clothespin onto a penny, this time is similar to the time he required to complete all 5 clothespins in the assessment phase of Experiment 2. While it may be that the prompts provided when Ridley requested help during baseline may have influenced the results, it was always part of his program to respond to his requests for help. Also, Experiment 2 was conducted to assess the reinforcing potency of

the black tokens following the systematic pairings procedure utilized in Experiment 1; using prompts was consistent across baseline and experimental conditions.

Compared to the Moher et. al (2008) study, in which training a token to a specific stimulus took as many as 200 trials, the current study took dramatically fewer pairings and, more importantly, less time. It could be that once a black token is established as a reinforcer, it can generalize rapidly to other black tokens. Another possibility is that GCRs generalize faster because they lack that specific association with one stimulus and the opportunity for choice of reinforcement aids in the transfer of reinforcement. The study by Sran & Borrero (2010) does seem to support this supposition as they found that a condition where the choice of several reinforcing stimuli was preferred over no choice in reinforcer, despite that reinforcer being identified as highest across all available reinforcers.

In the current study, the presentation of the unconditioned token resulted in response latencies that were lower than baseline averages in 1-2 sessions. While no probes were conducted to assess whether the black tokens could be used across all 5 token positions earlier in the study, or if the black tokens had achieved sufficient reinforcing potency to produce task acquisition, the data does suggest that might be the case. In the Milan & McKee (1976) study, prisoners worked for points (GCRs) that were earned and redeemed in a checkbook system that resembled regular check booking systems outside of the prison system. When these points were first introduced, they were provided non-contingently and still behavior increased by more than 60% across the first three sessions; it took a short number of pairings to achieve reinforcing value. When the points were made contingent, a change to the quality of the GCR occurred, responding again dropped off before reaching a high level. This occurred again when the value of the points were altered. This suggests that it only requires a small number of pairings with an established GCR for a novel, yet similar, GCR to achieve high reinforcing value.

It should be noted, however, that formal reinforcer assessment were not conducted with the dinosaur or black tokens immediately before Experiment 1. Dinosaur tokens were routinely used with both participants and they may have not been potent reinforcers or may have lost their potency. While black squares of paper had never been presented to either participant contingent on a task, it is possible

that the collecting of any stimulus might have been reinforcing. These possibilities could be explored in future research.

Another area of research that would be interesting would be to use the same pairing procedure employed in Experiment 1 but use pictures of non-preferred tasks rather than black tokens. Then, following successful conditioning, assess whether the non-preferred task can function as a reinforcer.

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Table 1

*Maintenance tasks that were utilized in experiment 1 for each participant*

	Maintenance Tasks
Ridley	Days of the week in order Months of the year in order Select pictures that begin with the letter A Select pictures that begin with the letter B Single digit math: 1's table
Newton	Days of the week in order Months of the year in order Numbers 1-9 in order Numbers 10-19 in order Numbers 20-29 in order

## Figure Captions

*Figure 1.* The baseline token board with varied dinosaur tokens. The order/type of token presentation was random across baseline and all subsequent phases.

*Figure 2.* Phase 1 token presentation. The 3<sup>rd</sup> token provided for task completion was a black token.

*Figure 3.* Phase 2 token presentation. The 2<sup>nd</sup> and 3<sup>rd</sup> tokens provided for task completion were black tokens. The 2<sup>nd</sup> position was selected so the black token was conditioned more to the dinosaur tokens than to the backup reinforcer.

*Figure 4.* Phase 3 token presentation. The 2<sup>nd</sup>, 3<sup>rd</sup>, & 4<sup>th</sup> tokens presented for task completion were black tokens.

*Figure 5.* Phase 4 token presentation. All but the first token presented for task completion were black tokens.

*Figure 6.* Phase 5 token presentation. All 5 tokens provided for task completion were black tokens.

*Figure 7.* Latency of task engagement from token presentation for Ridley. The blue diamonds are the average latency per session for dinosaur tokens. The red squares show the latency of the black token presented in the 3<sup>rd</sup> position. The green triangles show the latency for the black token in the 2<sup>nd</sup> position. The purple X's show the latency for the black token in the 4<sup>th</sup> position. The blue plusses show the latency for the black token in the 5<sup>th</sup> position. The orange circles show the latency for the black token in every position

*Figure 8.* Latency of task engagement from token presentation for Ridley. The blue diamonds are the average latency per session for dinosaur tokens. The red squares show the latency of the black token presented in the 3<sup>rd</sup> position. The green triangles show the latency for the black token in the 2<sup>nd</sup> position.

*Figure 9.* Total session times for Ridley. The red squares show the total session times in seconds across BSL and all phases.

*Figure 10.* Total session times for Ridley. The red squares show the total session times in seconds across BSL, Phase 1, and Phase 2.

*Figure 11.* Reinforcer assessment for Ridley. The green bars show percent independent completion of putting clothespins on pennies along the first Y-axis. The red diamonds show the total session times in seconds along the second Y-axis.

Figure 1



Figure 2



Figure 3



Figure 4



Figure 5



Figure 6



Figure 7

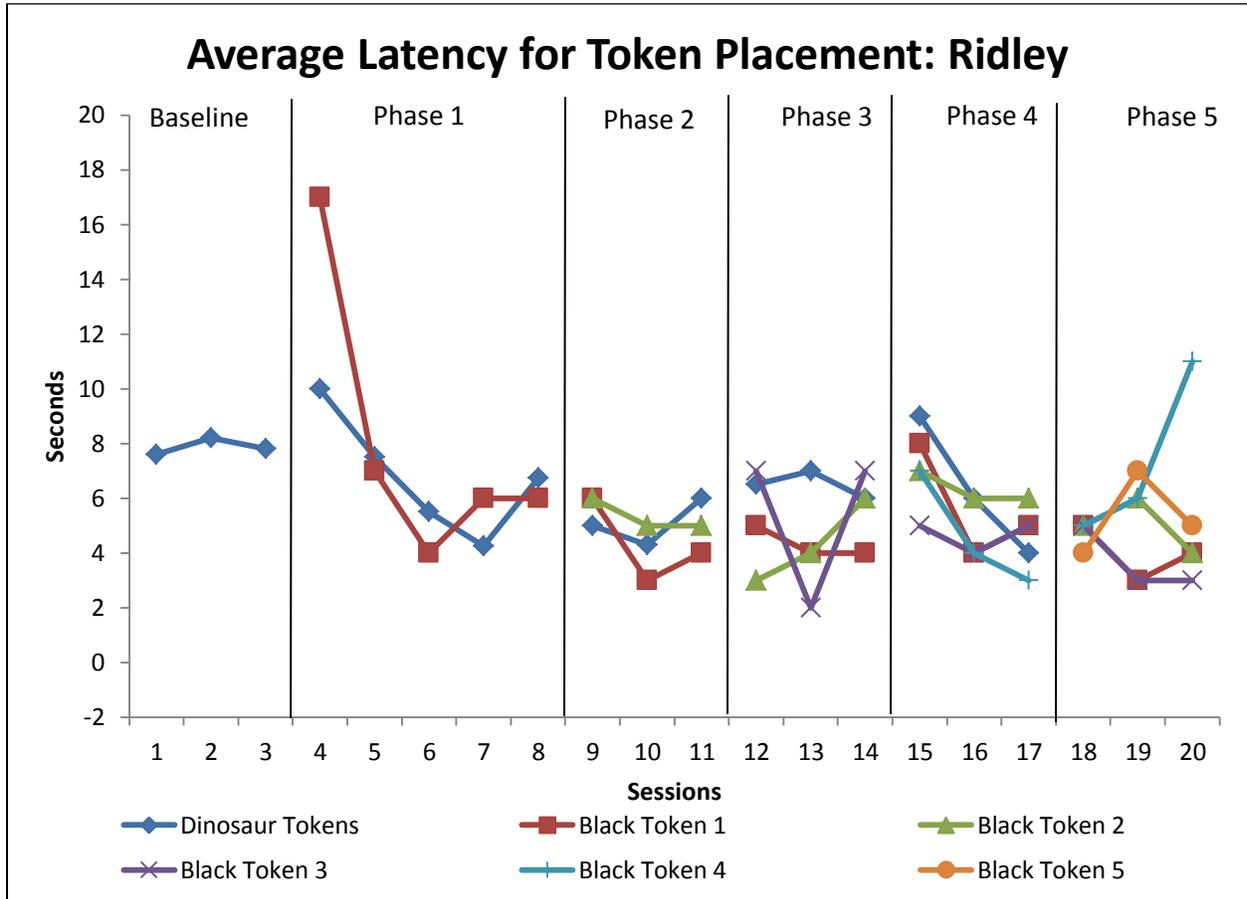


Figure 8

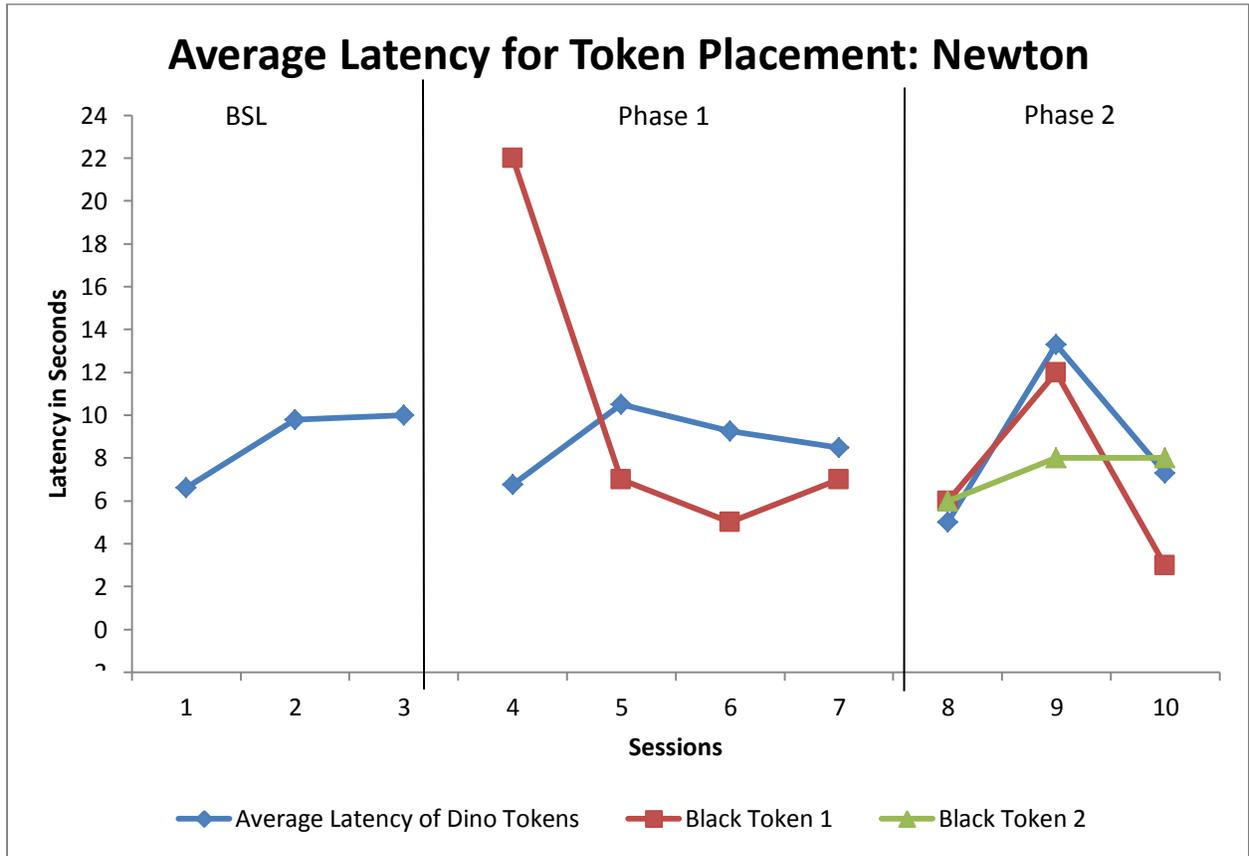


Figure 9

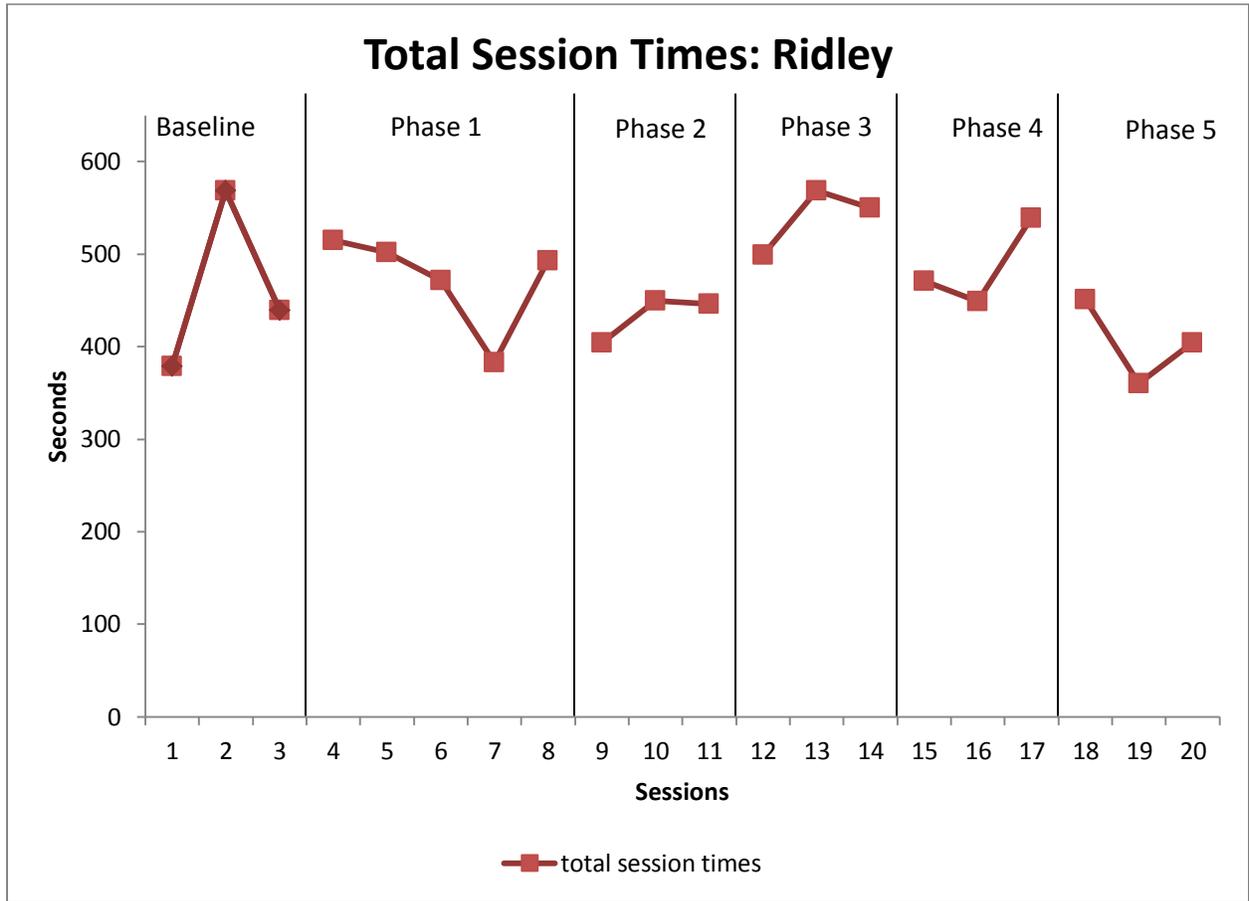


Figure 10

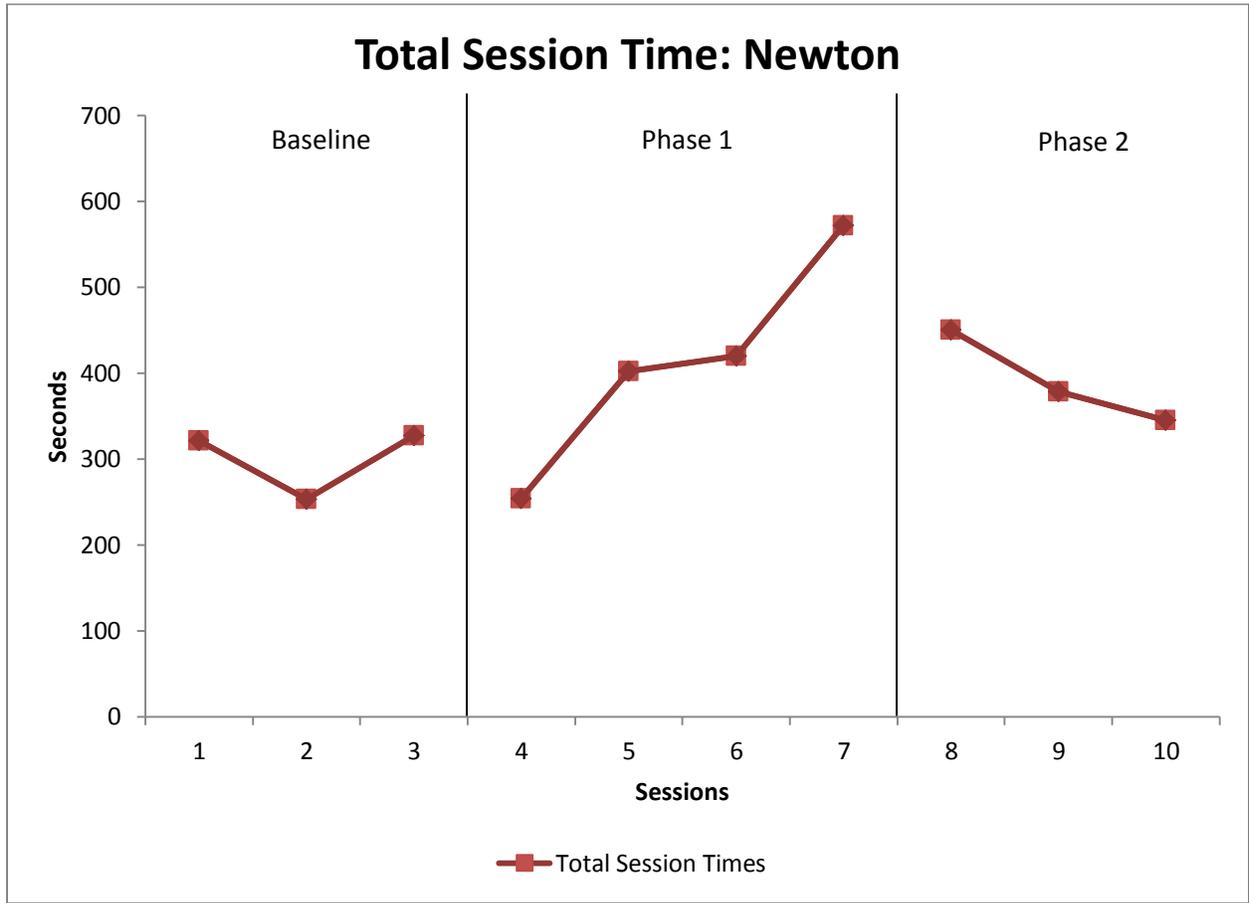


Figure 11

