
THE EFFECTS OF TOKEN REINFORCEMENT ON ATTENDING IN A YOUNG CHILD WITH AUTISM

Rachel S. F. Tarbox^{1,2*}, Patrick M. Ghezzi¹ and Ginger Wilson¹

¹University of Nevada, Reno, USA

²Center for Autism & Related Disorders Inc., USA

The benefits of token economies have been widely established, however there are very few empirical studies on the effects of token reinforcement on the behavior of young children with autism. The establishment of conditioned reinforcers such as tokens may be important in interventions for children with autism. Token reinforcement was used to increase the attending behavior of a young child with autism during discrete trials instruction for academic and communication skills. A reversal design showed that token reinforcement sustained attending only when the back-up reinforcer was available and was accessed immediately. The results extend and corroborate findings on token reinforcement reported in other applied settings and are also consistent with findings from basic research on conditioned reinforcement. Copyright © 2006 John Wiley & Sons, Ltd.

INTRODUCTION

The benefits of the token economy with people from diverse populations and in a variety of settings have been widely acknowledged (e.g., Ghezzi, Wilson, Tarbox, & MacAleese, 2003; Kazdin, 1994; Miltenberger, 2001; Sulzer-Azaroff & Mayer, 1991). Variations of a token economy have been implemented with individuals with psychiatric disorders who were hospitalized (Ayllon & Azrin, 1965, 1968), children diagnosed with attention deficit hyperactivity disorder (Ayllon, Layman, & Kandel, 1975; Hupp & Reitman, 1999; Robinson, Newby, & Ganzell, 1981), adolescents with behavior disorders (Foxy, 1998), students with learning disabilities (Cavalier, Ferritte, & Hodges, 1997), workers in industrial settings (Foxy, Hopkins, & Anger, 1987), prison inmates (Milan & McKee, 1976), and university students (Everett, Hayward, & Meyers, 1974).

*Correspondence to: Rachel S. F. Tarbox, Center for Autism & Related Disorders, Inc., 19019 Ventura Blvd. Tarzana, CA, 91356. E-mail: r.tarbox@centerforautism.com

The effects of different parameters of token reinforcement have been investigated thoroughly and it has been demonstrated that token reinforcement is most effective when back-up reinforcement is available, and when tokens can be exchanged without delay (Kazdin, 1977). Basic research conducted with non-humans has also corroborated these findings and has further demonstrated that response patterns observed under a variety of schedules of token delivery resemble those obtained under schedules of primary reinforcement, contributing to the validity of the token economy (e.g., Kelleher, 1958). More recently, Foster, Hackenberg, and Vaidya (2001) demonstrated that the response rates of pigeons decrease systematically with increases in the exchange schedule when tokens are delivered on a fixed-ratio schedule. Basic research conducted in the controlled laboratory setting, such as the investigation by Foster, et al., enhances the general understanding of the mechanisms that contribute to the effectiveness of the token economy.

Although it has been demonstrated that the behavior of both non-humans and humans can be established and maintained by schedules of token reinforcement, there are very few empirical studies on the effects of token reinforcement on the behavior of young children with autism (Charlop-Christy & Haymes, 1998; Hung, 1977; Mangus, Henderson, & French, 1986). It may be particularly socially significant to investigate the use of token economies with individuals diagnosed with autism because, as has been suggested elsewhere, the initial development of conditioned reinforcers may be delayed in this population (e.g., Bijou & Ghezzi, 1999). Specifically, as compared to typically developing children, an absence or only partial development of conditional positive social stimuli has been noted in children with autism, and as such, more specific training for the development of conditioned reinforcers may be necessary.

Children with autism may also particularly benefit from the use of a token economy in that this population often requires a dense schedule of programmed reinforcement for appropriate behavior (Anderson, Taras, & Cannon, 1996). In some circumstances (e.g., school) it may not be practical to provide reinforcement contingent on each response, especially if the programmed reinforcer requires time and effort (e.g., coloring). Therefore a token economy may prove useful in that tokens can be used to reinforce the target behavior immediately after it occurs. Other potential benefits of a token economy include; (1) a token economy is highly structured; therefore desirable target behaviors may be reinforced more consistently, (2) tokens are generalized conditioned reinforcers and as such may function as reinforcers regardless of any specific establishing operation that may exist for a client at any time, and (3) tokens are easy to dispense and easy for the recipients to accumulate. For these reasons, further research on the effects of token reinforcement for children with autism is warranted.

One purpose of the current study was to demonstrate how token reinforcement may be used to increase the attending behavior of a young child with autism during Discrete Trials Training (DTT). DTT involves breaking a skill into discrete components and using mass trials until the skill is learned (Smith, 1999). Many DTT programs involve the use of task materials, and require the child to attend to both the person providing the instruction, and the task materials. Under these conditions, many DTT programs can be conceptualized as requiring joint attention skills on the part of the child. Joint attention is defined as the ability to coordinate attention between an object and a person in a social context (Adamson & McArthur, 1995). Recently an increasing number of investigators have suggested that joint attention deficits may underlie many of the characteristics that define autism; including deficits in social behavior, language, imitation and play skills (Whalen & Shrieberman, 2003). Although the purpose of the current investigation was not to investigate joint attention skills per se, it is important to note that it may be necessary to specifically target the acquisition of attending skills in children with autism. The participant in the current investigation was reported to have engaged in low levels of eye contact, a prerequisite skill to more complex attending skills such as joint attention, and as such this skill was chosen as the target response for investigation. A second purpose of the current investigation was to examine various parameters of the token economy in an applied context under controlled conditions. We sought to do so by systematically manipulating the cost of the back-up reinforcer and the delay between the last token earned and the delivery of reinforcement.

METHOD

Participant, Setting and Materials

The participant in the study, Adam, was a 5-year-old boy with an independent diagnosis of autism. A record review indicated that Adam's diagnosis was provided by a licensed psychologist and specified that Adam met the criteria for autism based on the Diagnostic and Statistical Manual of Mental Disorders—DSM-IV (American Psychiatric Association, 1994). Adam had some pre-academic, fine motor, gross motor, independent play and self-help skills, but was delayed in these domains and was significantly delayed in his expressive communication and social skills as compared to age equivalent peers.

Adam had prior experience with a token economy during DTT. Specifically, Adam had received training on exchanging tokens for back-up reinforcement on a one-to-one schedule (i.e., one token and then access to the unconditioned reinforcer). However tokens had not been delivered for the target response in the current

investigation, and the schedule of reinforcement and the delay to the back-up reinforcer had not been previously manipulated.

At the time of investigation Adam attended a day treatment center for young children with developmental disabilities. All sessions were conducted in a small therapy room located in adjacent to a larger classroom 5 days per week. DTT was conducted at a table with two chairs located in the corner of the therapy room, and during breaks Adam was allowed to play anywhere in the therapy room.

Data were collected during all of Adam's one-to-one acquisition opportunities across the day, except during review of previously mastered skills (i.e., 'maintenance' skills) which were reviewed at the beginning of the day, and during which Adam did not receive tokens. As such, various training programs were included in this investigation. Adam's curriculum consisted of DTT for academic and communication skills, including programs such as imitation (motor, object and vocal), matching, gesturing, receptive labels, body part identification, following directions, prepositions, etc. Between 12 and 16, 10-trial sessions were conducted per day ($M = 14$), and each day concluded at the end of a 10-trial session.

During conditions in which tokens were provided (see descriptions below) Adam received laminated star stickers with a Velcro[®] adhesive. These stickers were placed on a 'token board' (laminated cardboard strip) with corresponding adhesive strips. The number of adhesive strips on the board corresponded with the number of tokens required per condition. The token board was visible on Adam's work table across all sessions during which tokens were provided. In conditions without tokens, the board and the stickers were removed. Back-up reinforcement was available when all of the adhesive strips on the board were filled with stickers.

Response Measurement

Data were collected during DTT by the instructional tutor on Adam attending to his tutor prior to the delivery of an instruction. Attending was defined as making eye contact with a tutor for at least 3 s.

Interobserver Agreement and Treatment Integrity

Treatment integrity was assessed by an independent observer that was blind to the purpose of the study. Data were collected on correct implementation for all procedures (including delivery of prompts, tokens, and breaks, as appropriate for each given trial) by both the tutor (self-recorded) and the independent observer for 30% of all instructional trials. Integrity was evaluated by dividing the number of agreements by the total number of agreements plus disagreements and multiplying that number by 100%. A mean percentage of agreement of 92% was obtained (range, 86–100%).

Interobserver agreement (IOA) on Adam's attending was assessed by an independent observer that was blind to the purpose of the study for 34% of all instructional trials by dividing the number of agreements by the total number of agreements plus disagreements and multiplying that number by 100%. A mean percentage of agreement of 96% was obtained (range, 80–100%).

Experimental Design and Procedure

A reversal design was used to evaluate different parameters of a token economy with respect to the attending behavior of a young child diagnosed with autism.

Baseline

During baseline (BL), Adam was prompted to attend to the tutor at the start of each instructional trial. A prompt consisted of the tutor providing non-vocal prompts for eye contact with Adam for a total of 5 s (alternating between orienting their eye gaze towards Adam, moving their face towards Adam, and using an isolated finger prompt moving their finger from in front of Adam's eyes to the their eyes). Correct eye contact was scored if Adam made eye contact for 3 s during this 5 s opportunity. If Adam did not attend to the tutor for 3 s within 5 s after the initial prompt was provided, incorrect eye contact was scored and then a vocal prompt was given to him by the tutor to 'Look at me.' If Adam did not attend to the tutor for 3 s within 5 s after the vocal prompt was provided, the same vocal prompt was delivered a second time. No additional prompts for attending were given, and there were no programmed consequences for attending, or not attending, to the tutor. Instead, the tutor proceeded to deliver a task-related instruction, prompting and reinforcing correct responses with social praise, as appropriate. Adam received a break from work (90 s) after each 10-trial teaching session. During the break Adam was allowed to play with a selection of preferred toys. Preferred items were identified per a preference assessment that was conducted at the beginning of each day based on the procedures described by DeLeon and Iwata (1996). Items that were chosen at least 80% of opportunities during the initial preference assessment were available throughout the day during every break.

Token Reinforcement (TR)

This condition was identical to the baseline condition except Adam received a token (a star sticker) immediately for attending to the tutor after the tutor provided the 5 s initial prompt, per BL conditions, for each trial. At the beginning of each 10-trial session the instruction, 'you can earn stickers to get a break' was stated to Adam. If Adam attended to the tutor contingent on the initial prompt, a token and social

praise was provided (e.g., 'nice looking at me, you earned a sticker!'). Adam did not receive a token for attending to the tutor following a vocal prompt. Adam was required to earn a total of 10 tokens for attending before exchanging them for access to back-up reinforcement, a 90 s break from instruction. When Adam earned all 10 tokens, the tutor provided social praise (e.g., 'great job, you earned all of your tokens, you can take a break!'). During the break Adam was allowed to play with a selection of preferred toys (as identified per a preference assessment) and the tokens were removed from the board and the board was replaced on the worktable.

Schedule Thinning (ST)

This condition was identical to the TR condition except after two consecutive 10-trial sessions with at least 80% attending, the number of tokens required for back-up reinforcement was increased by a factor of 5 to an eventual maximum of 50 tokens. The time that Adam was allowed to take a break from instruction also increased by 90 s for each 5 token increase (e.g., Adam received a 15 min break after earning 50 tokens).

No-backup Reinforcement (NB)

This condition was identical to the TR condition except tokens were earned but never exchanged for back-up reinforcement. Specifically, when Adam earned all 10 tokens, the tutor provided social praise (e.g., 'great job, you earned all of your tokens') and the tokens were removed from the 'token board' and the next trial began.

Delay to Reinforcement (DR)

During this condition a delay to back-up reinforcement was implemented. Specifically, this condition was identical to the TR condition except when Adam earned all 10 tokens he was given the instruction, 'great job, you earned all of your tokens! You have to wait.' No instructions were provided during the delay and Adam was not allowed to engage in any other activity. When the delay ended, Adam was told, 'you can take your break now.' The delay to back-up reinforcement was increased by 5 s following two consecutive blocks of 10 trials to a maximum of 190 s.

RESULTS

Shown in Figure 1 are the percentages of instructional trials across all phases of the study that Adam attended to the tutor and/or to the teaching materials for at least 3 s.

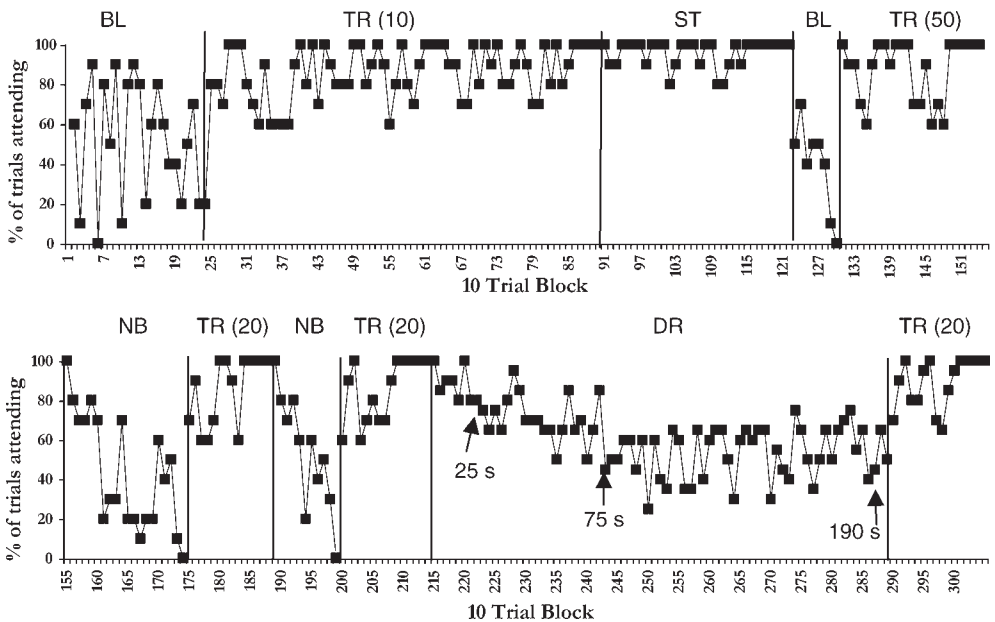


Figure 1. Data are shown as the percentage of trials that Adam was attending out of 10-trial blocks. The top panel shows the results from the BL, TR and ST phases of the study, while the bottom panel shows the results from the NB, TR, and delay to reinforcement (DR) phases. The number of tokens required for back-up reinforcement is indicated in parentheses for the TR and ST phases. Included within the DR phase are 25, 75, and 120 s delay values.

Adam's attending was variable throughout the initial BL, ranging from 0% to 90% of the trials. The first token reinforcement phase (TR [10]) reduced that variability (range, 60–100%) and eventually increased attending to 100%. Attending was consistently high throughout the schedule thinning (ST [50]) phase, where the number of tokens required for back-up reinforcement was increased by a factor of 5 to a maximum 50 tokens.

Adam's attending fell to 0% during the second BL phase. Reintroducing token reinforcement, this time with a 50 token requirement (TR [50]), increased attending to 100%. Attending decreased during the first NB phase, where no back-up reinforcement was provided, and then increased to 100% when back-up reinforcement was reinstated, this time with a 20 token requirement (TR [20]). A return to the NB phase eventually decreased attending to 0%. Attending once again increased to 100% upon returning again to the TR (20) phase.

In the DR phase, when the delay to back-up reinforcement increased from 5 s through 190 s, attending steadily declined as the delay moved from 5 s through 75 s. As the delay moved from 75 s through 190 s, however, attending remained at the same

low level that was seen at 75 s. A third and final return to the TR (20) phase increased attending to 100%.

DISCUSSION

These results show that token reinforcement increased the attending behavior of a young child with autism. The results also show that the tokens required for back-up reinforcement can be increased without sacrificing the strength or stability of attending. The results further show that token reinforcement is most effective in sustaining attention when back-up reinforcement is available, and when tokens can be exchanged without delay. On the whole, the results are consistent with findings in the applied literature on token reinforcement (e.g., Kazdin, 1977) and the basic literature on conditioned reinforcement (e.g., Hendry, 1969). Additionally, the results may have implications for caregivers in settings such as classrooms wherein reinforcers for appropriate behavior are often provided after a long delay (e.g., during a morning activity children may earn going to the playground early for lunch).

There are a number of potential limitations to the current investigation. First, the current investigation was conducted across the school day for a young child with autism. Although there may be benefits to evaluating the effects of a token economy under these more 'natural' circumstances, by doing so, the types of teaching activities presented to the child were not controlled for. Specifically, although all of the skills were acquisition skills (maintenance skills were not included) it is possible that certain teaching sessions were more or less difficult than others. It may be argued that under these conditions attending behavior may have 'naturally fluctuated.' However, it is unlikely that 'natural fluctuation' could account for the repeated reversals demonstrated in the current investigation. Future investigators may want to consider evaluating the effects of token economies on tasks of varying difficulties.

Another potential limitation is that it is unclear whether positive and/or negative reinforcement were responsible for the accumulation of tokens in the current investigation. Specifically, although Adam received access to preferred toys during the break, it is unclear whether the preferred toys or the break from work maintained Adam's attending. Adam's instances of attending decreased during the NB condition; but in the absence of a back-up only condition for both positive (preferred toys) and negative (escape from demands) reinforcement, it is impossible to determine the nature of the reinforcer. Future investigators should further evaluate these parameters.

Finally, data were collected on correct and incorrect responding to the instruction provided after eye contact was established during the course of this investigation. However, the purpose of the current investigation was to evaluate the effects of token reinforcement on attending, and as such, reliability and treatment integrity data were

not collected on acquisition data (and therefore those gains are not reported here). The investigators did note an increase in learning among the different programs relative to Adam's rate of acquisition pre-training for eye contact, and as such, future investigators should systematically evaluate this potential benefit.

In summary, the use of token reinforcement and schedule thinning was effective in increasing the attending behavior of a young child with autism. Token reinforcement in the current investigation sustained attending only when the back-up reinforcer was available and was accessed immediately. The results extend and corroborate findings on token reinforcement reported in other applied settings and are also consistent with findings from basic research on conditioned reinforcement. Future investigators should further evaluate various parameters of the token economy, in addition to evaluating the effects across multiple participants and diverse settings.

ACKNOWLEDGEMENTS

We thank Brian Fenney, Jennifer McDuffee, Aubry Gurzi, and Deborah Grinager for their assistance in data collection.

REFERENCES

- Adamson, L., & McArthur, D. (1995). Joint attention, affect, and culture. In C. Moore, & P. Dunham (Eds.), *Joint attention: Its origins and role in development* (pp. 205–221). Hillsdale, New Jersey: Erlbaum.
- American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: American Psychiatric Association.
- Anderson, S. R., Taras, M., & Cannon, B. O. (1996). Teaching new skills to young children with autism. In C. Maurice, G. Green, & S. C. Luce (Eds.), *Behavioral Intervention for young children with autism*. Austin, TX: PRO-ED, Inc.
- Ayllon, T., & Azrin, N. H. (1965). The measurement and reinforcement of behavior of psychotics. *Journal of the Experimental Analysis of Behavior*, 8, 357–383.
- Ayllon, T., & Azrin, N. H. (1968). *The token economy: A motivational system for therapy and rehabilitation*. New York: Appleton-Century-Crofts.
- Ayllon, T., Layman, D., & Kandel, H. J. (1975). A behavioral-educational alternative to drug control of hyperactive children. *Journal of Applied Behavior Analysis*, 8, 137–146.
- Bijou, S. W., & Ghezzi, P. M. (1999). The behavioral interference theory of autistic behavior in young children. In P. M. Ghezzi, W. L. Williams, & J. E. Carr (Eds.), *Autism: Behavior analytic perspectives* (pp. 33–43). Reno, NV: Context Press.
- Cavalier, A. R., Ferritti, R. P., & Hodges, A. E. (1997). Self-management within a token economy for students with learning disabilities. *Research in Developmental Disabilities*, 18, 167–178.
- Charlop-Christy, M. H., & Haymes, L. K. (1998). Using objects of obsession as token reinforcers for children with autism. *Journal of Autism and Developmental Disorders*, 28, 189–198.

- DeLeon, I. G., & Iwata, B. A. (1996). Evaluation of a multiple-stimulus presentation format for assessing reinforcer preferences. *Journal of Applied Behavior Analysis, 29*, 519–532.
- Everett, P. B., Hayward, S. C., & Meyers, A. W. (1974). The effects of a token reinforcement procedure on bus ridership. *Journal of Applied Behavior Analysis, 7*, 19.
- Foster, T. A., Hackenberg, T. D., & Vaidya, M. (2001). Second-order schedules of token reinforcement with pigeons: Effects of fixed- and variable-ratio exchange schedule. *Journal of the Experimental Analysis of Behavior, 76*, 159–178.
- Foxx, R. M. (1998). A comprehensive treatment program for inpatient adolescents. *Behavioral Interventions, 13*, 67–77.
- Foxx, D. K., Hopkins, B. L., & Anger, W. K. (1987). The long-term effects of a token economy on safety performance in open pit mining. *Journal of Applied Behavior Analysis, 20*, 215–224.
- Ghezzi, P. M., Wilson, G. R., Tarbox, R. S. F., & MacAleese, K. R. (2003). Token Economy. In W. O'Donohue, J. E. Fisher, & S. C. Hayes (Eds.), *Cognitive behavior therapy*. Hoboken, NJ: John Wiley & Sons, Inc.
- Hendry, D. P. (1969). *Conditioned reinforcement*. Homewood, IL: Dorsey Press.
- Hung, D. W. (1977). Generalization of 'curiosity' questioning behavior in autistic children. *Journal of Behavior Therapy and Experimental Psychiatry, 8*, 165–173.
- Hupp, S. D., & Reitman, D. (1999). Improving sports skills and sportsmanship in children diagnosed with attention deficit/hyperactivity disorder. *Child and Family Behavior Therapy, 21*(3), 35–51.
- Kazdin, A. E. (1994). *Behavior modification in applied settings*. Pacific Grove, CA: Brookes/Cole.
- Kazdin, A. E. (1977). *The token economy: A review and evaluation*. New York: Plenum.
- Kelleher, R. T. (1958). Fixed-ratio schedules of conditioned reinforcement with chimpanzees. *Journal of the Experimental Analysis of Behavior, 1*, 281–289.
- Mangus, B., Henderson, H., & French, R. (1986). Implementation of a token economy by peer tutors to increase on-task physical activity time of autistic children. *Perceptual and Motor Skills, 63*, 97–98.
- Milan, M. A., & McKee, J. M. (1976). The cellblock token economy: Token reinforcement procedures in a maximum security correctional institution for adult male felons. *Journal of Applied Behavior Analysis, 9*, 253–275.
- Miltenberger, R. G. (2001). *Behavior modification: Principles and procedures*. Belmont, CA: Wadsworth.
- Robinson, P. W., Newby, T. J., & Ganzell, S. L. (1981). A token economy for class of underachieving hyperactive children. *Journal of Applied Behavior Analysis, 14*, 307–315.
- Smith, T. (1999). Outcome for early intervention for children with autism. *Clinical psychology: Science and Practice, 6*, 33–49.
- Sulzer-Azaroff, B., & Mayer, G. R. (1991). *Behavior analysis for lasting change*. Fort Worth, TX: Holt, Rinehart, & Winston.
- Whalen, C., & Shriebman, L. (2003). Joint attention training for children with autism using behavior modification procedures. *Journal of Child Psychology and Psychiatry, 44*, 456–468.

Copyright of Behavioral Interventions is the property of John Wiley & Sons Inc. and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.