Token reinforcement: Bridging the gap between science and application

Timothy Hackenberg
Reed College

National Autism Conference, Penn State, August 2018


GOOD FOR
ONE FARE


160
140
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1997
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Objectives

summarize basic and applied research

identify gaps in the literature

make applied recommendations

Ayllon & Azrin (1965)

JOURNAL OF THE EXPERIMENTAL ANALYSIS OF BEHAVIOR VOLUME 8, NUMBER 6 NOVEMBER, 1965

THE MEASUREMENT AND REINFORCEMENT OF BEHAVIOR OF PSYCHOTICS[1]

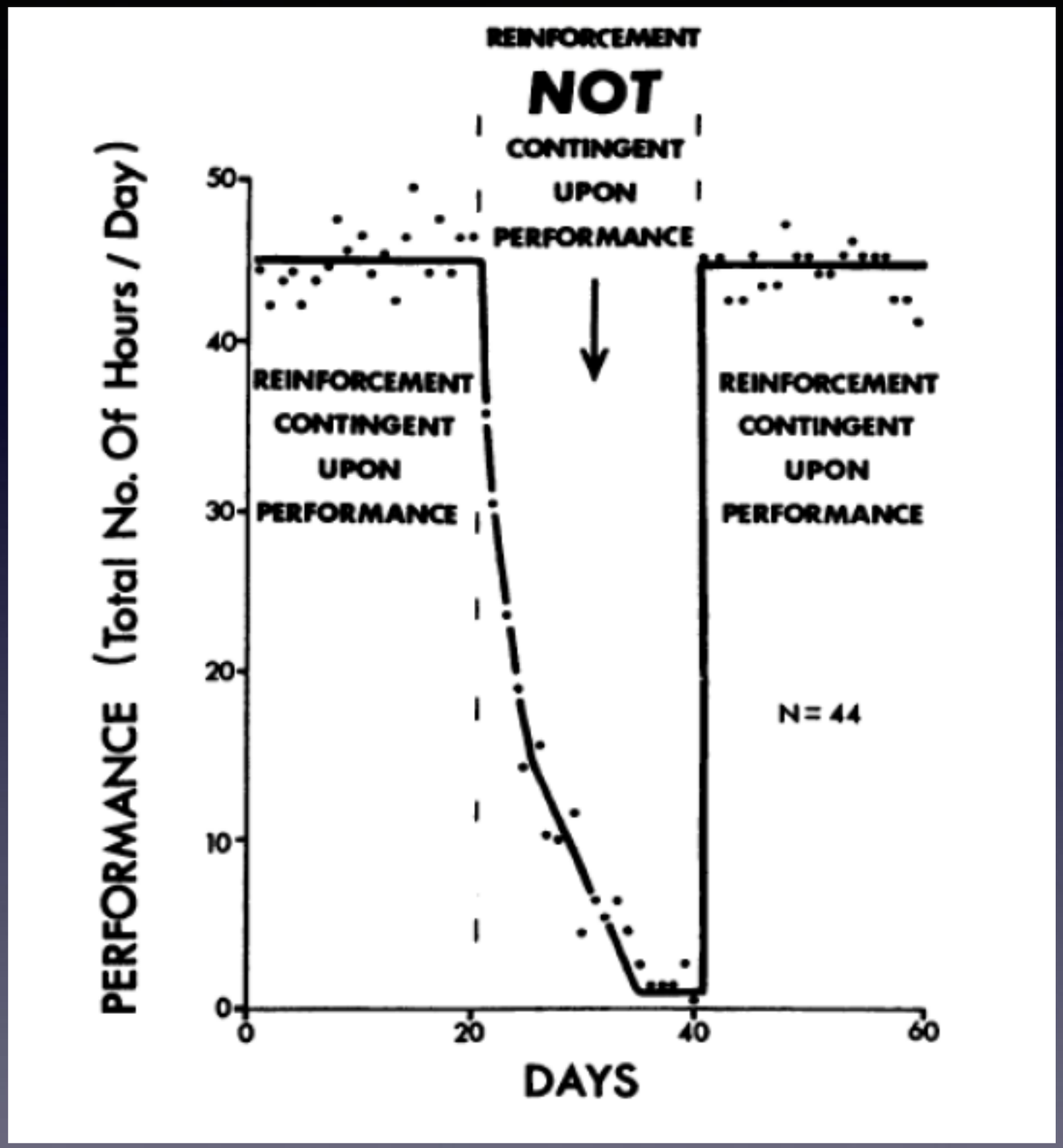
T. AYLLON AND N. H. AZRIN

ANNA STATE HOSPITAL

An attempt was made to strengthen behaviors of psychotics by applying operant reinforcement principles in a mental hospital ward. The behaviors studied were necessary and/or useful for the patient to function in the hospital environment. Reinforcement consisted of the opportunity to engage in activities that had a high level of occurrence when freely allowed. Tokens were used as conditioned reinforcers to bridge the delay between behavior and reinforcement. Emphasis was placed on objective definition and quantification of the responses and reinforcers and upon programming and recording procedures. Standardizing the objective criteria permitted ward attendants to administer the program. The procedures were found to be effective in maintaining the desired adaptive behaviors for as long as the procedures were in effect. In a series of six experiments, reinforced behaviors were considerably reduced when the reinforcement procedure was discontinued; the adaptive behaviors increased immediately when the reinforcement procedure was re-introduced.

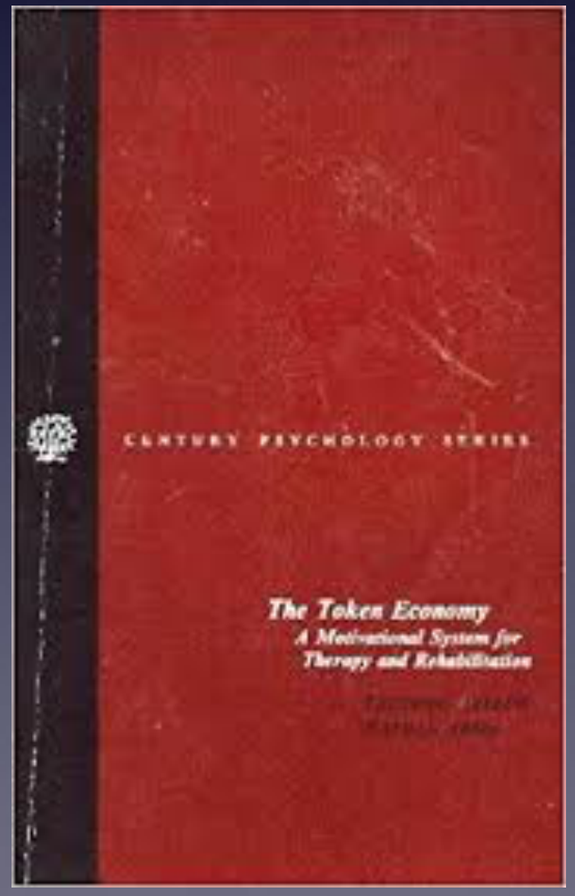
Ayllon & Azrin token economy

- Adult patients in psychiatric setting
- Tokens earned for vocational or self-help skills
- Exchanged 3x per day for preferred activities
  - cigarettes, snacks, off-site passes


REINFORCEMENT
NOT
CONTINGENT
UPON
PERFORMANCE
REINFORCEMENT
CONTINGENT
UPON
PERFORMANCE
REINFORCEMENT
CONTINGENT
UPON
PERFORMANCE
N= 44
PERFORMANCE (Total No. Of Hours / Day)
DAYS
0
10
20
30
40
50
0
20
40
60

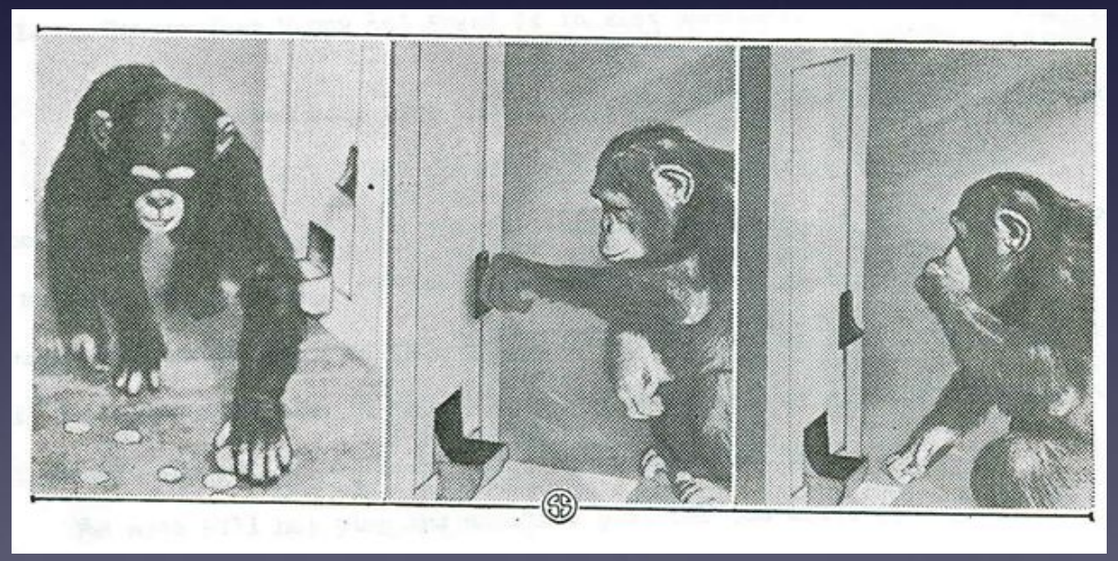
Ayllon & Azrin token economy

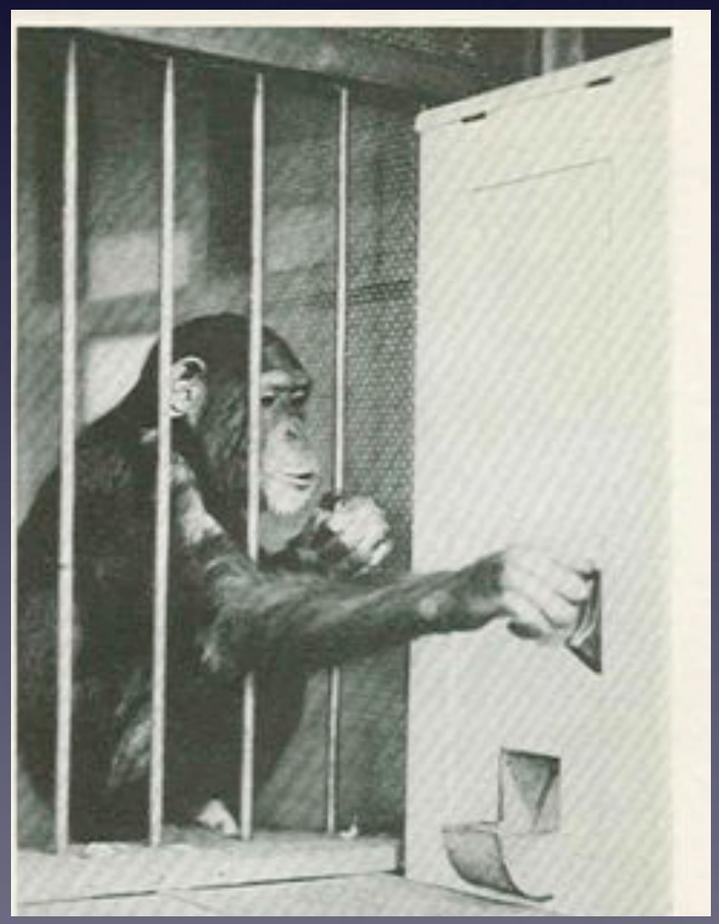
- Launched applied token economies
- Other settings
    - classrooms
    - prisons
    - clinics

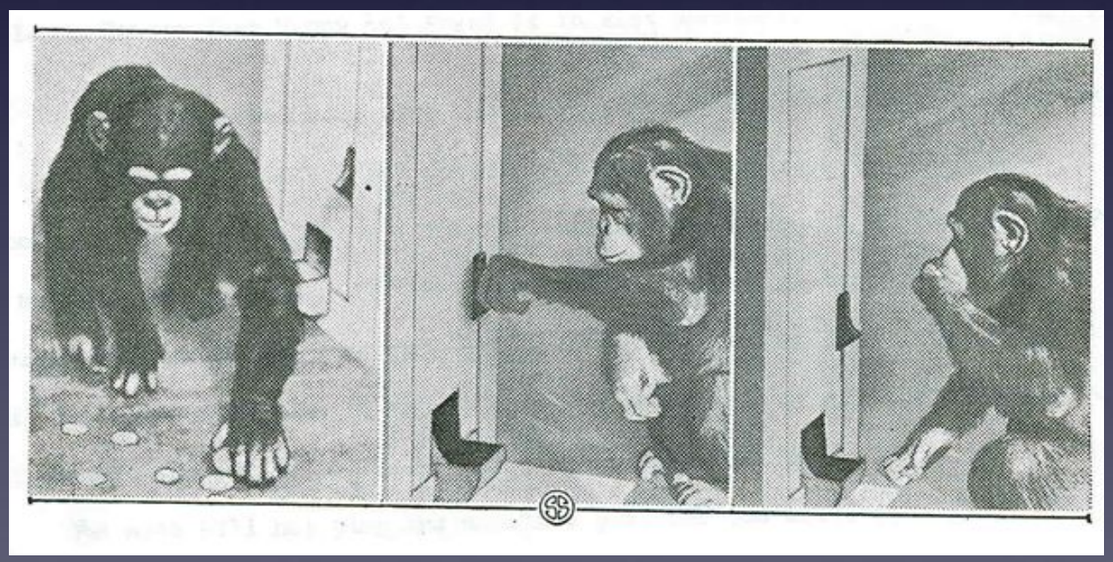


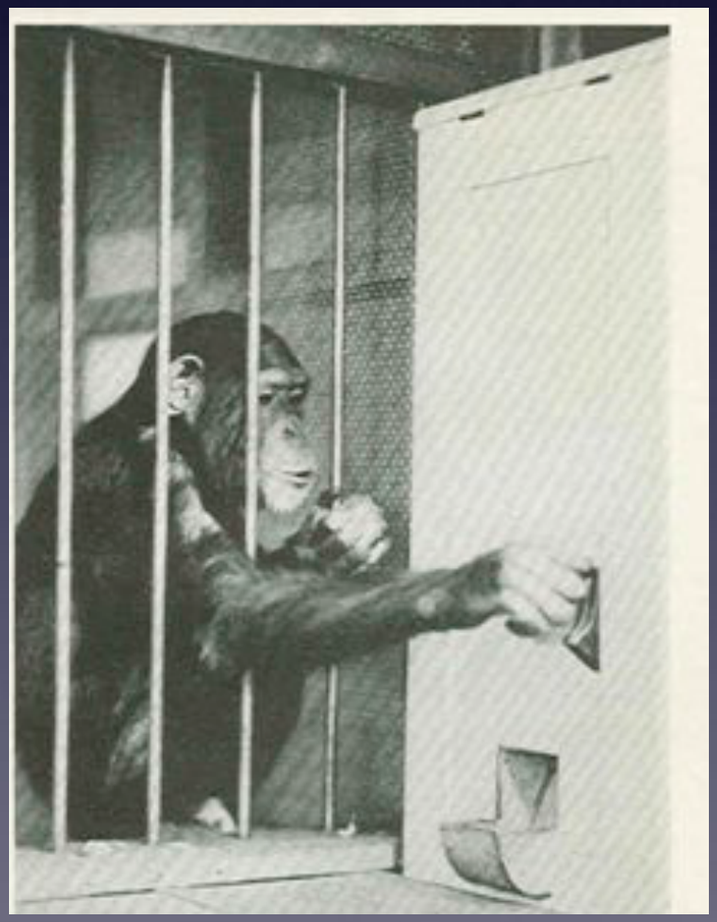
Wolfe and Cowles (1930s)

- Poker chip tokens
- Exchanged for preferred activities
  - food, social interaction









species continuity

JOURNAL OF THE EXPERIMENTAL ANALYSIS OF BEHAVIOR 1996, 66, 29–49 NUMBER 1 (JULY)

TOKEN REINFORCEMENT, CHOICE, AND SELF-CONTROL IN PIGEONS

KEVIN JACKSON AND TIMOTHY D. HACKENBERG

UNIVERSITY OF FLORIDA

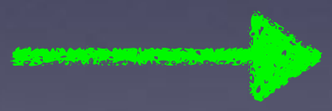
Pigeons were exposed to self-control procedures that involved illumination of light-emitting diodes (LEDs) as a form of token reinforcement. In a discrete-trials arrangement, subjects chose between one and three LEDs; each LED was exchangeable for 2-s access to food during distinct posttrial exchange periods. In Experiment 1, subjects generally preferred the immediate presentation of a single LED over the delayed presentation of three LEDs, but differences in the delay to the exchange period between the two options prevented a clear assessment of the relative influence of LED delay and exchange-period delay as determinants of choice. In Experiment 2, in which delays to the exchange period from either alternative were equal in most conditions, all subjects preferred the delayed three LEDs more often than in Experiment 1. In Experiment 3, subjects preferred the option that resulted in a greater amount of food more often if the choices also produced LEDs than if they did not. In Experiment 4, preference for the delayed three LEDs was obtained when delays to the exchange period were equal, but reversed in favor of an immediate single LED when the latter choice also resulted in quicker access to exchange periods. The overall pattern of results suggests that (a) delay to the exchange period is a more critical determinant of choice than is delay to token presentation; (b) tokens may function as conditioned reinforcers, although their discriminative properties may be responsible for the self-control that occurs under token reinforcer arrangements; and (c) previously reported differences in the self-control choices of humans and pigeons may have resulted at least in part from the procedural conventions of using token reinforcers with human subjects and food reinforcers with pigeon subjects.

Key words: choice, self-control, reinforcer amount, reinforcer delay, token reinforcement, key peck, pigeons

Jackson & Hackenberg (1996)

Jackson & Hackenberg (1996)

Different reinforcement systems



JOURNAL OF THE EXPERIMENTAL ANALYSIS OF BEHAVIOR 1996, 66, 29–49 NUMBER 1 (JULY)

TOKEN REINFORCEMENT, CHOICE, AND SELF-CONTROL IN PIGEONS

KEVIN JACKSON AND TIMOTHY D. HACKENBERG

JOURNAL OF THE EXPERIMENTAL ANALYSIS OF BEHAVIOR 2003, 79, 207–218 NUMBER 2 (MARCH)

DETERMINANTS OF PIGEONS' CHOICES IN TOKEN-BASED SELF-CONTROL PROCEDURES

TIMOTHY D. HACKENBERG AND MANISH VAIDYA

JRNAL OF THE EXPERIMENTAL ANALYSIS OF BEHAVIOR 2010, 93, 27–44 NUMBER 1 (JANUARY)

RISKY CHOICE IN PIGEONS AND HUMANS: A CROSS-SPECIES COMPARISON

CARLA H. LAGORIO AND TIMOTHY D. HACKENBERG

JOURNAL OF THE EXPERIMENTAL ANALYSIS OF BEHAVIOR 2012, 98, 45–64 NUMBER 1 (JULY)

SAVING THE BEST FOR LAST? A CROSS-SPECIES ANALYSIS OF CHOICES BETWEEN REINFORCER SEQUENCES

LEONARDO F. ANDRADE AND TIMOTHY D. HACKENBERG

UNIVERSITY OF FLORIDA AND REED COLLEGE

Two experiments were conducted to compare choices between sequences of reinforcers in pigeon (Experiment 1) and human (Experiment 2) subjects, using functionally analogous procedures. The subjects made pairwise choices among 3 sequence types, all of which provided the same overall reinforcement rate, but differed in their temporal patterning. Token reinforcement schedules were used in both experiments and the type of exchange schedule varied across blocks of sessions. Some

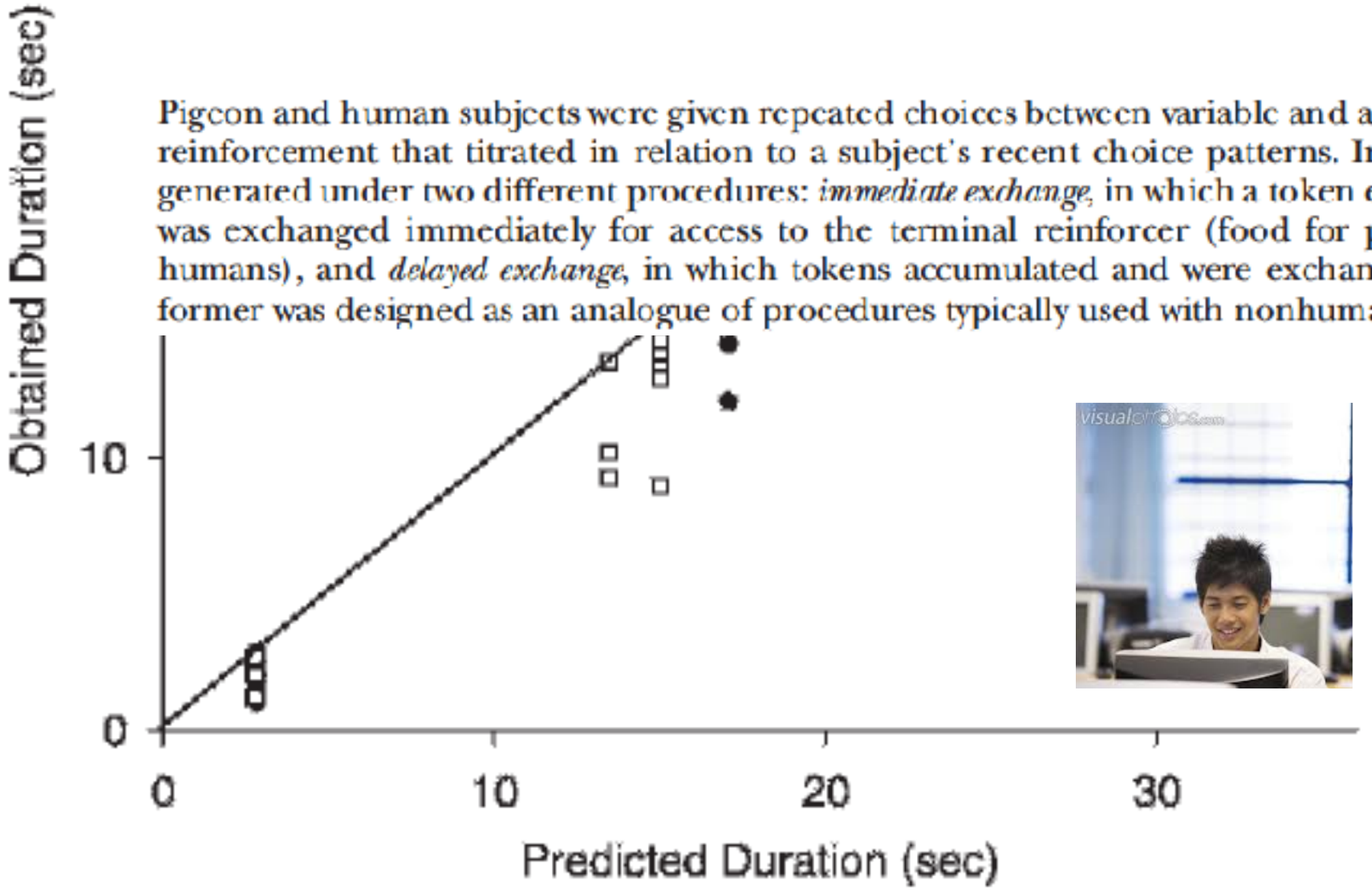
JRNAL OF THE EXPERIMENTAL ANALYSIS OF BEHAVIOR 2010, 93, 27–44 NUMBER 1 (JANUARY)

RISKY CHOICE IN PIGEONS AND HUMANS: A CROSS-SPECIES COMPARISON

CARLA H. LAGORIO AND TIMOTHY D. HACKENBERG

UNIVERSITY OF FLORIDA

Pigeon and human subjects were given repeated choices between variable and adjusting delays to token reinforcement that titrated in relation to a subject's recent choice patterns. Indifference curves were generated under two different procedures: *immediate exchange*, in which a token earned during each trial was exchanged immediately for access to the terminal reinforcer (food for pigeons, video clips for humans), and *delayed exchange*, in which tokens accumulated and were exchanged after 11 trials. The former was designed as an analogue of procedures typically used with nonhuman subjects, the latter as



When procedures are made more similar, species differences are reduced or eliminated

Token reinforcer

Terminal reinforcer

reinforce

minal reinforcer

Functional taxonomy

- conditioned reinforcing functions
- motivational variables
- generalized reinforcing functions
- discriminative functions
- schedule variables
- aversive functions

Functional taxonomy

JOURNAL OF THE EXPERIMENTAL ANALYSIS OF BEHAVIOR 2009, **91**, 257–286 NUMBER 2 (MARCH)

TOKEN REINFORCEMENT: A REVIEW AND ANALYSIS

JOURNAL OF APPLIED BEHAVIOR ANALYSIS 2018, **51**, 393–435 NUMBER 2 (SPRING)

TOKEN REINFORCEMENT: TRANSLATIONAL RESEARCH AND APPLICATION

TIMOTHY D. HACKENBERG

REED COLLEGE

REED COLLEGE

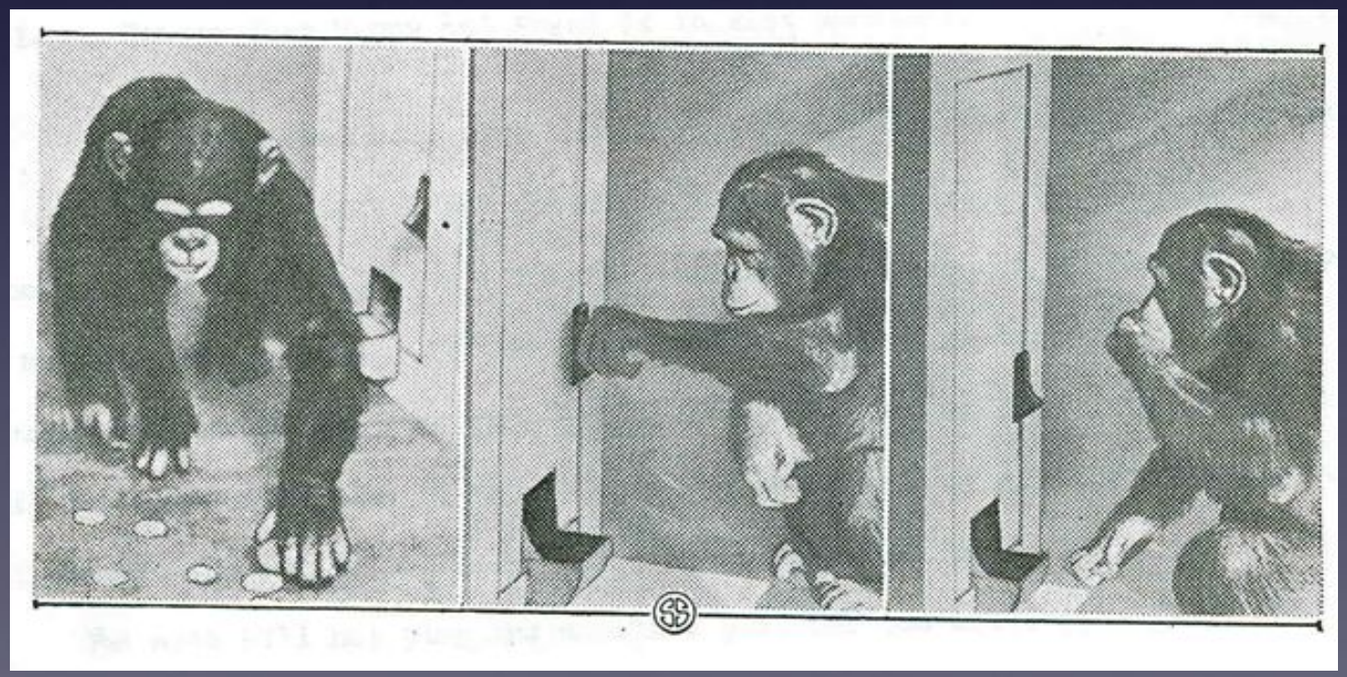
The present paper provides an integrative review of research on token reinforcement systems, organized in relation to basic behavioral functions and economic variables. This type of functional taxonomy provides a useful way to organize the literature, bringing order to a wide range of findings across species and settings, and revealing gaps in the research and areas especially ripe for analysis and application. Unlike standard translational research, based on a unidirectional model in which the analysis moves from laboratory to the applied realm, work in the area of token systems is best served by a bidirectional interplay between laboratory and applied research, where applied questions inspire research on basic mechanisms. When based on and contributing to an analysis, applied research on token economies can be on the leading edge of theoretical advances, helping set the scientific research agenda.

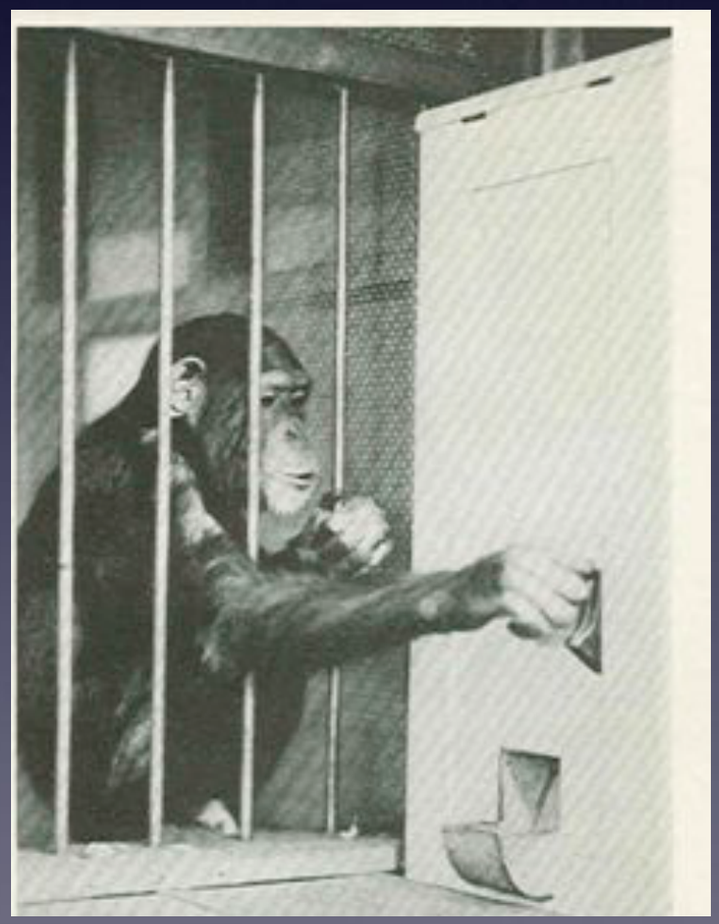
Key words: behavioral economics, comparative analysis, review, token reinforcement, token economy, translational research

Reinforcement functions

Do tokens function as conditioned reinforcers?

Wolfe (1936)





Behavioral Interventions
Behav. Intervent. **23**: 13–38 (2008)
Published online in Wiley InterScience
(www.interscience.wiley.com) **DOI**: 10.1002/bin.253

NON-GENERALIZED AND GENERALIZED CONDITIONED REINFORCERS: ESTABLISHMENT AND VALIDATION

Carly A. Moher, D. Daniel Gould*, Elisa Hegg and Amanda M. Mahoney
New England Center for Children, Northeastern University, Southboro, MA, USA

Conditioned reinforcers, or tokens, are frequently used in clinical settings; however, little applied research has focused on establishing and validating their effectiveness. Following pairing of a novel token with an edible reinforcer in the present study, preference and reinforcer assessments verified that the tokens functioned as conditioned reinforcers. Results indicated that the tokens were established as conditioned reinforcers that matched the reinforcer value of the primary reinforcers with which they had been paired. The effects of motivating operations (MOs) on the effectiveness of these conditioned reinforcers were then evaluated. Conditioned reinforcer effectiveness decreased during satiation conditions. Subsequently it was found that increasing the number of backup reinforcers with which the token was paired resulted in the effectiveness maintaining during satiation conditions.

Moher et al. (2008)

Do tokens function as conditioned reinforcers?

Moher et al. (2008)

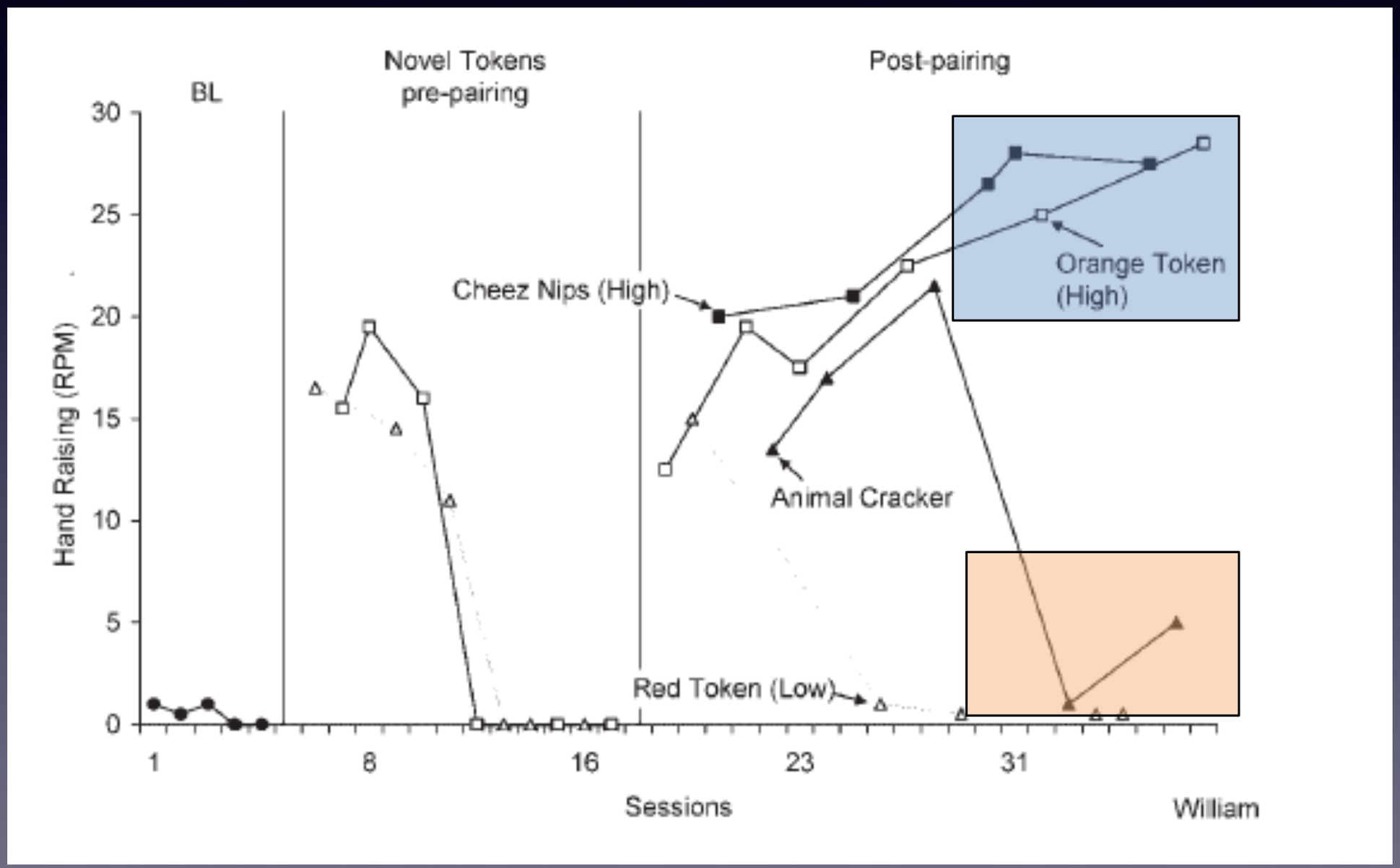
classroom setting

adolescents with intellectual disabilities

established relations between tokens
and HP and LP reinforcers

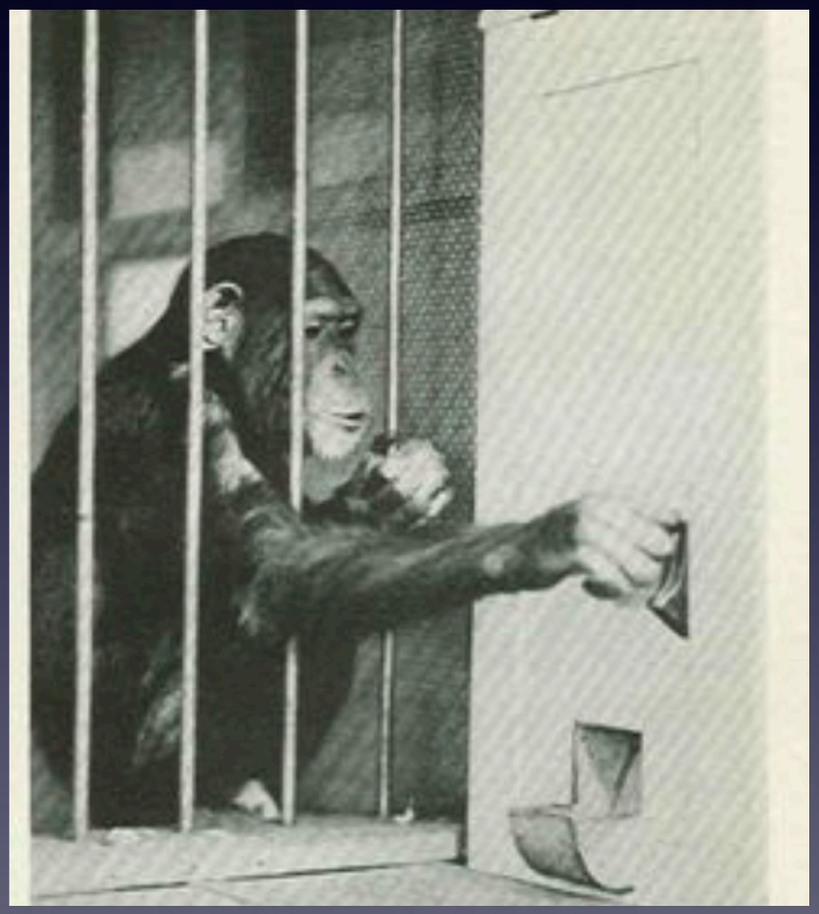
Moher et al. (2008)

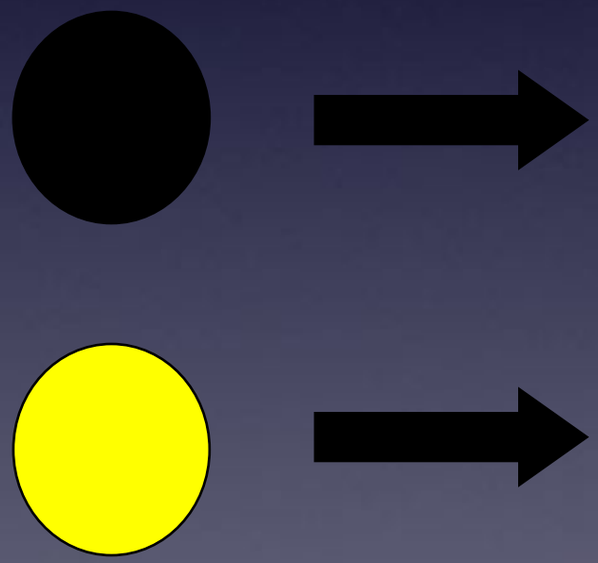
Moher et al. (2008)



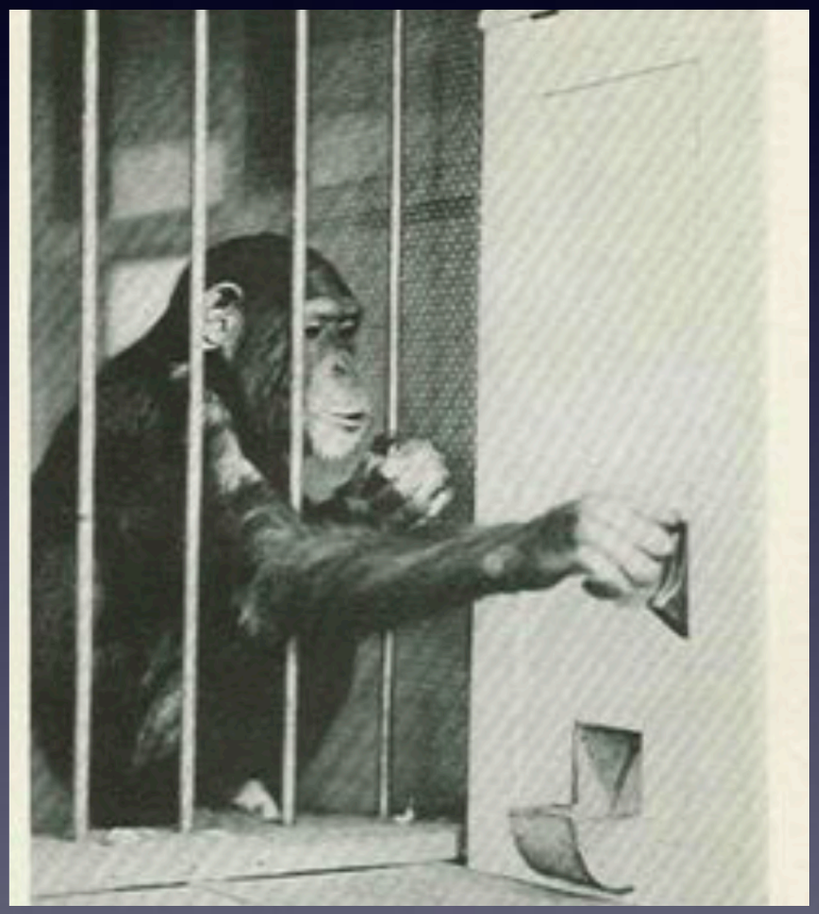
Motivational variables

Are tokens sensitive to motivational conditions?

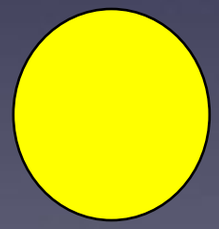




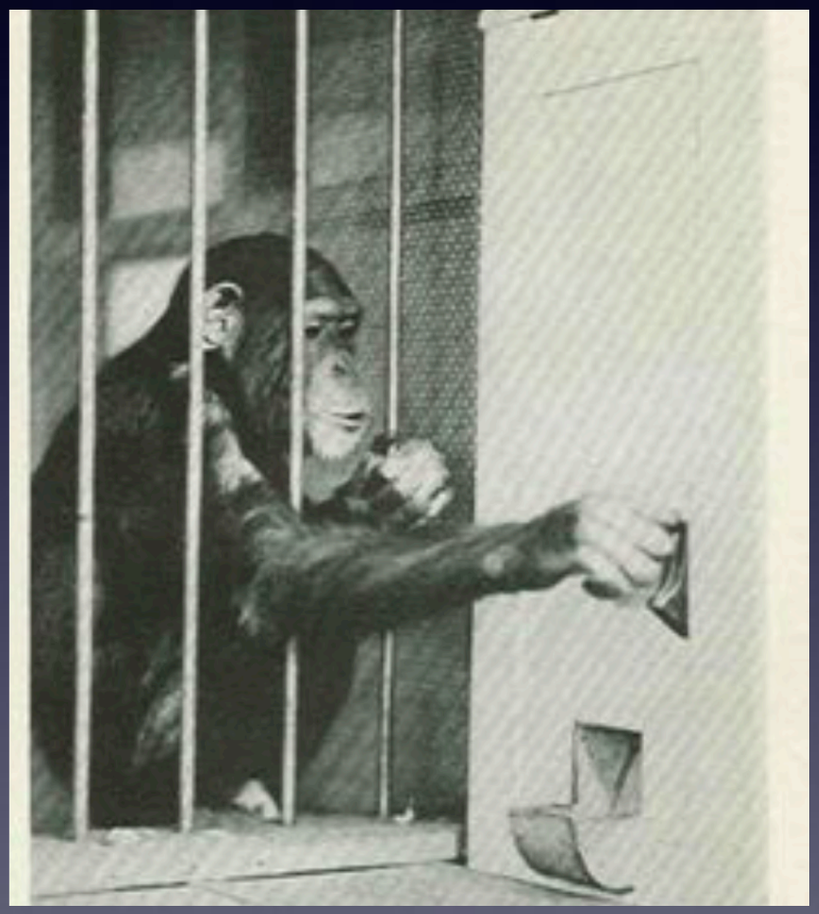
Wolfe (1936)



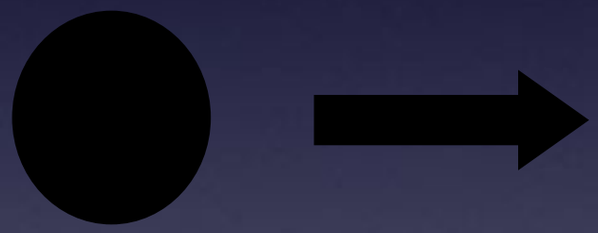
Food deprivation

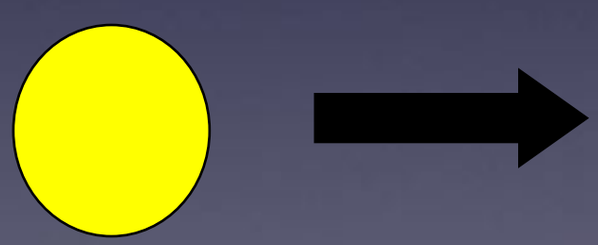


Wolfe (1936)



Water deprivation





Are tokens sensitive to motivational conditions?

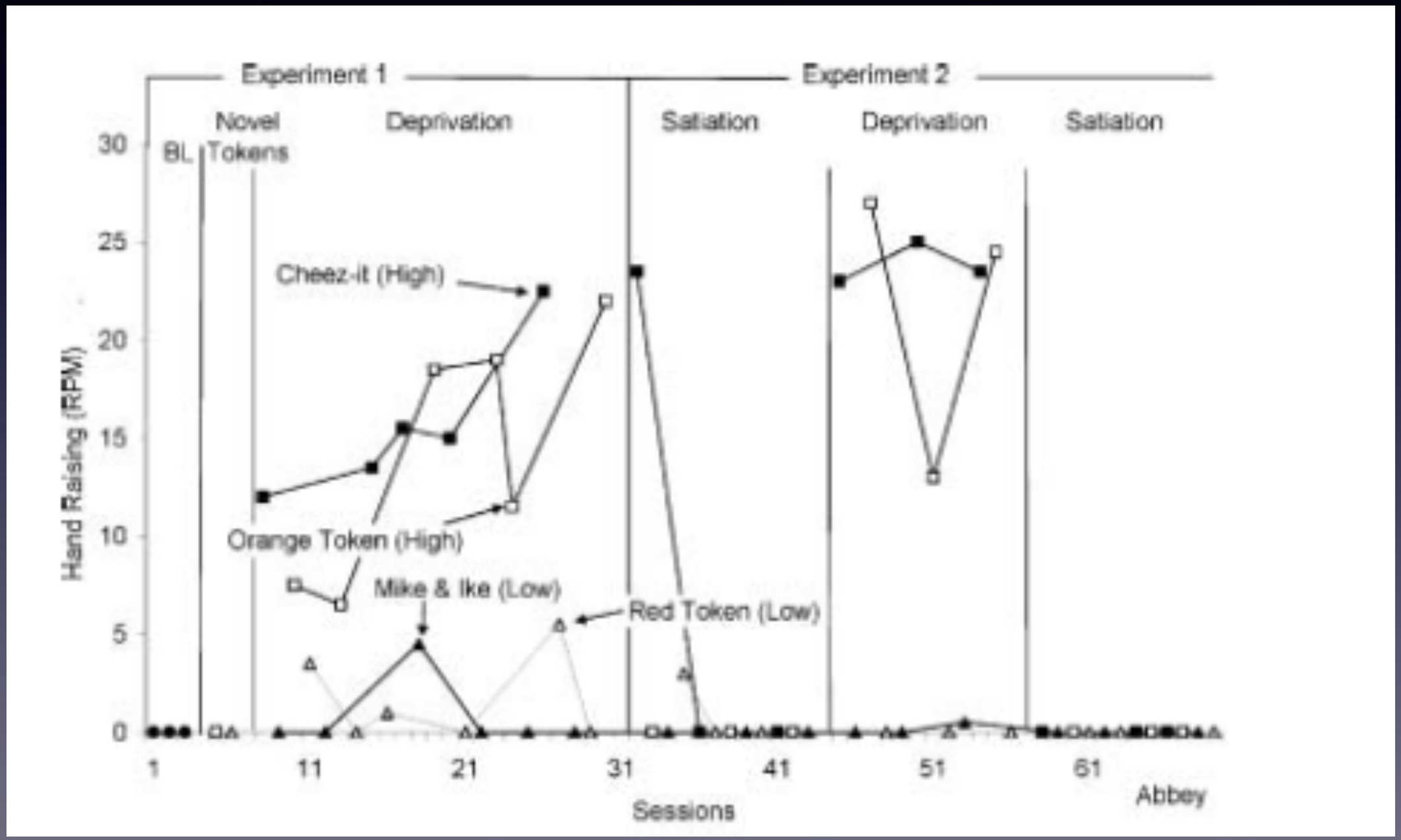
Moher et al. (2008)

manipulated MO conditions

satiation: pre-session access

deprivation: restricted pre-session access

Moher et al. (2008)



generalized reinforcement

conditioned reinforcers established as such via relations
to two or more sources of reinforcement

generalized reinforcement

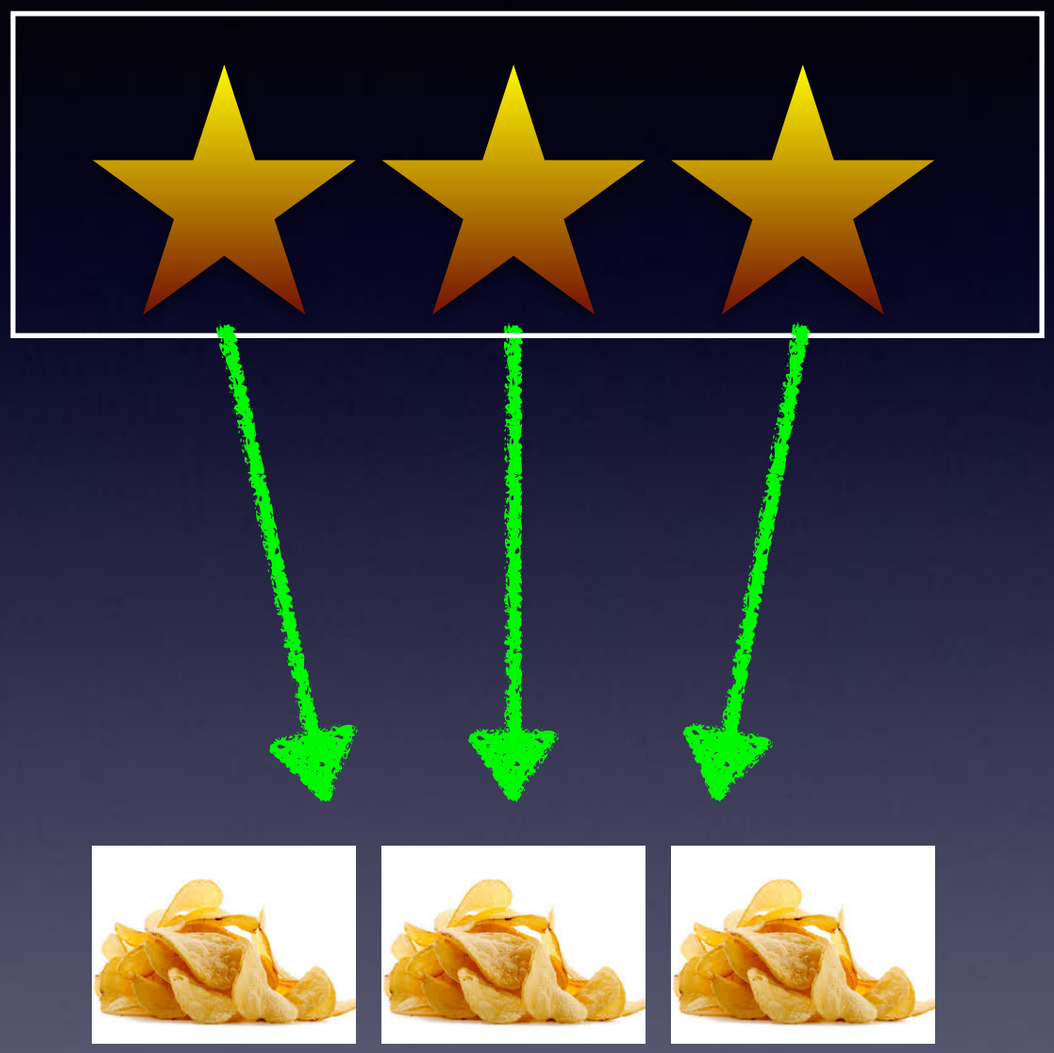
conditioned reinforcers established as such via relations to two or more sources of reinforcement

"The generalized reinforcer is useful because the momentary condition of the organism is not likely to be important." (Skinner, 1953, p. 77)

Generalized reinforcers

- Less prone to satiation effects

specific tokens

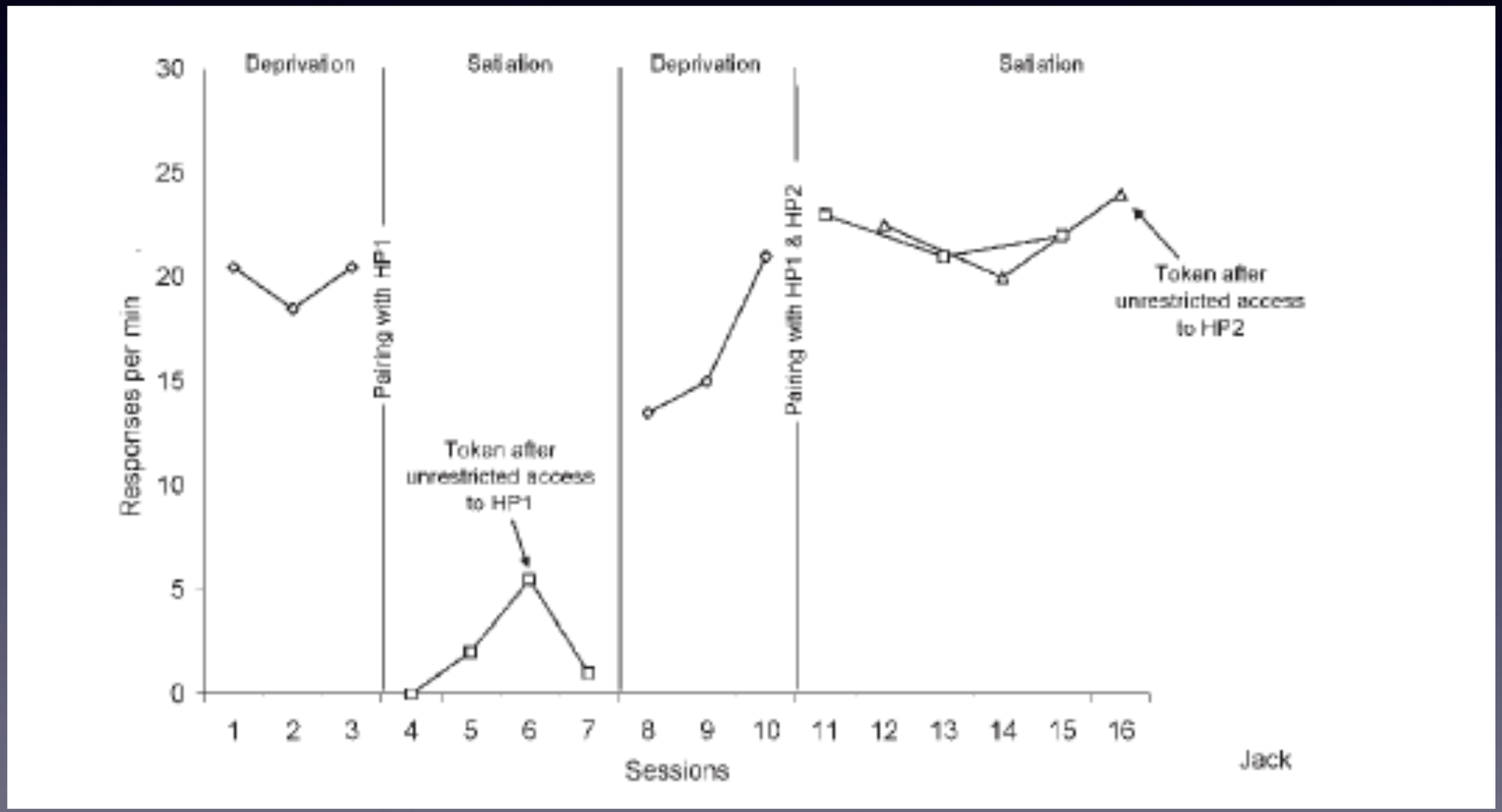


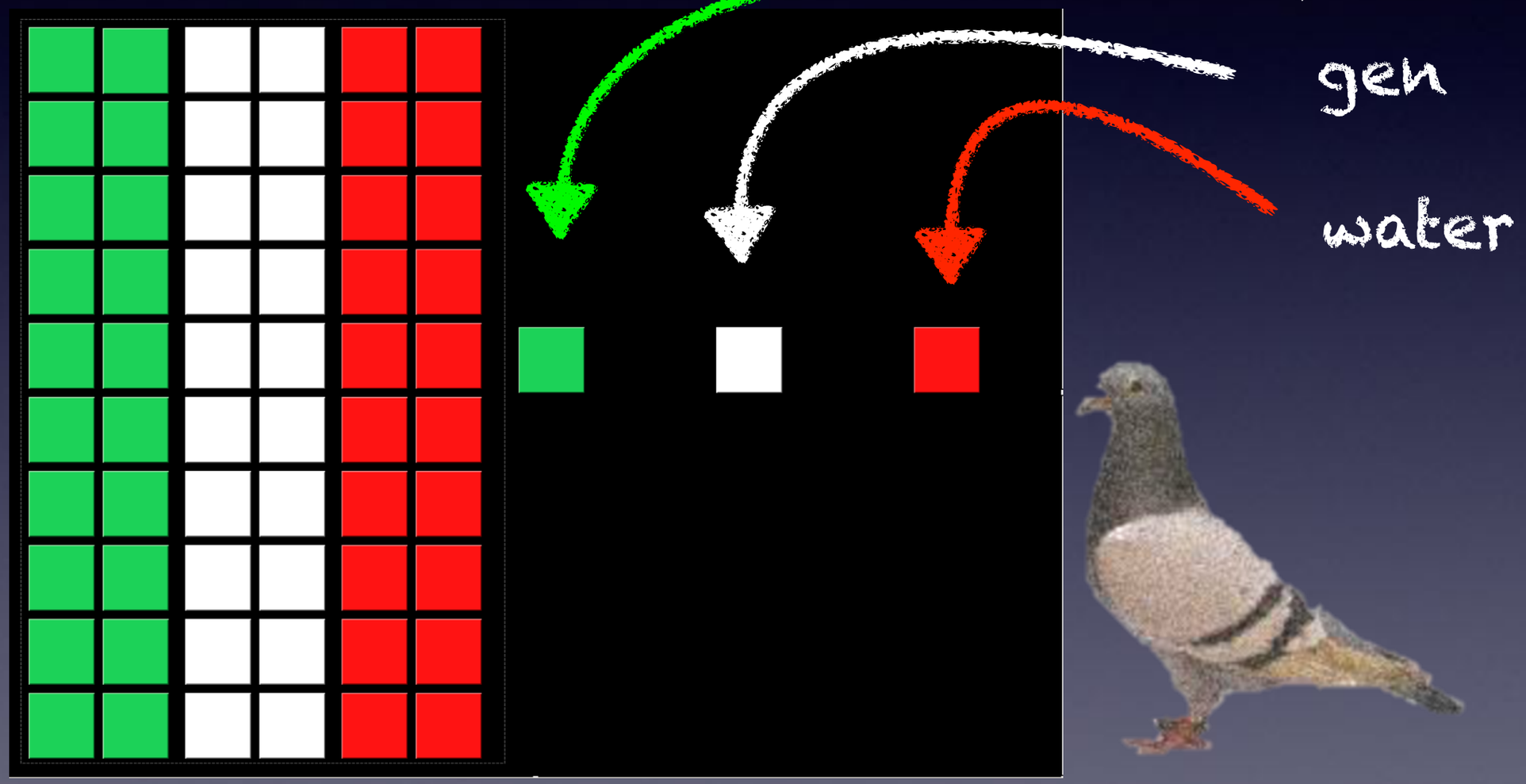
exchange

generalized tokens

exchange

Moher et al. (2008)




food
gen
water

JOURNAL OF THE EXPERIMENTAL ANALYSIS OF BEHAVIOR 2015, **104,** 296–314 NUMBER 3 (NOVEMBER)

PIGEONS' DEMAND AND PREFERENCE FOR SPECIFIC AND GENERALIZED CONDITIONED REINFORCERS IN A TOKEN ECONOMY

LAVINIA TAN AND TIMOTHY D. HACKENBERG

REED COLLEGE

Pigeons' demand and preference for specific and generalized tokens was examined in a token economy. Pigeons could produce and exchange different colored tokens for food, for water, or for food *or* water. Token production was measured across three phases, which examined: (1) across-session price increases (typical demand curve method); (2) within-session price increases (progressive-ratio, PR, schedule); and (3) concurrent pairwise choices between the token types. Exponential demand curves were fitted to the response data and accounted for over 90% total variance. Demand curve parameter values, P_{max}, O_{max} and α showed that demand was ordered in the following way: food tokens, generalized tokens, water tokens, both in Phase 1 and in Phase 3. This suggests that the preferences were predictable on the basis of elasticity and response output from the demand analysis. P_{max} and O_{max} values failed to consistently predict breakpoints and peak response rates in the PR schedules in Phase 2, however, suggesting limits on a unitary conception of reinforcer efficacy. The patterns of generalized token production and exchange in Phase 3 suggest that the generalized tokens served as substitutes for the specific food and water tokens. Taken together, the present findings demonstrate the utility of behavioral economic concepts in the analysis of generalized reinforcement.

Key words: generalized conditioned reinforcement, token reinforcement, demand analysis, progressive ratio schedules, concurrent schedules, behavioral economics, pigeons, key peck

Tan & Hackenberg (2015)

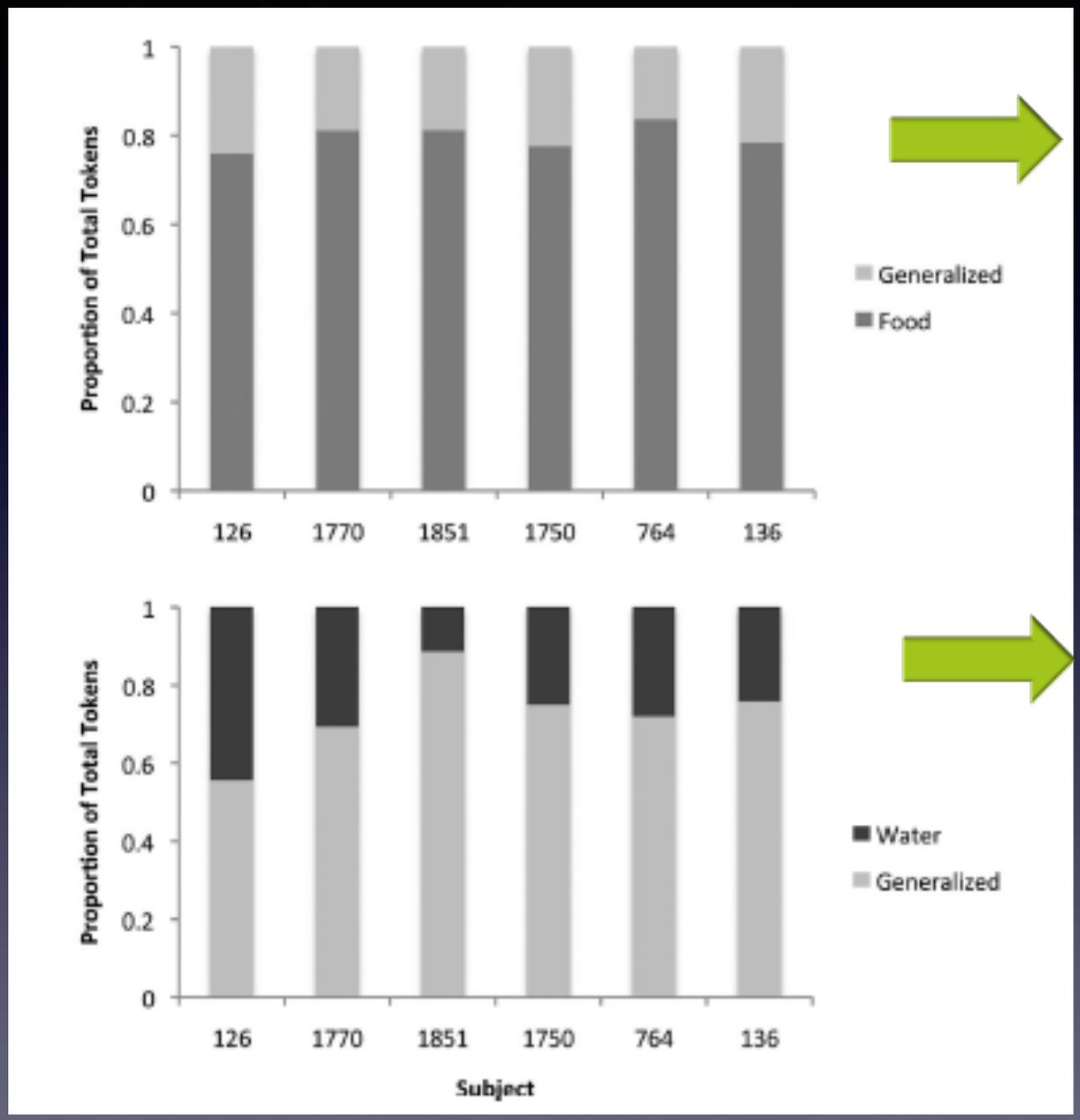
Tan & Hackenberg (2015)

pigeons chose between token types

- food vs water tokens
- food vs generalized tokens
- water vs generalized tokens

Closed economy

Tan & Hackenberg (2015)



Generalized tokens substitute for other reinforcers

discriminative functions

tokens are part of extended sequence of behavior

conditioned reinforcing (SR+)

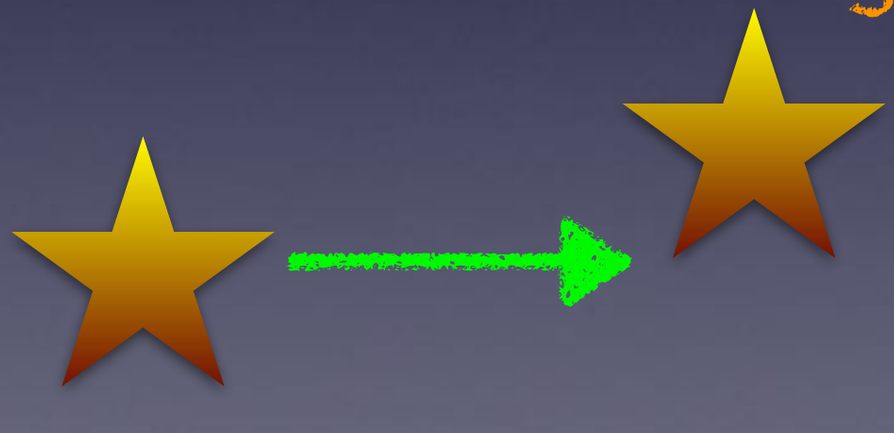
discriminative (Sd)

Three-term contingency

Establishing tokens as reinforcers

Stimulus pairing

Three-term contingency



EUROPEAN JOURNAL OF BEHAVIOR ANALYSIS 2009, 10, 143 - 158 NUMBER 2 (WINTER 2009)

An operant analysis of joint attention and the establishment of conditioned social reinforcers

Per Holth, Monica Vandbakk, Jonny Finstad, Else Marie Grønnerud, and Janne Mari Akselsen Sørensen
Akershus University College

An operant analysis of joint attention skills suggests that conditioned social reinforcers play a crucial role in shaping and maintaining joint attention skills in typically developing humans. Although joint attention response topographies can be established successfully in children with autism through contrived reinforcers, natural consequences may not maintain the behavior. Hence, treatment of joint attention problems in children with autism may require the establishment of natural social consequences as conditioned reinforcers. The standard procedure for conditioning new reinforcers is the "pairing procedure." However, clinical observations suggest that a pairing procedure may not be particularly effective. The current study compared the "pairing procedure" with an explicit operant discrimination procedure. First, a previously neutral stimulus was established as discriminative stimulus for a response that produced a reinforcer, and then tested for conditioned reinforcer effects when being presented contingent upon an arbitrary response with no additional contingent reinforcers. Second, another previously neutral stimulus was repeatedly paired with a reinforcer, and then tested for conditioned reinforcer effects as in the first procedure. Seven of the eight children completed both sequences, and five of these seven children emitted a markedly higher number of responses when stimuli established as S^Ds were contingent upon them than when stimuli used in the pairing procedure were response contingent. For the sixth child, the difference in favor of the S^D procedure was minor, whereas for the last child, the difference was in the opposite direction. In sum, the results suggest that conditioned reinforcers can be more effectively established through the discriminative stimulus procedure than through simple pairing with an unconditioned reinforcer. Possible implications for joint attention teaching procedures are discussed.

Keywords: Joint attention, conditioned reinforcers, pairing, operant discrimination, operant analysis.

Holth et al.(2009)

Holth et al.(2009)

8 children w with autism

training joint attention skills

compared two procedures

stimulus pairing

3-term contingency

Holth et al. (2009)

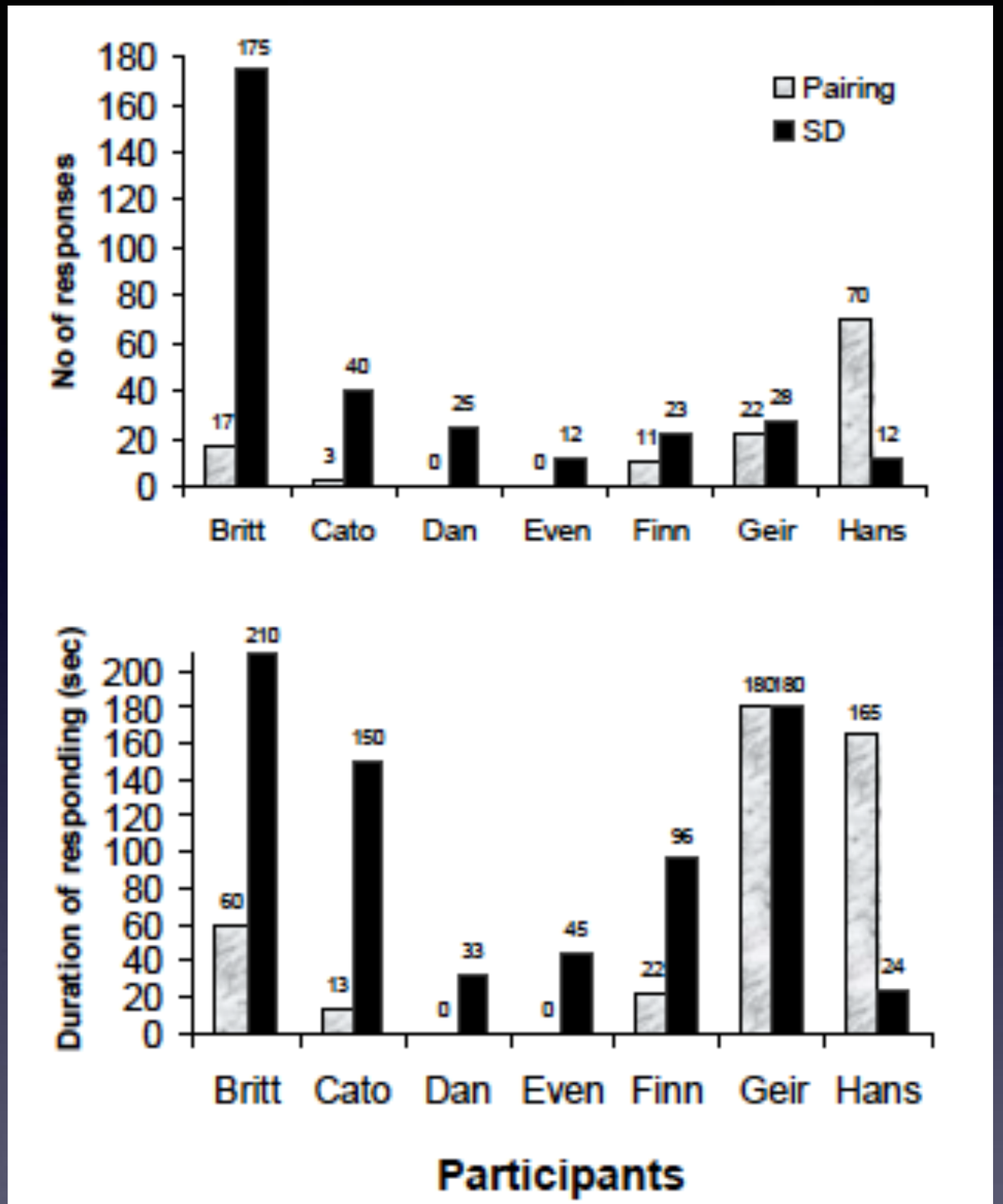


Figure 2. The number of responses emitted by each participant during tests of conditioned reinforcers (upper panel) and the duration of responding (lower panel) for each participant post pairing and S^D procedures.

Recommendations:

- Restrict access to the terminal SR+ to enhance value

- Use generalized reinforcers, including both edible and non-edible

- Require an exchange response at the beginning of training to establish SR+ and Sd

- Use backward chaining to train the rest of the token-reinforcement sequence

Token reinforcement schedules

- Token production schedule

  How are when tokens are earned

- Token exchange schedule

  How and when tokens are exchanged

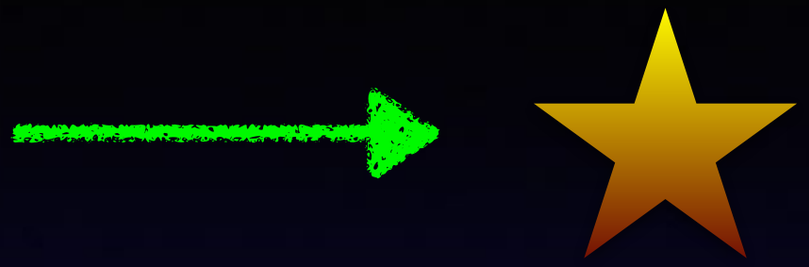
FR 1

token production

Exchange schedule

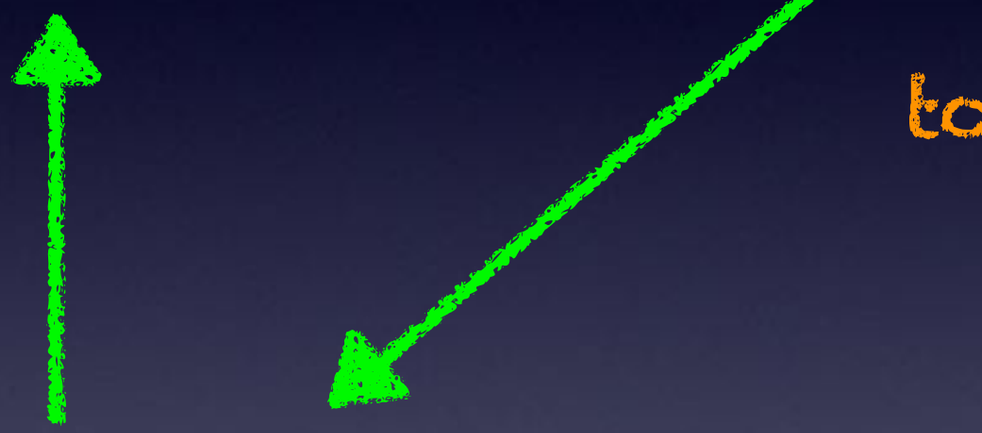
FR 3

Exchange



FR 1

token production



Exchange schedule

FR 3

Exchange

Schedule types

- Ratio (worked-based)

  FR 3: Exchange after 3 tokens

- Interval (time-based)

FI 30: Exchange after the first token every 30 sec

FIXED-RATIO SCHEDULES OF CONDITIONED REINFORCEMENT WITH CHIMPANZEES[1]

ROGER T. KELLEHER[2]

YERKES LABORATORIES OF PRIMATE BIOLOGY

In earlier studies of conditioned reinforcement, I investigated both fixed-interval and multiple schedules with fixed-interval and fixed-ratio components (2, 3, 4). These studies demonstrated several similarities between the characteristics of behavior maintained by conditioned reinforcers and behavior maintained by food reinforcers. However, one consistent difference was found in the general trend toward higher response rates as the time approached when the conditioned reinforcers could be exchanged for food. The purpose of this experiment was to extend the results of these earlier studies by elucidating the characteristics of performance maintained by fixed-ratio schedules of conditioned reinforcement.

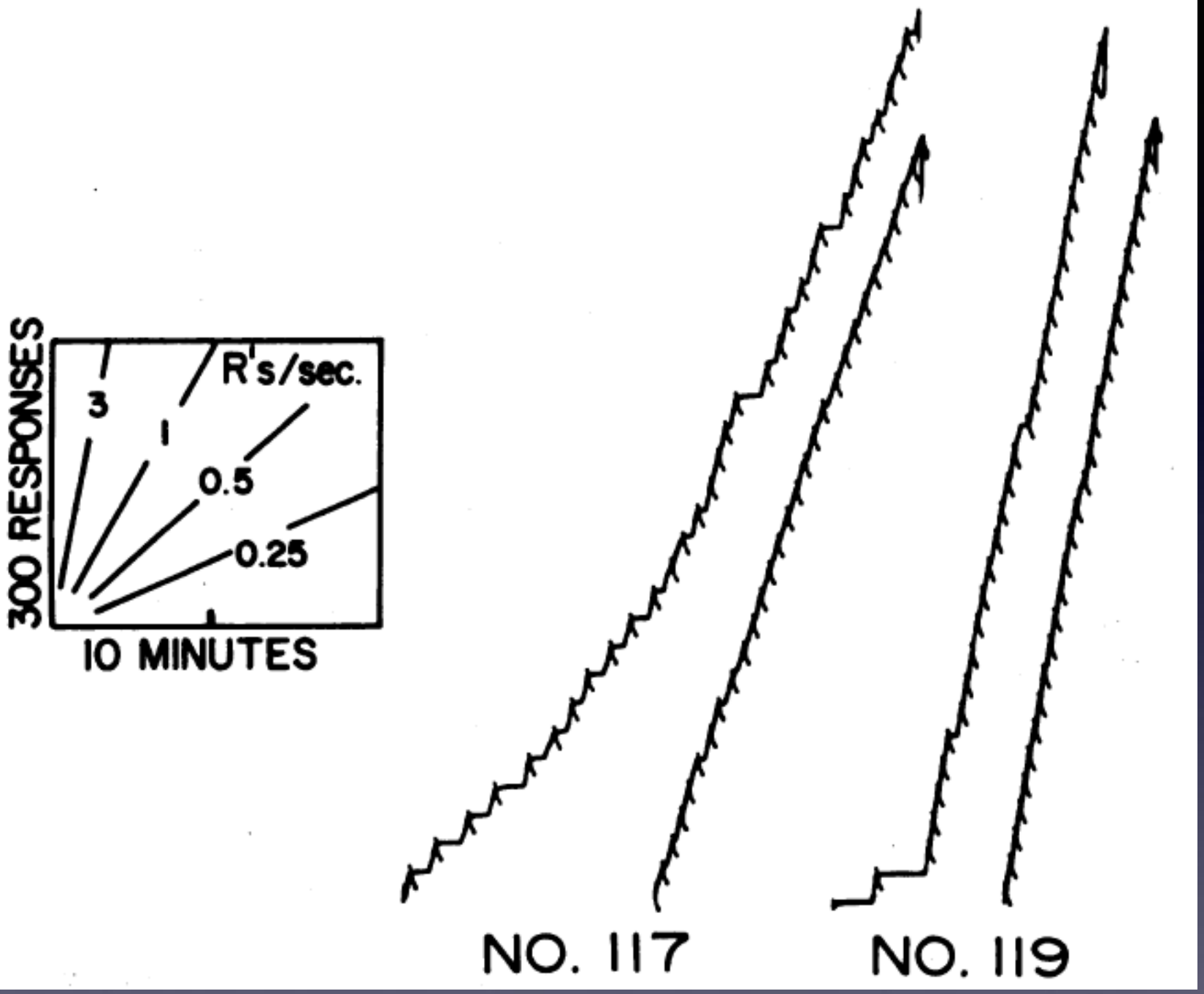
Kelleher (1958)

Kelleher (1958)

chimps, poker chip tokens exchanged for food

FR token production varied

FR exchange held constant



FR schedules of token production

JOURNAL OF APPLIED BEHAVIOR ANALYSIS 1971, 4, 45-59 NUMBER 1 (SPRING 1971)

ACHIEVEMENT PLACE: MODIFICATION OF THE BEHAVIORS OF PRE-DELINQUENT BOYS WITHIN A TOKEN ECONOMY[1,2,3]

ELERY L. PHILLIPS, ELAINE A. PHILLIPS,
DEAN L. FIXSEN, AND MONTROSE M. WOLF

UNIVERSITY OF KANSAS

The "pre-delinquent" behaviors of six boys at Achievement Place, a community based family style behavior modification center for delinquents, were modified using token (points) reinforcement procedures. In Exp. I, point losses contingent on each minute late were effective in producing promptness at the evening meal. During the reversal phase, threats (which were not backed up with point losses) to reinstate the point consequences initially improved promptness but the last two of five threats were ineffective. In Exp. II, point consequences effectively maintained the boys' room-cleaning behavior and, during a fading condition where the percentage of days when the contingency occurred was decreased, the point consequences remained effective for over six months, even when they were delivered on only 8% of the days. Experiment III showed that the boys saved considerable amounts of money when point consequences were available for deposits but saved little money when no points were available. Also, when points were given only for deposits that occurred on specific days the boys deposited their money almost exclusively on those days. In Exp. IV, point consequences contingent on the number of correct answers on a news quiz produced the greatest increase in the percentage of boys who watched the news and, to a lesser extent, increased the percentage of correct answers for the boys who watched the news. The results indicate that "pre-delinquent" behaviors are amenable to modification procedures and that a token reinforcement system provides a practical means of modifying these behaviors.

Phillips et al. (1971)

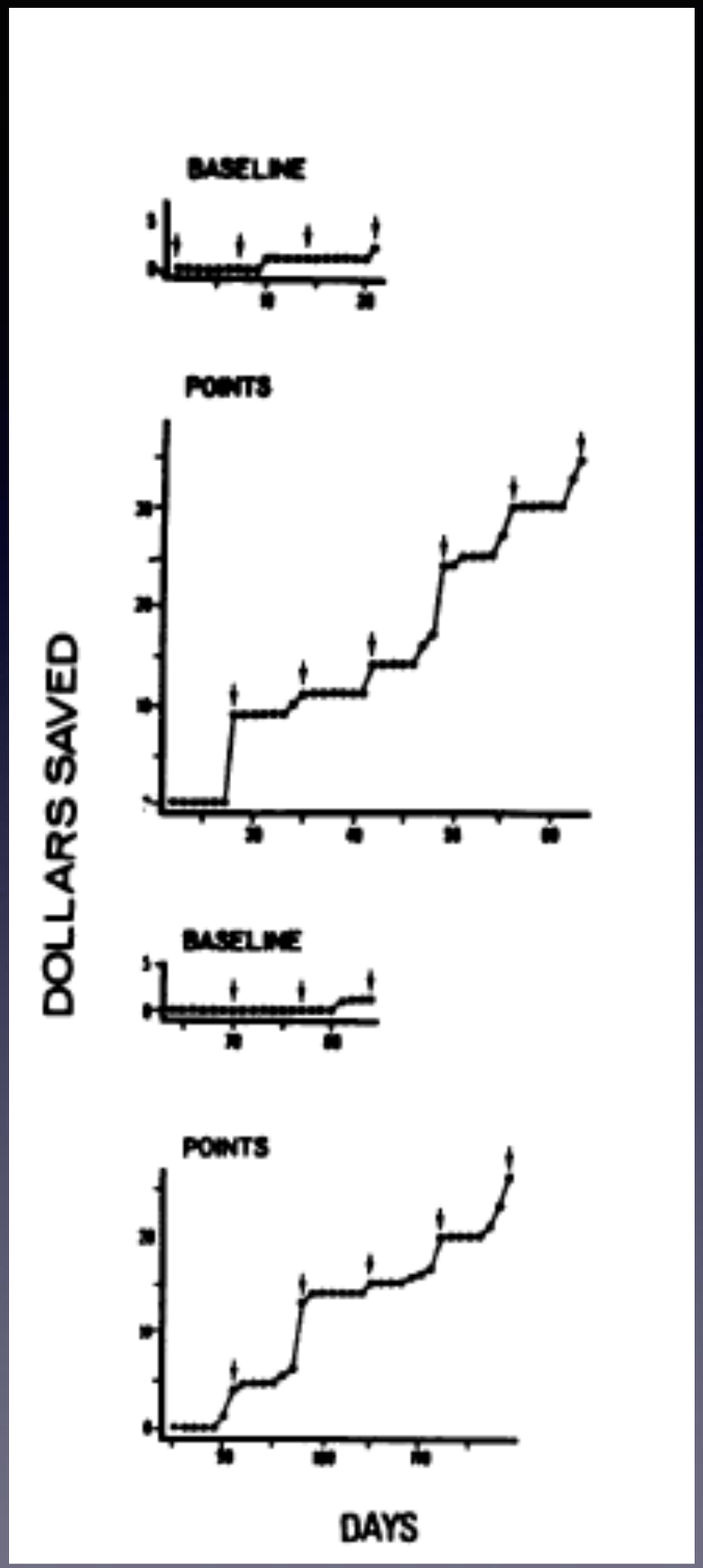
Phillips et al. (1971)

delinquent adolescents, group home setting

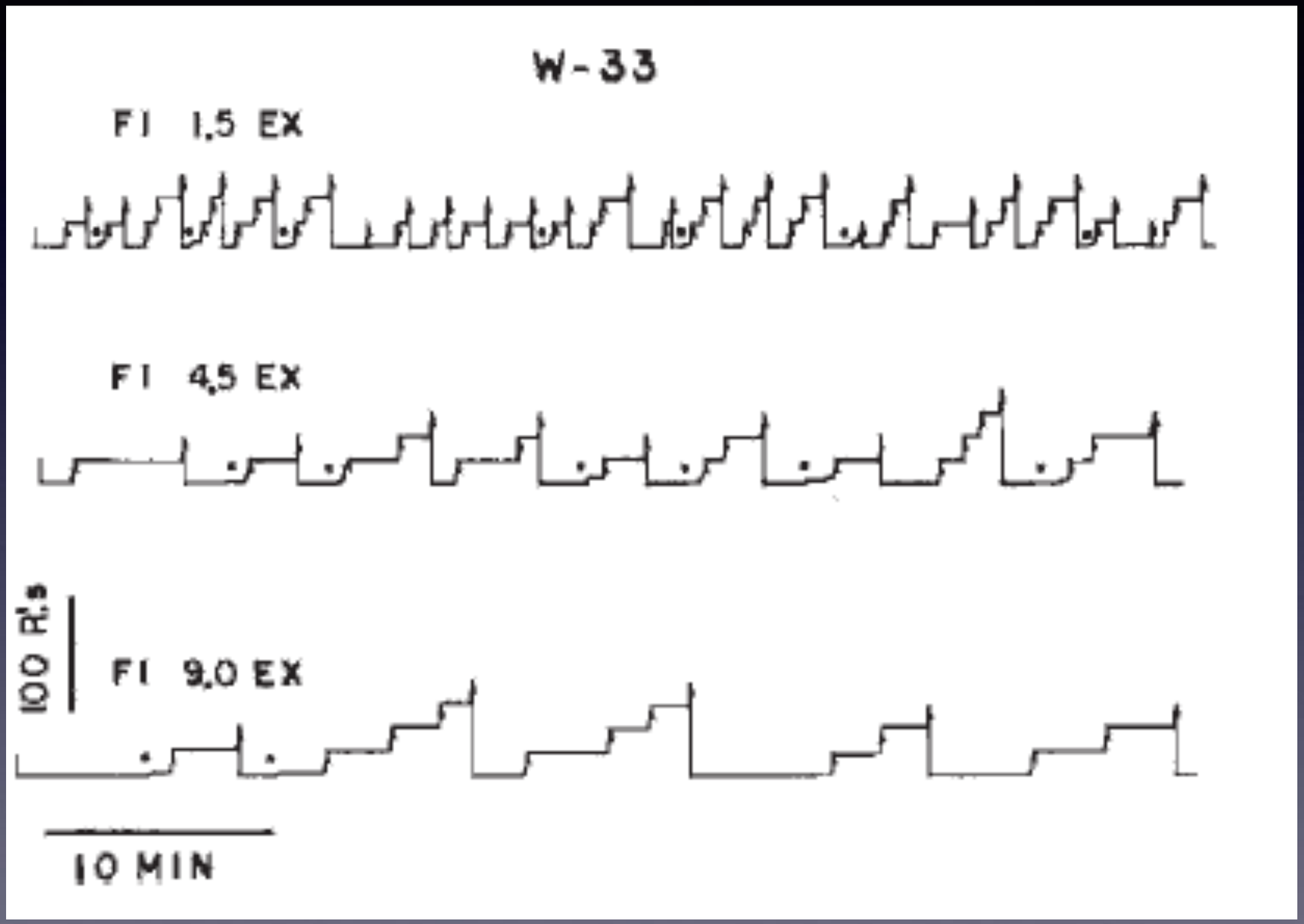
reinforced deposits into a savings account

exchange periods every Friday

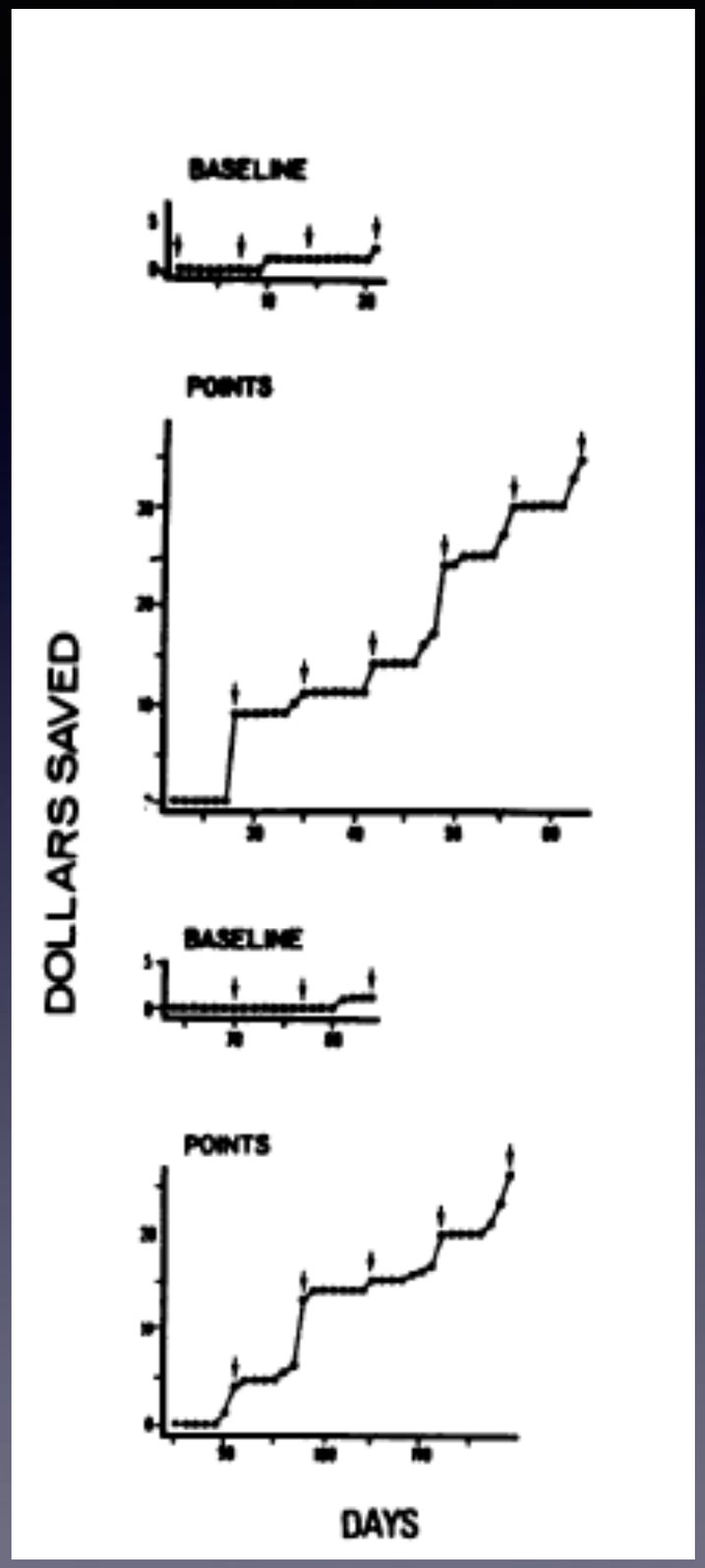
Phillips et al. (1971)

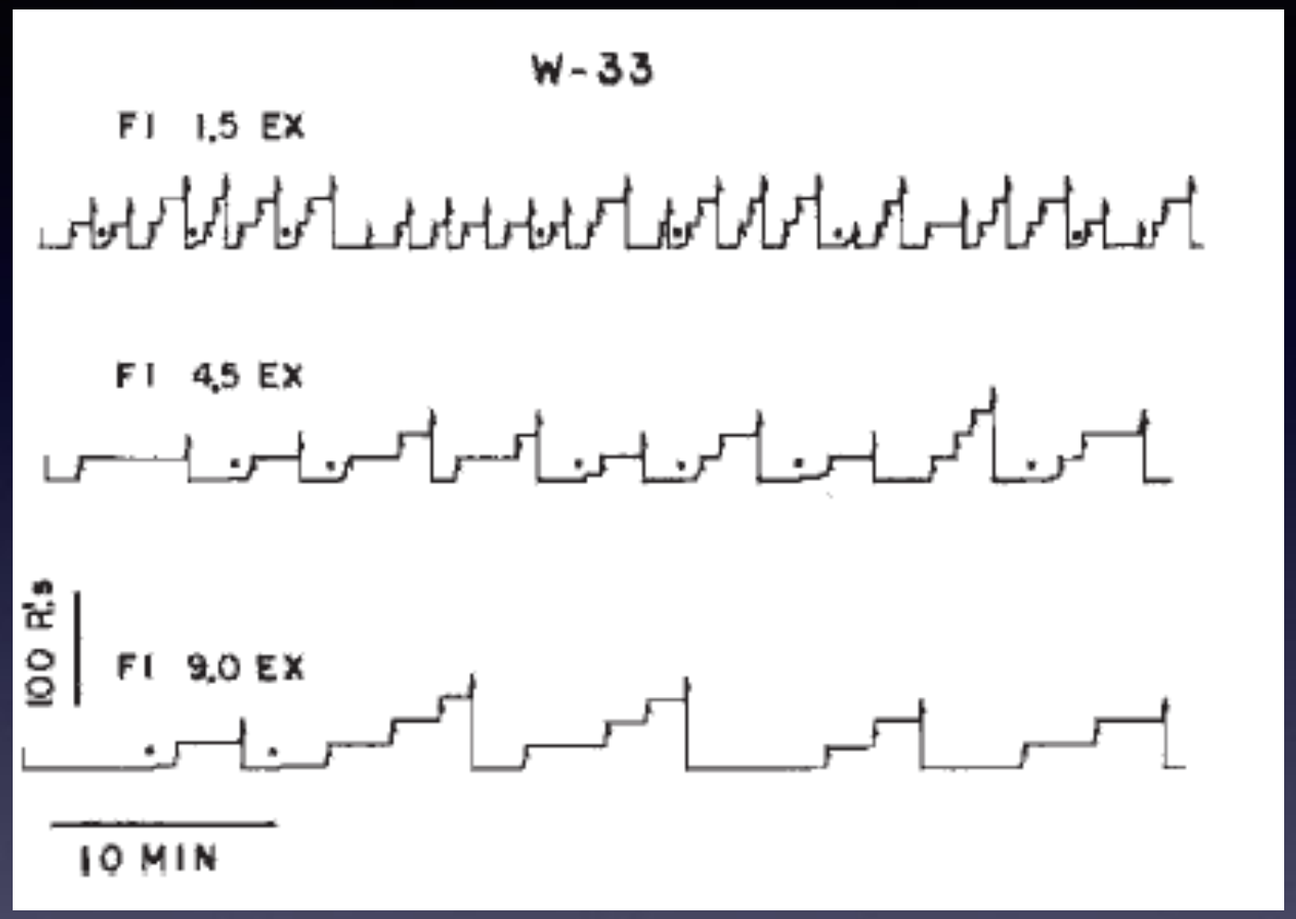


Waddell et al. (1972)



FI exchange schedules





Schedule types

- Fixed (certain)

  FR 3: Exchange after 3 tokens

- Variable (uncertain)

  VR 3: Exchange after 6 tokens, on average

Variable schedules generate high rates of behavior

JOURNAL OF THE EXPERIMENTAL ANALYSIS OF BEHAVIOR 2001, **76,** 159–178 NUMBER 2 (SEPTEMBER)

SECOND-ORDER SCHEDULES OF TOKEN REINFORCEMENT WITH PIGEONS: EFFECTS OF FIXED- AND VARIABLE-RATIO EXCHANGE SCHEDULES

THERESA A. FOSTER, TIMOTHY D. HACKENBERG, AND MANISH VAIDYA

UNIVERSITY OF FLORIDA

Pigeons' key pecks produced food under second-order schedules of token reinforcement, with light-emitting diodes serving as token reinforcers. In Experiment 1, tokens were earned according to a fixed-ratio 50 schedule and were exchanged for food according to either fixed-ratio or variable-ratio exchange schedules, with schedule type varied across conditions. In Experiment 2, schedule type was varied within sessions using a multiple schedule. In one component, tokens were earned according to a fixed-ratio 50 schedule and exchanged according to a variable-ratio schedule. In the other component, tokens were earned according to a variable-ratio 50 schedule and exchanged according to a fixed-ratio schedule. In both experiments, the number of responses per exchange was varied parametrically across conditions, ranging from 50 to 400 responses. Response rates decreased systematically with increases in the fixed-ratio exchange schedules, but were much less affected by changes in the variable-ratio exchange schedules. Response rates were consistently higher under variable-ratio exchange schedules than under comparable fixed-ratio exchange schedules, especially at higher exchange ratios. These response-rate differences were due both to greater preratio pausing and to lower local rates under the fixed-ratio exchange schedules. Local response rates increased with proximity to food under the higher fixed-ratio exchange schedules, indicative of discriminative control by the tokens.

Key words: fixed-ratio schedules, variable-ratio schedules, second-order schedules, token reinforcement, behavioral units, key peck, pigeons

Foster et al. (2001)

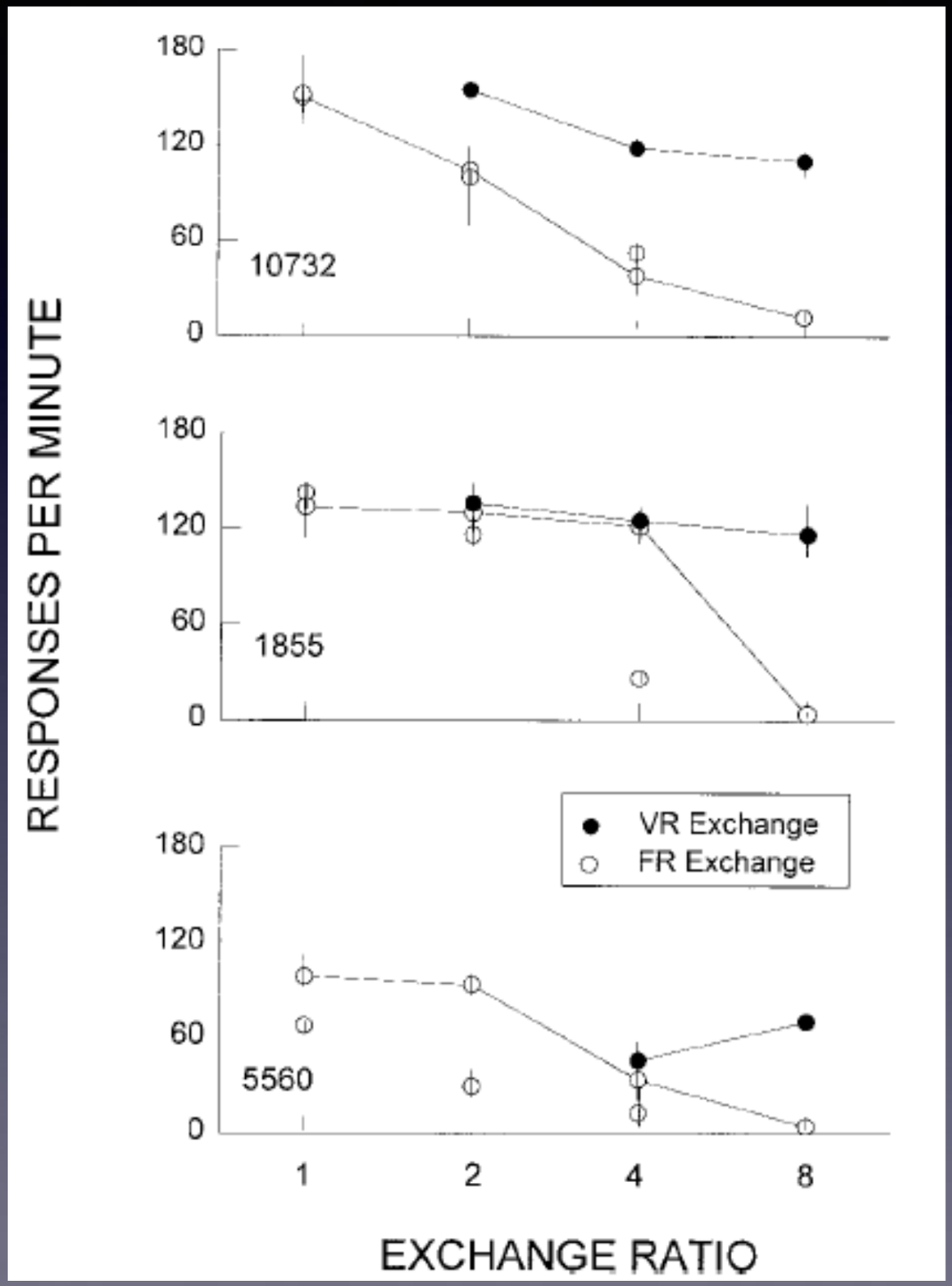
Foster et al. (2001)

FR 50 token production

FR vs VR exchange production

1, 2, 4, 8

Foster et al. (2001)










Preference for variable is widespread

JOURNAL OF THE EXPERIMENTAL ANALYSIS OF BEHAVIOR 2017, **107,** 161–175 NUMBER 1 (JANUARY)

CHILDREN'S PREFERENCE FOR MIXED- VERSUS FIXED-RATIO SCHEDULES OF REINFORCEMENT: A TRANSLATIONAL STUDY OF RISKY CHOICE

MICHAEL P. MULLANE, BRIAN K. MARTENS, EMILY L. BAXTER, AND DANICA VER STEEG

SYRACUSE UNIVERSITY

Laboratory research has shown that when subjects are given a choice between fixed-ratio and bi-valued mixed-ratio schedules of reinforcement, preference typically emerges for the mixed-ratio schedule even with a larger ratio requirement. The current study sought to replicate and extend these findings to children's math problem completion. Using an ABCBC reversal design, four fourth-grade students were given the choice of completing addition problems reinforced on either a fixed-ratio 5 schedule or one of three mixed-ratio schedules; an equivalent mixed-ratio (1, 9) schedule, a mixed-ratio (1, 11) schedule with a 20% larger ratio requirement, and an equally lean mixed-ratio (5, 7) schedule without the small fixed-ratio 1 component. This was followed by a reversal back to the preceding phase in which preference for the mixed-ratio schedule had been observed, and a final reversal back to the mixed-ratio (5, 7) phase. Findings were consistent with previous research in that all children preferred the mixed-ratio (1, 9) schedule over the equivalent fixed-ratio 5 schedule. Preference persisted for the leaner mixed-ratio (1, 11) schedule for three of the four children. Indifference or preference for the fixed-ratio 5 alternative was observed in phases containing the mixed-ratio (5, 7) schedule. These results extend previous research on risky choice to children's math problem completion and highlight the importance of a small ratio component in the emergence of preference for bi-valued mixed-ratio schedules. Implications of these results for arranging reinforcement to increase children's academic responding are discussed.

Key words: risky choice, mixed-ratio schedules, math problem completion, children

Mullane et al. (2017)

Mullane et al. (2017)

4th graders, classroom setting

students chose between

FR 5 (certain) exchange

VR 5 (uncertain) exchange

DV: math problem completion

Mullane et al. 2017

FR 5 vs VR 5/6

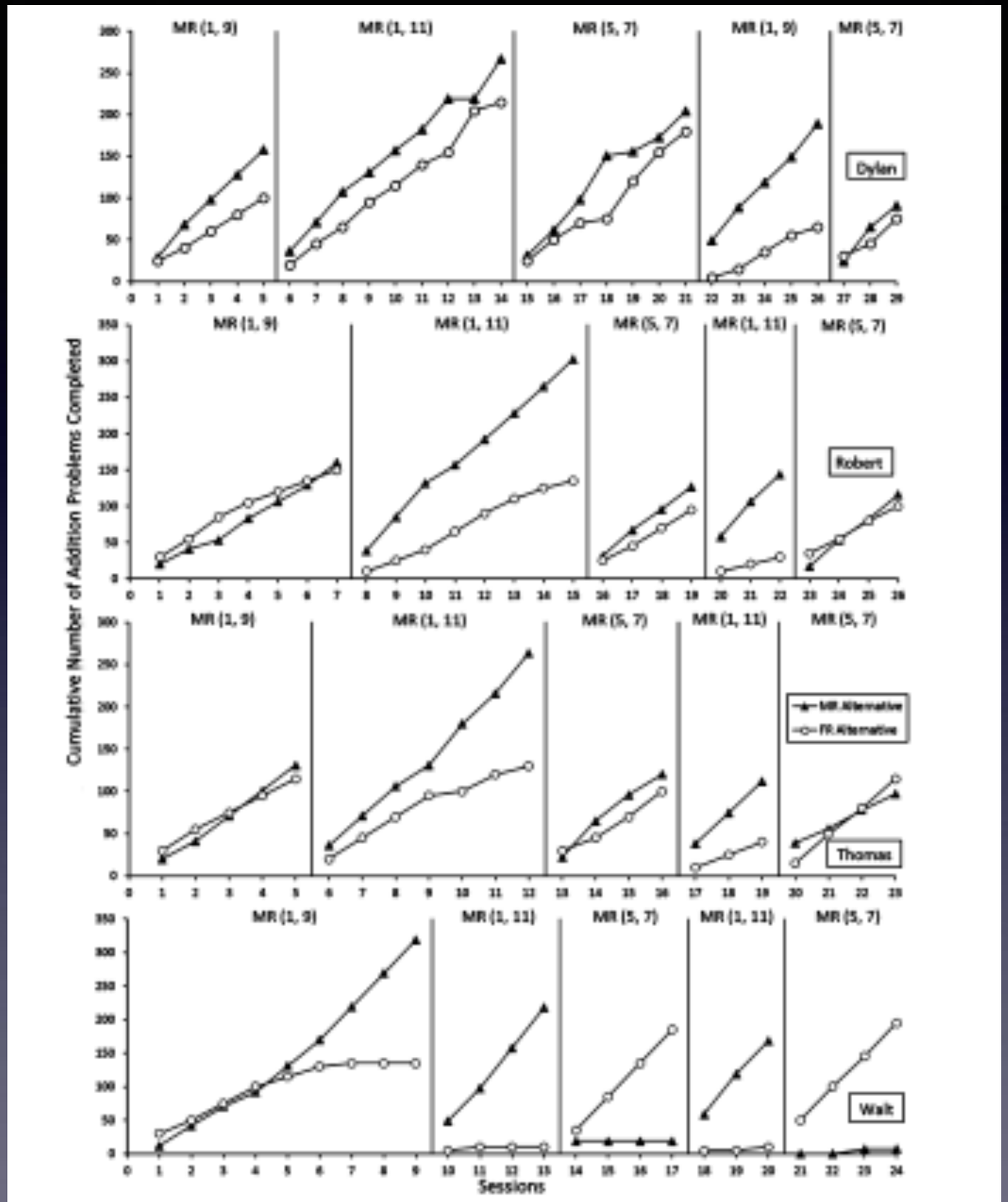


Fig. 3. The cumulative number of addition problems completed by each participant at the FR (open circles) and MR (closed triangles) alternative within each phase.

Applied recommendations

Which schedules should be used?

- Use ratio rather than interval schedules
- Use variable rather than fixed schedules

Which schedule should be changed first?

- Token production schedule
- Token exchange schedule

Token reinforcement schedule

each token is exchanged for unit of terminal reinforcer

correlation between tokens and reinforcer magnitude

Extended chain schedule

one reinforcer at end of chain

tokens correlated with proximity to exchange but not reinforcer magnitude

Extended chain schedule

Increase token exchange schedule

FR 1 PROD/FR 3 EXC

Increase token production schedule

FR 3 PROD/FR 1 EXC

Token reinforcement schedule

Increase token exchange schedule

FR 1 PROD/FR 3 EXC

Increase token production schedule

FR 3 PROD/FR 1 EXC

Which schedule should be changed first?

Both give you the same behavior output

Exchange schedule does it:

- at a lower unit price (token schedule)
- with additional tokens (chained schedule)

Recommendation:

increase the exchange schedule first
and foremost

Aversive functions

Do token losses punish behavior?

JOURNAL OF APPLIED BEHAVIOR ANALYSIS 1972 5, 271-282 NUMBER 3 (FALL 1972)

AN ANALYSIS OF TIMEOUT AND RESPONSE COST IN A PROGRAMMED ENVIRONMENT[1]

JOHN D. BURCHARD AND FRANCISCO BARRERA

UNIVERSITY OF VERMONT AND UNIVERSITY OF NORTH CAROLINA

A group of mildly retarded adolescents with high rates of antisocial behavior was exposed to two parameters of timeout and response cost within the context of a programmed environment. For five of the six subjects, the two higher values (30 tokens response cost or 30 min timeout) were significantly more suppressive than the lower values (five tokens or 5 min). For the one remaining subject, there was a strong relationship in the opposite direction. Also, the timeout and response cost of higher value became increasingly more suppressive over time, whereas those of lower value did not. There were few appreciable differences between the timeout and response cost of similar magnitude. A discussion of these results is presented in support of the notion that the functional aversiveness of timeouts (and response costs) appears to be critically dependent upon interactions with the environmental conditions in which they are implemented and the reinforcement histories of the subjects.

Burchard & Barrera (1972)

Burchard & Barrera (1972)

adolescents with intellectual deficits

tokens earned for workshop tasks

antisocial behavior punished

compared token loss vs timeout

- low magnitude (5 tokens, 5 min)
- High magnitude (30 tokens, 30 min)

Burchard & Barrera (1972)

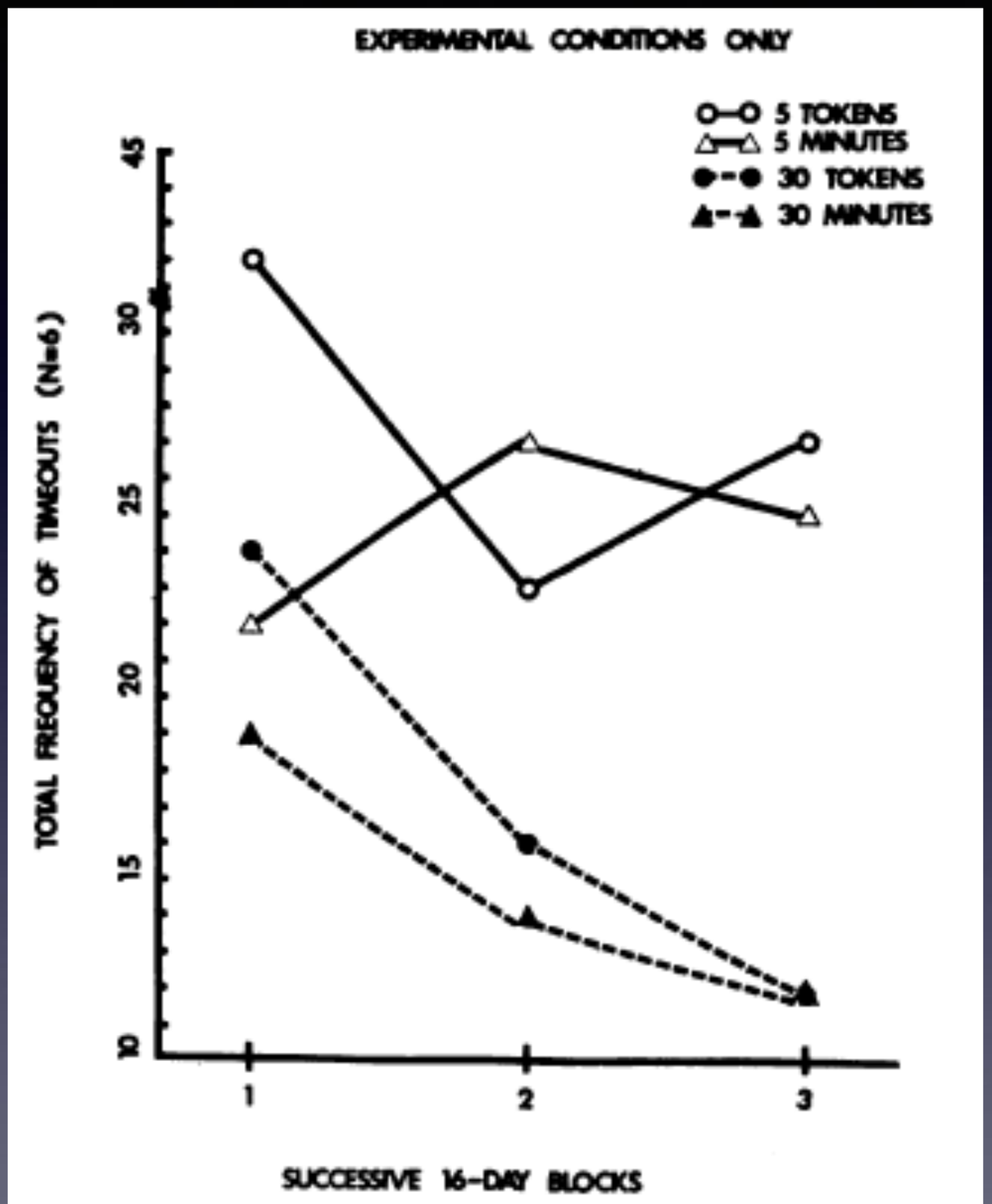


Fig. 4. Total frequency of timeouts per successive 16-day blocks for each of the four experimental procedures.

negative punishment

- suppression by punishment?
- reduced rate of positive reinforcement?

Learning & Behavior
2008, 36 (1), 29-41
doi: 10.3758/LB.36.1.29

Response-cost punishment with pigeons: Further evidence of response suppression via token loss

Bethany R. Raiff, Christopher E. Bullock, and Timothy D. Hackenberg
University of Florida, Gainesville, Florida

Four pigeons responded on a two-component multiple token-reinforcement schedule, in which tokens were produced according to a random-interval 30-sec schedule and exchanged according to a variable-ratio 4 schedule in both components. To assess the effects of contingent token loss, tokens were removed after every second response (i.e., fixed-ratio 2 loss) in one of the components. Response rates were selectively lower in the loss components relative to baseline (no-loss) conditions, as well as to the within-condition no-loss components. Response rates were decreased to a greater degree in the presence of tokens than in their absence. To control for the effects of changes in the density of token and food reinforcement, two parts consisted of additional conditions where food density and token loss were yoked to those in a previous loss condition. In the *yoked-food* condition, tokens were produced as usual in both components, but the overall density of food reinforcement in one of the components was yoked to that obtained during a previous token-loss condition. In the *yoked token-loss* condition, tokens were removed during one component of the multiple schedule at a rate that approximately matched the obtained rate of loss from a previous token-loss condition. Response rates in these yoked components were less affected than those in comparable loss components, despite similar densities of token, exchange, and food reinforcement. On the whole, the results support the conclusion that contingent token loss serves as an effective punisher with pigeons.

Raiff et al. (2008)

Raiff et al. (2008)

Two contingencies

gain: VI 30 token production
VR 4 exchange

loss: FR 2 token loss

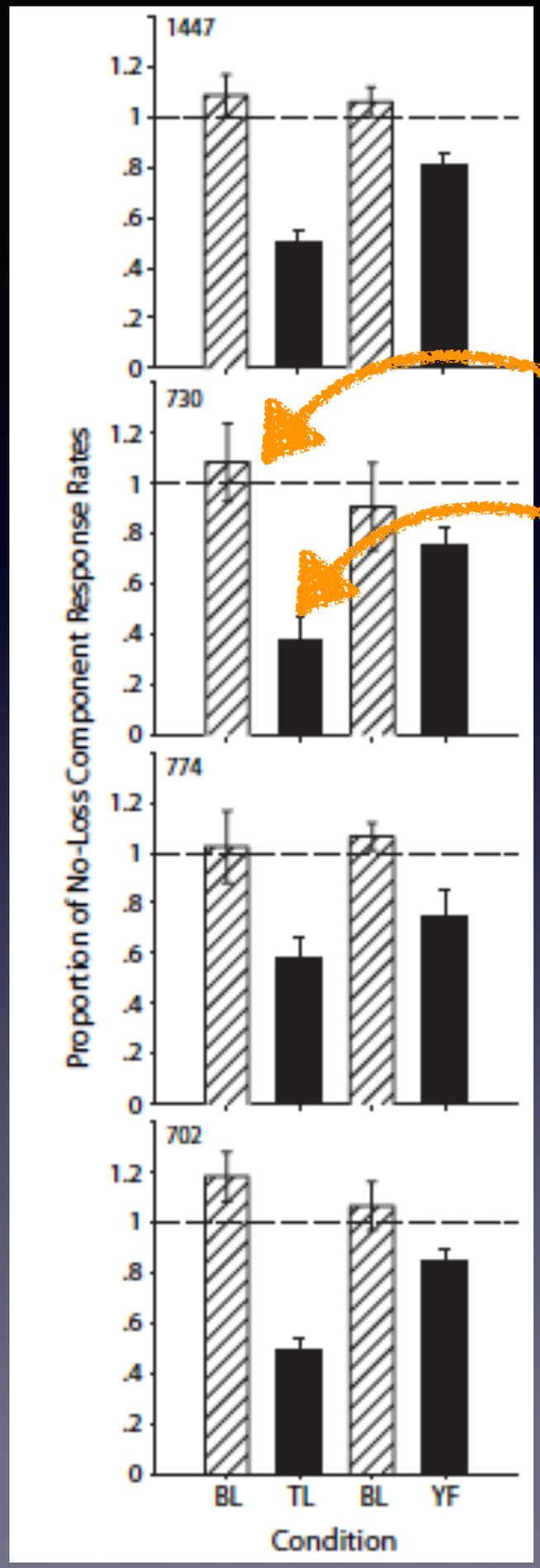
Multiple schedule with 2 components

Gain only

Gain+Loss

Yoked control

Raiff et al. (2008)



Gain only

Gain+Loss

JOURNAL OF APPLIED BEHAVIOR ANALYSIS 2014, 47, 1–12 NUMBER 3 (FALL)

EFFECTS OF AND PREFERENCE FOR CONDITIONS OF TOKEN EARN VERSUS TOKEN LOSS

JEANNE M. DONALDSON

TEXAS TECH UNIVERSITY

ISER G. DELEON

KENNEDY KRIEGER INSTITUTE AND THE JOHNS HOPKINS UNIVERSITY SCHOOL OF MEDICINE

ALYSSA B. FISHER

KENNEDY KRIEGER INSTITUTE

AND

SUNGWOO KAHNG

KENNEDY KRIEGER INSTITUTE AND THE JOHNS HOPKINS UNIVERSITY SCHOOL OF MEDICINE

The effects of earning and losing tokens on the disruptive behavior of 12 first-grade students were evaluated under symmetrical contingencies of earn and loss. Both contingencies produced decreases in disruptive behavior. For some participants, more consistent decreases were observed during the loss contingency. In addition, participants generally earned or kept more tokens during the loss contingency. When offered a choice of contingencies, most participants preferred the loss contingency. The results showed some consistency with behavioral economic principles of loss aversion and the endowment effect.

Key words: positive reinforcement, response cost, tokens, loss aversion

Donaldson et al. (2014)

Donaldson et al. (2014)

Compared token gain and token loss

Participants: 1st-grade kids, typical development

Setting: classroom

Target behavior: on-task and disruptive behavior

Token gain

Token loss

Choice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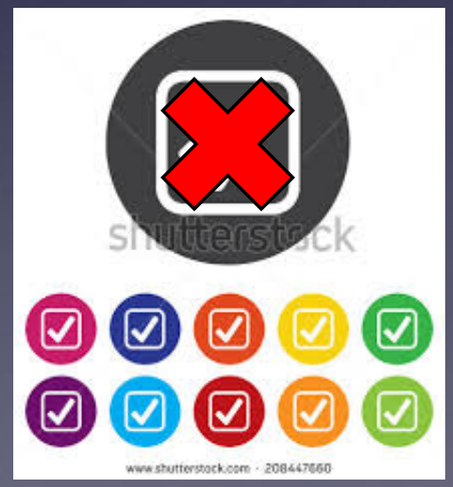
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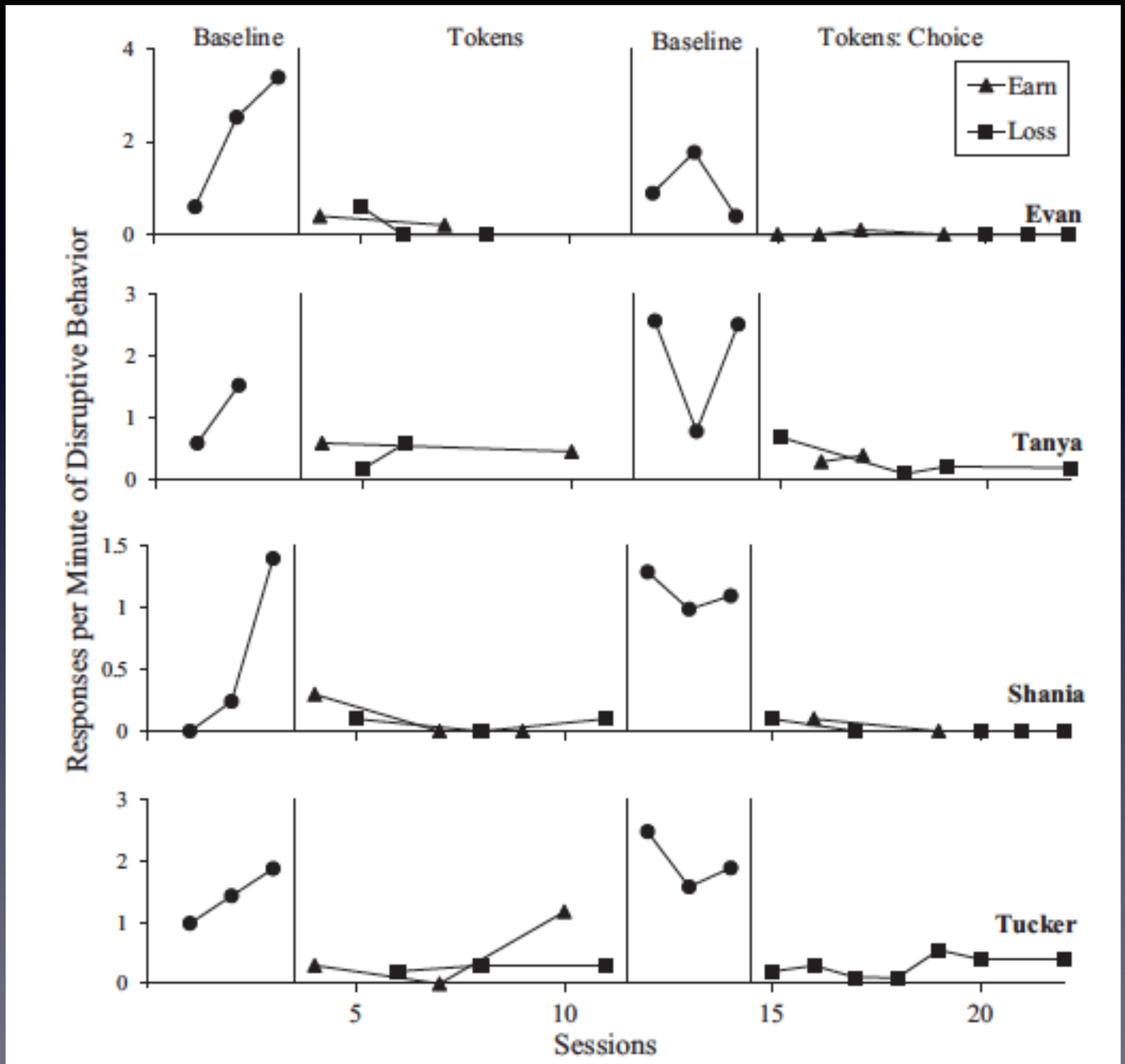
Donaldson et al. (2014)



What loss schedules to use?

Ratio schedules: high ratio of punished to unpunished behavior

But...

too many losses will reduce SR+ rate

Alternative response: provide non-punished option

What exchange (gain) schedules to use?

Ratio exchange: token losses increase exchange delays

Interval exchange: token losses do not necessarily affect exchange delays

Does it matter whether tokens are earned?

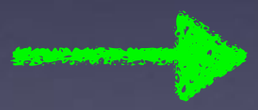
...or provided freely?

Yes, it matters..

Tokens that are earned are:

more valued than free tokens

more aversive to lose than free tokens



Recommendations

- Use dense/high-rate loss schedules
- Provide alternative (unpunished) alternative
- Use interval-based gain schedules, if SR+ rate is a concern
- Use response-dependent gain and loss schedules

economic considerations

- create a robust economy
  - frequent exchanges
  - closed economy

JOURNAL OF APPLIED BEHAVIOR ANALYSIS 1972 5, 263-270 NUMBER 3 (FALL 1972)

INTRINSIC REINFORCERS IN A CLASSROOM TOKEN ECONOMY[1]

THOMAS F. MCLAUGHLIN AND JOHN MALABY

SPOKANE SCHOOL DISTRICT 81
AND EASTERN WASHINGTON STATE COLLEGE

An inexpensive, easily managed token economy was used in a normal classroom for one academic year, and data were collected for the entire academic performance in spelling, language, handwriting, and math for that year. During a baseline period, assignment completion was variable. The introduction of a token economy with a point exchange every five days increased assignment completion and decreased variability of performance. An application of a token economy that had a point exchange averaging four days was accompanied by an assignment completion rate that approximated 100%. A reinforcement contingency for which quiet behavior rather than for assignment completion was eased quiet behavior was accompanied by a marked diminution of assignment completion. A reintroduction of the token reinforcement for assignment completion system increased assignment completion again.

McLaughlin & Malaby (1972)

McLaughlin & Malaby (1972)

Classroom token economy

- 4th–5th grade class
- entire academic year

Academic subjects

- Spelling
- Language
- Math
- handwriting

McLaughlin & Malaby (1972)

Table 2
Weekly Privileges

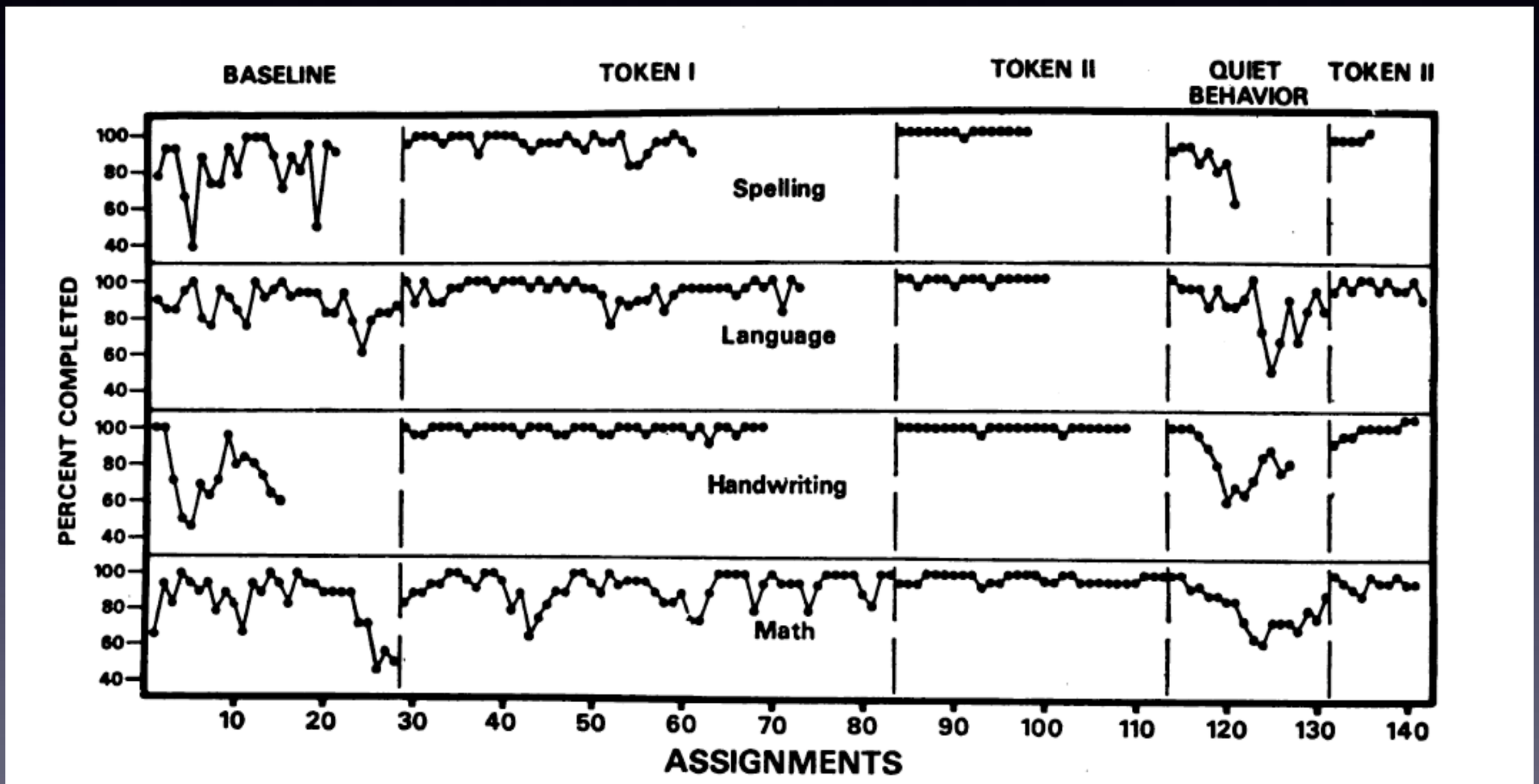
Privilege	*Price in Points* *Sixth*	*Fifth*[a]
1) Sharpening pencils	20	13
2) Seeing animals	30	25
3) Taking out balls	5	3
4) Sports	60	40
5) Special writing on board	20	16
6) Being on a committee	30	25
7) Special jobs	25	15
8) Playing games	5	3
9) Listening to records	5	2
10) Coming in early	10	6
11) Seeing the gradebook	5	2
12) Special projects	25	20

Points were exchanged for naturally occurring reinforcers

McLaughlin & Malaby (1972)

- Baseline
  - Traditional techniques used
    - Staying after school to complete assignments
    - Parent-teacher conferences
    - Standard letter grades
- Token economy I
  - Points for good academic performance & good behavior
  - Fixed exchange every 5 days (Monday)
- Token economy II
  - Variable exchange every 5 days on average (2-6 days)
- Quiet behavior
  - Points for good behavior, but not for academic performance
- Token economy II

McLaughlin & Malaby (1972)



Recommendations

- Restrict or reduce access to terminal reinforcers outside the sessions (closed economy)
- Include all behavioral programs in the token economy

translational research

bidirectional translation

hack@reed.edu