Motivating Operations and Reinforcers

Further Analysis of Effects and Interaction

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Can thirst be a cause of this behavior?

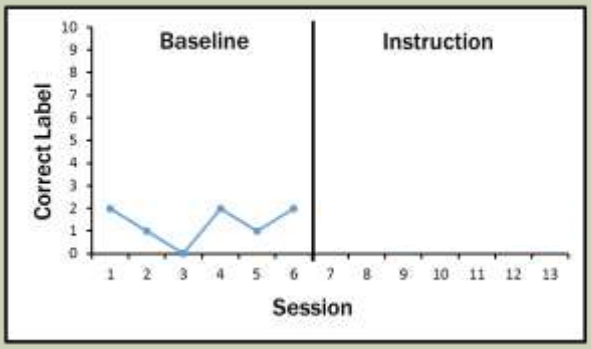
*Can **thirst** be a cause of this behavior?*

Case Study In Behavior Analysis

Case Study in Behavior Analysis

- **Client**: Gerry is a 9-year old male diagnosed with an Autism Spectrum Disorder receiving special education services.
- **Target Skill**: Labeling (tact) common household items.
- **Teaching Procedures**: Place single household item on table, say, "Gerry, what is this?" (point to item), using a time delay prompt provide object name immediately, and reinforce response; gradually increase time delay to promote independent labeling.

Case Study in Behavior Analysis



- **Results**. During baseline, Gerry correctly labeled 1.33 (AVG) per session. The correctly labeled items varied across sessions.

Case Study in Behavior Analysis

- **Diagnose the Problem.** What are the reasons that instruction may have failed to produce desired behavior change?

$$\text{“}S^R\text{”} \neq S^R$$

Case Study in Behavior Analysis

- **Diagnose the Problem.** What are the reasons that instruction may have failed to produce desired behavior change?

Why do some stimuli function as reinforcers and others do not?

How does a neutral stimulus come to function as a reinforcer?

Why does a stimulus function as a reinforcer in some situations and not others?

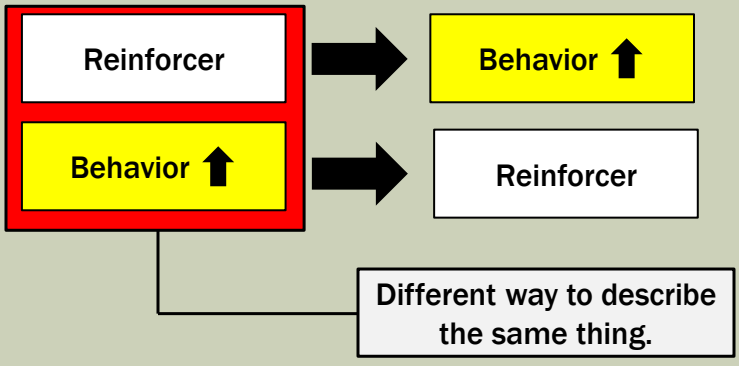
The Problem of Imprecision

But we delivered a ***reinforcer*** following each correct response…

- **Reward or Reinforcer.** The term ***reinforcer*** is often misused and misapplied when referring to rewards.

The Problem of Circularity

- **Logic Error.** Circular reasoning refers a logic error in which a phenomenon is attributed to some event and the event is attributed to the phenomenon.



Motivating Operations and Reinforcers

Further Analysis of Effects and Interaction

Purpose of this Workshop

- **Primary Objective**. This tutorial workshop will provide attendees with an in-depth and practical overview of reinforcement, motivating operations, and the interaction between motivating operations and reinforcers.

About this Workshop

- **Assumptions of Intermediate Level**: Attendees have a general understanding of reinforcement and motivating operations concepts and clinical applications.

Review of Basic Concepts

The Origin of Behavior

Variables of which Behavior is a Function

- **An Inclusive Science**: "We are concerned, then, with the causes of behavior… Any condition or event which can be shown to have an effect upon behavior must be taken into account" (Skinner, p. 23, 1953).

Biology

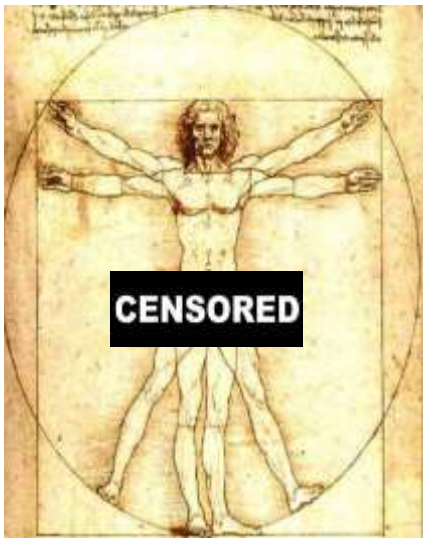
History

Environment

The Anatomy of Behavior

- Behavior is…
  - Everything you do.
  - Yes, **EVERYTHING**.
- For the technocrat…
  - Behavior "is that portion of an organism's interaction with its environment that is characterized by detectable displacement in space through time of some part of the organism."

(Johnson and Pennypacker, 1993, p. 23)



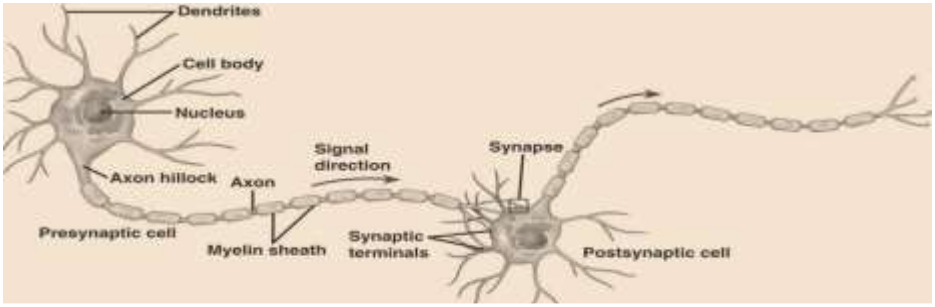
On Terms: Operant Behavior

- An **operant** is a behavior that is altered by its consequences, within a given antecedent situation, which can acquire control.
  - Although respondent behavior plays an important role in learning, operant behavior and conditioning will be the focus of this workshop.

Antecedent	Behavior	Consequence
Compound S:The sum of stimuli that set the occasion for behavior.	**Response**: A member of a larger response class is evoked.	**Stimulus change**: Has a function-altering effect.

- The three-term contingency is the context in which operant behavior is occasioned and is changed in the future.

The Action Potential



- **Behavior as an Action Potential**: Might operant behavior function the same way?
  - The confluence of stimuli (S^D & S^Δ) cause a specific response to occur.
- What do you think of this account?

Reinforcement

On-Terms: Reinforcement

- What is **Reinforcement**?
  - A stimulus change that increases/maintains the probability of some dimension of the response class and/or increases/maintains the future probability of the response in similar situations.

On-Terms: Antecedent Control

- **Relevance of Antecedent**. Behavior reinforced in the presence of a stimulus can come to evoke behavior.
- **Discriminative Stimuli**. An antecedent stimuli associated reinforcement for a given response.
- **Behavior as Contextual**. The antecedent "sets the stage."
  - Lights, camera, action!

On Terms: S^R Class

- A stimulus that **functions as a reinforcer** can be categorized across two broad classes – multiple terms exist to describe the taxonomy of reinforcers.

Unconditioned	Conditioned
A stimulus that functions as a reinforcer **without prior history**.	A stimulus that functions as a reinforcer **as a result of prior history**.

What is the Reinforcer?

- Let's assume this ice-cream sundae functions as a reinforcer, what aspect of this stimulus is the actual reinforcer?

Creating Reinforcers

Creating Reinforcers

- **Contingency-Conditioned**. The creation of a conditioned reinforcer requires two essential ingredients: an already established reinforcer and a non-reinforcing stimuli*.

Creating Reinforcers

- Does the order in which the stimuli are paired matter?
  - If so, what order would be best and why?

A stimulus that reliability precedes the deliver of a reinforcer may come to function as a reinforcer itself.

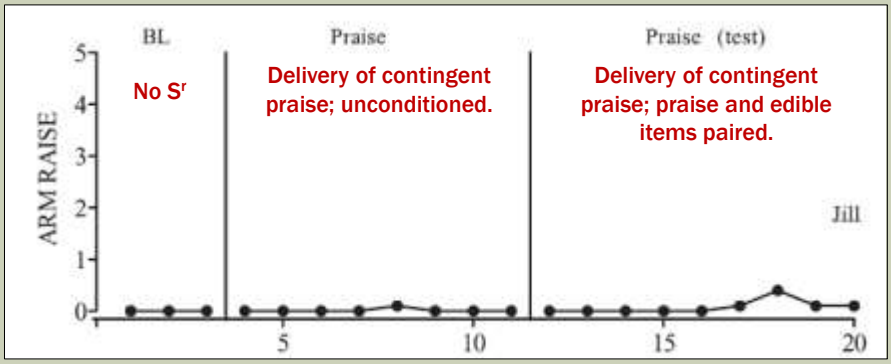
Creating Reinforcers

- **Established Theory, Missing Research**. Despite the importance of reinforcer conditioning, few applied studies have empirically examined reinforcer conditioning.

- **Dozier**, **Iwata**, **Thomason-Sassi**, **Worsdell**, and **Willson** (2012) compared two pairing procedures to establish praise as a S^r.
  - **Study #1**. Participants (four adults with DD) were exposed to three conditions (baseline, unconditioned praise and conditioned praise), rate of target response was measured.

Creating Reinforcers

- Results of **Dozier**, **Iwata**, **Thomason-Sassi**, **Worsdell**, and **Willson** (2012), *A Comparison of Two Pairing Procedures to Establish Praise as a Reinforcer*.



Results representative of three of four participants.

Creating Reinforcers

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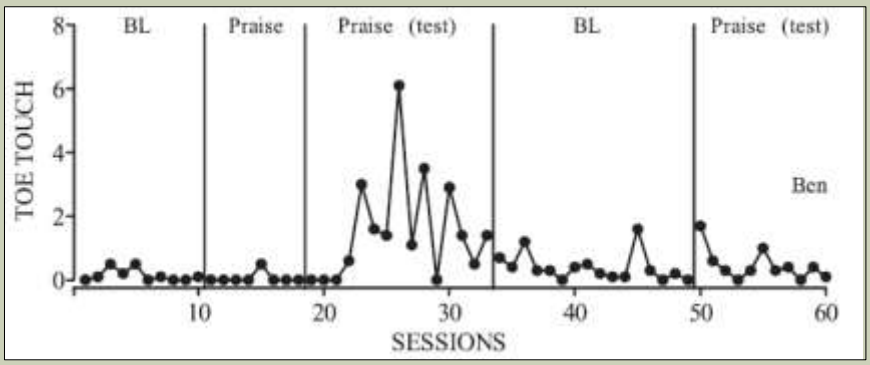

Creating Reinforcers

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  - **Study #1**. Participants (four adults with DD) were exposed to three conditions (baseline, unconditioned praise and conditioned praise), rate of target response was measured.
  - **Study #2**. Participants (seven adults and one child with DD), were exposed to similar conditions as Study #1, with addition of reinforcer plus praise condition.

Creating Reinforcers

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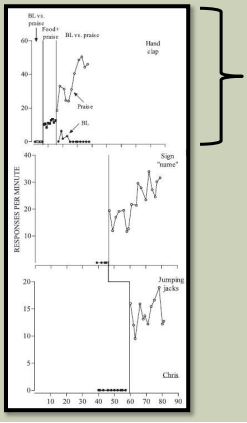

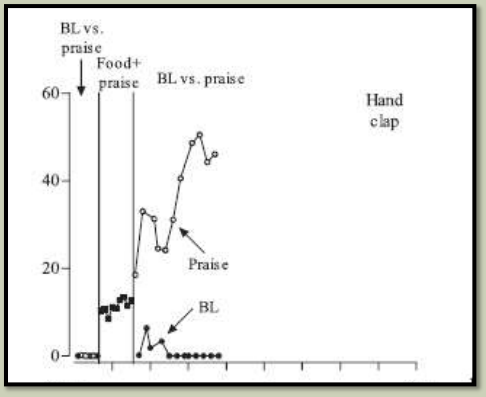

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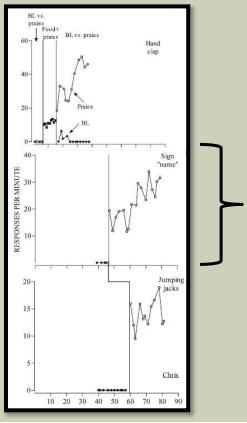

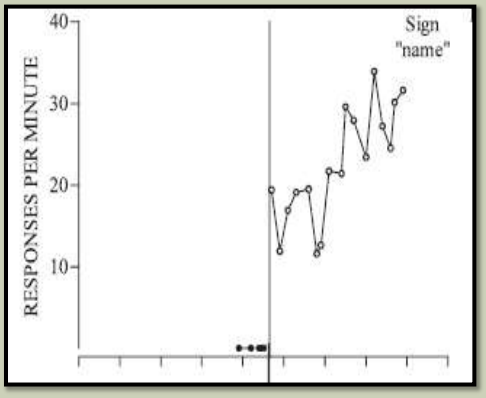

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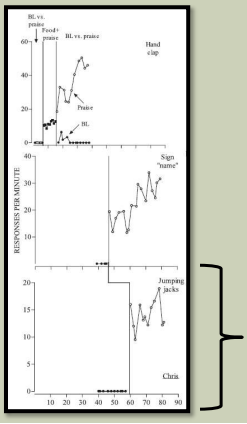
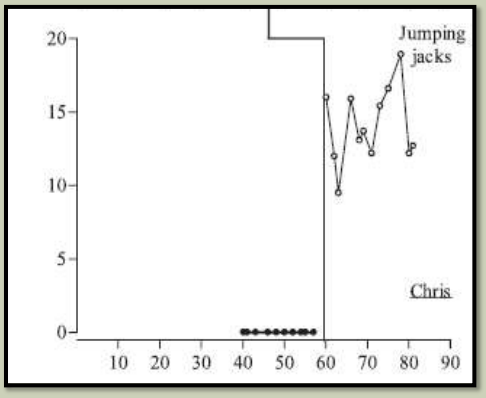
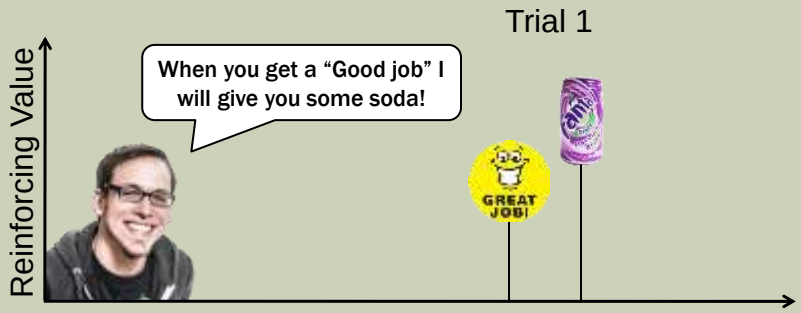




Creating Reinforcers

- **Rule-Conditioned**. Providing a verbal rule, a description of the contingency, to an individual with the requisite history and experience to respond to a rule can create a reinforcer.



On Terms: Generalized S^R

- A conditioned reinforcer that has been paired with multiple other reinforcers can function as a **generalized conditioned reinforcer** – this subclass is assumed to have unique properties.

Token Reinforcement

- What is a ***Token***?
  - "an object or symbol that is exchanged for goods and services" (Hackenberg, p. 257, 2009).

Tokens

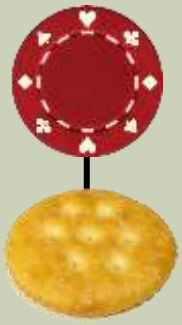
Back-Up Reinforcer

Exchange

Token Conditioning

The Tale of Two Tokens

- Not all tokens are created equally – two separate functions, depending on conditioning history.



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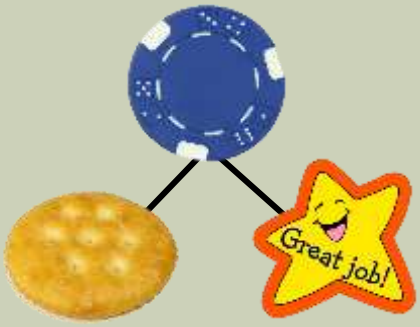
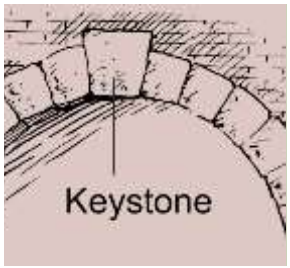


Conditioned Token

Generalized Conditioned Token

Implications of Reinforcement

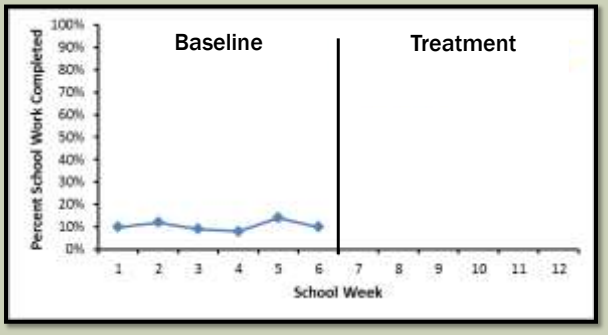
- **Reinforcement** is the mechanism by which new behavior is built and existing behavior shaped to fit the current environment.
- If we were **engineers**, reinforcement would be the keystone of programming.
  - I am a behavioral engineer, what about you?



Implications of Reinforcement

- **New Functions from Old Behavior**. Although not explicit, many reinforcement programs attempt to alter the response function.

Treatment



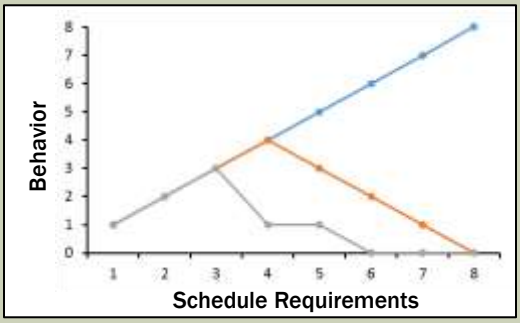
Implications of Reinforcement

- **Meaningful Differences**. The reinforcing strength of a stimulus is not uniform; a stimulus that functions as a reinforcer can have highly varied effects.
  - **Reinforcer Strength Analysis**. Using a progressive ration schedule of reinforcement it is possible to measure reinforcer effectiveness.

= Social Praise

= Pretzels

= Game with Peer



Motivating Operations

What would not I give to wander
where my old companions dwell?
Absence makes the heart grow fonder.

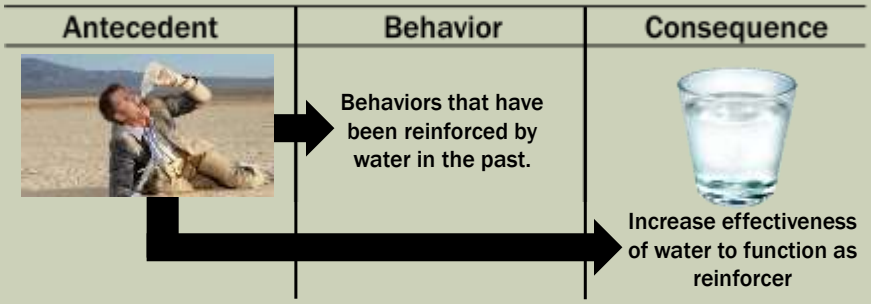
- Bayly, Isle of Beauty, 1844

A New Formulation of Motivation?

- Skinner (1953) described a **deprivation-satiation model** of motivation; reinforces were stimuli for which there was a current depravation – why abandon this model?

On Terms: Motivating Operations

- What is a **Motivating Operation** (MO)?
  - An antecedent event that temporarily alters (increase or decrease) the effectiveness of a stimulus to function as a reinforcer and alters (increase or decrease) the frequency of the response class that has been reinforced by that stimulus.



MO Reinforcer Relation

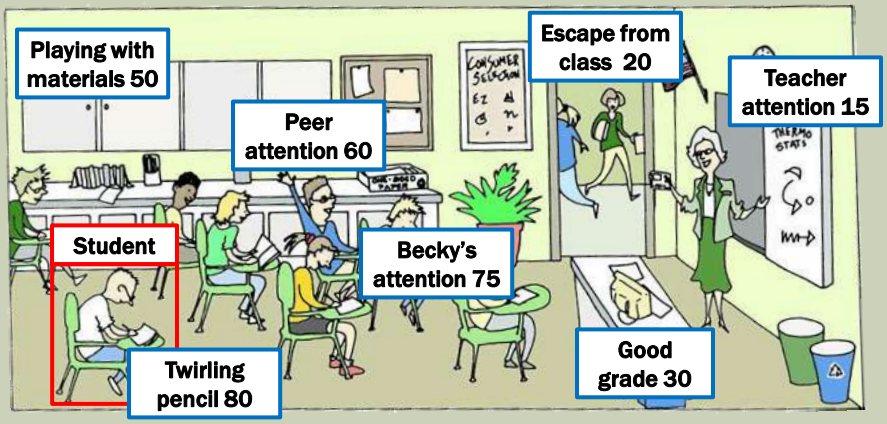
- **Dual Action**. Motivating operations can increase or decrease the effectiveness of a stimulus to function as a punisher.
  - Although the relation between MO and punisher is important, it is beyond the scope of this workshop.

On Terms: Two-Effects of MOs

- A motivating operation has two independent effects:
  - **Value-Altering Effect**. A change in the effectiveness of a stimulus to function as a reinforcer (increase or decrease).
  - **Behavior-Altering Effect**. A change in the current frequency (or some dimension) of the response class that as been reinforced by the stimulus.

On-Terms: Two-Effects of MOs

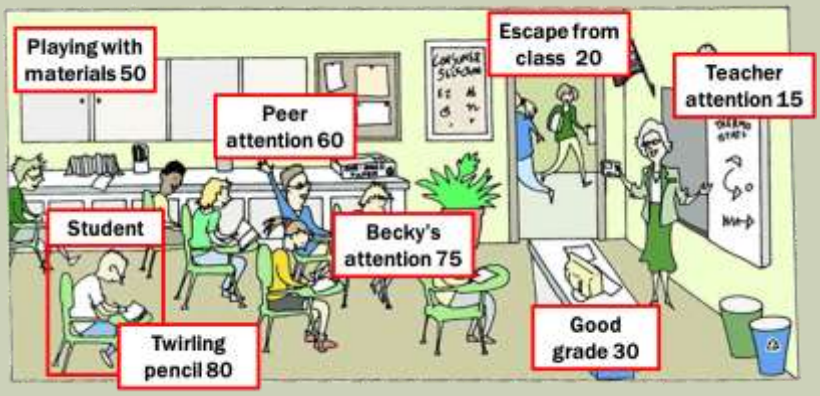
- A closer look at the **reinforcers** from the perspective of an individual sitting in a classroom – which response is most likely?



Subjective Reinforcer Value 0-100

Variables that Influence Behavior

- Given the current subjective value, what other factors determine if a student will engage in a response or not?



On-Terms: Response Effort

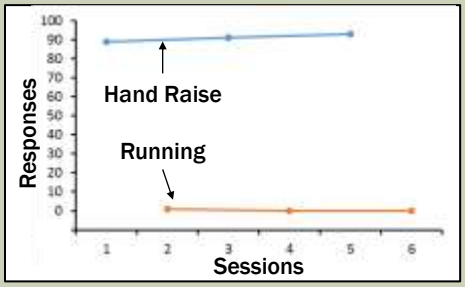
- **Reinforcer in Context**. A stimulus that functions as a S^r for a low-effort response may not function as a S^r for a high-effort response; what constitutes effort is idiosyncratic..
  - Alternatively, if the antecedent signals an effortful response, the behavior may not occur even in the presence of the S^D.

Condition A

Hand raise on FR1

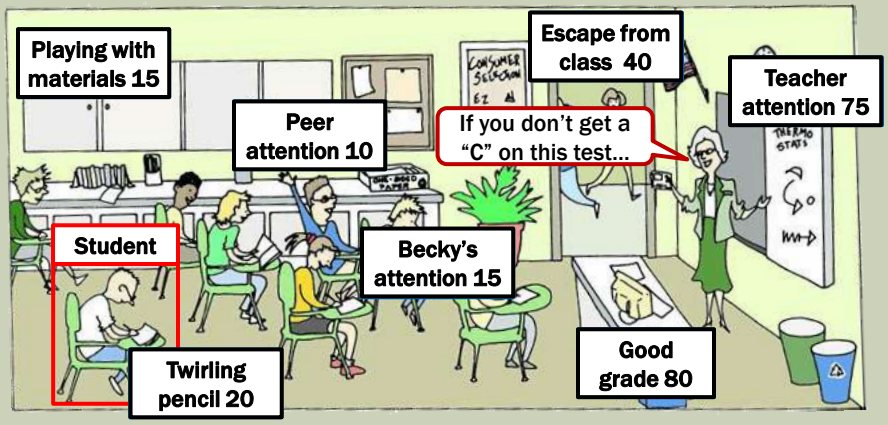
Condition B

Run 1mi. on FR1

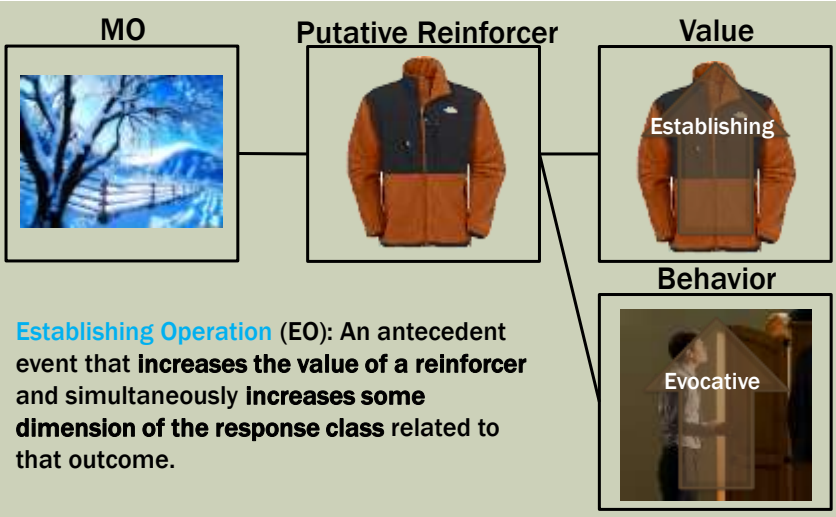


The Effect of MOs

- The value of all consequent events are in flux – ever changing.
  - **Stimulus change**. Changes in the environment can have a value-altering effect on stimuli, increasing or decreasing the effectives to function as S^r.

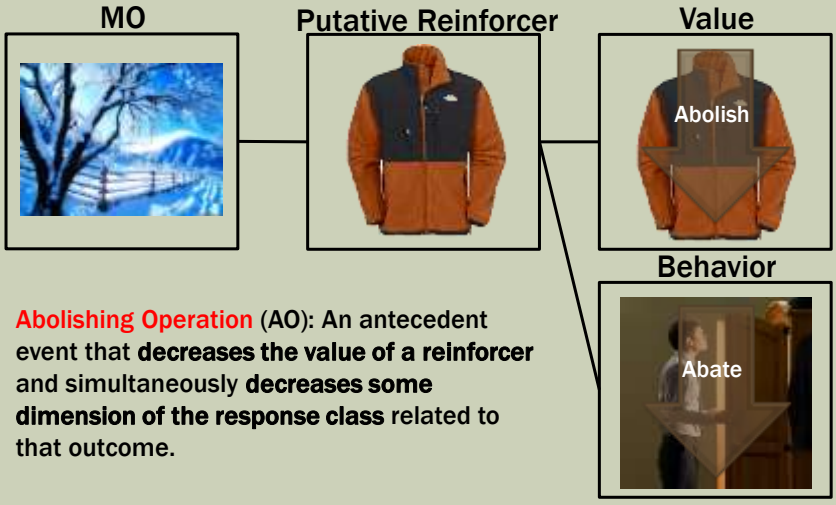


On Terms: Two Operations



Establishing Operation (EO): An antecedent event that **increases the value of a reinforcer** and simultaneously **increases some dimension of the response class** related to that outcome.

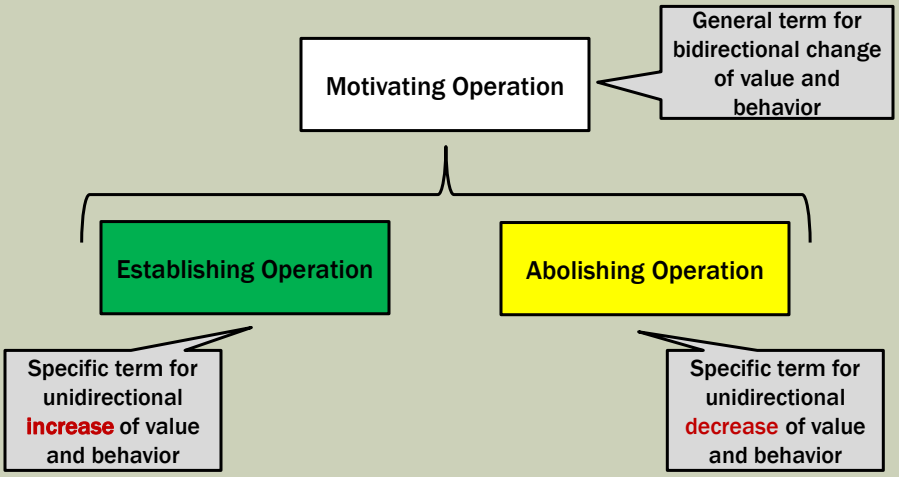
On Terms: Two Operations



Abolishing Operation (AO): An antecedent event that **decreases the value of a reinforcer** and simultaneously **decreases some dimension of the response class** related to that outcome.

On Terms: Two Operations

- Overview of MO for Potential Reinforcer.



On Terms: MO Class

- A stimulus that **functions as a motivating operation** can be categorized across two broad classes – the terminology and conceptualization is similar to reinforcement categorization.

Unconditioned	Conditioned
A stimulus that functions as a MO **without prior history.**	A stimulus that functions as a MO **as a result of prior history.**

Events that Establish Reinforcers

- What environmental events **increase** the reinforcing value of and behavior associated with contacting an electrical outlet?

Events that Abolish Reinforcers

- What environmental events **decrease** the reinforcing value of and behavior associated with contacting an electrical outlet?

Implications of MOs

- **The Creation of Reinforcers**. Although pairing a neutral stimulus with a reinforcer can condition a reinforcing effect, an MO must be present to establish the reinforcer.
  - A stimulus without an establishing MO event is just a stimulus…

S^r Value = 80

Implications of MOs

- **Reinforcer Abolishing Threshold**. The effect of a given abolishing operation may produce differing decreases in the reinforcing value of stimuli and associated behavior.

AO Event: Eating large meal.

Ice Cream
S^R Value = 65

Steak
S^R Value = 82

Implications of MOs

Implications of MOs

- **An Analysis of Frustration**. Frustration is often offered as an explanation of challenging behavior – Billy poked me in the eye because he was frustrated.
- What is it we "feel" in situations label as "frustrating?"

Imagine your alarm sounds; however, it cannot be turned off… What sort of behavior might you engage?

An aversive event, that cannot be avoided or terminated (e.g., the alarm) and is un-signaled can set the occasion for "frustration" behavior.

Implications of MOs

- **Practical Considerations**. When developing and implementing reinforcement-based interventions, the MO for the reinforcer must be taken in to account.
  - **Reinforcer Variation**. Alter the type and class of reinforcer provided throughout the day and/or session.
  - **Reinforcer Choice**. Offering choice among multiple potential reinforcers is a great way to mitigate waning motivation.
  - **Adjust to Current Environment**. Consider environmental events (e.g., lunch) that likely have strong establishing or abolishing effects on reinforcers (e.g., edible items).

Implications of MOs

Implications of MOs

- **MO for Challenging Behavior**. When conducting functional behavior assessments, understand that the target challenging behavior is a evoked by a range of MO conditions.
  - Identifying the characteristics of the MO can lead to a more precise analysis of behavior and treatment program.

Work Demand

Individuals who engage in problem behavior reinforced by escape or avoidance of work, a work demand could function as an establishing operation.

Low Attention

Characteristics of the word demand (e.g. length or difficulty) would have differing establishing effects.

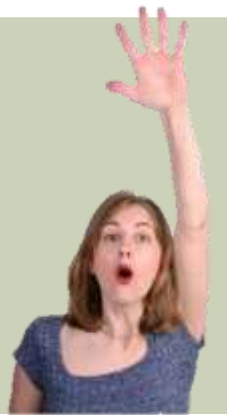
The duration of low attention would likely affect the establishing effects.

Individuals who engage in problem behavior reinforced by social attention, low attention could function as an establishing operation.

Implications of MOs

- **The Analysis of Verbal Behavior**. A mand is a verbal operant that is under the control of a motivating operation and reinforced by a characteristic consequence.

Antecedent	Behavior	Consequence
S1: Person present. **S2**: Difficult math equation. **S3**: History of S^r by raising hand. **S4**: Escape not possible.	**R1**: Raise hand.	S^r **1**: Help offered



Implications of MOs

- The most important aspect of mand training is to reproduce the **relevant motivating operation** for the given reinforcer being trained.
  - The occurrence of behavior is under the control of S^D and MOs, if training does not include the relevant MO the response is not a mand.
  - Furthermore, the response will not likely maintain or generalize.

Pre-Trial Manipulation	Chain Interruption	Incidental Teaching

Manipulating MOs

- Two predominant approaches in the literature:
  - **Incidental MO Manipulation**. Take advantage of natural occurring MOs (e.g., lunch or gym) and alter programming to produce desired effect.
    - For example, North and Iwata (2005) evaluated repeated S^r access to same and varied reinforcers; results showed mixed effects.

Why do many school or education centers plan academic content early in the morning as opposed to the afternoon?

Manipulating MOs

- Two predominant approaches in the literature:
  - **Pre-Session Manipulation**. Provide pre-session access (abolish a S^r) or pre-session deprivation (establish a S^r) to the reinforcer.
    - For example, O'Reilly et al. (2009) examined different lengths of pre-session access; the results suggest that the duration of pre-session access can influence the abolishing effect.

Behavioral interventions that include NCR attention are often designed to reduce the establishing operation for a particular challenging behavior.

Research Findings

- Impact of MO (pref, FA, and etc.)

A Preliminary Examination of Motivating Operation and Reinforcer Class Interaction

Empirical Study (In Press)

The Token Economy Advantage

- The effectiveness of a token reinforcer is relatively free from current motivational states (Catania, 1998; Cooper, Heron, & Heward, 2007; Skinner, 1953).

http://www.educateautism.com/token-economy.html

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Token Economy

"One of the most important technologies of behaviour modifiers and applied behaviour analysts over the last 40 years has been the token economy"
- Matson and Boisjoli (2009, p. 240)

What is a Token Economy?

Within an educational setting, a token economy is a method of providing positive reinforcement to a child or children by giving them tokens for completing tasks or behaving in desired ways.

Token economies are used as a method of strengthening a behaviour, or increasing its frequency, because the tokens are a way of "paying" children for completing tasks and the children can then use these tokens to buy desired activities or items (Miltenberger, 2008).

Interestingly, "tokens, in the form of clay coins, first appeared in human history in

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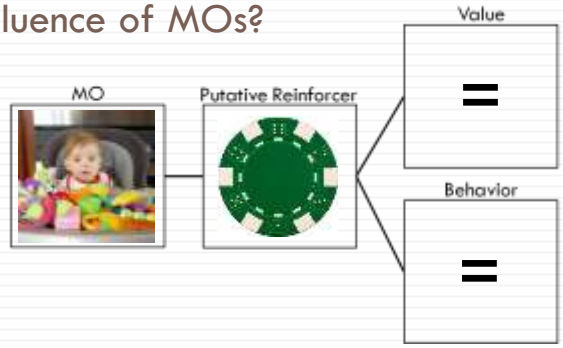
Tokens and MOs

Are tokens relatively free from the influence of MOs?



Tokens and MOs

- Moher, Gould, Hegg, and Mahoney (2008) examined the relation between MO and tokens.
  - **Participants**: Three individuals with developmental disabilities (ages 9–14, 2 females, 1 male).
  - **MO Manipulation**: Pre-session access to the back-up reinforcer (AO; e.g., cookie) until rejection or 24 hr restriction (EO).
  - **Results**: Token effectiveness varied according to the MO condition.
  - **Limitations**: Token exchangeable for one back-up reinforcer, which is not consistent with most conceptualizations of a token.

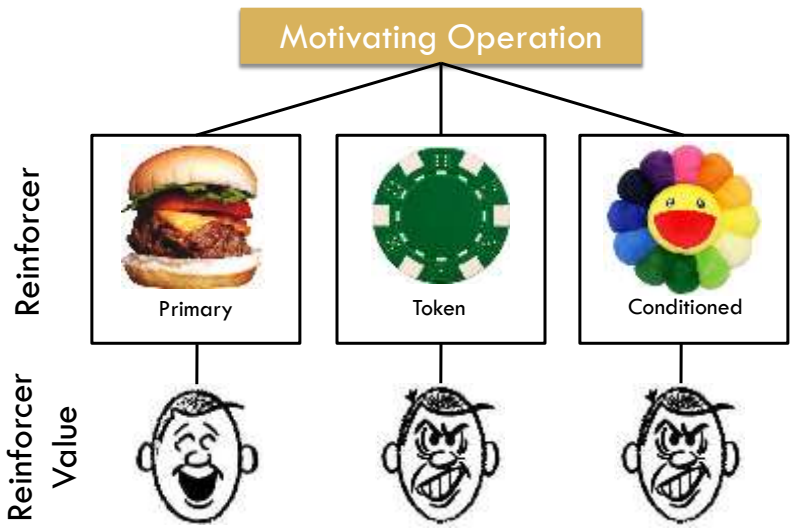
Tokens, MOs, and Beyond

- **My "Aha!" Moment**: If a token is somehow ***free*** from current motivational states than the effects of an MO must ***vary*** according to the reinforcer class.

The effect of the MO. ≠  ,  , & 

- Although not explicitly stated, the influence of an MO is conceptualized as one-directional. That is, the MO alters the value of the reinforcer (Michael, 1982; 1993; 2000).

Do MOs have Differential Effects?



Research Questions

1. Will a functionally defined MO produce a clear abative- and evocative-effect on a target behavior maintained by primary, conditioned, and token reinforcers?

2. Will a functionally defined MO have differential effects across the reinforcer classes?

Methods

Methods

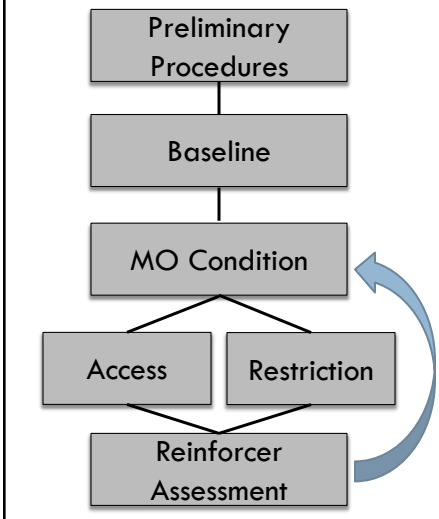
- Participants
  - **Jack**
    - 14 year-old male with diagnoses of PDD-NOS, bipolar disorder, ADHD, and type II diabetes.
    - Staff report that Jack had a history of engaging in challenging behavior when presented with work demands.
  - **Michael**
    - 12 year-old male diagnosed with PDD-NOS.
    - Staff reported that Michael needed frequent prompting to stay on task.
- Setting and Materials
  - Session were conducted in a therapy room.
  - Items necessary to engage in target behavior, reinforcers, digital timer, data sheets, digital camera, and colored paper.

Methods

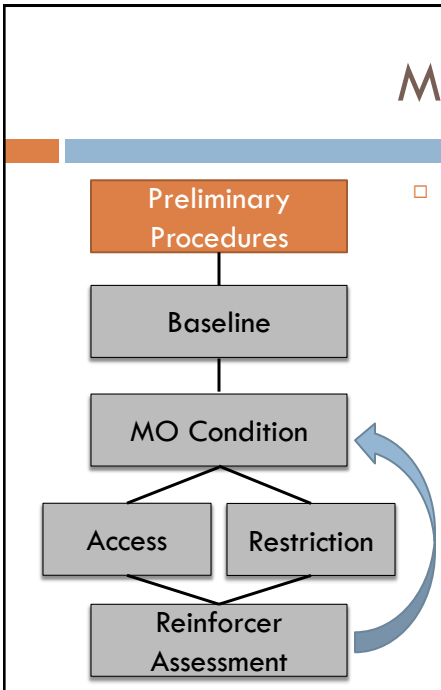
- Experimental Design
  - Superordinate multielement design (Hains &Baer, 1989) with an initial baseline.

		Motivating Operation Condition	
		Establishing	Abolishing
Reinforcer Class	Primary	Primary Establishing	Primary Abolishing
	Conditioned	Conditioned Establishing	Conditioned Abolishing
	Token	Token Establishing	Token Abolishing

Methods

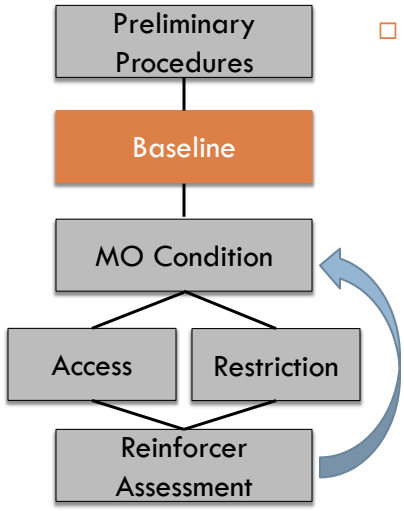


Methods



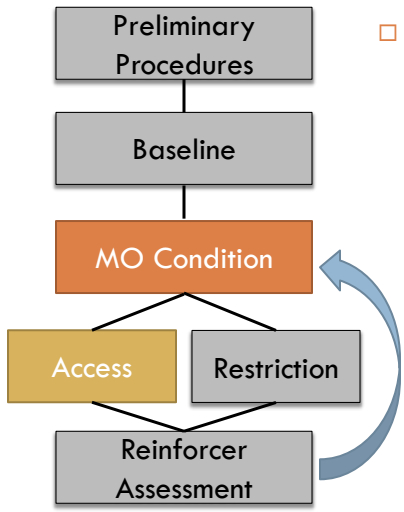
- Preliminary Procedures
  - **Preference assessments**
    - A MSWO preference assessment (DeLeon & Iwata, 1996) to identify the top two primary and conditioned reinforcers.
  - **Functional skills assessment**
    - Jack and Michael: Correct responses to math problems.
  - **Conditioning the token reinforcer**
    - Tokens were paired with the back-up reinforcers using the procedures described by Sran and Borrero (2010).
    - Lastly, the relation between the token and the back-up reinforcer was described to each participant (Kazdin & Bootzin, 1972)

Methods



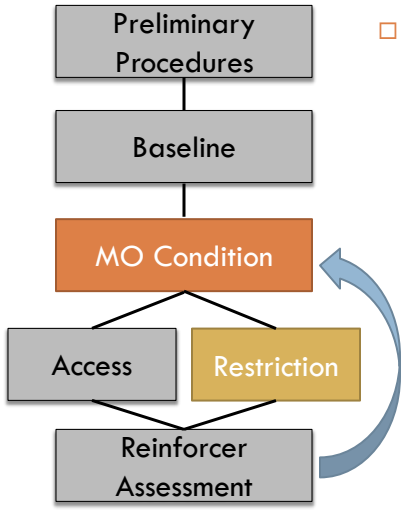
- Baseline
  - No programmed consequence.
  - Participants were given. instruction then provided with task materials.
    - "*You can do as much as you like but you don't have to do any if you don't want to. There will be no rewards this session*"
  - Sessions lasted 10 min or until 30 s elapsed without target behavior.

Methods



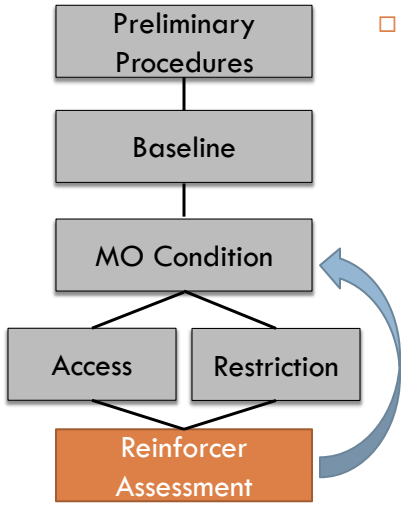
- MO Condition
  - **Pre-Session Access (AO)**
    - Continuous access to the reinforcer until rejection.
    - Followed a meal and free time.
    - Participants were given instruction then provided with the putative reinforcers according to the subsequent session.

Methods



- MO Condition
  - **Pre-Session Restriction (EO)**
    - Access restricted for ~24 hr.
    - Occurred in the natural environment.
    - Staff and parents were asked not to give the participant access to the reinforcer.

Methods



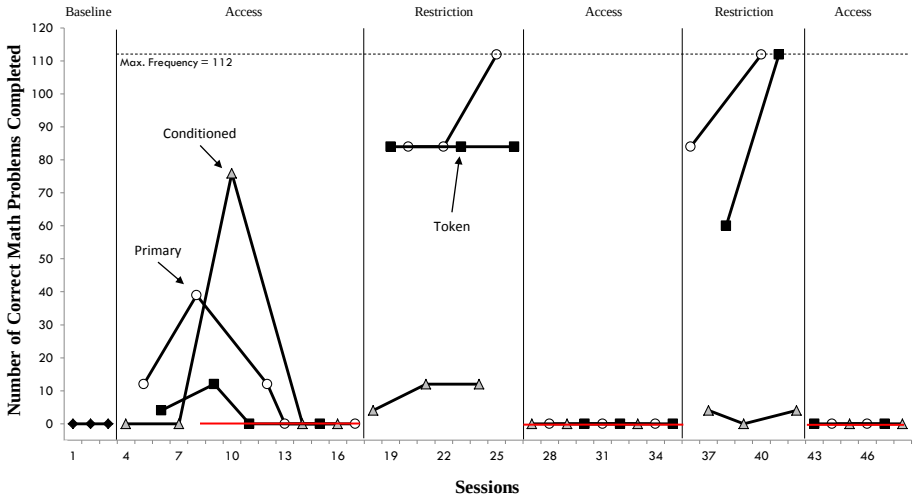
- Reinforcer Assessment
  - Session made of up multiple trials.
  - Reinforcers delivered on a progressive ratio (PR) schedule of reinforcement (Hodos, 1961).
    - Tokens: Delivered after each PR requirement. Back-up: after completion of all PR requirements.
    - Primary and Conditioned: Delivered after the completion of all the PR requirements.
  - Sessions continued until the participant reached PR max or 30 s elapsed without an occurrence of the dependent variable.

Methods

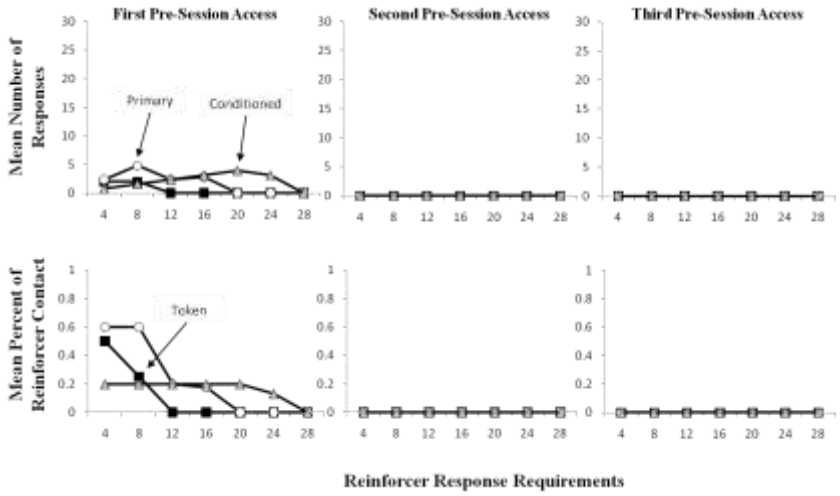
- Procedural Integrity
  - At least 75% of all sessions were videotaped.
    - 79% for Jack and 75% for Michael.
  - Assessed for at least 20% of the sessions.
    - 35% for Jack and 43% for Michael.
  - Procedural integrity was 100% for all participants.
- Interobserver Agreement
  - Assessed for at least 20% of the sessions.
    - 33% for Jack and 43% for Michael.
  - IOA coefficients were calculated by using the trial-by-trial and total count methods.
  - IOA was 100% for all participants.

Results

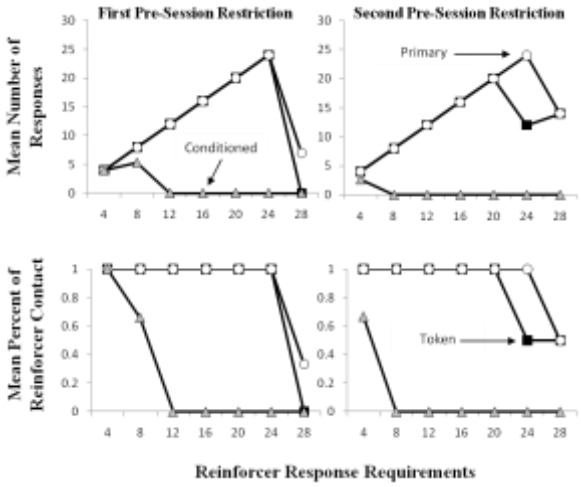
Results: Jack



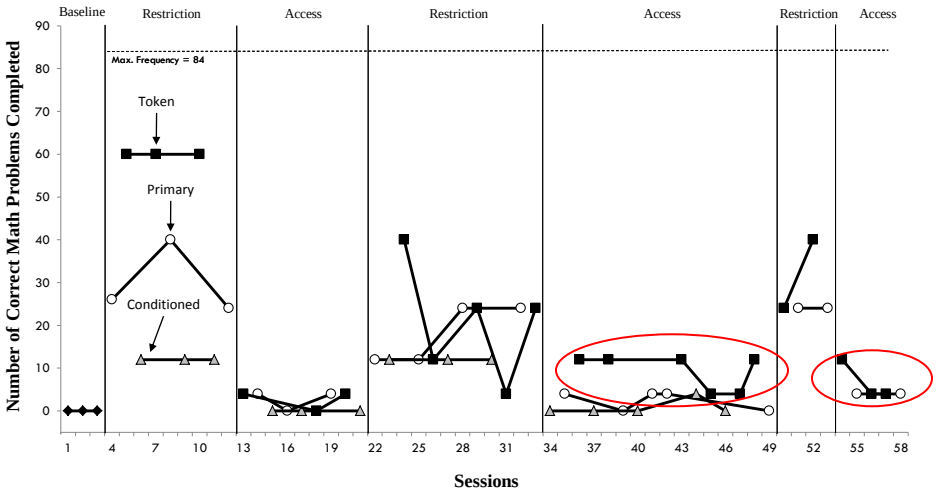
Results: Jack



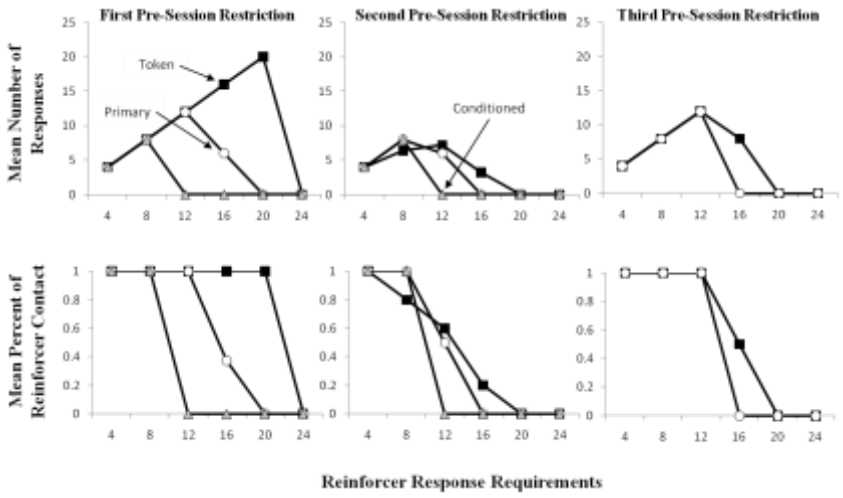
Results: Jack



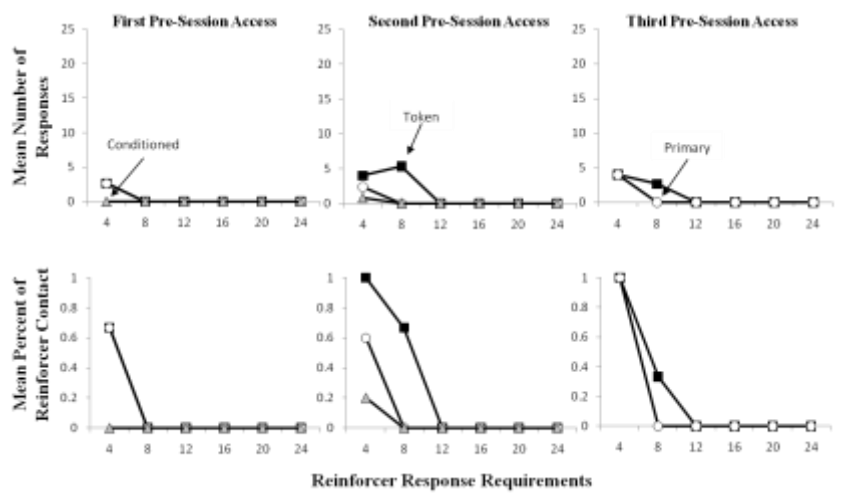
Results: Michael



Results: Michael



Results: Michael



Discussion

Discussion

- Research Question #1
  - *Will a functionally defined MO produce a clear abative- and evocative-effect on a target behavior maintained by primary, conditioned, and token reinforcers?*
  - The results show that pre-session access and restriction could reliably alter the effectiveness of primary, conditioned, and token reinforcers as well as the frequency of behavior maintained by those consequences.

Discussion

- Research Question #2
  - *Will a functionally defined MO have differential effects across the reinforcer classes?*
  - The results show possible differential effects for Michael, more responding was observed in the AO condition when token reinforcers were available.

Discussion

- The findings of this study support previous research that used a functionally defined MO (Lang et al., 2009; O'Reilly et al., 2009).
  - Extends this research by explicitly examining the effects of an MO across each reinforcer class.
- Address the limitations of Moher et al. (2008) in which one back-up reinforcer was used.
  - The results show that pre-session access to a limited number of back-up reinforcers had an abative-effect on the target behavior.
- It appears that an AO was in effect across conditions.
  - The procedures (e.g., PR schedule) may have exacerbated the behavior altering-effects of the AO.

Discussion

- Applied Implications
  - Contact with back-up reinforcers can abolish the value of a token.
    - Tokens are ***not free*** from the influence of MOs.
  - The time necessary to abolish the reinforcer can be excessive.
    - This type of MO may not be practical in many applied settings.
  - In a number of occasions, the naturally occurring AO was sufficient to abolish the reinforcer value of the stimulus.
    - Naturally occurring MOs should be taken into consideration when developing programming.

Discussion

- Considerations and Limitations
  - The initial variability in the level of responding for Jack.
    - It is possible that there was some uncontrolled variable that exerted influence over the target behavior.
  - Pattern of responding during the first pre-session restriction condition was not replicated for Michael.
    - Although functional control was demonstrated, overall experimental control was weakened.
  - Multiple treatment interference
    - The level of responding in association to one of the independent variables may have been different if examined in isolation.

Discussion

- Future Research
  - Examine the influence of the MO at the reinforcer level.
    - Deliver primary and conditioned reinforcers following the completion of each PR requirement.
  - Evaluate within-session probes of reinforcer effectiveness as a means of functionally identifying an AO.
    - This method may be more time efficient as well as provide more accurate information.
  - Isolating the variables that determine token reinforcer effectiveness.
    - The interactions between MO and token reinforcer could reveal the variables that influence token reinforcer effectiveness.

Discussion

- Conclusion
  - The analysis of motivation has come a long way.
    - Behavior analysts now possess a working theory of motivation.

  - A thorough understanding of MOs will further reinforcement theory and technology.
  - The findings of this study shed light on the interactions between MO and reinforcer class.
  - The contemporary analysis of MOs holds much promise as it relates to changing behaviors of social significance.