Preference Assessments for Students with ASD

Iser G. DeLeon

The Kennedy Krieger Institute and Johns Hopkins University School of Medicine

Overview

• Assessing the “strength” of reinforcers
• The “intrinsic motivation” issue
• Identifying stimulus preferences
• Additional considerations in arranging preference assessments
• The stability of preferences and reinforcer effectiveness
• Determinants of preferences and reinforcer effectiveness
Assessing the Strength of Reinforcers

• Reinforcer Assessment: **Rationale**
  – SPAs are just a prediction.
  – SPAs are conducted under extremely low effort requirements, often with simplistic responses
  – Predictions made under these conditions do not necessarily guarantee the utility of the stimulus in actual training or treatment

• Therefore, the predictions of SPA should be verified under conditions that more closely parallel actual training contexts
  – Actual work
  – Realistic schedules

“Single-Operant” Reinforcer Assessment

• Single programmed stimulus is available at any given time for a single response
• Typically, FR schedule
• DV = response rate or frequency
• Compare to baseline rates

Carr, Nicolson, & Higbee, 2000, Journal of Applied Behavior Analysis
**Concurrent-Schedule Reinforcer Assessment**

- Multiple response options concurrently available
- Each associated with a distinct stimulus delivered contingent upon appropriate response
- DV = relative response allocation across available alternative
- Often includes a control condition

---

**Relative vs. Absolute “Value”**

- HP and LP stimuli in concurrent schedules
- Then LP stimuli in single-operant (FR1)
- Two Outcomes:
  1. LP stimulus produces rates as high as HP stimulus (Ellen)
  2. LP stimulus produces lower rates (Mark)
- Outcome 1 observed in 7 of 8 participants

---

Conclude: Concurrent schedules are more sensitive to relative reinforcement, but can mask absolute reinforcement effectiveness.
Progressive-Ratio Schedules

- Ratio requirements increase across successive “trials.”
- Session continues until the participant ceases to respond for criterion amount of time
- Dependent measure = “break point”, highest schedule requirement completed before responding ceased

Conclude: Stimuli of different preferences levels may produce equal results in how “fast” an individual might work, but different results in “how much” work is done.


Demand Curves

- Behavioral economics tool
- Relates:
  - Unit price of the reinforcer
  - To total amount of a reinforcer that is consumed

Conclude:
- Law of Demand - All else being equal...as unit price increases demand (consumption) decreases and vice versa.
- “Relative Value” can be gauged by relative elasticity.

DeLeon et al, under review
**Overjustification Effects in IDD**

**Q: Do extrinsic rewards decrease intrinsic motivation in persons with IDD??**

![Table 1](image)

"...extrinsic motivators—including A’s, sometimes praise, and other rewards—are not merely ineffective over the long haul but counterproductive with respect to the things that concern us most: desire to learn, commitment to good values, and so on."

Alfie Kohn
*Educational Leadership*

---

**Extrinsic Reinforcement & Intrinsic Motivation**

- Eisenberger & Cameron (1996)
  - Meta-analysis of the available research - using effect sizes
    - Useful in putting all outcomes on the same quantitative scale
  - Separated effects according to reward type
    - Reward for what (quality dependent, completion-dependent, performance independent)
    - What sort of reward (tangible, verbal)
  - Examined separate effects on engagement (“free time”) and attitudes towards task
Calculation of Effect Sizes:

Experimental Group Mean Value – Control Group Mean Value
Pooled Standard Deviation

Interpretation of Effect Sizes:
• EF < 1 = Effect of the independent variable (detrimental effects of reward)
• EF > 1 = No effect of the independent variable (no detrimental effects)

Eisenberger & Cameron, 1996, American Psychologist
**Overjustification Effects in IDD**

- Range of $d = -5.45$ to 7.63
  - Mean = 0.07
  - Median = -0.06
  - Mode = 0.00

- Single-sample t-test
  - $t = 1.90, p = .850$

---

**Schultz, Sigurdsson, & DeLeon (accepted pending revision), Journal of Applied Behavior Analysis.**

---

- Higher proportional levels of responding in BL have higher effect sizes
  - $r = .384$
  - $p = .016$
  - $R^2 = .147$

- Overjustification effects observed for behaviors of greater “intrinsic interest”

---

**Schultz, Sigurdsson, & DeLeon (accepted pending revision), Journal of Applied Behavior Analysis.**
Extrinsic Reinforcement & Intrinsic Motivation

• What are some behavioral mechanisms that may account for what appears to be lessened intrinsic motivation?
  – Satiation, especially when…
    • Reinforcers increase task engagement
    • Lessened motivation examined for brief periods immediately after reward period
  – Contrast effects
    • Changes in the rate of reinforcement under one condition can produce an opposite change in rate of responding in another condition
  – Learned helplessness phenomena
    • In performance-independent reward
    • “It doesn’t matter how well I do”

Extrinsic Reinforcement & Intrinsic Motivation

• So what might we say when confronted with overjustification hypothesis?
  – Reinforcement systems depends on task completion, performance quality, or both…reward procedures not reliably found to reduce intrinsic task interest.
  – Some effects may be best attributed to satiation, especially when reward does increase engagement in the response and the effects are measured immediately afterwards.
  – Quality-dependent verbal rewards actually have a positive effect on intrinsic interest.
  – We generally do not arrange reinforcement contingencies for behaviors already occurring at high rates.
Identifying Stimulus Preferences

Q: What sort of stimuli should we assess?
Q: What procedures do we use to assess them?

What sorts of stimuli are commonly delivered?

Table 2. Categories of Stimuli Most Frequently Delivered, by Certification Status

<table>
<thead>
<tr>
<th>Category of Item Used</th>
<th>Percentage of All Responses</th>
<th>Percentage of Responses: BCBA/BCaBA</th>
<th>Percentage of Responses: Non-BCBA/BCaBA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social praise/attention (high-fives, etc.)</td>
<td>91.5</td>
<td>94.4</td>
<td>90.0</td>
</tr>
<tr>
<td>Tokens/Points</td>
<td>65.6</td>
<td>81.3</td>
<td>57.6</td>
</tr>
<tr>
<td>Breaks from work</td>
<td>65.0</td>
<td>77.6</td>
<td>58.6</td>
</tr>
<tr>
<td>Edibles</td>
<td>50.2</td>
<td>69.2</td>
<td>40.5</td>
</tr>
<tr>
<td>Toys</td>
<td>49.0</td>
<td>71.0</td>
<td>37.6</td>
</tr>
<tr>
<td>Independent free play</td>
<td>49.0</td>
<td>59.8</td>
<td>43.3</td>
</tr>
<tr>
<td>Access to physical activities (e.g., running, sports, playground)</td>
<td>37.5</td>
<td>42.1</td>
<td>35.6</td>
</tr>
<tr>
<td>Sensory items (e.g., thera-band, theraputty, muscle massager, fan)</td>
<td>33.8</td>
<td>43.0</td>
<td>29.0</td>
</tr>
<tr>
<td>Community-based activities</td>
<td>19.2</td>
<td>21.5</td>
<td>18.1</td>
</tr>
</tbody>
</table>

Graff & Karsten, 2012, Behavior Analysis in Practice
Reinforcer Selection

Ecological Fit of Reinforcers

- Is it easily replenished?
- Does it cost much?
- Does it fit naturally in the environment in which it will be used?
- Can its use cause other sorts of detrimental effects?
- Does its effectiveness wane easily across short periods of time?
- Does its delivery disrupt ongoing behavior?

Common Forms of Assessment

Table 4. Types of Assessment Procedure Used by Certified and Non-Certified Respondents

<table>
<thead>
<tr>
<th>Method</th>
<th>Percentage of All Respondents</th>
<th>Percentage of BCBAs/BCaBAs</th>
<th>Percentage of non-BCBAs/BCaBAs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Informally observing the individual</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Asking parents/caregivers what the individual likes</td>
<td>89.3</td>
<td>84.3</td>
<td>89.7</td>
</tr>
<tr>
<td>Informally asking the individual what he/she likes</td>
<td>82.4</td>
<td>83.3</td>
<td>82.2</td>
</tr>
<tr>
<td>Formal (i.e., published parent/caregiver survey)</td>
<td>75.6</td>
<td>73.1</td>
<td>77.1</td>
</tr>
<tr>
<td>Percentage who reported using at least one direct (i.e., published approach-based or free operant) preference assessment method</td>
<td>36.5</td>
<td>42.6</td>
<td>33.2</td>
</tr>
</tbody>
</table>

Graff & Karsten, 2012, Behavior Analysis in Practice
The RAISD
Reinforcer Assessment for Individuals with Severe Disabilities

Client Name: __________________________ Date: __________________________
Caregiver Name: __________________________

The purpose of this structured interview is to get as specific information as possible from the parent (or caregiver) as to what they believe would be useful reinforcers for the client. After the parent has generated a list of preferred stimuli, ask additional probe questions to get more specific information on the reinforcer and these stimulus conditions under which the object or activity is most preferred (e.g., what specific TV shows is his favorite? What does she do when she plays with a mirror? Does she prefer to do this alone or with another person?).

We would like to get some information on __________________________ preferences for different items and activities.

Fisher, Piazza, Bowman, & Amari, 1996, American Journal on Mental Retardation

4. Some children really enjoy certain food or snacks such as ice cream, pizza, juice, graham crackers, cookies, McDonald’s hamburgers, etc. What are the things you think __________ most likes to eat?

Response to probe questions:

5. Some children really enjoy physical play or movement such as being tickled, wrestling, running, dancing, swinging, being pulled on a scooter board, etc. What are the activities of this kind that you think __________ most enjoys?

Response to probe questions:

6. Some children really enjoy touching things of different temperatures, cold things like snow or an ice pack, or warm things like a hand warmer or a cup containing hot tea or coffee. What are the activities of this kind that you think __________ most enjoys?

Response to probe questions:
After completion of the survey, select all the stimuli which could be presented or withdrawn contingent on target behaviors during a session or classroom activity (e.g., a toy could be presented or withdrawn, a walk in the park could not). Write down all of the specific information about each selected stimulus on a 3x5 index card (e.g., “having a female adult read him the Three Little Pigs”). Then have the parents select the top 16 stimuli and rank order them using the cards. Then list the ranked stimuli below.

1. 
2. 
3. 
4. 
5. 
6. 
7. 
8. 
9. 
10. 
11. 
12. 
13. 
14. 
15. 
16. 

Are there any items (from the above list) that you would not want to use?

Are there any items (from the above list) that you would not want to limit your child’s access?

Accuracy of Caregiver Rankings

- Compared teacher & SPA rank hierarchies; 9 typically developing preschoolers
- Strong positive correlation between rankings in 1/9 cases
- Negative correlation between rankings in 5/9 cases
- Presented these stimuli contingently upon occurrence of a response

Conclude: Direct observation methods are more accurate in determining reinforcer effectiveness than self-, parent-, or care-giver report.

Cote et al., 2007, Journal of Applied Behavior Analysis
Identifying Stimulus Preferences

• Approach- or selection-based preference assessments
  – Items are presented systematically to produce preference hierarchies
  – Variations differ with respect to how many items are presented during a given trial
  – Preference hierarchies are derived from calculations of the number of times a stimulus is select given the number of times each is available

Video of Single-Stimulus Presentation
Identifying Stimulus Preferences

- Single-Item/Approach Method
  - AKA single-stimulus assessment
  - Place items, one at a time in front of the person
    - Typically, 10 trials per item
  - Measure whether or not they approach the item
  - Hierarchy based on the number of times an item was approached given the number of times it was available:
    - Approaches/trials

Single-Stimulus Presentation Method

Identifying Stimulus Preferences

- Paired-choice preference assessment
  - AKA forced-choice preference assessment
  - Place items, two at a time in front of the person
    - Trials continue until each item has been paired with each other item once (all possible pair-wise permutations)
    - Number of trials = n (n-1) / 2
      - for example: (5 x 4) / 2 = 10 trials
  - Record which of the two items they approach
  - Hierarchy based on the number of times an item was approached given the number of times it was available:
    - Approaches/trials
Video of MSWO

Identifying Stimulus Preferences

- Multiple-Stimulus Preference Assessments
  - Present all items in the array simultaneously
    - Participants select one from among all items during each trial
  - Variations:
    - With replacement –
      - Selected items are returned to the array
      - Provides info on the single most preferred stimulus
    - Without replacement –
      - Selected items are not returned to the array
      - Provides more information about preferences among the array
Identifying Stimulus Preferences

- Relative advantages and disadvantages of selection-based methods:
  - Single stimulus
    - Simple procedure; can incorporate as many items as you like
    - May be prone to false positives
  - Paired-choice
    - May be more sensitive to relative preferences; thus useful when you want a larger selection of predicted reinforcers
    - Time-consuming (length expands dramatically with the number of items assessed)
  - Multiple stimulus
    - Can be very brief; thus useful for daily use
    - Number of items included might be limited by person’s abilities
    - Reports of “saving the best for last” phenomena
Identifying Stimulus Preferences

- Duration-based preference assessments - items are presented to the individual and the proportion of time spent engaging the items is recorded
  - Free operant (or multiple item) assessments - all items are presented simultaneously
  - Single item presentation - each item is presented individually several items

Video of Free Operant
Roane, Vollmer, Ringdahl, & Marcus (1998) Journal of Applied Behavior Analysis

Identifying Stimulus Preferences

• Competing stimulus preference assessments
  – Duration based assessments used also to determine the extent to which stimuli displace problem behavior
  – Two measures simultaneously:
    • Stimulus engagement
    • Problem behavior
  – Stimuli selected based on the combined measures

DeLeon, Toole, Gutshall & Bowman (2005), Research in Developmental Disabilities
SPA: Additional Considerations

Q: How can we assess larger items, community activities and other things we can’t fit on the table?

Q: Does it matter if we mix up all kinds of times in the same assessment?

Q: Does it matter what sort of preference assessment I use if the person displays problem behavior?

Q: The individual has an ASD—should I even consider using praise? How do I assess it?
SPA: Inclusion of activities

- Sometimes we want to determine preferences among items that do not easily fit on a table top.
- What options are there for these potential reinforcers:
  - Verbal assessments (e.g., Cohen-Almeida, Graff, & Ahearn, 2000; Northup, 2000).
    - Depends on language abilities
  - Pictorial assessments (e.g., Clevenger & Graff, 2005; Conyers et al., 2002; Graff & Gibson, 2003; Graff, Gibson, & Galiatsatos, 2006)
    - Depends on picture-to-object matching abilities

SPA: Inclusion of activities

- Conyers et al. (2002)
  - Determined preferences via paired-choice assessments
  - Compared “accuracy” (how often participants chose the known preferred food in 2-choice trials) under 3 conditions:
    - Object – presented actual items
    - Spoken – “Do you want X or Y”
    - Picture – presented pictures of the items
  - Examining correspondence of accuracy in these 3 modes as a function of abilities on the Assessment of Basic Learning Abilities (ABLA)
SPA: Inclusion of activities

- Level 3 = Can make 2 choice visual discriminations
- Level 4 = a two-choice visual quasi-identity match-to-sample discrimination
  - put a manipulandum into the matching container (e.g., a yellow cylinder in the yellow can and a red cube in the red box)
- Level 6 = a two-choice auditory-visual combined discrimination
  - E.g., place a piece of foam into the container that was verbally requested by the tester (e.g., “yellow can” or “red box”, not necessarily matched on color).

Conclude: Verbal and pictorial SPAs can be accurate, but reserve them for individuals with established discrimination abilities.

Conyers et al., 2002, Journal of Applied Behavior Analysis

SPA: Mixed Arrays - Food & Leisure

- Conducted preference assessments with mixed (food & leisure items) arrays
- Repeated preference assessments, minus the food items
- Assessed whether initially LP activities functioned as reinforcers.

**SPA: Mixed Arrays - Food & Leisure**


Conclude: Food items often downward displace leisure items in mixed arrays; but those leisure items might be effective reinforcers nonetheless—assess separately!

---

**SPA: Function of Problem Behavior**

- Children with problem behavior sensitive to varying reinforcers (tangible, attention, escape)
- Conducted 3 forms of preference assessments (PS, MSWO, Free Operant)
- Examine with forms interact with which functions

Conclude: PS & MSWO evoke problem behavior maintained by tangible reinforcers; FO does not, but FO evoked problem behavior maintained by attention.

Kang et al., 2011, Journal of Applied Behavior Analysis
SPA: Praise & Other Social Stimuli

- Arguments in favor of praise/social reinforcers
  - Natural in the classroom
  - Does not interrupt responding
  - No cost other than caregiver effort
  - Takes little time
    - Can be delivered immediately
    - Can be delivered simultaneously to multiple individuals
  - As a generalized conditioned reinforcer, may be less subject to satiation
  - Behaviors developed using social reinforcers may be more easily maintained in generalization settings
  - May increase task interest?

SPA: Praise & Other Social Stimuli

- However,
  - Praise not effective for all
    - Hence, it is important to assess as we do with other reinforcers
  - Social reinforcers may be difficult in incorporate into preference assessment
  - Children with ASD less sensitive to social stimuli as reinforcers?
**SPA: Praise & Other Social Stimuli**

Goldberg, Allman, Hagopian, Triggs, Frank-Crawford, Mostofsky, Denkcla, & DeLeon (in preparation)

---

**Assessing Social Reinforcers**

- Social reinforcers often difficult to include in preference assessments
- Obviated preference assessments
  - conducted brief reinforcer assessments for social stimuli
    - Rapid alternation
    - Social consequence vs. extinction
- Eliminates difficulty of incorporating social stimuli in preference assessment.
- Note the variety of social stimuli

Smaby, McDonald, Ahearn, & Dube, 2007, Behavioral Interventions
Assessing the Strength of Reinforcers

• Preference/Reinforcer Assessment Summary
  – Select methods best suited to your objectives:
    • How are you using the stimuli?
      – What behavior are you seeking to reinforce?
      – What sort of schedule will you arrange?
      – Do you need a single or multiple reinforcers (For stimulus variation? For differential outcome effects?).
    • Will you be able to conduct frequent assessments?
    • What is the extent of person’s disability?
    • Are you concerned about problem behavior?
  – Stimuli determined to be of low preference may still be valuable reinforcers

Assessing the Strength of Reinforcers

• What we do not know:
  – Studies on acquisition rates
    • We have data on correct responding, choice, etc.
    • But these measures do not indicate the differential ability of one stimulus or another to enhance new learning.
    • This is important because presumably, that is what the reinforcer will be used for.
  – Studies on longer-term effects (e.g. are more IEP goals mastered) through careful selection of reinforcers?
  – Studies that examine differential effects of HP stimuli on other response/reinforcer dimensions
    • Do HP stimuli result in greater tolerance to reinforcer delays?
    • Can HP stimuli be thinned more readily?
**Shifts in Preference and Stimulus Value**

*Q:* How stable are preferences and reinforcer efficacy over time?

*Q:* Are changes in preference associated with corresponding changes in the utility of reinforcers?

**Shifts in Preference and Stimulus Value**

- 22 adults with IDD
- Conducted PS preference assessments at point 1
- Repeated the PS preference assessments for leisure items at intervals ranging between 12 and 20 months apart
- Examined rank-order correlations between the first and second assessments

*Zhou, Iwata, Goff, & Shore, 2001, Journal of Applied Behavior Analysis*
Frequency of Preference Assessment

Table 6. Frequency of Conducting Full-scale* and Mini Preference Assessments** by Certification Status

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Hourly</td>
<td>0</td>
<td>0</td>
<td>23.0</td>
<td>8.6</td>
</tr>
<tr>
<td>Several times a day</td>
<td>2.9</td>
<td>1.5</td>
<td>29.0</td>
<td>19.3</td>
</tr>
<tr>
<td>Once a day</td>
<td>3.8</td>
<td>1.0</td>
<td>9.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Several times a week</td>
<td>2.9</td>
<td>2.6</td>
<td>7.0</td>
<td>5.6</td>
</tr>
<tr>
<td>Once a week</td>
<td>4.6</td>
<td>1.0</td>
<td>7.0</td>
<td>4.1</td>
</tr>
<tr>
<td>More than once a month</td>
<td>12.5</td>
<td>8.2</td>
<td>10.0</td>
<td>4.1</td>
</tr>
<tr>
<td>Once a month</td>
<td>18.3</td>
<td>4.1</td>
<td>2.0</td>
<td>4.6</td>
</tr>
<tr>
<td>Less than once a month</td>
<td>44.2</td>
<td>24.0</td>
<td>9.0</td>
<td>9.6</td>
</tr>
<tr>
<td>Never</td>
<td>10.6</td>
<td>57.7</td>
<td>4.0</td>
<td>43.1</td>
</tr>
</tbody>
</table>

Graff & Karsten, 2012, Behavior Analysis in Practice

Shifts in Preference and Stimulus Value

- Zhou et al. (2001)
  - Mean rank-order correlation = 0.11 across participants
  - However, greater stability for most participants when only the top 5 stimuli are considered
    - Suggests highest preferences may be more stable
    - Corresponds with informants ability to offer accurate opinions about reinforcers

Graff & Karsten, 2012, Behavior Analysis in Practice
Shifts in Preference and Stimulus Value

**Q: Do individuals with ASD display more stable preferences than individuals without similar diagnoses?**

<table>
<thead>
<tr>
<th>Time Between 1st and Subsequent Preference Assessment</th>
<th>Mean Rank Order Correlation Between First and Subsequent Preference Assessments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Day</td>
<td>0.0</td>
</tr>
<tr>
<td>1 Week</td>
<td>0.2</td>
</tr>
<tr>
<td>2+ Weeks</td>
<td>0.4</td>
</tr>
</tbody>
</table>

**Autism Spectrum Disorders Group**

<table>
<thead>
<tr>
<th>Time Between 1st and Subsequent Preference Assessment</th>
<th>Percentage of Assessments in Which the Top Ranked Item was the Same as in the First Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Day</td>
<td>0</td>
</tr>
<tr>
<td>1 Week</td>
<td>20</td>
</tr>
<tr>
<td>2+ Weeks</td>
<td>40</td>
</tr>
</tbody>
</table>

**Non ASD Group**

**Shifts in Preference and Stimulus Value**

**Q: Are food preferences more or less stable than non-food preferences?**

- Ciccone, Graff, & Ahearn (2007)
  - Examined rank-order correlation coefficients for food only, N = 8
    - After 6 mos, mean coefficient = 0.66
    - After 12 mos, mean coefficient = 0.46
  - Recall Zhou et al. (2001) used leisure items only, coefficient = 0.11
    - However, differing preference assessment, N, and interval between assessments

64
Shifts in Preference and Stimulus Value

- What shall we make of these differences?
  - Why might food preferences be more stable?
    - Local and temporally extended satiation effects for leisure items?
  - Potentially, categories showing greater stability may require less frequent assessment?
    - However, there are dangers inherent in adopting this stance…

- DeLeon et al. (2001)
  - Are changes in preference associated with corresponding changes in the utility of reinforcers?
  - Analysis:
    - Conducted one lengthy paired-choice assessment before the study
    - Conducted a brief SPA before daily training sessions
  - Examined
    - How regularly did the daily SPA match the initial results
    - One days that it did not match, was the stimulus identified as most highly preferred that day the more potent reinforcer?
Utility of Frequent Assessment in Acquisition

- Frequent assessment
- Sometimes helps; sometimes does not help

Thompson, DeLeon, Frank-Crawford, Triggs, & Carreau (unpublished manuscript)
Utility of Frequent Assessment in Acquisition

- What’s the determining factor?
  - Variable preferences!

Determinants of Stimulus Value

- Preferences are not static
- Changes in preference can also mean changes in the effectiveness of stimuli
  - Not offering this as an intervening variable
  - Parallel processes
- Time is not necessarily the relevant independent variable

Q: What other operations are responsible for changes in preference and effectiveness?
Determinants of Stimulus Value

• What operations might alter the prolonged value of a stimulus?
  – Repeated exposure?
    • Value enhancing effects (mere exposure)
      – Learning how to extract reinforcement from a stimulus?
      – Explains displacement of leisure items by food?
      – Reinforced engagement?
    • Value diminishing effects (long-term satiation)
  – Stimulus-stimulus pairings?
  – Contingency?

Determinants of Stimulus Value

• Hanley et al. (1999, 2003, 2006)
  – Shifting activity preferences: Can we make something preferred when it was not already?
    • By pairing less preferred activity with established reinforcers through contingent delivery?
    • By pairing less preferred activity with established reinforcers through noncontingent delivery?
**Determinants of Stimulus Value**

- Hanley, Iwata, & Lindberg (1999)
- Examined choices between activities in a concurrent chain:
  - First link determined the subsequent activity through selections of pictorial representations
  - Differing arrangements/schedules in the subsequent activity
- 10 selections per session
- Measured proportion of selections as a function of
  - Access vs. no access to chosen activity
  - Reinforcement delivered for engagement (not choosing) in the less preferred activity

---

**Determinants of Stimulus Value**

- Selected 1 HP and one LP activity
  - Measured relative response allocation
- Attempted to shift preferences towards the LP activity through conditioning procedure:
  - Established reinforcers delivered on fixed-time schedules during access to LP stimulus
  - No reinforcement during access to HP stimulus
  - Each arranged for 3, 5-min sessions, followed by tests sessions (no consequences for either activity)

Determinants of Stimulus Value

- Hanley, Iwata, & Roscoe (2006)
  - Examined the effects of satiation and conditioning on preference ranks across subsequent assessments for adults with developmental delay
  - Conducted initial preference assessments, then:
    - Satiation for highest ranked stimulus
      - Free access for 2-3 hours per day
    - Conditioning for lower ranked stimuli
      - Pairing the stimulus with continuous attention and continuous availability of preferred edibles, 5 1-min trials per day
    - Exposure for control stimuli, 5 1-min trials per day
  - Repeated preference assessments at least 24 hrs after last satiation & conditioning procedures

**Determinants of Stimulus Value**

- Conclusions from Hanley et al. studies:
  - Clear preferences emerged when access follows pictorial representation
  - Enhancing an activity with supplemental contingent reinforcement can shift choices towards that activity
  - Noncontingent pairing of an activity with established preferred stimuli can shift choices towards that activity
  - Effects seem to be transient (do not persist after discontinuation of the pairing procedures)

**Determinants of Stimulus Value: Variation and Choice**

**Q:** *Can varying reinforcers or providing choice of reinforcers produce beneficial effects?*

- Several methods for incorporating different reinforcers
  - *Stimulus variation*
  - *Daily brief preference assessment*
  - *Pre-session selection*
  - *Post-response reinforcer choice*

**Determinants of Stimulus Value: Variation and Choice**

- **Pre-session selection**
  - ask the learner which reinforcer they would like to earn in the following instructional session

- **Within-session (post-response) choice**
  - Permit the learner to choose from a small array of reinforcers each time the schedule requirements are met
Determinants of Stimulus Value: Variation and Choice

- Graff & Libby (1999)
  - Pre-session selection
    - Participant permitted to choose 1 of 3 HP edible items prior to each session
    - That stimulus used to reinforce responding (button pressing; FR 50 to 60) throughout the session
  - Within-session choice
    - 3 HP edible items placed behind response button
    - Participant chose 1 of the 3 after each reinforcer delivery
  - Compared these conditions in both single and concurrent arrangements

- N = 4
- All displayed preference for within-session choice during concurrent schedule
- 3 of 4 displayed higher rates during within-session choice condition in single-operant schedule

Determinants of Stimulus Value: Variation and Choice

- Reinforcer choice: Smith et al. (1995)
- Pre-session choice
  - Compared 2 conditions to BL (no reinforcer) and to each other
    - Subject choice:
      - Subject selected 1 of 4 HP stimuli to be used during the upcoming session
      - Stimulus delivered on FR5 schedule for simple responses (place blocks in bucket)
    - Experimenter choice:
      - Same response and schedule
      - Random selection among the stimuli by the experimenter prior to session

Determinants of Stimulus Value: Variation and Choice

- Reinforcer choice: Lerman et al. (1997)
- **Within-trial choice**
  - Compared choice of reinforcer and yoked no-choice conditions on response rates during simple FR schedules
  - All reinforcers were HP stimuli identified via SS assessment method
    - Choice = present 2 from a pool of 5
    - **Yoked No Choice:**
      - Delivered the reinforcer without choice
      - Reinforcers selected on the basis of order chosen in the preceding choice condition

Determinants of Stimulus Value: Variation and Choice

• Smith et al. and Lerman et al. suggested no choice effects if all stimuli are high-preference
  – Do you therefore get choice effects if stimuli are low-p?
• Waldron-Soler et al. (2000)
  – Replicated Lerman procedures, except…
  – Used LP stimuli
    • To perhaps obviate ceiling effects

**Determinants of Stimulus Value: Variation and Choice**

- Yoking studies suggest no effects of choice
- The problem with yoking procedures:
  - Although they approximate a method of control for momentary fluctuations in preference
  - They are not perfect because preferences may change across brief time spans or as a function of exposure in preceding sessions
- How, then, to perfectly isolate the effects of choice?

---

**Determinants of Stimulus Value: Variation and Choice**

  - Concurrent-chain schedule
    - Initial link = choose one of 3 terminal link conditions
    - Terminal links = VI reinforcement schedule
      - (a) the choice of a reinforcer (choice), but identical reinforcers (5 red M & M’s)
      - (b) the delivery of an identical reinforcer (no choice)
      - (c) no material reinforcer (control)
    - Preference for choice determined by selection in the initial link
Determinants of Stimulus Value: Variation and Choice

- Smith et al., Lerman et al., Waldron-Soler et al.
  - No effect of choice in single operant
- Tiger et al.
  - Preference for choice in concurrent choice
- Conclusions:
  - Choice may be preferable but not always beneficial
  - Is it a case of a slight effect that would show up under very sensitive arrangements, but not insensitive arrangements?
Determinants of Stimulus Value: Variation and Choice

• Geckeler, Libby, Graff, & Ahearn (2000)
  – Examined response rates during choice and no-choice conditions on FR schedules (FR20 to FR30)
  – Evaluated under single-operant schedule
  – Evaluated under concurrent schedule
    • Two identical responses available
    • Could work on either one

Determinants of Stimulus Value: Variation and Choice

- Things we know less about when considering choice of reinforcement
  - Are there situations in which choice may be aversive?
  - Are choice effects sufficient to override other inequities in concurrent reinforcement arrangements?
  - Choice effects in single-operant schedules when preference levels are unknown?
  - Choice under PR schedules?
  - Does it matter in acquisition?

Determinants of Stimulus Value: Motivational Operations

Q: Do relative states of deprivation and satiation impact the effectiveness of common reinforcers?

- Motivational Operation: An environmental event, operation, or stimulus condition that serves the following 2 functions:
  - Reinforcer establishing function – momentary alters the reinforcing effectiveness of other events.
  - Evocative function – momentarily alters the frequency of occurrence of the type of behaviors that produces those other events as a consequence.
Determinants of Stimulus Value: Motivational Operations

• Stimulus deprivation –
  – Momentarily increases the reinforcing effectiveness of that stimulus.
  – Momentarily increases the frequency of behavior that produce the stimulus as a consequence.

• Stimulus satiation –
  – Momentarily decreases the reinforcing effectiveness of the stimulus.
  – Momentarily decreases the frequency of behaviors that have produced the stimulus as a consequence.

Determinants of Stimulus Value: Motivational Operations

• Gottschalk, Libby, & Graff (2000)
  – Deprivation & satiation effects with food on preference assessment outcomes
    • Control: Regulated (premeasured) access for 24 hr before assessment
    • Deprivation: 48 hour deprivation for one stimulus at a time; regulated access for others
    • Satiation: 10 min free access before assessment; regulated access for other
  – Paired-choice preference assessment following manipulations
Determinants of Stimulus Value: Motivational Operations

- McAdam et al. (2005)
  - Deprivation and satiation effects with activities


Determinants of Stimulus Value: Motivational Operations

- Satiation can influence preference rank (see also Hanley et al., 2006)

Q: Does satiation similarly influence performance?
   - Depends upon the specific operation and the person
   - Are the sorts of changes in deprivation/association correlated with normal life enough to shifts response patterns?

Determinants of Stimulus Value: Motivational Operations

- Vollmer & Iwata (1991)
  - Examined rates of simple responses under conditions of deprivation and satiation for various stimuli
  - Food
    - Dep: 30 min before lunch
    - Sat: 15 min after lunch + 10 min of free feeding
  - Leisure activity
    - Dep: No access for at least 30 min
    - Sat: Continuous access for 30 min
  - Attention (effects on praise)
    - Dep: 15 min with no interaction
    - Sat: 15 min of continuous interaction
Table 1
Overall Mean Response Rates: All Stimuli

<table>
<thead>
<tr>
<th>Stimulus</th>
<th>Baseline</th>
<th>Satiation</th>
<th>Deprivation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Craig</td>
<td>0.36</td>
<td>0.68</td>
<td>2.62</td>
</tr>
<tr>
<td>Sam</td>
<td>0.93</td>
<td>2.80</td>
<td>4.64</td>
</tr>
<tr>
<td>Lonny</td>
<td>2.65</td>
<td>0.42</td>
<td>9.48</td>
</tr>
<tr>
<td>Music</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rich</td>
<td>2.16</td>
<td>1.54</td>
<td>8.24</td>
</tr>
<tr>
<td>Donny</td>
<td>5.88</td>
<td>2.48</td>
<td>5.06</td>
</tr>
<tr>
<td>Social</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Donny</td>
<td>2.48</td>
<td>10.36</td>
<td>17.78</td>
</tr>
<tr>
<td>Sam</td>
<td>1.34</td>
<td>3.99</td>
<td>5.32</td>
</tr>
</tbody>
</table>

Zhou, Iwata, & Shore (2002)

- Deprivation and satiation for food reinforcers under less contrived arrangements
  - Dep: 30-min before lunch
  - Sat: 30-min after lunch
  - No additional exposure, unlike Vollmer & Iwata (1992)
Distinguishing Stimulus Value: Motivational Operations

- Conclusions on Motivational Operations
  - Can influence preference assessment results
  - May influence reinforcer value, but not necessarily under naturalistic conditions
  - More interesting examples may not involve deprivation or satiation, but conditioned establishing operations:
    - Transitive CEO manipulated to enhance motivation for mands in response chains
  - Are there different “kinds” of satiation?
Contingency and Stimulus Value

Q: Does the amount of work the person has to complete to earn a reinforcer influence the subsequent effectiveness of that reinforcer?

```
Contingency and Stimulus Value

"..such are the Tempers and dispossessions of Seamen in general that whatever you give them out of the common way, altho it be ever so much for their good yet it will not go down with them and you will hear nothing but murmurrings gainest the man that first invented it; but the Moment they see their superiors set a Value upon it, it becomes the finest stuff in the World and the inventor an honest fellow."

Captain James Cook, April, 1769

"The harder the conflict, the more glorious the triumph. What we obtain too cheap, we esteem too lightly."

Thomas Paine, The Crisis, 1776
```
• Free reinforcers lose value more rapidly than earned reinforcers
• Are interventions that involve contingent reinforcers more durable than interventions that involve noncontingent reinforcers?
• Is the loss of earned reinforcers more potent than the loss of free reinforcers?


Contingency and Stimulus Value

“Gambling with house money”
Group Mean Number of Phase 2 Trials Completed

Earn Free

$t (13) = -3.47, p < .05$
Contingency and Stimulus Value

• Variable effects:
  – Contingent stimuli do not always increase in value and greater effort not related to greater increase in value
    • Weak pre-post design
    • Under what conditions do effects occur?
• Consistent effects:
  – Noncontingent delivery may devalue stimuli more rapidly
    • Did contingency at least help to preserve value against what me be a natural decline?
  – Is the decrement sufficient to impact clinical intervention?

Continuity and Stimulus Value

• Q: Much of our knowledge of reinforcer effectiveness in IDD is built on providing brief access to reinforcers following small numbers of responses? Is this really what kids want?
• “Procedures that interrupt continuity might alter the quality of the reinforcer, thus discounting its effectiveness (Hackenberg & Pietras, 2000)”
  – The effectiveness of some reinforcers (e.g., video) might partly depend on uninterrupted access
  – Is the individual willing to “pay” to preserve continuity?
**Continuity and Stimulus Value**

- Token for each correct response
- Tokens exchanged after session.
- Each token = 30 s access to activity
- 30 s access to reinforcer immediately following each response
- No tokens used

---

DeLeon, Chase, Frank-Crawford et al. (under review), Journal of Applied Behavior Analysis
**Summary and other directions**

*Demand functions for stimulus classes*
- Demand is less elastic for tokens exchangeable for a reinforcer than for the reinforcer itself

![Graph showing consumption expressed as percentage consumed under FR1.](image)

**Substitutability and Stimulus Value**

*Q*: *Can the effectiveness of a reinforcer influenced by the nature of other, qualitatively different reinforcers in the environment?*

- Behavioral economics: Imports principles of microeconomics to the study of operant behavior
- Why behavioral economics in IDD?
  - Investigation of choice under conditions of asymmetrical reinforcers
  - Investigation of consumption under various conditions of constraint
  - *Once the parallels are drawn and validated, opens the door to relations heretofore only considered by economists*
Behavioral Economics

- Commodities
  - Econ: Goods and services
  - B. Econ: Reinforcers

- Unit Price:
  - Econ: $$$$ paid per unit of commodity (4.05 per gallon)
  - B. Econ: Number of responses “paid” per unit of reinforcer

- Consumption:
  - Econ: Total quantity of a commodity consumed, typically at the population level
  - B. Econ: Total amount of a reinforcer obtained per unit time, typically at the individual level

Population Demand Curve

Estimated demand curve based on scan data

Above, the estimated demand curve of Turning Leaf Merlot illustrates the inverse relationship between price and quantity.
Individual Demand Curve

**Fig. 4.** Left panel: Daily consumption of food or saccharin as a function of FR schedule, in log–log coordinates. Right panel: Total daily lever presses for either food or saccharin as a function of FR schedule, in log–log coordinates. Data from a representative rhesus monkey.

---

**Elasticity of Demand**

- Elasticity of demand = sensitivity to price
  - Extent to which changes in unit price influence consumption of the commodity:

  Inelastic demand - Changes in price produce less than proportional changes in consumption
  
  E.g., 1% increase in price produces < 1% decrease in consumption

  Elastic demand – Changes in price produce larger than proportional changes in consumption
  
  E.g., 1% increase in price produces > 1% decrease in consumption

- **Stimuli with equivalent initial consumption (under low cost conditions) may have very different demand profiles**
The Basic Behavioral Process

**Elasticity of Demand**

- What influences elasticity of demand?
  - Constraints on income re: “luxury goods” vs. “necessary goods”
    - Demand for luxury goods is more elastic
  - Open vs. closed economies
    - Greater defense of consumption (less elastic curves) under closed economies than open economies
  - Nature of available alternatives
    - Demand is more elastic when substitutable reinforcers are concurrently available
    - E.g. Demand for gasoline at $4.00/gallon is relatively inelastic; demand for Coca-Cola at $4.00/can would not be

*Fig. 4. Left panel: Daily consumption of food or saccharin as a function of FR schedule, in log-log coordinates. Right panel: Total daily lever presses for either food or saccharin as a function of FR schedule, in log-log coordinates. Data from a representative rhesus monkey.*

*Harsh (1991) Journal of the Experimental Analysis of Behavior*
**The Basic Behavioral Process**

![Graph showing demand and response output](image)

Fig. 4. Left panel: Daily consumption of food or saccharin as a function of FR schedule, in log-log coordinates. Right panel: Total daily lever presses for either food or saccharin as a function of FR schedule, in log-log coordinates. Data from a representative rhesus monkey.

*Hursh (1991) Journal of the Experimental Analysis of Behavior*

---

**Does the Finding Hold in Our Population?**

*Demand curves vary with similarity of available alternatives*
- Consumption declines more rapidly as price increases when the alternative is functionally similar

![Graph showing consumption vs fixed ratio](image)

*DeLeon, Hursh, Frank-Crawford, Bullock, Triggs, & Carreau-Webster (in preparation)*
**Does the Finding Hold in Our Population?**

*Demand curves vary with similarity of available alternatives*
- Consumption declines more rapidly as *price* increases when the alternative is functionally similar

---

*DeLeon, Hursh, Frank-Crawford, Bullock, Triggs, & Carreau-Webster (in preparation)*

---

**Does the Finding Hold in Our Population?**

*Demand curves vary with similarity of available alternatives*
- Consumption declines more rapidly as *delay* increases when the alternative is functionally similar

---

*DeLeon, Hursh, Frank-Crawford, Bullock, Triggs, & Carreau-Webster (in preparation)*
Summary and other directions

Open vs. Closed Economies:
- Does scheduled “inexpensive” access to the relevant reinforcer decrease demand for that reinforcer throughout the day?

Figure 5. Two demand curves produced by a rhesus monkey responding for food during a 12 hr work period, either with no other source of food or with a one hr period of FR 1 food reinforcement made available immediately following the work period. Consumption is shown as a function of the FR schedule that ranged from FR 10 to FR 372. Alpha values were derived using Equation 1.

Hursh, Madden, Spiga, DeLeon & Francisco (2012), APA Handbook of Behavior Analysis