The ABCs of Behavior Analysis

A REVIEW OF THE BASICS

National Autism Conference
Workshop
The Pennsylvania State University
August 2017
Topics

• Reinforcement, Extinction, and Their Side-Effects
• Contingencies, Contiguities, and Pairings
• Motivation: Establishing Operations
• Positive vs Negative Reinforcement
• Punishment
• Reinforcement as Selection - Shaping
• Operant Classes
• Stimulus Control and Attention
• Popular assumptions about reinforcement and about getting rid of problem behavior
  - These assumptions probably originated in superficial treatments, as in intro psych courses taught by those without a background in behavior analysis
• Ignoring (extinction) is not the procedure of choice

• Reinforcement and its misrepresentations
  - Reinforcement differs from bribery
  - The so-called Hidden Costs of Reward mainly occur (if they occur at all) when reinforcers are delivered noncontingently
• Reinforcement: Reinforcing responses or reinforcing organisms?
  - Where is the response in self-reinforcement?

The Vocabulary of Reinforcement

<table>
<thead>
<tr>
<th>Term</th>
<th>Restrictions</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>reinforcer (noun)</td>
<td>A stimulus</td>
<td>Food pellets were used as reinforcers for the rat’s lever presses</td>
</tr>
<tr>
<td>reinforcing (adjective)</td>
<td>A property of a stimulus</td>
<td>The reinforcing stimulus was presented more often than other stimuli</td>
</tr>
<tr>
<td>reinforcement (noun)</td>
<td>As procedure: the delivery of consequences when a response occurs</td>
<td>The fixed-ratio reinforcement schedule delivered food after every tenth key peck</td>
</tr>
<tr>
<td>to reinforce (verb)</td>
<td>As outcome: the increase in responding following from the reinforcement</td>
<td>The experiment demonstrated reinforcement produced by social consequences</td>
</tr>
<tr>
<td></td>
<td>As procedure: to deliver consequences when a response occurs (responses are reinforced, not organisms)</td>
<td>When a period of free play was used to reinforce the child’s completion of school work, the child’s grades improved</td>
</tr>
<tr>
<td></td>
<td>As outcome: to increase responding through a reinforcement procedure</td>
<td>The experiment showed that gold stars did not reinforce cooperative play among first-graders</td>
</tr>
</tbody>
</table>
The Side-Effects of Extinction

- spontaneous recovery
- disinhibition,
- rapid reacquisition
- emotional behavior
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The distinction between contingencies and pairings
- The distinction between contingencies and pairings
  - Reinforcement
  - Extinction
  - Free or noncontingent reinforcement (NCR)
REINFORCEMENT

REINFORCEMENT

EXTINCTION

NONCONTINGENT

REINFORCEMENT

Responses: A A A A A A A A A A A A A A A A A A
Reinforcers: + + + + + + + + + + + + + + + + + +
Time: ____________________________

WINNING MAY NOT BE EVERYTHING, BUT LOSING ISN'T ANYTHING!
Schedule: EXT
Responses: 126 0
Time (sec): 300 177
Reinforcers: 0 Reserve (max/now): 250 -1
row/2: 07 24 9 5 1 0 0 0 0
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• Sensory-motor phenomena: The effects of subtle but pervasive contingencies
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• The shaping of phonetic structure in infants
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• Positive vs Negative Reinforcement
• Examples:
  - Food presentation and shock removal
  - Thirst and water reinforcers
  - Heat and cold
• Is there a behavioral criterion?

Criteria for Distinguishing Positive and Negative Reinforcement and Punishment

<table>
<thead>
<tr>
<th>Response Produces Stimulus</th>
<th>Responding Increases</th>
<th>Responding Decreases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response Removes or Prevents Stimulus</td>
<td>Positive Reinforcement</td>
<td>Negative Reinforcement</td>
</tr>
<tr>
<td></td>
<td>Positive Punishment</td>
<td>Negative Punishment</td>
</tr>
</tbody>
</table>
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• Does punishment work?

• Criteria: Effectiveness while the contingency continues vs effectiveness after the contingency ends
• Side-effects of punishers
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• Evolution: Variation and Selection
  - Selection in Phylogenic and Ontogeny
  - Cultural Selection (Memetics)
• Artificial and Natural Selection

• Shaping as Selection
• The selection of behavior
• Shaping as a skill and (sometimes) as an art form
• Function vs topography in the creation of operant classes
  - Lever presses and key pecks
  - SIB, attention getting and their variants
  - Higher-order classes
• Shaping

• Where did all of this come from?
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• Why the lever press as an arbitrary class mattered

• Why the lever press as an arbitrary class mattered

• How about higher-order classes?

• And how about the other classes: the stimulus classes and the reinforcer classes?
Higher-Order Class (Generalized Imitation)

Sub-Classes (Specific Imitations)

The Vocabulary of Differential Reinforcement

<table>
<thead>
<tr>
<th>Differential Reinforcement (Procedure)</th>
<th>Concentration of Effects of Reinforcement (Outcome)</th>
<th>Spread of Effects of Reinforcement (Outcome)</th>
<th>Differential Reinforcement by Approximations</th>
<th>Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>With Respect to Response Properties</td>
<td>Differentiation</td>
<td>Induction</td>
<td>Shaping</td>
<td>Operant</td>
</tr>
<tr>
<td>With Respect to Stimulus Properties</td>
<td>Discrimination</td>
<td>Generalization</td>
<td>Fading</td>
<td>Discriminated Operant</td>
</tr>
</tbody>
</table>
- Some Sources of Novel Behavior
  - Shaping
    - Direct reinforcement of novelty
  - Emergence based on higher-order classes
  - Adduction
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- **Stimulus Control and Attention**
• Stimulus control (discrimination)
• What is the role of attention?
• Should we look at the stimuli or at the behavior?
The Three-Term Contingency

In presence of S1, R1 may produce C1
In presence of S2, R2 may produce C2

S = Stimulus
R = Response
C = Consequence

When R1 in presence of S1 differs from R2 in presence of S2, we say that the individual discriminates S1 from S2.
The Feature-Positive vs Feature-Negative Experiment
Creating a Conditional Discrimination
Observing Response Procedures

- Two pigeon keys:
  - The schedule key, on which pecks may produce food
  - The observing key, on which pecks do not produce food but may change whether relevant stimuli are available on the schedule key
RFT or EXT

RFT

EXT

(Examples show stimuli that would appear if observing responses are emitted; stimulus remains yellow if no observing responses occur.)

Observing Responses Have No Effect (Mixed Schedule)

Observing Responses Produce Both RFT & EXT Stimuli

Observing Responses Produce RFT Stimulus Only
RFT or EXT  (Examples show stimuli that would appear if observing responses are emitted; stimulus remains yellow if no observing responses occur.)

Observing Responses Have No Effect (Mixed Schedule)

Observing Responses Produce Both RFT & EXT Stimuli

Observing Responses Produce RFT Stimulus Only

Observing Responses Produce EXT Stimulus Only
• Terminological issues in the language of stimulus control
  ‣ The vocabularies of corrects and errors
    - The role of delayed reinforcement

The relation between reinforcers and responses that precede them: at the top, only one response is followed by a reinforcer; at the bottom, many are followed, at different delays. Thus, the effect of the reinforcer is larger.
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• Circular reasoning in everyday accounts of the causes of behavior
  ‣ Attitudes
  ‣ The language of emotions and feelings
    - Anger as a cause of behavior
    - Skinner’s pecking order demonstration

• Multiple Causation
  ‣ An example from Verbal Behavior: ordering at the fast food counter
    - lunchtime as establishing operation; sights and smells of food occasioning tacts; menus occasioning textual behavior; orders placed by others occasioning echoic behavior; server as audience occasioning manding; ....
• NOTE FOR ONLINE VIEWERS:

• SLIDES PAST THIS POINT ARE ABOUT OPTIONAL TOPICS THAT PROBABLY WOULD NEED MORE TIME THAN AVAILABLE FOR THE MAIN WORKSHOP.

• Issues of behavior chains and extended sequences of behavior

• Chains vs chunks
Chain (Fl 15-s) x 6 (6 key colors in constant order)

Tandem (Fl 15-s) x 6 (vertical lines)

100 responses

5 minutes
BEHAVIOR CHAINS VS EXTENDED BEHAVIOR SEQUENCES: CHAINS VS CHUNKS

- How to decide:
  - Can sequences in which one response produces a discriminative stimulus that occasions the next one be identified?
  - This is not an issue of whether sequences are all chains or all chunks. Instead, given a behavior sequence, which kind is it?
• Reinforcer classes in three-term contingencies
• Matching-to-sample as an example
<table>
<thead>
<tr>
<th>REFLEXIVITY</th>
<th>Matching comparison key</th>
<th>Nonmatching comparison key</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color Match</td>
<td>R  R  R  G  G  G  R  R</td>
<td>G  G  G  R  G  G  R  R</td>
</tr>
<tr>
<td>Form Match</td>
<td>△  △  △  △  △  △  △  △</td>
<td>△  △  △  △  △  △  △  △</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SYMMETRY</th>
<th>Matching comparison key</th>
<th>Nonmatching comparison key</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arbitrary match (color-form)</td>
<td>R  R  R  G  G  G  R  R</td>
<td>G  G  G  R  G  G  R  R</td>
</tr>
<tr>
<td>Reversal test (form-color)</td>
<td>R  △  R  G  △  G  R  △</td>
<td>△  G  △  R  G  △  △  G</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TRANSITIVITY</th>
<th>Matching comparison key</th>
<th>Nonmatching comparison key</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arbitrary match 1 (color-form)</td>
<td>△  R  △  △  △  △  △  △</td>
<td>△  R  △  △  △  △  △  △</td>
</tr>
<tr>
<td>Arbitrary match 2 (form-intensity)</td>
<td>△  △  △  △  △  △  △  △</td>
<td>△  △  △  △  △  △  △  △</td>
</tr>
<tr>
<td>Transitivity test (color-intensity)</td>
<td>△  △  △  △  △  △  △  △</td>
<td>△  △  △  △  △  △  △  △</td>
</tr>
<tr>
<td>Combined reversal-transitivity test (intensity-color)</td>
<td>△  △  △  △  △  △  △  △</td>
<td>△  △  △  △  △  △  △  △</td>
</tr>
</tbody>
</table>
• Intermittent Reinforcement
  ‣ Variable and fixed ratio and interval contingencies
    - VR, FR, VI, FI
  ‣ Temporal contingencies
    - DRL, DRH, DRO and their variations
SCHEDULE COMBINATIONS

• Multiple and mixed
• Chained and tandem
  ‣ Concurrent
    • Concurrent chains
• and many others....