Reinforcement

Definition:
> A stimulus change
> contingent on some aspect of a response that
> increases the future probability of the response

Distinguishing Characteristics of Reinforcement

Nature of the response on which reinforcement is contingent
> Occurrence of a target (R): \( R^+ \)
> Nonoccurrence of a target response (not R): \( R^- \)
> Occurrence of an alternative response (Alt R): \( R^- \)?

Nature of the stimulus change that serves as reinforcement (see examples in Table 4-1)
> Positive reinforcement (Sr+): Stimulus presentation
> Negative reinforcement (Sr-): Stimulus removal
  ⇔ Escape: Removal or reduction of ongoing stimulation
  ⇔ Avoidance: Postponement (prevention) of stimulation

Reinforcement history
> Primary (unconditioned) reinforcer: Reinforcer whose effects are not dependent upon prior learning
> Secondary (conditioned) reinforcer: Reinforcer whose effects are acquired through pairing with other reinforcers

Source or reinforcement
> Mediated (socially): Reinforcement delivered by an agent (person)
> Automatic: Reinforcement directly produced by a response

Types of reinforcers
> Physical characteristics: Social, material, activity
> Generalized: Substitutable for other reinforcers; therefore, supports numerous behaviors
> Premack principle: Access to a high-probability response serves as reinforcement for a low-probability response

Determinants of Reinforcement Effects

Antecedent events: The Establishing Operation (EO)
> Antecedent event that:
  > alters the effectiveness of a given reinforcer, and
  > increases behavior that has produced that form of reinforcement in the past
  ⇔ Deprivation: Typical EO for behavior maintained by Sr+
  ⇔ Aversive stimulation: Typical EO for behavior maintained by Sr-

Reinforcement parameters
> Contingency (probability of Sr given R vs. not R): Strong > weak
> Delay: Immediate delivery > delayed delivery
> Frequency: More frequent > Less frequent
> Quality: Higher quality > lower quality
> Magnitude: Higher magnitude > lower magnitude

Concurrent reinforcement: Alternative reinforcement options

Reinforcement schedules STOP HERE; SCHEDULES COVERED IN NEXT CLASS

Schedules of Reinforcement

Definition:
A formula (or rule) describing the probability that a given R will produce reinforcement; or, a formula describing the proportion of Rs that will be reinforced

Schedules are based on a continuum of probability values

<table>
<thead>
<tr>
<th>Contingency</th>
<th>Schedule</th>
<th>Probability of Sr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Every R → Sr</td>
<td>Continuous Sr (CRF)</td>
<td>p = 1.0</td>
</tr>
<tr>
<td>No Rs → Sr</td>
<td>Extinction (EXT)</td>
<td>p = 0</td>
</tr>
<tr>
<td>Some Rs → Sr</td>
<td>Intermittent Sr (INT)</td>
<td>0 &lt; p &lt; 1.0</td>
</tr>
</tbody>
</table>

Advantages of Intermittent Reinforcement
> Prevents satiation: INT Sr maintains state of deprivation (EO)
> Resistance to EXT: INT is less predictable than CRF; therefore; change to EXT more difficult to discriminate
> Can produce high rates of R (more Rs required for Sr)
> Naturalistic: Most schedules in natural environment are INT
> Cost effective: Easier for agent to administer

Basic Schedule Parameters
Response requirement:
> Ratio: Sr based on number of Rs
> Interval: Sr based on time elapsed since last reinforced R

Regularity:
> Fixed: Requirement constant between Sr deliveries
> Variable: Requirement changes from one Sr delivery to another
**Basic Schedules of Reinforcement**

<table>
<thead>
<tr>
<th>Ratio</th>
<th>Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>(# of Rs)</td>
<td>(Time since last reinforced R)</td>
</tr>
</tbody>
</table>

**Fixed**
- **FIXED RATIO (FR)**
  - Sr delivered following fixed # of Rs
- **FIXED INTERVAL (FI)**
  - Sr delivered following 1st R after fixed amt time since last reinforced R

**Variable**
- **VARIABLE RATIO (VR)**
  - Sr delivered following # Rs that varies around an average value
- **VARIABLE INTERVAL (VR)**
  - Sr delivered following 1st R after variable amt time since last reinforced R

**Schedule Effects on Behavior**

<table>
<thead>
<tr>
<th>Ratio</th>
<th>Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>(High R rate)</td>
<td>(Moderate R rate)</td>
</tr>
</tbody>
</table>

**Fixed**
- **FIXED RATIO (FR)**
  - High, irregular rate ("Break and run")
- **FIXED INTERVAL (FI)**
  - Moderate irregular rate ("FI scallop")

**Variable**
- **VARIABLE RATIO (FR)**
  - High stable rate
- **VARIABLE INTERVAL (VI)**
  - Moderate stable rate
Response Patterns Generated by Basic Schedules

VR: High stable rate
FR: High irregular rate
VI: Moderate stable rate
FI: Moderate irregular rate