Early Cognitive Foundations: Sensation, Perception, and Learning

- Methods for Study Infant Sensation and Perception
- Infant Sensory Capabilities
- Infant Differential Responses to Attractive Faces
- Consequences of Operant Behavior
- Operant Conditioning in Infancy
- Using Punishment Effectively

Making Sense of Infant’s Sensory and Perceptual Experience

- **Preference Method** – present two or more stimuli and observing which stimulus the infant prefers
  - believed that if an infant looked longer at one target than another, it was assumed that she preferred that pattern
  - Fantz found that newborns can easily discriminate visual forms & preferred to look at patterned stimuli such as faces or concentric circles
  - Ability to detect and discriminate patterns is innate
  - Limitation → if shows no preference, did he/she fail to discriminate or are they equally interesting?

- **Habituation Method** → decrease in one’s response to a stimulus that has become familiar through repetition
  - head or eye movements, changes in respiration or heart rate
  - Simple form of learning
  - infant stops responding to familiar stimulus – recognizes as ”old hat” – something experienced before
  - Test for Discrimination?
Making Sense of Infant’s Sensory & Perceptual Experience

- **Evoked Potentials (ERPs)** – change in patterning of the brain waves that indicates that an individual detects (senses) a stimulus.
  - Electrodes are placed on the infant’s scalp above those brain centers that process the kind of sensory information that investigator is presenting
    - visual ➔ occipital lobe (back of the head)
    - sounds ➔ temporal lobe (side of the head)
  - Resultant P300 waveform is typically larger in amplitude when stimulus is novel than when the stimulus is non-relevant.
  - Difference in brain amplitudes is interpreted as a physiological index of cognitive related attention resources and the efficiency of processing the specific information
- **High-Amplitude Sucking** – capitalizes on the ability of the infants to make interesting events last by varying the rate at which they suck on a special pacifier.
  - Obtain baseline sucking rate
  - When infant sucks faster or harder (than baseline) ➔ trips electrical circuitry in pacifier ➔ activating a stimulus ➔ lasts with bursts of high amplitude sucking

Infant Sensory Capabilities

- **Vision**
  - least mature of sensory capabilities
  - changes in light ➔ changes in subcortical pupillary reflex ➔ neonates sensitive to light
  - more likely to track faces than other patterns (disappears in month or two)
  - Neonates see the world in color; trouble distinguishing between certain colors.
  - Poor visual acuity (20/600); need sharper visual contrasts to see them
- **Early Pattern Perception (0-2 months)**
  - infants prefer to look at high-contrast patterns with many sharp boundaries between light and dark areas, and at moderately complex patterns that have curvilinear features
  - Sees dark blob when looking at highly complex checkerboard
  - Prefer to look at whatever they see well!
- **What are the “best” toys for an infant?**
Infant Sensory Capabilities

**Hearing**
- Sounds must be noticeably louder (than what adults can hear) for a neonate to hear them
- In first few hours → hear as well as an adult with a head cold
- Capable of discriminating sounds that differ in loudness, duration, direction, and frequency
- Particularly attentive to voices, especially high-pitched female voices
  - neonates recognize mother’s voice
- Able to recognize basic speech sounds (i.e., phonemes)

**Consequences of Hearing Loss**
- *Otitis media* → common bacterial infection of the middle ear that produces mild to moderate hearing loss
  - Strikes hardest between 6 months and 3 years of age
  - Difficulty understanding speech → hamper their language development and cognitive and social skills that normally emerge with childhood
    - delays in language development; Poorer academic performance in elementary school
    - Chronic Otitis media may lead to acquisition of poorer social skills

**Taste and Smell**
- **Taste** - born with definite taste preferences
  - preference for sweet things; suck faster and longer for sweet liquids
  - Sweets → reduce crying and produce smiles and lip smacking
  - Sour → wrinkle nose and purse lips
  - Bitter → elicit disgust – tongue protrusions & spitting (adaptive reason?)
  - Can also discriminate different concentrations of the “taste”
- **Smell**
  - React vigorously and turn away from unpleasant smells (vinegar, ammonia, or rotten eggs)
  - 1-2 week old can recognize mother by smell of breasts and underarms (i.e., her unique olfactory signature)
Infant Sensory Capabilities

- **Touch, Temperature, and Pain**
  - **Touch**
    - Premature infants show better developmental progress when they are touched and massaged.
    - Primary means to learn about environment; important for cognitive development
  - **Temperature**
    - Sensitive to warmth, cold, and temperature changes
      - refuse to suck if milk is too hot
      - try to maintain body heat by becoming active if room becomes colder
  - **Pain**
    - Even 1-day old infants cry when pricked with a needle; show more distress after inoculation than do 6-month olds
    - Male babies highly stressed by circumcision
      - emit high-pitched wails that are similar to cries of premature babies or those who are brain damaged
      - Plasma cortisol significantly higher after circumcision
      - Babies treated with a mild anesthetic before circumcision & given a sugary solution to suck → less stressed and can sleep more peacefully

Operant (or Instrumental) Conditioning

- Four possible consequences of operant responses
  - Positive reinforcement: Something pleasant is added to increase response.
  - Negative reinforcement: Something unpleasant is removed to increase response.
  - Positive punishment: Something unpleasant is added to decrease response.
  - Negative punishment: Something pleasant is removed to decrease response.

- Operant conditioning in infancy is at best limited in early infancy.
- Infants can remember what they have learned.
- The social significance of early operant learning is evident in infants and their caregivers.
Operant Conditioning in Infancy

- Even babies born prematurely are susceptible to operant conditioning
  - limited to few biologically significant behaviors they can control
  - Inefficient information processors
    - 2-day old → 200 trials to acquire simple habit; 3-months old → 40 trials; 5-month old → 30 trials
- Can infants remember what they learn?
  - Rovee-Collier → mobiles in cribs of 2-3 month olds and attach a ribbon from the mobile to the infants’ ankles
  - Memory task → recognize mobile AND recall that it moved when kicked
  - 2-month old → remembered up to 3 days
  - 3-months old → remembered for more than a week
- Why do infants eventually forget?
  - Not that previous learning has been lost
  - Infant reminded 2-4 weeks after original training → looked briefly at it and kicked up a storm
  - RETAIN meaningful information for weeks → hard to retrieve from memory unless given explicit reminders!

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<thead>
<tr>
<th>Four Consequences of Operant Behavior</th>
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<tbody>
<tr>
<td><strong>Positive Stimulus (Pleasant)</strong></td>
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<td>Administered Positive Reinforcement (strengthens Response) → Father gives into whining → making whining more likely in the future</td>
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<tr>
<td>Withdrawn Negative Punishment (Weakens Response) → confiscates Nintendo game to discourage whining in the future</td>
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<tr>
<td><strong>Negative Stimulus (Unpleasant)</strong></td>
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<tr>
<td>Administered Positive Punishment (Weakens response) → calls Julio a crybaby and yells at him → less inclined to whine in the future</td>
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<tr>
<td>Withdrawn Negative Reinforcement (strengthens the response) → Dad stops joking with Rita when Julio’s whining becomes rather obvious. His whining enabled him to bring this unpleasant state of affairs to an end (and thus reinforced)</td>
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Using Punishment Effectively

- **Characteristics of Punishment that Influence a Child’s Behavior**
  - **Timing of punishment**
    - administer as child initiates deviant act than after the act is performed
  - **Intensity of Punishment**
    - high intensity punishment more effective than milder forms of the same punitive consequence (i.e., punish firmly!)
      - Note - a lot less aversive than spanking or week’s restriction
      - Spanking as several disadvantages!
      - Curvilinear Function
  - **Consistency of Punishment**
    - Must be administered consistently
    - Inconsistent punishment - partial reinforcement - strengthen behavior - > resistant to extinction

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<td><strong>Relationship to Punitive Agent</strong></td>
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<td>Establish warm and friendly relationship with child</td>
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<td>Inhibit punished act as means of regaining approval</td>
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<td><strong>Alternatives to Punishment</strong></td>
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<td>Punishment -&gt; suppresses behavior by conditioning fear or anxiety to the punished act</td>
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<td>Time-out -&gt; removes child from the situation in which their behavior is positively reinforced -&gt; misbehavior no longer reinforced, it weakens through extinction</td>
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<td>Reinforce alternative behavior</td>
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<td>Cognitive Rationales (Hoffman, 1984, 1988)</td>
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<td>Most effective when explain to child why their conduct is wrong and helps them control the behavior in the future</td>
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<td><em>Attribution Theory</em> - want child to make internal rather than external attribution for arousal</td>
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Attribution Theory

Punishment
produces
Negative Arousal
which stimulates
Causal Interpretations:
Why am I uneasy?

Internal Attributions
if
General Response Inhibition

but if
External Attribution

Limited Response Inhibition