Learning

Chapter 7

Understanding the Big Picture

- In no more than two sentences, explain the purpose (or responsibility) of the brain.
- The purpose of the brain is to promote a stable physiology so that the organism can produce behavior that results in reproductive success.
- In no situation is this more important than in survival from predation, which implies avoidance.

Design a Brain

- The organism’s problem: Avoid predation and injury so you can reproduce.
- Be sensitive to cues that predict predation & injury, and produce correct behavior.
- “What characteristics of the physical world can an organism use to match perceived reality to actual reality in order to behave adaptively and reproduce successfully?”

Design a Brain

- Now, solve this problem using neurons, behavior.
  - You must consider what the animal’s environment actually is -- the correct behavior will depend upon the predator, hiding places, cues, etc. which may be very different for an insect than a bird.
- What features will you build into this brain?
One Neural Structure or Many?

- Consider: nearly all animal species face the same problem, so the solution must not be based on a single brain structure!
- This must be done with widely varying neural structures (fruit flies, bees, sea slugs, octopus, birds, reptiles, mammals).

What features are important?

- Be sensitive to cues that predict predation?
- Would a "causality detector" be useful?
  - Environmental causes or behavioral causes?
  - React to stimuli or to behaviors?
- Would emotions like fear be useful?
  - (Why do emotions exist, anyway?)
- How about hedonism?

Discovery of Behavioral Principles

- Over the last century or so, we have discovered certain General Behavioral Principles that exist in (nearly) all animal species, which allow animals to produce the appropriate behaviors in their particular environments (niche).
- These principles are so important to the survival of each species that the principles are “built into” every species’ DNA, no matter what their brain looks like.
“Conditioning”

Classical and operant conditioning **ARE** these features!
They are “causality detectors,” and both create emotion!

Classical and operant conditioning are the solutions to the problem of adaptation:
They allow one event to predict some more important event.
Classical: cue = stimulus
Operant: cue = behavior

Chapter 7: Learning

- Learning theory:
  - How we acquire knowledge
- Behavior-environment relationships
  - Role of the environment
  - Measure observable behaviors
- Classical conditioning:
  - Train natural reflexes (drooling, blinks)
- Operant conditioning:
  - Train new behavior (push a lever, roll-over)

Ivan Pavlov’s Discovery (1849-1936)

- a Russian **physiologist**
- generally credited with the first systematic investigations into **classical conditioning**
- investigated salivation, the initial step in the digestive process
- found that salivation could be initiated with “psychic” factors

Classical conditioning (Pavlov, 1927)

US: Unconditioned Stimulus

Neutral Stimulus

Orientation but no salivation

UCS automatically produces UCR. Neutral stimulus does not produce salivation.
Classical conditioning

**Summary of the Procedure:**
- Reflexes (innate responses)
- Unconditioned Stimulus (UCS)
- Unconditioned Response (UCR)
- Conditioned Stimulus (CS)
- Conditioned Response (CR)

**Examples of Classical Conditioning**
- **ex1.** Natalie goes to the park and bumps into a wasp nest. After she recovers from stings she refuses to go back to the park.
- **ex2.** Susan heard a song on a first date with her boyfriend. Now when she hears the song she gets goosebumps and feels happy.
- **ex3.** Every time little Jim goes to grandma’s house he gets knocked down by their dog. Now he cries when approaching the house.

- What is the US? (Stimulus that causes reflex)
- What is the UR? (Reflex or automatic natural behavior)
- What is the CS? (Learned stimulus that causes natural behavior)
- What is the CR? (Learned behavior)
Pavlovian “experiments”
- The Office
  - http://vimeo.com/5371237
- A Clockwork Orange:
  - http://www.youtube.com/watch?v=rT1DCun3U9M&NR=1

Think:
- What is a real world example of classical conditioning?
- What is the US?
  - Stimulus that causes reflex
- What is the UR?
  - Reflex or automatic natural behavior
- What is the CS?
  - Learned stimulus that causes natural behavior
- What is the CR?
  - Learned behavior

What about simpler “brains”?
- But if insects and sea slugs produce all of the classical conditioning phenomena that mammals do, clearly such a complex brain is NOT necessary for conditioning.
- Less than a dozen neurons are necessary for classical conditioning in Aplysia, the sea slug.
- In fact, complex brains don’t seem to be necessary for ANY of the General Principles of learning identified throughout your text.

Pavlov’s findings
- What variables can you vary?
- Number of reinforced trials
  - Learning curve
- Number of unreinforced trials
  - Extinction
  - Spontaneous recovery
What produces classical conditioning?

- Order of CS and US: togetherness in time
  - Forward pairing
  - Backward pairing
  - Simultaneous pairing

- What is best?
  - CS before US
  - CS serves as a signal

Classical conditioning

- Stimulus generalization & stimulus discrimination
  - Study w/ rabbits
  - CS = tone 1,200Hz
  - US = electric shock
  - CR = blink
  - Test: 400-2000Hz
  - DV: Probability of response

- How can you change response?

Little Albert

- Stimulus generalization
  - Generalization gradient

- Stimulus discrimination

Second-order Conditioning

- Metronome
  - Followed by
    - Food
    - Elects
    - Salvation

- Black square
  - Followed by
    - Unconditioned stimulus (US)
    - Unconditioned response (UR)

- Second-order stimulus
  - Followed by
    - Conditioned stimulus (CS)
    - Conditioned response (CR)

- Second-order stimulus
  - Followed by
    - Elects
    - Salvation
    - Conditioned response (CR)
Second-Order Conditioning

Classical conditioning beyond Pavlov

- Notice real examples in your everyday life!
  - Reflect on the relationship between events
  - Sights and sounds that signal something will occur
- Hunger at mealtime
- Alcohol or taste aversion (see p230!)
  - One-trial learning
  - Even if interval between CS and US is 24hrs
- Phobias and treatment of phobias
  - Conditioned emotional response (CER)
- Drug addiction
- Anorexia (trauma paired with food?)

Why is classical conditioning important?

- Responsible for nearly all our emotions: happiness to fear
  - Notice learned expectation in your everyday life!
  - You learn the relationship between events (causality or correlation)
- Responsible for most of our expectations
- Alcohol or taste aversion (see p230!)
  - One-trial learning
  - Even if interval between CS and US is 24hrs
- Phobias and treatment of phobias
  - Conditioned emotional response (CER): fear or safety
- Drug addiction: CS’s produce compensatory responses, that when changed will kill!