Learning:
Classical Conditioning

Chapter 7

Psy 12000.003

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Learning

How Do We Learn?

One way is through Classical Conditioning

- Pavlov's Experiments
- Extending Pavlov's Understanding
- Pavlov's Legacy

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Definition of Learning

Learning is a *relatively permanent change* in an organism's *behavior* as the *result of experience*.

Learning is more flexible in comparison to the genetically-programmed behaviors of Chinooks, for example.

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To What Does Learning Apply?

- New information (for exams)
- New skills
  - Sports
  - Vocational
- Hobbies and Interests
  - Gambling
- Fears
- Rituals, behavioral predispositions (personality?)
- Beliefs
- Values
- Social behavior (how to behave among others)
- Attitudes, stereotypes, prejudices
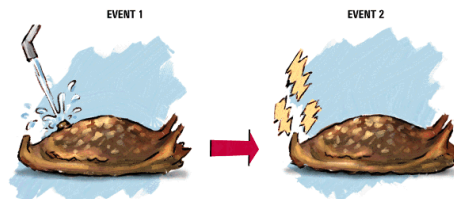
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How Do We Learn?

We learn by association. Our minds naturally connect events that occur in sequence.

2000 years ago, Aristotle suggested this law of association. Then 200 years ago Locke and Hume reiterated this law.

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Stimulus-Stimulus Learning
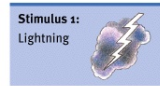
Learning to associate one stimulus with another.

EVENT 1   EVENT 2
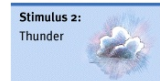
Sea snail associates splash with a tail shock

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Stimulus-Stimulus Learning
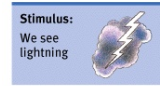
Learning to associate one stimulus with another.

Two related events:

Stimulus 1:
Lightning

+

Stimulus 2:
Thunder

Result after repetition:

Stimulus:
We see lightning

Response:
We wince anticipating thunder

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Response-Consequence Learning

Learning to associate a response with a consequence.

(a) Response: balancing a ball
(b) Consequence: receiving food
(c) Behavior strengthened

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Response-Consequence Learning

Learning to associate a response with a consequence.

Response: Pushing vending machine button

Consequence: Receiving a candy bar

Behavior strengthened
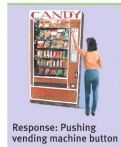
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Classical Conditioning

Ideas of classical conditioning originate from old philosophical theories. However, it was the Russian physiologist Ivan Pavlov who elucidated classical conditioning. His work provided a basis for later behaviorists like John Watson and B. F. Skinner.

Ivan Pavlov (1849-1936)

http://www.youtube.com/watch?v=hhqumfpxuzI
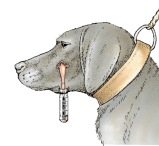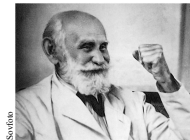
Classical Conditioning: *Unconditioned* Stimuli and Responses

Unconditioned Stimulus (US) – a stimulus that unconditionally (naturally and automatically) triggers a response
- Example: smell, taste, sight of food

Unconditioned Response (UR) – unlearned, natural response to the unconditioned stimulus
- Example: salivation

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Classical Conditioning: *Conditioned* Stimuli and Responses

Conditioned Stimulus (CS) – an originally neutral stimulus that, after association with an unconditioned stimulus (US), comes to trigger a conditioned response.
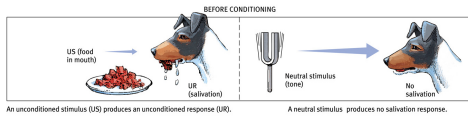- Example: tone, bell ringing

Conditioned Response (CR) – learned response to a previously neutral (but now conditioned) stimulus
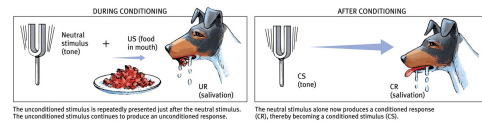
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Pavlov's Experiments

Before conditioning, food (Unconditioned Stimulus, US) produces salivation (Unconditioned Response, UR). However, the tone (neutral stimulus) does not.

BEFORE CONDITIONING

US (food in mouth)
UR (salivation)

Neutral stimulus (tone)
No salivation

An unconditioned stimulus (US) produces an unconditioned response (UR).   A neutral stimulus produces no salivation response.

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Pavlov's Experiments

During conditioning, the neutral stimulus (tone) and the US (food) are paired, resulting in salivation (UR). After conditioning, the neutral stimulus (now Conditioned Stimulus, CS) elicits salivation (now Conditioned Response, CR)

DURING CONDITIONING

Neutral stimulus (tone) + US (food in mouth)
UR (salivation)

AFTER CONDITIONING

CS (tone)
CR (salivation)

The unconditioned stimulus is repeatedly presented just after the neutral stimulus. The unconditioned stimulus continues to produce an unconditioned response.   The neutral stimulus alone now produces a conditioned response (CR), thereby becoming a conditioned stimulus (CS).

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Acquisition

Acquisition is the initial stage in classical conditioning in which an association between a neutral stimulus and an unconditioned stimulus takes place.

- In most cases, for conditioning to occur best, the neutral stimulus needs to come *before* the unconditioned stimulus.
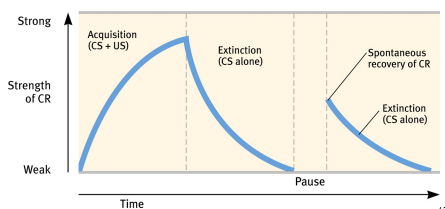- The time in between the two stimuli should be about *half a second*.

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Extinction

When the US (unconditioned stimulus: food) does not follow the CS (conditioned stimulus: tone), the CR (conditioned response: salivation) begins to decrease and eventually causes extinction.

Strong

Strength of CR

Weak

Acquisition (CS + US)
Extinction (CS alone)

Time
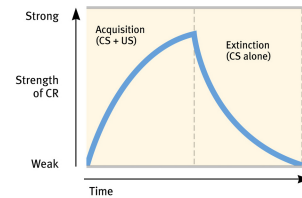
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Spontaneous Recovery
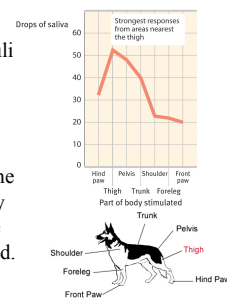
After a rest period, an extinguished CR (salivation) spontaneously recovers if you pair CS and US again. But if the CS (tone) persists alone, the CR becomes extinct again.

Strong

Strength of CR

Weak

Acquisition (CS + US)
Extinction (CS alone)
Spontaneous recovery of CR
Extinction (CS alone)

Pause

Time

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Stimulus Generalization

Tendency to respond to stimuli similar to the CS is called generalization. Pavlov conditioned the dog's salivation (CR) by using miniature vibrators (CS) on the thigh. When he subsequently stimulated other parts of the dog's body, salivation dropped.

Drops of saliva

Strongest responses from areas nearest the thigh

Hind paw   Pelvis   Shoulder   Front paw
Thigh   Trunk   Foreleg
Part of body stimulated

Trunk
Pelvis
Thigh
Shoulder
Foreleg
Hind Paw
Front Paw

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Stimulus Discrimination

Discrimination is the learned ability to distinguish between a conditioned stimulus and other stimuli that do not signal an unconditioned stimulus.

256 c/s tone

Salivation

392 c/s tone

No salivation
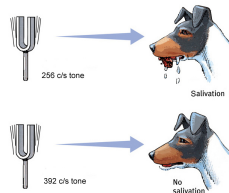
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Extending Pavlov's Understanding

Pavlov and Watson considered consciousness, or mind, unfit for the scientific study of psychology. However, they underestimated the importance of cognitive processes and biological constraints.

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Cognitive Processes

Early behaviorists believed that learned behaviors of various animals could be reduced to mindless mechanisms.

Stimulus ⟶ "Black Box" ⟶ Response
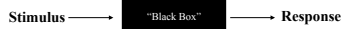
However, later behaviorists suggested that animals learn the predictability of a stimulus, meaning they learn *expectancy* or *awareness* of a stimulus (Rescorla, 1988).

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Biological Predispositions

Pavlov and Watson believed that laws of learning were similar for all animals. Therefore, a pigeon and a person do not differ in their learning.

However, behaviorists later suggested that learning is constrained by an animal's biology (i.e., Robert Bolles and "species-specific defense reactions").

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Biological Predispositions

Taste (CS)   Radiation (US)   Nausea (CR)
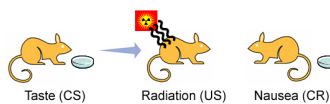
The bright and noisy water studies.
Garcia showed that the duration between the CS and the US may be long (hours), but yet result in conditioning. A biologically adaptive CS (taste) led to conditioning and **not** to others (light or sound).
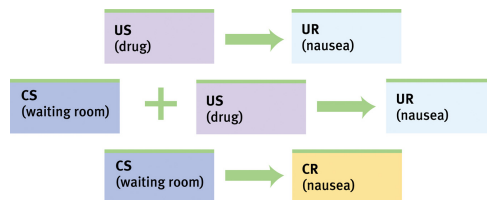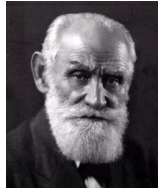
John Garcia

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Biological Predispositions

Even humans can develop classically to conditioned nausea.

US (drug) → UR (nausea)

CS (waiting room) + US (drug) → UR (nausea)

CS (waiting room) → CR (nausea)

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Pavlov's Legacy

Pavlov's greatest contribution to psychology is isolating elementary behaviors from more complex ones through objective scientific procedures.

Ivan Pavlov
(1849-1936)

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Applications of Classical Conditioning

- Alcoholics may be conditioned (aversively) by reversing their positive-associations with alcohol.
- Through classical conditioning, a drug (plus its taste) that affects the immune response may cause the taste of the drug to invoke the immune response.

A Clockwork Orange

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Applications of Classical Conditioning

Watson used classical conditioning procedures to develop advertising campaigns for a number of organizations, including Maxwell House, making the "coffee break" an American custom.

See also, "Little Albert" experiment:
http://www.youtube.com/watch?v=Xt0ucxOrPQE
And
Clockwork Orange:
http://www.youtube.com/watch?v=Jv1Bmne20l4

John Broadus Watson

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An example of Classical Conditioning

Every time you take a shower, someone in your apartment flushes the toilet. As a result, you are sprayed with very hot water and you jump back to get away from the water. Now, every time you are in the shower and hear the toilet flush, you jump back before you feel the hot water.

What is the US? What is the UR? What is the CS? What is the CR?

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An example of Classical Conditioing

"The Office" – Dwight and the Altoids
http://www.youtube.com/watch?v=iTWopzBJFyY

Every time Jim restarts his computer, he gives Dwight a breath mint. Soon, Dwight finds himself reaching for the breath mint whenever he hears Jim restart him computer.

What is the CS?

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Two Famous John Watson Quotes

- "Psychology as the behaviorist views it is a purely objective experimental branch of natural science. Its theoretical goal is the prediction and control of behavior. Introspection forms no essential part of its methods, nor is the scientific value of its data dependent upon the readiness with which they lend themselves to interpretation in terms of consciousness. The behaviorist, in his efforts to get a unitary scheme of animal response, recognizes no dividing line between man and brute. The behavior of man, with all of its refinement and complexity, forms only a part of the behaviorist's total scheme of investigation."
- "Give me a dozen healthy infants, well-formed, and my own specified world to bring them up in and I'll guarantee to take any one at random and train him to become any type of specialist I might select -- doctor, lawyer, artist, merchant-chief and, yes, even beggar-man and thief, regardless of his talents, penchants, tendencies, abilities, vocations, and race of his ancestors. I am going beyond my facts and I admit it, but so have the advocates of the contrary and they have been doing it for many thousands of years."(1930)

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