

Psyc 101, Pomerantz
Section 6: Learning

Learning and the CNS

Neuroplasticity

Changes at the synapse

Learning = relatively long-term change in behavior resulting from experience

Simplest learning: Habituation

- Decreased responsiveness to a repeated stimulus
- Simplest because there is no new stimulus-response pairing, just a weakening of an established link.

Classical (Pavlovian) Conditioning: next most complex form of learning

Pavlov: salivation in dogs

Classical Conditioning begins with a reflex: US -> UR

After conditioning, CS -> CR

- US: Unconditioned stimulus (food in mouth)
- UR: Unconditioned response (salivation)
- CS: Conditioned stimulus (bell)
- CR: Conditioned response (salivation)

CR is acquired through repeated pairings of CS with US

Timing:

- Forward (delayed and trace, ½ second time interval optimal)
- Backward (bell follows food)
- Simultaneous (bell sounds concurrently with food)
- Number of pairings is also critical (cf. “one-trial learning”)

Classical conditioning is nearly universal, is found in fetuses, even in single-celled organisms

Another example: Watson, Rayner, and “Little Albert”: conditioned emotional response (fear to sight of rat). Q: Operational definition of fear?

Biological preparedness / contrapreparedness: some CS-US pairings work better than others (thus, organisms are not universal learning machines): food aversions

Extinction: repeated presentation of the CS w/o the US following > disappearance of CR.

Extinction is not the same as forgetting; it’s overwriting (e.g. faster re-learning)

Spontaneous recovery: the reappearance of the CR to the CS after it was extinguished, when the CS is first presented after a long absence

Stimulus generalization: vary bell’s pitch

Stimulus discrimination: pitch of bell signals food vs. no food

Higher order conditioning: Pair a new CS with a previously conditioned CS (e.g. flash of a light is paired with a bell in Pavlov's experiment).

The Role of Cognition in Classical Conditioning

- Backward conditioning doesn't work (this suggests a cognitive understanding of time relations in cause-and-effect)
- Blocking: adding a second CS leads to no conditioning (because it adds no new information)
- Imagery is sufficient to yield a CR (e.g., salivation to imagined food), which thus shows that an external CS is not required

Applications of Classical Conditioning

- Drug Use (e.g., classically conditioned anticipatory action in preparation for an infusion of drugs such as heroine)
- Advertising (evaluative conditioning through association with positive stimuli)
- Taste aversion: associating a novel food with sickness even when there is no causal relation (Garcia effect). Interesting because
 - Learning can take place with a single pairing
 - CS – US interval can be hours!
- Similar effects with ice cream preceding chemotherapy
- Stress and mental disorders linked to classical conditioning (e.g., discriminative classical conditioning in which two stimuli are made more similar and test animal shows “neurotic”-like stress behavior.

Operant Conditioning (Thorndike, Skinner)

Thorndike puzzle box: cat escapes puzzle box through trial-and-error learning

Law of Effect: actions leading to a “satisfying state of affairs” (reward or reinforcement) are more likely to be repeated. This may be the number one law in all of psychology.

B. F. Skinner: advanced technology through the “Skinner Box”, established basic principles on schedules of reinforcement, a so-called “technology of behavior.”

Note on Skinner's daughter.

Learning curves: steep and shallow

Classic Skinnerian Operant Conditioning: a rat learns to press a level to get food. Receiving food is *contingent* on the rat's *emitting* the response.

Differences between Classical and Operant conditioning:

- Classical starts with a reflex, Operant does not.
- The response in classical conditioning is a reflex that is *elicited*, whereas the response in operant conditioning is voluntary and is *emitted*
- Classical involves learning a pairing between two events, CS and US, whereas Operant involves learning a pairing between an action and a consequence.

- Loosely speaking, Classical involves learning what stimulus follows another stimulus (food follows bell) whereas Operant involves learning what stimulus follows a response (food follows lever press)

Similarities between Classical and Operant conditioning:

- Both depend on associations
- Both involve extinction, spontaneous recovery, generalization, and discrimination
- Both affected by number of repetitions, timing, etc.
- Both are affected by biological factors (neural mechanisms, fatigue, drugs, etc.)

Reinforcement: an object or event that, following a response, *increases* the probability that response will be repeated. This sounds circular, but it is an operational definition. Note that a reinforcer for one person may be a punishment for another.

Two types of reinforcement: positive and negative. They are both good things! (i.e., negative reinforcement is not punishment).

- Positive reinforcement: the introduction of a reward (something good starts)
- Negative reinforcement: the removal of a punishment (something bad ends)

Primary reinforcers: inherently rewarding, like food, water, relief from pain
 Secondary reinforcers: learned and symbolic, like money, grades, praise. Chimps will work for tokens, redeemable later for primary reinforcers.

Negative reinforcement is tied in closely with *escape conditioning* and *avoidance learning*.

Timing of reinforcement is critical (more below). Delayed reinforcement usually slows learning (but note that humans often work for years for a reward, although there are often intermediate reinforcements (grades before diplomas, raises before promotions)).

Punishment: an object or event that, following a response, decreases the probability that the response will be repeated.

- Positive punishment: the introduction of a punishment (something bad starts)
- Negative punishment: the removal of a reward (something good ends)

To be maximally effective, punishment should be:

- Swift
- Consistent

- Not overly aversive (because that can lead to escaping the punishment by means other than not repeating the behavior that led to the punishment; thief learn not to stop stealing but to avoid being caught)
- Combined with reinforcement of an alternative, desirable behavior (counter-conditioning).

There is evidence that punishment can lead to aggression, perhaps via modeling (more below)

Clinical application of operant conditioning: Behavior modification (more later in this course)

Generalization, discrimination, extinction, and spontaneous recovery work in operant condition, just as they do in classical.

Learning complex operant behaviors (e.g., circus animals performing stunts) via shaping: the reinforcement of successively closer approximations to the final desired behavior.

- Example: training a rat or pigeon in a Skinner Box (mix of art and science)
- Twist of interpretation: Who is conditioning whom?

Schedules of Reinforcement (B. F. Skinner): large effect on learning curves

Simplest schedule: continuous reinforcement (one-for-one)

- Far from optimal: quick learning but quick extinction

Partial reinforcement: not every response is reinforced

- Fixed interval (e.g., reinforce first response after 1 minute following previous reinforcement). Leads to scalloping. Salaried jobs.
- Variable interval: vary the interval unpredictably. Slow but steady.
- Fixed ratio (e.g., reinforce every 10th response). Leads to fast rates of response and step functions. Cf. Piece work, sales commissions.
- Variable ratio: vary the ratio unpredictably. The “gambling schedule” of slot machines. Leads to a very high rate of responding, very resistant to extinction.

Example of schedules: checking US mail vs. checking email (assuming either is reinforcing!)

Phenomena related to operant conditioning:

- Learned helplessness (related to depression?)
- Superstition (resulting from random, contingentless reinforcement)
- Learning without awareness (conditioning the instructor)

Operant conditioning and society

- Is control of behavior morally acceptable?
- Skinner: we control behavior all the time, but we do it poorly!
- Utopia and communities based on conditioning: Walden Two

Combinations of classical and operant condition: conditioned fear.

- Animal has an unpleasant experience in a novel, white room
- Animal will then learn to escape/avoid that room
- Cf. child's reaction to a doctor's office where shots are administered.

Cognitive Learning

The acquisition of information not acted upon immediately but stored for later use.

Historical example: Tolman's rats learning a maze.

Rats who simply explored maze w/o reward ended up surpassing rewarded rats once their rewards were introduced.

Thus, *latent learning* had occurred (learning without reward)

Insight learning: the "aha experience"

Köhler's chimp Sultan putting sticks together

Kekule's dream, Archimedes' Eureka experience

Observational learning

Learning by merely watching: no responses, no reinforcements.

Clearly, it works in humans: modeling (Bandura)

Important characteristics of the modeler: expertise, appearance, status

But we can learn from models with lesser statures too.