

9.00 EXAM 1 NOTES

KOSSLYN CHAPTER 4 – Learning: How the Experience Changes Us

Learning – the acquisition of information or a behavioral tendency that persists over a relatively long period of time

- Typically changes behavior
- Long-term – once you learn to read, you remember it for the rest of your life!
- Learning some elements of a task ≠ learning to do the task itself.
- Helps us survive and underlies most of our behavior
- Does not always yield positive results!

2 types of learning:

1. Associative learning – occurs when one object or event becomes associated with another object or event
2. Nonassociative learning – does not rely on the association between two or more objects or events; occurs when repeated exposure to the same stimulus alters how an animal responds to that stimulus
 - a. Habituation – occurs when repeated exposure to a stimulus decreases responsiveness to that stimulus
 - b. Sensitization – occurs when repeated exposure to a stimulus increases responsiveness

CLASSICAL CONDITIONING – a neutral stimulus becomes paired (associated) with a stimulus that causes a reflexive behavior, and in time, is sufficient to produce that behavior

Pavlov's Experiments – salivation in dogs

Phases of Classical Conditioning

- Unconditioned stimulus – elicits an automatic response that does not depend on prior learning (ex: food)
- Unconditioned response (UR) – reflexive or automatic response elicited by a US (ex: salivation)
 - Does not require learning, but depends on certain circumstances
- Conditioned stimulus (CS) – an originally neutral stimulus that comes to produce a response evoked by a US After it has been paired enough times with that US (ex: hearing tone while being fed → associate tone with food)
- Conditioned response (CR) – aka acquisition – response that depends / is conditional on pairings of CS with US; once learned, CR occurs when CS is presented alone (ex: salivation with tone, but no food)
 - Acquisition – in classical conditioning, the initial learning of the CR

Variations of the Procedure

Timing between CS and US

- Forward conditioning – CS begins before the US begins
 - In order to create the CR, the US must immediately follow the CS.
- Backward pairing – US comes first, followed quickly by the CS
 - When Pavlov tried to reverse the order, conditioning did not occur – fed dogs first, and then presented tone 1, 5, or 10 s later... dogs did not salivate when hearing the tone after eating the food
 - Pavlov couldn't get backward pairing, but other researchers have found it in very specific circumstances
- Simultaneous conditioning – presenting US and CS simultaneously
 - Usually does not lead to a CR, but conditioning is possible under specific circumstances

Forward conditioning is the most likely to lead to classical conditioning

When there is a delay between the CS and the US, conditioning can occur, but not very well. For best results, US must be presented immediately after the CS.

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Classical Conditioning: Variations on a Theme

Avoidance learning – CS is paired with unpleasant US that leads organism to avoid CS

- *Vladimir Bechterev* – pairing bell (CS) with shock, dog learned to withdraw food (CR) after bell but before shock (i.e.: learning to avoid pain)
- Show that CRs can affect motor reflexes

Conditioned Emotions: Getting a Gut Response

Conditioned emotional response – emotionally charged response elicited by previously neutral stimulus

- *Watson & Rayner* – classical conditioning can produce a straightforward CER; fear can lead to a: Phobia – irrational fear of a specific object or situation

Preparedness and Contrapreparedness

Biological preparedness – built-in readiness for certain previously neutral stimuli to come to elicit particular CR, which means that less conditioning (training) is necessary to produce learning when these neutral stimuli are paired with the appropriate conditioned responses

- Ex: eating a particular kind of cheese for the 1st time and feeling nauseated → aversion

It is easier to condition a fear response to some objects than to others.

Contrapreparedness – built-in disinclination (or even inability) for certain stimuli to elicit particular CR

- Ex: woman who sees a snake, but gets a car door slammed on her hand → fear of snake, not of car door which had actually done damage

Extinction and Spontaneous Recovery in Classical Conditioning: Gone Today, Here Tomorrow

Extinction – CR is gradually eliminated by repeated presentations of CS without US

- Production of new learning interferes with previous classically conditioned response

Spontaneous Recovery – CS again elicits CR after extinction has occurred... although CR may not be as strong as before

When the animal is retrained so that the CS again elicits the CR, learning takes place more quickly than it did during the original training period → the connection between the CS and US does not vanish!

Generalization and Discrimination in Classical Conditioning: Seen One, Seen 'Em All?

Stimulus generalization – tendency for CR to be elicited by neutral stimuli that are similar, but not identical, to the CS

- Generalization gradient – the more closely the new stimulus resembles the original CS, the stronger the response

Stimulus discrimination – ability to distinguish among stimuli that are relatively similar to the CS and to respond only to the actual CS

Cognition and the Conditioned Stimulus

Numerous mental processes typically are engaged between the time of the initial presentation of the CS and its eventual ability to elicit a CR. These can influence the learning that occurs:

- Attention to the stimuli
- Expectations that arise following the CS influence

Differences in conditioning occur because:

- CS provides *information* by heralding the upcoming US (And therefore UR), and conditioning occurs because the animal learns that relationship. The CS is an indicator that the US will occur, at least in the particular context in which the conditioning took place.
- Idea that has less support: CS provides information about the upcoming US. (Classical conditioning takes place only if the pairing of CS and US provides useful information about the likelihood that the US will occur.)

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Strongest evidence for the role of mental processes in conditioning: mental images of an object function as either CS or US

- Ex: imagining food can produce salivation → visual mental imagery relies on most of the mental processes used during visual perception, so conditioning that arises from perceiving a stimulus generalizes to imagining it

All of this provides evidence for: *placebo effect*.

Dissecting Conditioning: Brain Mechanisms

Learning to Be Afraid

1. Stimuli registered by brain
2. Amygdala reacts – the result of classical conditioning is that sets of neurons in the amygdala become linked to the neurons that respond to the stimulus

When the CS later occurs, these stimulus-response associations are activated, and the amygdala sends signals to parts of the brain that actually produce the behaviors that express fear and conditioned fear. The amygdala automatically triggers the CR, and this linked activity never disappears entirely, so relearning a conditioned fear response is easy.

More Than One Type of Conditioning

Numerous types of conditioning exist, each of which relies on different mechanisms. Depending on the particular characteristics of the underlying brain mechanisms, conditioning is more or less easily acquired and extinguished.

Ex: eye-blink conditioning relies on cerebellum, which plays a key role in forming and storing the conditioned associations / producing the eye-blink itself

Classical Conditioning Applied

Drug Use and Abuse

Overdose:

A user who generally takes a drug in a particular setting (ex: bathroom) typically develops a CR to that place.

Conditioned compensatory response – as the user walks into the bathroom, their body begins to compensate for the influx of drug that is soon to come

CR is the body's attempt to counteract / dampen the effect of the drug.

When the user takes the drug in a new setting (ex: friend's living room), compensatory response does not occur. With no conditioned compensatory response to the new setting, the user's body does not try to counteract the effect of the drug. In this new setting, the net result is a higher dose of the drug, which may be higher than the user can tolerate → overdose!

Addiction:

People addicted to cocaine can experience drug cravings merely from handling money.

- CS = handling money
- Virtual CSs can induce cravings.
- Certain environmental stimuli can act as CSs as well.

Therapy Techniques

Classical conditioning to treat phobias:

- According to classical conditioning principles, phobias are conditioned emotional responses, and thus treatment can be designed to disrupt the associations learned through classical conditioning

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Systematic desensitization – structured and repeated presentation of a feared CS in circumstances designed to reduce anxiety

1. Relax
2. Continue to relax when exposed to feared CS
3. CS no longer elicits CR

Exposure – treatment technique that works by repeatedly presenting the patient with a fear-eliciting CS in a planned and systematic way; similar to systematic desensitization, without first inducing relaxation

- After exposure to feared stimulus, patients will learn that their fear response will decrease naturally (because of habituation), and that nothing terrible happens as a result of contact with the feared stimulus

Advertising

Sex appeal to increase sales:

- US = some type of sexually arousing stimulus
- UR = mild to strong sexual arousal

Other examples: food (US) and political slogans (CS)

Evaluative conditioning – the goal is to change your liking, or evaluation of the CS – the product that advertisers want you to buy

Food and Taste Aversion – classically conditioned avoidance of a certain food or taste

- US = bacteria
- CS = whatever food the bacteria was in
- UR / CR = nausea, vomiting, other symptoms of food poisoning

Food aversion is born when you avoid eating whatever food elicited the UR / CR.

Garcia et al. – discovered mechanism behind taste aversion when studying the effects of radiation on rats

- Rats exposed to high doses of radiation so they became sick. Rats drank less water from the plastic water bottle in the radiation chamber than from the glass water bottle in their “home” cage. Why??
 - US = radiation
 - CS = taste of water from the plastic bottle
 - UR / CR = getting sick
- Rats also avoided novel-tasting water even if the nausea didn’t occur until several hours after they drank.
 - The US doesn’t need to come immediately after the CS!

Classical conditioning is often adaptive → the more readily an animal can learn associations, the more likely that animal is to survive.

Conditioning the Immune System

Robert Ader et al. – saccharin-flavored water was paired with injections of cyclophosphamide (drug given to organ transplant donors to suppress the immune system; side effect = nausea)

- Rats began to die!
- The taste of the sweetened water was not only triggering nausea, but it was also suppressing the rats’ immune systems, which eventually caused them to die. Each time the rats drank the sweetened water, their immune systems were weakened, even without the immune-suppressing drug.
 - CS = saccharin-sweetened water... acting as a sort of placebo!
- Showed that a type of placebo response can be classically conditioned in animals
- Showed that the animal doesn’t have to believe that the placebo has medicinal properties in order to have a placebo response

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OPERANT CONDITIONING – the process by which a stimulus and response become associated with the consequences of making the response

The Roots of Operant Conditioning: Its Discovery and How It Works

If a behavior is followed by a positive consequence, an animal is more likely to repeat that behavior in the future. If a behavior is followed by a negative consequence, an animal is less likely to repeat that behavior.

Operant conditioning – AKA instrumental conditioning

- Voluntary, nonreflexive behavior is required (instrumental) to produce the effect
- Key component of S-R Psychology: consequences of making a response strengthen the connection between the stimulus and the response that led to the pleasant consequences.

Thorndike's Puzzle Box

Thorndike – studied behavior by creating a puzzle box, a cage with a latched door that a cat could open by pressing down a pedal inside the cage. Food was placed outside the cage door. Once the cat learns to press down the pedal to open the door, it is quicker to do so in subsequent sessions.

- It had learned that pressing the pedal opened the door and enabled it to get food
- Called this type of learning “trial-and-error” learning

Law of Effect – actions that subsequently lead to a “satisfying state of affairs” are more likely to be repeated

The Skinner Box

Mice get food when a lever is pressed → pressing lever is associated with the likelihood of getting food.

- Mice will press the lever (and eat) more frequently, learning that pressing the lever will be followed by the appearance of a food pellet.

Outside the box is a cumulative recorder, a device that records each lever press and the time interval between presses.

Principles of Operant Conditioning

A stimulus leads to a particular response, and the association between stimulus and response is forged by the consequence of the response

- Reinforcement – consequences of a response lead to an increase in the likelihood that the response will occur again when the stimulus is present
- Response Contingency – circumstance in which a consequence depends on the animal's producing the desired response
- Responses in operant conditioning are voluntarily produced
- Reinforcer – object or event that, when it follows a response, increases the likelihood that the animal will make that response again when the stimulus is present
 - What constitutes a reinforcer depends on the recipient
- Involves cognitive processing → simply telling people about the contingency between a behavior and its consequence can lead to behavior change

Reinforcement: Increasing Responses

Positive Reinforcement – a desired reinforcer is presented after a response, thereby increasing the likelihood of a recurrence of that response in the future (ex: getting a treat)

Negative Reinforcement – an unpleasant object or event is removed after a response, thereby increasing the likelihood of that response in the future (ex: people drink to reduce their anxiety because it reduces the aversive state of anxiousness)

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Both positive and negative reinforcement are reinforcing because they increase the likelihood that a behavior will be repeated.

Punishment – an unpleasant object or event is presented after a response, which decreases the likelihood of that response in the future

- Has the opposite effect of reinforcement!

Positive Punishment – response leads to an undesired consequence, thereby decreasing the likelihood of that response in the future (ex: a failing grade for not spending a lot of effort writing a term paper)

Negative Punishment (aka punishment by removal) – a response leads a pleasant object or event to be removed, thereby decreasing the likelihood of that response in the future

Punishment is most likely to lead to learning (i.e.: decrease the likelihood of that response in the future) when it has 3 characteristics:

1. Swift – occur immediately after the undesired behavior
2. Consistent – undesired behavior must be punished each and every time it occurs
3. Aversive

Caution:

1. Although punishment may decrease the frequency of a response, it doesn't eliminate the capacity to engage in that behavior.
2. Physical punishment (ex: spanking) may actually increase aggressive behavior by the person on the receiving end because the person may "learn" that physical aggression is an acceptable behavior.
3. Through classical conditioning, one being punished may come to fear the one doing the punishing.

Because of the disadvantages of punishment, many training programs for parents emphasize positive reinforcement for good behavior.

Primary and Secondary Reinforcers

Primary reinforcer – event / object that is inherently reinforcing (ex: food, relief from pain)

Secondary reinforcer – event / object that is not inherently reinforcing, but instead has acquired its reinforcing value through learning (ex: attention, praise, good grades)

Behavior modification – technique in which behavior is changed through the use of secondary reinforcers

Immediate Versus Delayed Reinforcement

Immediate reinforcement – given immediately after the desired response is exhibited

Delayed reinforcement – given some period of time after the desired response is exhibited

Beyond Basic Reinforcement

Generalization and Discrimination in Operant Conditioning

Generalization – the ability to transfer a learned stimulus-response association to a new stimulus that is similar to the original one, making the same response to it that led to reinforcement previously

- Ex: child blowing nose into a tissue; generalizes the learned behavior to wipe on similar stimuli with a soft surface (sleeve, etc.)

Discrimination – ability to respond only to a particular stimulus and not a similar one

- Depends on the ability to distinguish among different stimuli or among different situations (contexts) in which a given stimulus may occur

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- Discriminative stimulus – cue that signals to the animal whether a specific response will lead to the expected reinforcement

Extinction and Spontaneous Recovery in Operant Conditioning: Gone Today, Back Tomorrow

Extinction – in operant conditioning, the fading out of a response following an initial burst of that behavior after reinforcement ceases

Spontaneous recovery – in operant conditioning, the process by which an extinguished, previously reinforced response reappears if there is a period of time after extinction

Building Complicated Behaviors: Shaping Up

Shaping – the gradual process of reinforcing an organism for responses that get closer to the desired response

- Successive approximations – series of relatively simple responses involved in shaping a complex response

Reinforcement Schedules: An Hourly or a Piece Work Wage?

Continuous Reinforcement – reinforcement given for each desired response

Partial Reinforcement – reinforcement given only intermittently after desired responses

Acquiring a response is slower with partial reinforcement than with continuous reinforcement. When shaping new behaviors, it is best to use continuous reinforcement until the desired behavior is stable.

Different reinforcement schedules affect how easily responses are acquired and extinguished:

- Interval Schedules – partial reinforcement schedule based on time
- Fixed Ratio Schedules – partial reinforcement schedule based on a specified number of responses

Fixed Interval Schedule – reinforcement given for responses only when they are produced after a fixed interval of time

- Ex: one treat for rat after every 10 minutes of work, regardless of how many times the lever is pressed; bi-weekly paycheck

Variable Interval Schedule – reinforcement given for a response produced after a variable interval of time

- Ex: treat for rat after 8 minutes, then 19 minutes, then 13 minutes, etc.

Fixed Ratio Schedule – reinforcement given for responses produced after a fixed number of prior responses

- Ex: after 10th lever press, rat gets treat; people paid for how much work they complete;
- Efficiency and accuracy often decline in this schedule, but it usually produces a higher rate of responding than does a fixed interval schedule.

Variable Ratio Schedule – reinforcement given after variable ratio of responses

- Ex: slot machines
- Most resistant to extinction; most prone to addiction because you don't know exactly when you will be reinforced, you keep responding.
- Animals on this schedule tend to respond frequently, consistently, and without long pauses.

The Operant Brain

Operant Conditioning: The Role of Dopamine

In animals, when a particular stimulus arises, the animals plan their response in advance, with the expectation that the response will have certain consequences (ex: producing reinforcement).

Operant conditioning occurs only after the animal comes to expect certain (positive) consequences if it makes a particular response to a stimulus. The process of building up the associations between stimulus, response, and the expected consequences depends crucially on dopamine-releasing neurons.

→ *Dopamine Reward System*

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Classical Conditioning Versus Operant Conditioning: Are They Really Different?

SIMILARITIES

Classical Conditioning

Learning based on an association between the unconditioned stimulus and the conditioned stimulus

Avoidance learning

Extinction

Spontaneous Recovery

Stimulus generalization

Stimulus discrimination

Moderating factors can affect learning

Operant Conditioning

Learning is based on an association between response and reinforcement

Avoidance learning

Extinction

Spontaneous Recovery

Generalization

Discrimination

Moderating factors can affect learning

DIFFERENCES

Classical Conditioning

Organism is passive

Responses are reflexes (limited number of responses)

Responses are elicited

“Reinforcement” is unrelated to learning the association

Operant Conditioning

Organism is active – “operating” on the world

Responses are voluntary behaviors (limitless possible responses)

Responses are emitted

Reinforcement is contingent on the desired response

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COGNITIVE AND SOCIAL LEARNING

Cognitive Learning – the acquisition of information that may not be acted on immediately but is stored for later use

- Information is used to plan / evaluate / other forms of thinking, without producing any overt behavior
- Ex: learning how to add numbers; learning the names of the 50 states

Tolman & Honzik – cognitive learning is more than simple associations between stimuli and responses

- Experiment: rats in maze that led to food box; rats in maze with no reinforcement
 - Rats that were rewarded with food quickly increased their speed in the maze and decreased the number of mistakes
 - The speed and accuracy of the unrewarded second group did not improve very much if at all.
 - Rats in the no reinforcement group that began to receive a food reward on the 11th day improved performance drastically (faster, fewer errors)

Latent learning – learning that occurs without behavioral indicators

- Unreinforced rats stored information about the maze's spatial layout, but they didn't use this map until they were motivated to do so by reinforcement
- Emphasizes distinction between learning something and acting on that knowledge

Insight Learning: Seeing the Connection

Insight learning – learning that occurs when a person or animal suddenly grasps how to solve a problem or how to interpret a pattern of information and incorporates that new knowledge into old knowledge

- The "Ah-Ha!" phenomenon – sudden flash of awareness that learning has occurred

Wolfgang Kohler – chimpanzee named Sultan, most famous insight learning studies

Observational Learning: To See Is To Know

Observational learning – learning that occurs through watching others, not through reinforcement

Albert Bandura – developed *social learning theory* – emphasizes the fact that much learning occurs in a social context

Observational learning depends on *modeling* – process in which other people function as models, presenting a behavior to be imitated

Bobo doll experiment – children who had observed the adult behaving aggressively with Bobo were themselves more aggressive.

Learning from Models

Advantages: avoid going through all the steps (and mistakes) that learning usually requires, can go directly to end product

Disadvantages: can produce undesired, maladaptive learning

You may learn how to behave by observing others, but whether you'll actually perform a behavior repeatedly depends, in part, on the consequences that occur when you first try out the behavior.

Characteristics of models that make learning through observation more effective: attention; expertise; good looking; high-status; socially powerful.

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