Learning

Today's lecture will be on learning.

Learning as we study it today has origins in research by a Russian physiologist: Ivan Pavlov. Pavlov was interested in salivation in dogs. He designed a tool that was capable of collecting and counting saliva drops from dogs when they were given a bowl of food. Then he noticed something interesting. He noticed that the dogs started to salivate before the food would even arrive, for example when the trainer walked into the room. Pavlov wanted to know why the dogs salivated although there was not any food. He suspected that maybe the dogs were learning about cues in the environment which signaled that the food was coming. He conducted an experiment to test that. In his experiment, there were 2 conditions: a control condition and an experimental condition. Dogs in both conditions were given meat powder on their tongues. However for the experimental group, the researchers rang a bell every time before putting the powder on the dog's tongue, whereas the control condition was given the powder without the bells. Then the researchers observed what would happen if they only ring the bell without the food to each group of dogs. They found that the dogs in the experimental condition which were used to receiving the meat powder after hearing the bells would salivate with the bell alone; the dogs in the control condition who have never heard the bell before did not salivate. The researchers concluded that the dogs in the experimental condition had learned something about what the bell meant that the dogs in the control condition had not learned. Although this seems pretty simple, it's an important finding because it tells us something fundamental about how we learn associations. This way of understanding learning is called classical conditioning.

What is classical conditioning?

Unconditioned stimulus: a stimulus an animal naturally responds to, without any learning being necessary. For instance, if we put cheese in front of a rat, it will salivate, that's just natural to rats. The salivation is an **unconditioned response:** it's a response to an unconditioned stimulus. Now imagine that every time we give the rat cheese, we turn on a light. The light then becomes a **conditioned stimulus**, it is a neutral stimulus that is constantly paired with an unconditional stimulus (the cheese). After seeing the light and cheese paired together many times, the rat might start to salivate when it sees the light only. Although the response (salivation) is the same, the salivation here is a **conditioned response:** the rat is not responding to a natural stimulus like cheese, it is responding to a once neutral stimulus which has been associated with an unconditioned stimulus. That association or pairing is called **conditioning.**

Noticing associations in our environment is essential for us to predict what will happen next. We talked in previous lectures about the fact that correlation does not equal

causation, but most times, it's very useful to know what things are associated, so we can predict what will come next. Through basic forms of classical conditioning, we learn what is associated with what. For example, a dollar bill in itself is just a piece of paper, but we have learned to associate it with things such as wealth, purchasing power, etc. When somebody gives us a finger, we are angry. But in fact it's not about the actual finger, it's what we have learned to associate with middle finger. Images can have multiple meanings depending on the context: what handcuffs are associated with might depend on whether the event is happening in the bedroom or in a police car.

Example: heroin overdose. The associations we make influence our behavior and our body. Many cases of heroin overdoses can be explained with conditioning principles. When heroin is injected into the body, the brain says "I have poison in me; I need to do something about it", and engages in compensatory responses to counter the effects of the poison on it. So in this example, heroin is an **unconditioned stimulus** that creates compensatory mechanisms which are an **unconditioned response** (the brain reacts naturally to poison in it without having to learn anything) . But for the typical heroin addict, heroin usage is accompanied by a ritual, for example getting high in the same environment, preparation. The brain then associates these routine behaviors with heroin coming into it, and basically says "heroin is coming, I'd better start doing something about it". Therefore the brain starts to initiate the compensatory responses as a result of the routines and before heroin is injected into the body. The routine activities are a **conditioned stimulus,** and the compensatory mechanisms here are a **conditioned response**. Because of the compensatory mechanisms to counter the effects of heroin, a habitual user would need a higher dose to get the same high. Many cases of overdose happen when the environmental cues (conditioned stimuli) that signal to the brain that it needs to start countering the effects disappear. The brain would not be ready to counter the effects, and a usual dose will be too strong and overwhelming for the brain, leading to overdose. This might happen if the environment changes (for instance taking heroin at a party instead of a home).This phenomenon has been shown in research on heroin addicted rats. In that study, a group of heroin addicted rats was given a usual dose of heroin. Some of the rats were given the dose in the cage in which they usually get it; other rats were given the dose in a different cage. The death rate was the double for the rats that were in a different cage.

Example: advertising . The point of many ads is not to convince us of the advantages of the properties of the product, but to create associations in our minds between a product and other things we already know and care about. As a result, many products we buy have a lot more meaning than what they are, can do, or have. We watched several ads to illustrate this. In the Coors light ad, we saw that the actual clip has nothing to do with beer but it has to do with a lot of other things like parties, football, pretty girls, sex with pretty girls. The hope is that people might associate Coors light with

those things that they like and sort of say "I like football and fun parties, so I must like Coors light and I should buy Coors light". Notice that the ad has nothing about the actual taste of the beer. We talked about ads for diamonds. If you think about it, a diamond in itself is just a shiny stone. But we have learned in the American culture to associate diamonds with lots of other things like marriage (one of the most fundamental institutions in human existence), love, commitment, wealth. We watched an ad clip about a toothbrush that makes music. The whole message in the ad was that the toothbrush makes the buyer cool and special. There was nothing in the ad about say the bristles of the brush, the ability of the brush to reach the back teeth. We watched an IPod ad; Macintosh has done a fantastic job of associating its products with being creative, hip, brilliant, up with the times, cool and the image is very strong. Mac is selling a great product, but they are also selling a powerful image and provide people with a lot of information on what their brand means. We saw an ad for a perfume by Armani called Diamonds, and Beyonce was advertising the perfume. The main property of a perfume is its smell, but it's impossible to advertise the actual smell quality on TV, so perfume makers have to rely on associations: the perfume is called diamonds (we like and value diamonds) and is advertised by Beyonce (we like Beyonce).

5 important concepts in classical conditioning

1) **Stimulus generalization**: this was discovered in a study by a psychologist named Watson. Watson observed a toddler named Albert who really liked to play with furry white rats, and liked white rats. But little Albert was really afraid of loud noises. Watson was interested in classical conditioning and wanted to see if he could make little Albert afraid of white rats. Watson carried a metal rod and a hammer, and every time Albert approached the white rat to play with it, Watson would hit the hammer against the rod, therefore make a very loud noise, and little Albert would cry. After a while, as you can expect now that you know more about classical conditioning, Albert would cry every time he saw a white rat. He had learned to associate white rats with loud noises. That part is not new, but something else happened that was new: stimulus generalization. Little Albert was not only afraid of white rats, he became afraid of anything that was white and furry: Santa Claus, white rabbits, fur coats, etc. Stimulus generalization means having a conditioned response to stimuli that are similar to the conditioned stimulus.

2) **Extinction** happens when an association between a conditioned stimulus and an unconditioned stimulus is lost after having been learned. Back to our rat we taught to associate light with cheese: imagine that after it has learned to associate the light with food coming, we keep turning on the light without giving the rat any food. Extinction would happen if the rat stops salivating when it sees the light because the light stopped meaning that food was coming.

3) Extinction is not forever, it's easy to relearn the lost associations and once an association has been formed, it's always present in the brain somewhere. **Spontaneous recovery** happens when after extinction, a conditioned response happens again when the conditioned stimulus is present. Back to our rat, it would be spontaneous recovery if after the rat has stopped to salivate when it sees the light, we take a break of a couple of weeks, and come back and turn the light on, then the rat salivates again.

4) **Blocking** is when one conditioned stimulus interferes with the learning of a second conditioned stimulus. Back to our rat: we have already taught the rat to associate a light with food coming, and the rat gets it. Now imagine that every time we turn on the light announcing that food is coming, we also ring a bell, and later we find that the rat did not learn to associate the bell with food coming. This would be an example of blocking. Basically the rat already knows that it already has a reliable predictor (light), it does not need to learn about another predictor (bells).

5) **Latent inhibition** is when having been exposed to a stimulus without it predicting an unconditioned stimulus makes it hard to later learn to associate the same stimulus with an unconditioned response. So in our rat example: we give the rat food at random times, and then we turn on the light at random times. The rat sees the light, but the light does not mean anything. Then we decide that we want to teach the rat to associate the light with food, so we start giving the rat food after turning on the light. Latent inhibition means that because previously the light did not announce anything, it's harder for the rat to now associate the light with food.

Implications of classical conditioning in clinical psychology

Behavior therapy by clinical psychologists might use the principles of classical conditioning to help people with phobias. In class, we watched a video about someone who had a phobia of heights. In a way, a phobia is an extreme association of a stimulus (height) with the fear response. The point of these therapies is to expose patients to increasing levels of the stimulus while walking them through it and helping them manage their anxieties until the association is extinguished. Patients typically go through 8 sessions of therapy that last 35 to 40 minutes. In the video, we learned about a man who was so afraid of heights that he would rather take the stairs to the 72nd floor than take the elevator. Systematic exposure is effective at extinguishing some of the fear response.

Summary: much of learning is based on observing associations in our environment. Classical conditioning is about how we learn that a novel stimulus predicts previously unassociated outcomes.