#9 To Sleep, Perchance to Dream - Crash Course Psychology

[Adapted from Crash Course Psychology with Hank Green, written by Kathleen Yale, edited by Blake de Pastino, with psychology consultant Dr. Ranjit Bhagwat]

Technically speaking, *sleep is a periodic, natural,* reversible *and near total loss of consciousness, meaning it's different than hibernation, being in a coma, or in say, an anesthetic oblivion*.

Although *we spend about a third of our lives sleeping, and we know that it's essential to our health and survival, there still isn't a scientific consensus for why we do it.*

Part of it probably has to do with simple recuperation, allowing our neurons and other cells to rest and repair themselves. *Sleep also supports growth, because that's when our pituitary glands release growth hormones, which is why babies sleep all the time.* Plus, sleep has all kinds of benefits for mental function, like improving memory, giving our brains time to process the events of the day, and boosting our creativity.

But even if we're not quite sure of all the reasons why we sleep, technology has given us great insight into how we sleep.

And for that we can thank little Armond Aserinsky. One night in early 1950s, Chicago, eight-year-old Armond was tucked into his bed by his father. But this night, instead of getting a kiss on the forehead, little Armond got some electrodes taped to his face.

Armond's dad was Eugene Aserinsky, a grad student looking to test out a new electroencephalograph, or EEG machine, that measures the brain's electrical activity. That night, as his son slept peacefully, he watched the machine go bonkers with brain wave patterns, and - after making sure that his machine wasn't somehow broken - discovered that the brain doesn't just "power down" during sleep, as most scientists thought.


Instead, he had discovered the sleep stage we now call REM or rapid eye movement, a perplexing period when the sleeping brain is buzzing with activity, even though the body is in a deep slumber.

Aserinsky and his colleague Nathaniel Kleitman went on to become pioneers of sleep research. Since then, sleep specialists armed with similar technology have shown that we experience four distinct stages of sleep, each defined by unique brainwave patterns.

Say you're just going to bed. *All day your endocrine system has been releasing "awake" hormones like cortisol*. *But with nightfall comes the release of sleepy melatonin hormones from the pineal gland.* Your brain is relaxed, but still awake, a level of activity that EEGs measure as alpha waves. Your breath slows, and suddenly you're asleep. This exact moment is clearly evident on an EEG reading, as those alpha waves immediately transition to the irregular non-Rapid Eye Movement stage one (NREM-1) waves. In this first stage of sleep you might experience *hypnagogic sensations* - those brief moments when you feel like you're falling, and your body jerks, startling you.

As you relax more deeply, you move into NREM-2 stage sleep, as your brain starts exhibiting bursts of rapid brain wave activity called sleep spindles. You're now definitely asleep, but you could still be easily awakened. NREM-3 comes with slow rolling delta waves. We know that you can have brief and fragmentary dreams in the first three stages of sleep, but eventually you'll get to the most important stage: full REM sleep, that stage of sugarplum slumber that makes eyeballs go nuts, grants vivid visual dreams, and provided the namesake for a certain famous rock band.

REM sleep is paradoxical. Your motor cortex is jumping all over the place, but your brainstem is blocking those messages, leaving your muscles so relaxed that you're paralyzed. Except for your eyes. That whole sleep cycle - NREM-1, NREM-2, NREM-3, and full REM - repeats itself every 90 minutes or so.

Sleep is super important, and lack of sleep is terrible for your health, mental ability, and mood. In fact it's a predictor for depression, and has been linked to things like weight gain, as your hunger-arousing and –hunger-suppressing hormones get out of whack. *Sleep deprivation also causes immune system suppression, and slowed reaction time, which is why you should not drive sleepy.*

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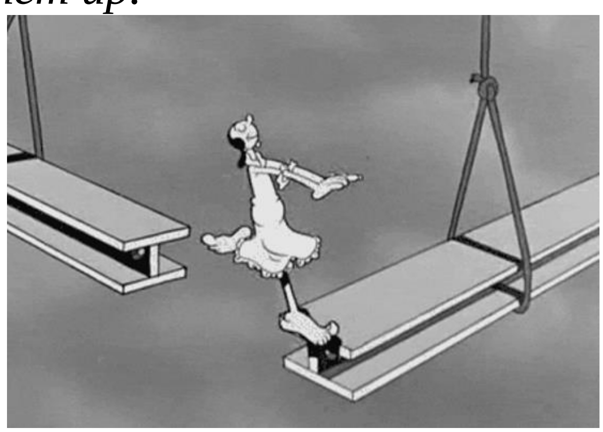
Some people suffer from insomnia, which is persistent problems in falling or staying asleep. And kind of its opposite, *narcolepsy, whose sufferers sometimes experience brief, uncontrollable attacks of overwhelming sleepiness, called "sleep attacks."* This, as you can imagine, can get in the way of all sorts of things that you might enjoy doing.

Narcolepsy may have several different causes, including a deficiency in the neurotransmitter hypocretin, which helps keep you awake. But in more rare cases, brain trauma, infection, and disease may contribute to it as well. Narcolepsy is rare, but you probably know *someone with sleep apnea, the disorder that causes sleepers to temporarily stop breathing, until their decreased oxygen levels wake them up.*



Some people suffer from night terrors, which are as terrible as they sound... spurring increased heart and breathing rates, screaming, and thrashing that's seldom remembered upon waking. *Night terrors are most common in children under seven, and may be spurred by stress, fatigue, sleep deprivation, and sleeping in unfamiliar surroundings*. Much like sleepwalking and sleep talking, night terrors occur during the NREM-3 stage of sleep, and are NOT the same as *nightmares, which occur, like most dreaming, during REM sleep.*

But oh, in REM sleep, what dreams may come... There you are, sitting naked as a jaybird in your school, while Star Wars spaceships fly overhead, and your instructor is singing “Oh Susanna.”. You wake up, feel yourself to make sure you are awake, thinking what? What? What?! WHAT?!

Welcome to your dreams, those vivid, emotional images racing through your sleeping brain, often providing a backdrop so bizarre that it may seem like a Tim Burton film are trying to out-weird the last Tim Burton film.

Sometimes you have really crazy dreams. But mostly, your average dream usually just sort of unpacks and reshuffles what you did that day. For example last night I dreamt about Schoology lessons, because I spent a lot of time making Schoology lessons yesterday.

Our two-track minds allow us to register more stimuli than we outwardly acknowledge during the day, and in that way, the sounds of car alarms or stinky dog farts that you might not even have noticed may get incorporated into your dream, too. So what's the real purpose of dreaming? Why do we do this? Well, as you might have guessed, there's more than one idea out there.

The study of dreams is a mix of neuroscience and psychology known as oneirology. *Oneiros is Greek for dream*, and if you're a Neil Gaiman fan you may recognize it as one of the Sandman's many names. The one that comes with a toga and Orpheus's head. But Sandman aside, if you want to talk dreams, we might want to start with our old friend Freud.

In his landmark 1900 book The Interpretation of Dreams, Freud proposed that our dreams offer us wish-fulfillment. He thought a dream's manifest content, the stuff you remember in the morning, was a sort of censored and symbolic version of whatever inner conflict was really going on in that dream's unconscious, or latent, content.

Not surprisingly, the wish-fulfillment theory lacks scientific evidence and has for the most part fallen out of favor - because, really, you can interpret a dream any way you want.

Modern theories suggest that REM sleep triggers neural activity - the idea that dreams are just sort of accidental side-effects, the brain's attempt to weave a story out of a bunch of random sights, emotions, and memories. For now scientists continue to debate the function of dreams, but one thing we know for sure is that REM sleep is vital, both biologically and psychologically.

Crash Course #10 – Altered States

[Adapted from Crash Course Psychology with Hank Green, written by Kathleen Yale, edited by Blake de Pastino, with psychology consultant Dr. Ranjit Bhagwat]

Here are some facts and fallacies worth knowing about hypnosis.

First off, let's define hypnosis simply as a calm, trance-like state during which you tend to have heightened concentration and focus, and in which you're typically more open to suggestion.

The phenomenon has been observed in a lot of rigorous studies, and it's been used effectively in treatments for stress and anxiety, weight loss, and chronic pain.

BUT! It's important to understand that *even though you're more open to suggestion when hypnotized, you do NOT lose control over your behavior.*

So, contrary to what you might see in The Manchurian Candidate or Zoolander, *hypnosis cannot make you act totally against your will and, say, jump off a building, rob a donut shop, or commit a murder most foul.*

Nor is hypnosis a reliable way to enhance the recall of deeply buried memories. We don't file away every single one of our experiences. We only permanently store some of them, and even they tend to mutate over time.

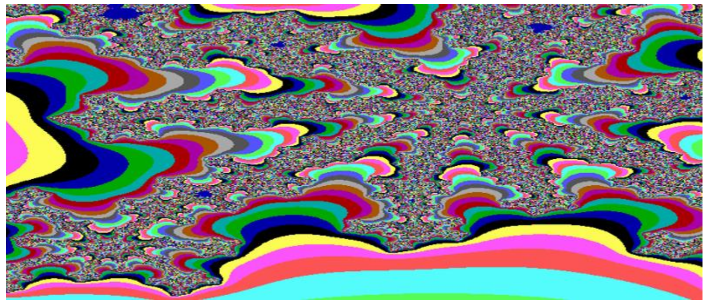
Finally, *only about 20 percent of us are thought to be highly hypnotizable.* And even though we know hypnosis can increase your suggestibility, there's still some disagreement about what exactly constitutes a hypnotic state, or how it's achieved. Remember, just because we observe a phenomenon doesn't mean that we have a clue about its mechanisms of action, or whether it works the way we think it works.

One popular theory looks at hypnosis as phenomenon of social influence. *This camp suggests that, like actors caught up in an intense role, hypnotized subjects may begin to feel and act like "good hypnotic subjects" if they just trust their hypnotist* to sort of act like a director and focus their attention.

Other researchers suggest that it has more to do with a special dual-processing state of split-consciousness called dissociation. Dissociation is a sort of detachment from your surroundings, which can range from mild spacing out all the way up to a total loss of your sense of yourself. It's something we all do to some degree or another, and we're often quite aware that we're doing it. It's not hard to think of instances where dissociation might even help us, like when we're faced with a dangerous situation that requires quick, reflexive action and not a ton of focus on our own thoughts and feelings.

In this way, hypnosis may ease pain, not by magically blocking pain receptors, but by helping us selectively not attend to that pain. Clinicians can do this by basically guiding the patient into a very relaxed, but voluntary state, sort of spaced-out, and then further guiding them through a series of positive thoughts and suggestions.

So, in legitimate clinical hypnosis, people aren't being made *to dissociate. Instead, think of them as being* asked *to dissociate* - and some people are better at this than others, which is essentially what being “highly hypnotizable” means.



So, clearly there’s a lot going on in our two-track brains at any given time, and *hypnosis* -- *as researchers understand it* -- *seems to help us tap into that adaptive dissociative capacity, or the ability to change our state of consciousness for a positive purpose, that we all seem to have.*

But say you’re not so into the idea of someone feeding you suggestions.

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Probably the most classic way to voluntarily enter an altered state of consciousness is by using drugs.

Most of us have used some kind of *legal* drug… your morning coffee, a beer at lunch, some Tylenol PM to put you the bed… and lots and lots of folks responsibly use prescription and nonprescription drugs.

But of course, some people develop problems. *The more you use a substance, legal or illegal, the less you feel its effects as your tolerance grows*. And soon enough, a two-beer buzz turns into a four-beer buzz or a case-of-beer buzz. That’s your brain chemistry adapting to offset the drug effect in a process called neuro-adaptation.

Keep on that road and soon you'll risk a physical and/or psychological addiction to the substance you choose, or the substance that chose you. And that's not even to mention serious physiological and neurological damage, as happens with severe and long-term alcohol abuse.

Psychoactive drugs are chemical substances that alter your mood and perception. *They're the ones that go right to your brain's synapses, mimicking the functions of neurotransmitters.* They also work by tapping into the psychological component - in other words, the user's expectations about what substance use might mean. Like if you really believe that drinking tequila makes you more aggressive, and I give you a virgin margarita (an alcohol-free margarita), your expectation of getting aggressive may actually lead you to punch someone in the face. That's also called the placebo effect.

Whether smoked, snorted, ingested, or injected, we'll put all of them into three general categories: depressants, stimulants, and hallucinogens.

Depressants, like alcohol, tranquilizers, and opiates, do exactly what you'd expect--they bring the mellow, slow body functions, and suppress neural activity.

Historically, the world's favorite depressant is alcohol. *A little bit of booze may get the party started, but not because it's stimulating anyone. Rather, it's acting as a disinhibitor, impairing your brain's judgment areas, while reducing your self-awareness and self-control*.

And then because alcohol disrupts memory formations you may wake up wondering where one of your eyebrows went. *Similar to booze, tranquilizers, or barbiturates, depress nervous system activity and may be prescribed to ease anxiety or insomnia*, though high doses can negatively affect memory and judgment. And really high doses, or bad interactions with other substances like alcohol, can kill you.

Opiates, like poppy-flower superstar opium and its derivatives morphine and heroin, work in a similar way, depressing neural activity and enveloping the brain in a fog of no-pain bliss. The thing is, if a brain keeps getting flooded with outside opiates, it will eventually stop brewing its own natural pain killing neurotransmitters, endorphins. The resulting withdrawal is particularly nasty.

Stimulants, obviously, excite rather than suppress neural activity, and speed up body functions, bringing up your energy, self-confidence, and changing your mood. On the legal end of the spectrum here, we've got caffeine, nicotine, and prescription amphetamines, building up to the more serious illegal stuff like street amphetamines, meth, Ecstasy, and cocaine.

And you know who loved his coke? Sigmund Freud. He loved it so much—it cheered him up when we was feeling down, opened up his mind, and turned him into chatty Kathy. He even wrote his first big publication, "Über Coca" ("Under Cocaine") in 1884 about it. During his famous coke years in his late 20s and 30s, he believed that the drug was a viable cure for morphine addiction!

Luckily he gave his nose a rest and finally dropped the habit by his 40s to focus full-time on his cigar addiction. Which is the thing that ultimately killed him.

Cocaine hits the bloodstream in a flash of energetic euphoria that quickly taxes the brain's supply of dopamine, serotonin, and norepinephrine. Methamphetamine also triggers the release of dopamine. You'll remember from our lesson on neurotransmitters how these chemical messengers affect our moods, emotions, attention, and alertness. So when those neurotransmitters are excessively activated, they can become temporarily depleted, which is what causes that agitated, depressive crash that users often feel.

If you drink coffee every morning, and then you skip a day, you'll likely be tired and cranky with a pounding headache. Now multiply that awful feeling by like thousands and you'll see why people with coke and meth addictions might keep chasing that high while their bodies and lives fall apart around them

In addition to depressants and stimulants, we've got hallucinogens, which come in a variety of plant and fungal forms, as well as synthetic forms like LSD or lysergic acid diethylamide. *Also called psychedelics, these drugs distort perceptions and evoke sensory images in the absence of actual sensory input.*

Which means you could end up seeing, hearing, smelling, or feeling things that are not real. This could be quite nice, if you're like, petting baby dolphins or something, but it could also be panic-inducing and generally messed up, if you think you've got a bunch of centipedes crawling under your skin.

But there are also others reason people hallucinate. *Many healthy people have reported experiencing vivid auditory hallucinations when in emergencies, like, you broke your knee skiing and you wanted to just fall asleep forever in that blanket of soft snow*, but a strong, seemingly audible voice ordered you to KEEP MOVING.

And bizarrely, *it isn't uncommon for people who lose the use of one sense—like vision or smell--to perceive sights and odors they are no longer capable of sensing as their brains pull from old memories* to produce hallucinations as a way to compensate for that loss.

All this just goes to show that whether you're a psychologist, neuroscientist, or philosopher, our various states of consciousness provide a rich, complex world of inquiry to contemplate, showing yet again, just what a messy and marvelous thing the human mind is.

If your consciousness wasn't too altered today, you learned what hypnosis is and what it can and can't do; how psychoactive depressant, stimulant, and hallucinogenic drugs work on the brain; and how non-drug induced hallucinations can happen to anyone.

#11 - How to Tran the Brain

[Adapted from Crash Course Psychology with Hank Green, written by Kathleen Yale, edited by Blake de Pastino, with psychology consultant Dr. Ranjit Bhagwat]

OK, I'm not a licensed dog-trainer - do they license dog trainers? But I can break down for you the sequence of steps in Pavlov's famous experiment, to help you get a sense of how conditioning works.

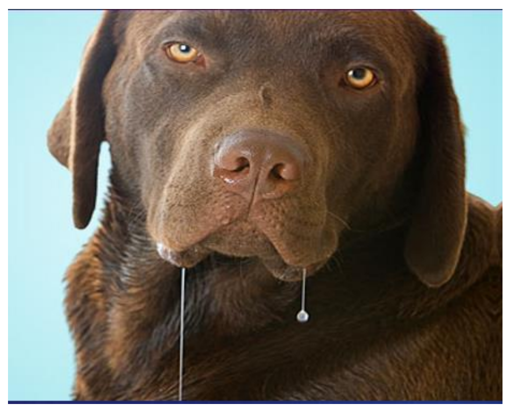
First, before conditioning, the dog just drools when it smells food. That smell is the unconditioned stimulus, and the slobbering, the unconditioned, or natural response. The ringing sound, which at this point means nothing to the dog, is the neutral stimulus, and it produces no drooling.

During conditioning, the unconditioned stimulus -- *that food smell* -- *is paired with the neutral stimulus* -- *the bell sound* -- and results in drooling. *This is repeated many times until the association between the two stimuli is made, in a stage called acquisition.*

By the time you get to the after-conditioning phase (after acquisition), that old neutral stimulus has become a conditioned stimulus, because it now elicits the conditioned response of drooling.

Sounds super simple, right? If you have a dog, you've probably seen it tap dance at the sight of a leash, but in Pavlov's day, this whole series of steps hadn't really been studied in a lab setting, or thought about in scientific terms.

Pavlov's work suggested that classical conditioning -- as this kind of learning came to be known -- could be an adaptive form of learning that helps an animal survive by changing its behavior to better suit its environment. In this case, a bell means food, and food means survival. So get ready! Not only that, but methodologically, classical conditioning shows how a process like learning can actually be studied through direct observation of behavior, in real time, without all those messy feelings and emotions.



This was something Pavlov especially appreciated given his disdain for "mentalistic" concepts like consciousness and introspection championed by Freud.

Behaviorist psychologists, like Pavlov's younger American analogues B.F. Skinner and John B. Watson, also embraced the notion that psychology was all about objective, observable behavior.

In his 1930 book Behaviorism, *John B. Watson argued that given a dozen healthy infants he could train any one of them to be a doctor, artist, lawyer, or even a thief, regardless of their talents, tendencies, or ancestry.*

Whoa there, Watson! Thankfully no one gave him any infants. In his most famous and, yes, controversial experiment, *Watson conditioned a young child, dubbed "Little Albert," to fear a white rat. Maybe that doesn't sound so bad, but he accomplished this by pairing the rat with a loud, scary noise, over and over* and then demonstrated that the child's terror could branch out and be generalized to include other furry, white objects… like bunnies, dogs, or even fur coats.

So yeah, that'd never fly today, obviously, but Watson's research did make other psychologists wonder whether adults, too, were just holding tanks of conditioned emotions -- and if so, whether new conditioning could be used to undo old conditioning. Like, if you're terrified of roller coasters, but you made yourself ride one ten times a day for two weeks, would your fears fade?

For the record, recent exploration has revealed that the boy known at Little Albert sadly died a few years after these experiments, while *Watson eventually left academia and got into advertising, where he put all that associative learning to lucrative use.*

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So that’s classical conditioning. But we’ve also got another kind of associative learning: operant conditioning.

If classical conditioning is all about forming associations between stimuli, operant conditioning involves associating our own behavior with consequences. The kid who gets a cookie for saying please, or the aquarium seal that gets a sardine for balancing a ball on its nose, they’ve both been trained with operant conditioning.

The basic premise here is that behaviors increase when followed by a reinforcement, or reward, but they decrease when followed by a punishment.

And the most well-known champion of operant conditioning is American behaviorist B.F. Skinner. He designed the famous operant chamber, or “Skinner Box”--a confined space containing a lever or button that an animal could touch to receive some sort of reward, typically a snack, along with a device that keeps track of its responses.

B. F. Skinner invented something called the Skinner Box, basically a rat training box. The box provided an observable stage to demonstrate Skinner’s concept of reinforcement, which is anything that increases the behavior that it follows. *In Skinner’s Box, a rat pushed a lever, and received a snack.*

But most rats aren't going to push a lever for no reason. I mean, *there aren't food-dispensing levers in a natural environment, so this type of behavior behavior required shaping.*

Maybe you give the rat a nibble of food each time it gets closer to the bar, then only when it touches the bar, until little by little, in a series of successive approximations to the desired behavior, you only reward them only when they do what you're trying to shape them to do.

In everyday life, we're all continually reinforcing, shaping, and refining each other's behaviors, both intentionally and accidentally. We do this with both positive and negative reinforcement.

Positive reinforcement obviously strengthens responses by giving rewards after a desired event, like the rat snack after a lever push, or getting a cookie when you say please.

Positive or negative reinforcement

Negative reinforcement is a little trickier. It's what increases a behavior by taking away an aversive or upsetting stimulus. Like, say, you get in your car and it does that infernal beeping thing until you fasten your seat-belt. The car is reinforcing your seat-belt-wearing by getting rid of that horrible beeping. And it's good, because you should wear your seat-belt.

It's important to recognize here that negative reinforcement is NOT the same as punishment.

Punishment decreases a behavior either positively, by say, giving a speeding ticket, or negatively, by taking away a driver's license.

Positive or Negative punishment

But negative reinforcement removes an unpleasant or punishing event or rule to increase a behavior. Your parents might respond to your straight-A report card by saying you have shown great maturity, and so you no longer have to abide by an 11:00 pm bedtime on school nights. They rewarded you by taking away an unpleasant rule.

So by now hopefully you're getting the picture. There are things that we want and things that we don't want, and we can be taught by way of those impulses to behave certain ways. But it's worth pointing out that conditioning is way more complex than just the cookie and the beeping car.

For one thing ending annoyance or getting a cookie, are types of primary reinforcers--you don't have to learn that, they just make innate biological sense. Beeping is annoying, cookies are delicious.

But there are other kinds of reinforcers that we only recognize after we learn to associate them with primary reinforcers. Like, a paycheck is a conditioned reinforcer--we want money because we need food and shelter, which are still the primary drivers.

Plus, just as there are different kinds of reinforcers, so are there various reinforcement schedules. Like, those boxed rats were getting continuous reinforcement when they got a treat every single time they hit that lever, so they picked it up pretty quickly.

But if one day the rat chow doesn't come, that connection quickly dwindles, and the rat stops hitting the lever. This is a process called extinction.

And it is important, because that's how real life works. *Outside of a Skinner box, you're not gonna get continuous reinforcement.*

All of life is a series of partial, or intermittent reinforcements, that occur only sometimes. Learning under these conditions takes longer, but it holds up better in the long run and is less susceptible to that extinction.

So, say a cafe gives out a free cup of coffee for every ten you buy, while another shop pours a free double shots every Tuesday morning, and yet another has a free-coffee lottery that customers win at random. These are all different kinds of intermittent reinforcement techniques that get customers coming back for more.

Now, Pavlov, Watson, and Skinner's ideas were definitely controversial -- as well as the whole scary-rat experiments. Plenty of folks disagreed with their insistence that only external influences, and not internal thoughts and feelings, shaped behavior.

It was clear to many of the behaviorists' rivals that our cognitive processes - our thoughts, perceptions, feelings, memories - also influence the way we learn.

Today you learned about how associative learning works, the essentials of behaviorist theory, the basic components of classical and operant conditioning, including positive and negative reinforcement, and reinforcement scheduling.

#12 – The Bobo Beatdown

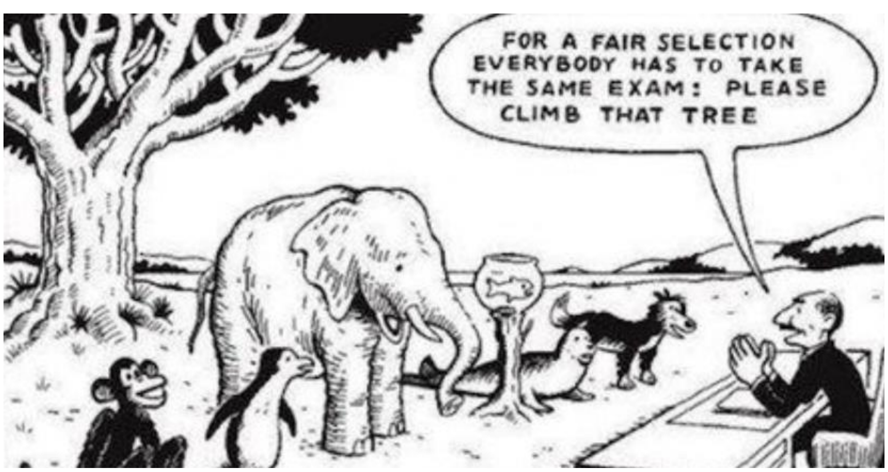
[Adapted from Crash Course Psychology with Hank Green, written by Kathleen Yale, edited by Blake de Pastino, with psychology consultant Dr. Ranjit Bhagwat]

It’s 1961. You’re wandering around Stanford University, looking for a sandwich or something when you happen to walk by a particular room in a particular lab, and see something a little unnerving. Namely, you find a woman punching an inflatable clown named Bobo in the neck. Over and over in its neck. This was the lab of legendary psychologist Albert Bandura, and in 1961 he was studying one of the most important phenomena in psychology.

See, while the woman was throttling that big inflatable clown, there was a child watching her. And after about ten minutes of observing this clown-beating display, the kid was taken to a room full of fun toys, which were soon taken away, and then the frustrated kid was left alone with Bobo, and Bandura watched what happened. And yeah, what happened was kind of scary. Kids who watched the woman beating the clown were much more likely to mimic her aggression -- kicking, punching, throwing, even attempting to maul Bobo with a hammer. But other children who saw an adult playing nicely with the doll, or just ignoring it, didn’t respond the same way in their frustration

We've talked about the differences between classical and operant conditioning in associative learning -- the kind of learning that comes from connecting different events and stimuli. And then, *in classical conditioning, this means associating a stimulus with some kind of involuntary response* -- *the whole dog slobbering a*t the sound of a bell phenomenon -- whereas *operant conditioning makes associations between stimulus and a voluntary behavior -- like the rat pressing a lever* to get delicious snacks, or jumping out of a cage to escape an electrical shock.

And that's all well and good, but if learning is the process of acquiring and retaining new behavior and information, then Bandura's experiments showed us that conditioning with external rewards, punishments, or other stimuli isn't the only way to do it. It's hard to deny that pretty much all animals are capable of learning certain things by association, but critics of behaviorists like *Pavlov, Watson, and Skinner asserted that when it came to learning, it didn't matter much whether you're training rats, pigeons, or people--it's all the same.* Because, lots of research has demonstrated that an animal's capacity for conditioning is actually limited by its biology.



Consider this scenario: *Say if I get a raging case of food poisoning after eating my head-weight in raw oysters with my friend Bernice. I'm probably not going to want to touch oysters again for a long, long time, because I associate their smell and taste with the smell and taste they made when I was — when I was puking them out,* is what I'm trying to say. But, that doesn't mean that the sight of Bernice, or the sound of the sea shanties they were playing at the restaurant would make me barf, because humans are, by our very nature, more taste averse than we are sight or sound averse. On the other hand, *sight-oriented animals, like birds, may be biologically predisposed to avoid tainted food by sight, since that's how they hunt and forage*. And presumably they go to restaurants that play better music.

Anyway, all of this tells us that *species can more easily learn associations that help them thrive or survive, and that not all associations are learned equally*. It's a lot easier to teach a pigeon to peck an X on the ground to obtain a food reward than it is get it to flap its wings to get that same reward, because pecking is a natural foraging behavior for a pigeon. In the same way, it would be much harder for the bird to learn to peck that X to avoid a shock, rather than to flap its wings to avoid the shock, because flying away from danger is what pigeons naturally do."

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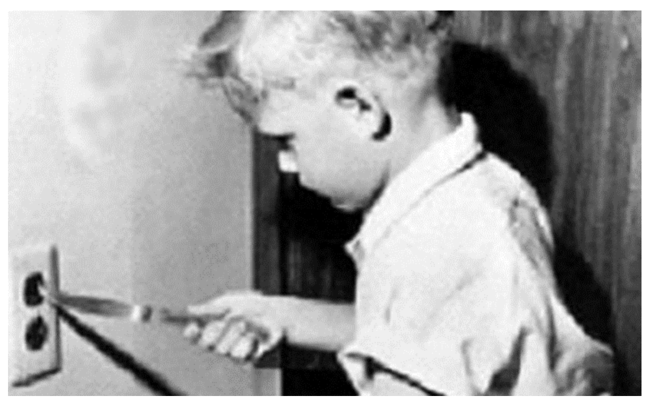
Learned associations are even more complicated in humans of course, because what we learn doesn't only influence our behavior, it also shapes our attitudes. *Our cognition -- that is, our thoughts, perspectives, and expectations -- is important for learning, as is our social context,* as Bandura figured out in the

Bobo experiment. So, Pavlov-style conditioning experiments that ignore those social-cognitive elements can really run into trouble. *For example, someone under treatment for an alcohol addiction may be given booze laced with a nauseating drug. According to the pure classical conditioning model, that person would then equate booze with feeling nasty.*

But the brain can override this association if it's aware that it's the added drug, and not the alcohol, is the thing that's causing the illness. Sometimes we can think our way out of intended associations. And by the same token, a person's social context - like, their friends, family traditions, or life stressors - can reinforce something like alcohol consumption more than the nauseating pill could ever punish it.

Plus, we also do a lot of latent learning, like without even knowing it. Have you ever been walking around a new city, someone stops you to ask directions, and you surprise yourself by actually being able to tell that tourist how to get to the park? That's because we're constantly developing cognitive maps, or mental representations of our surroundings, without explicitly telling ourselves to do it. We've all seen the experiments with in mazes: Well, those show us that even rats develop these cognitive maps, figuring out how to get around, even if there's no reward at the end. And days later, when they finally do get food at the end of the maze, they quickly demonstrate all that earlier latent learning by scuttling through the maze as fast, or faster, than rats that had been rewarded all along.

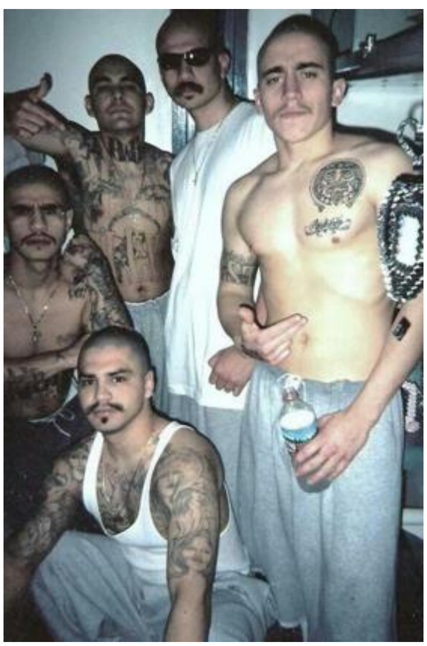
So, learning isn't just about associating a response with a consequence. There's thinking happening, too. And this kind of thinking is also a big part of observational learning, which is basically learning by watching other people, or being influenced by them in other ways. Because, you don't need direct experience to learn. You can just pick up stuff up through modeling -- not like modeling on the catwalk, I just mean observing and imitating specific behaviors.

Rats, crows, pigeons, primates, and other animals learn through imitation. Chimps learn how to use sticks to fish ants out of a nest this way. One study found rhesus macaques were usually slow to make up after a fight unless they grew up watching more forgiving older macaques, in which case they tended to make up more quickly. Of course *we humans learn A LOT from modeling -- I mean, most of our popular culture is based on it: new slang, skinny jeans, foodie trends, pixie cuts -- they're all racing around the globe through observation and imitation*. So it makes a lot of sense that social observation shapes behavior, especially in children.

Which brings us back to Bobo. Again, the fact that we learn by imitating, even when we don't mean to, seems pretty intuitive, but until Bandura's famous experiment, it hadn't been studied in a scientific way. I mean, these kids started abusing Bobo not just with little toddler punches, but with hostile language and even using things, like toy guns, that they previously had no interest in -- and all because they saw aggressive modeling in action. And since Bandura's time, technology has allowed us to peer even deeper into this dynamic.

Neuroimaging in humans, for instance, has shown that when an individual watches someone else, especially someone whom they relate to, receive an award or score a goal or something, their own brain's reward systems light up vicariously. Italian researchers found this out pretty much by accident in the early 1990s: They were studying signals from key regions in a lab monkey's brain that were associated with planning and doing. Their brain-monitoring device buzzed softly when the monkey did something like pick up a piece of fruit and eat it. But one hot day, a researcher came back from lunch licking an ice cream cone, and suddenly heard the animal's brain monitor buzz -- the monkey was watching him, and his brain worked as if it was actually doing the licking.

Many scientists suspect that this is the work of a previously unknown type of brain cell called mirror neurons, which fire when a subject both performs an action, and when they observe someone else doing it. *Mirror neuron research is still relatively new, and we're still figuring them out, but combined with Bandura's earlier work, it's revealing a strong connection between observation, imitation, and learning*. So the takeaway here is: Models are important! And not just Gisele and Antonio Sabàto Junior. You can, if you want, observe and imitate them; I'm just saying that *observational, social learning starts really early, and parental figures are powerful role models.*



Positive, supportive, and loving models usually prompt similar behavior in others, just as negative, aggressive modeling can spark antisocial effects. And, as we'll talk about later, what we see and feel and learn as children is not easily displaced when we're adults. Literary giant *George Bernard Shaw wrote,* *“Imitation is not just the sincerest form of flattery - it's the sincerest form of learning.”* And British statesman Lord Chesterfield once said, “We are, in truth, more than half what we are by imitation.” Even if these ideas were only half-true, they’d still be a powerful lesson on who you choose to spend your time with, and how you choose to act.

If you learned anything today, hopefully it involved the limitations of classical and operant conditioning, the basics of cognitive, observational, and social learning, a look at mirror neurons, and how to beat up a Bobo doll.