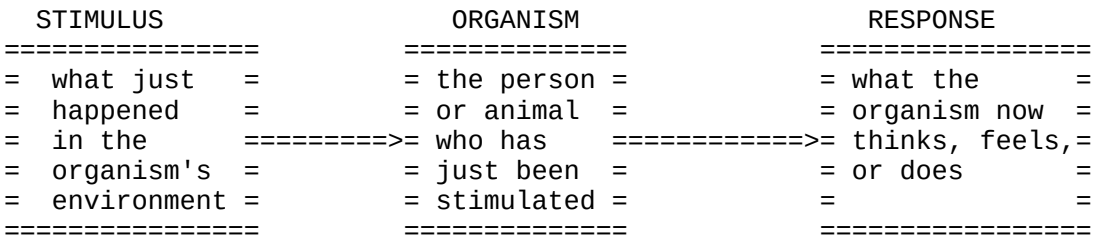
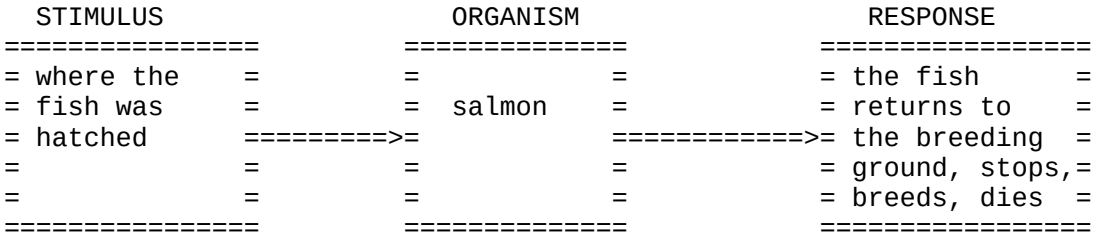
UNIT 6: LEARNING

QUESTION #6.1: What is classical conditioning?

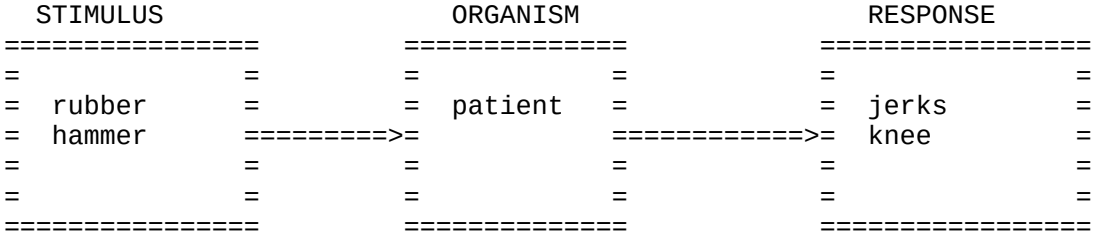
Learning is a change in behavior due to the organism's experience with the environment. The simplest form of learning is **conditioning**, which can be reduced to a basic **reflex** relationship between stimulus, organism, and response.



Not all reflexes are learned. Many reflexes are the result of heredity. The stimulus might come from the environment, but the reflex itself (the relationship between the stimulus and the response) can be pre-programmed inside of the organism. One example would be the spawning habits of the salmon fish. Salmon don't need special training or orientation to know that this is what they must do, or how to do it.

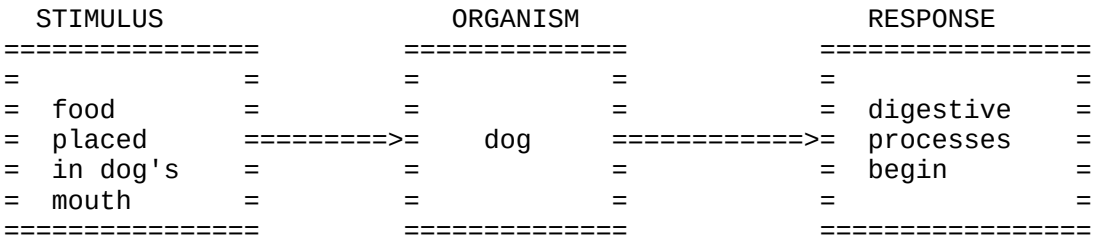


A human example would be the knee jerk reflex. When you go to the doctor for a general physical examination, you have to sit on the examining table, cross your legs, and then the doctor will use a little rubber hammer to strike just below your knee, and then observe the knee jerking in response. Your mother did not have to tell you to do that; your knee was pre-programmed to respond like that.

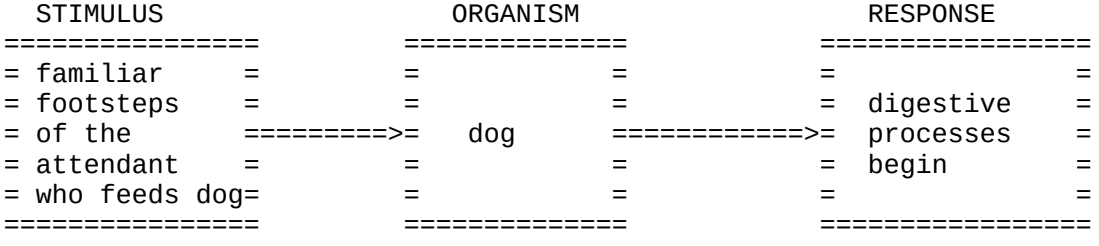


Classical conditioning is one way that the organism can learn a new stimulus-response relationship by building on an old one. **Classical conditioning requires the paired presentation of two stimuli**. The first stimulus was originally neutral (at least with respect to the response). The second stimulus already has a reflex relationship with the response. After enough paired trials of presentation (first stimulus followed by second stimulus) a new reflex will be acquired. At that point, the formerly neutral stimulus becomes a conditioned stimulus capable of eliciting the same response on its own, even if it is not always followed by the second stimulus.

Ivan **Pavlov** was one of the first researchers in classical conditioning. Most of his research subjects were mongrel dogs. He liked to work with the individual animals over a period of years, getting to know their peculiarities. As a skilled surgeon, he was able to install a glass window on a dog's stomach, so that the digestive processes could be directly observed. In 1904 he won the Nobel Prize for his work in the physiology of digestion.



One day as he was preparing an animal for observation, Pavlov noticed that the digestive processes did not start when the dog actually received the food in its mouth, but as soon as the dog could tell that the food was coming. After the dog had been through the procedure a few times, Pavlov noted that the dog's digestive juices began to flow at the first indication of the coming food: the distinctive sound of the shoes of the attendant who brought the food.



It is a natural reflex for a dog to salivate at the taste of the food, but there is no inherited reason for a dog to salivate to the sound of someone's footsteps. That sound was originally a neutral stimulus. Note that the dog did not salivate to the sound of the footsteps until it had learned to associate that sound with the subsequent stimulus of the

food. The dog's experience with the footsteps being followed by the food was a new learning experience. When the footsteps began to elicit the salivation on their own, we could say that the sound was no longer neutral, but had become a conditioned stimulus.

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(neutral       (unconditioned)   (organism)    (response)
 stimulus)       stimulus)        [PASSIVE]    (elicited)

  FOOTSTEPS ----->  FOOD --------->  DOG ------> DIGESTION


  after acquisition of new reflex

(conditioned                      (organism)    (response)
 stimulus)                         [PASSIVE]    (elicited)

  FOOTSTEPS  ---------------------->  DOG ------> DIGESTION
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Pavlov was a master researcher when it came to the precision of his measurements and thorough control of extraneous variables. He constructed a special observation cage for the dog: it was soundproof and had a one-way mirror, so Pavlov could observe the dog, but the dog could not see or hear the approach of an attendant with food. The dog was placed in a special harness to reduce extraneous movements. Pavlov surgically implanted a tube into the dog's salivary gland. The tube carried the saliva into a collection cup where the flow was measured by a drum rotating against an inked needle. Pavlov decided to try a different sound this time for his neutral stimulus, a bell.

The bell would be rung inside of the cage for the dog to hear, then the dog would get food in the form of meat powder. Pavlov observed the charted flow of the saliva, noting that after just a few trials (paired associations) of these two stimuli, the dog had acquired a new reflex. At that point, the bell could be called a conditioned stimulus, since the dog began to salivate as soon as the bell sounded, even before the food arrived.

```
(neutral       (unconditioned)   (organism)    (response)
 stimulus)       stimulus)        [PASSIVE]    (elicited)

  BELL  --------->  FOOD --------->  DOG ------> SALIVATION


  after acquisition of new reflex

(conditioned                      (organism)    (response)
 stimulus)                         [PASSIVE]    (elicited)

  BELL  -------------------------->  DOG ------> SALIVATION
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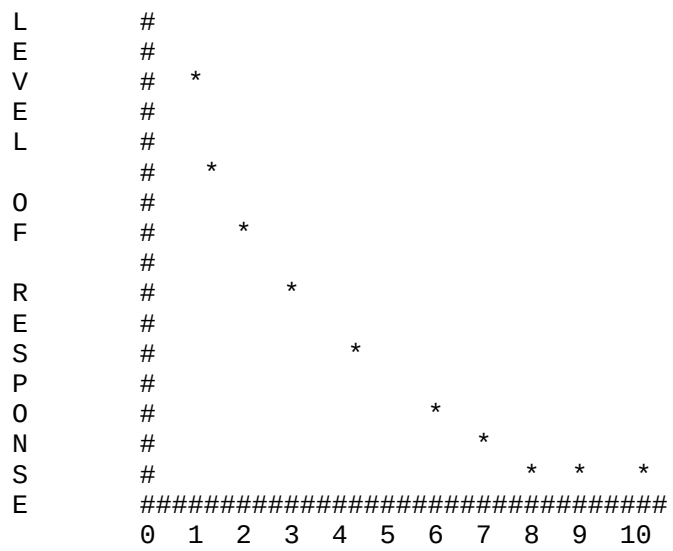
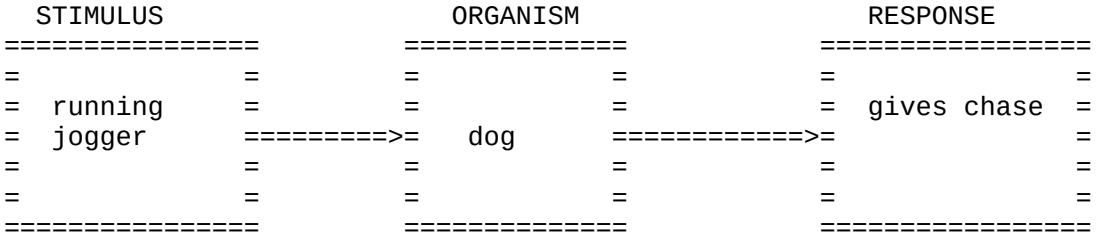
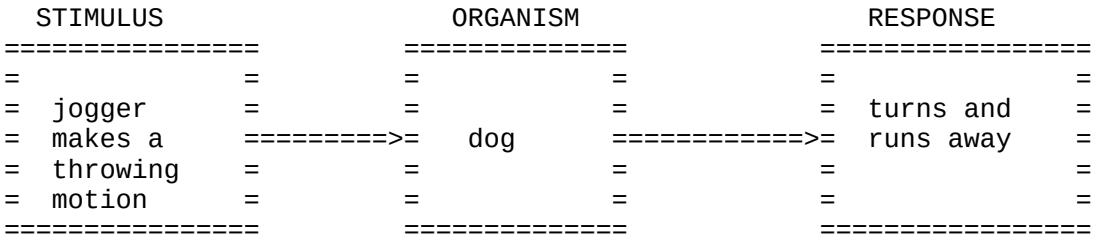
Pavlov experimented with several variables, and consistently found that timing was most important: the less delay between the neutral stimulus (the bell) and the unconditioned stimulus (the food), the sooner and

stronger the new reflex acquired. If he waited too long to present the food, the dog never associated the bell with the food.



Case Study: The subject is now a different dog, a street dog in Mexico. He sees a jogger, and decides to give chase. The jogger notices the approaching, growling dog, and stops, and brings his right hand back as if to throw a rock. The dog turns and runs in the opposite direction.





Classical condition might give us a useful insight on why the dog so drastically changed his behavior. Perhaps that dog has had some bad experiences with people throwing rocks at him.

(neutral stimulus) *(unconditioned stimulus)* *(organism [PASSIVE])* *(response elicited)*

THROWING MOTION ------> BEING HIT BY A ROCK ----> DOG ------> PAIN, FEAR, RUNS AWAY

after acquisition of new reflex

(conditioned stimulus) *(organism [PASSIVE])* *(response elicited)*

THROWING MOTION ----------> DOG ------> FEAR, RUNS AWAY

About the time that Pavlov was doing his research on salivating dogs, young John **Watson** was a graduate student at the University of Chicago. Most of his professors had studied or taught with Wundt or James, and emphasized introspection. Watson worked his way through graduate school doing various jobs, such as working on the other side of campus, in the medical school, cleaning out the animal cages in the laboratories. This experience led Watson to the conclusion that if psychology was to achieve the status of a respected science, it also had to embrace the precise measurement and control found in research on laboratory animals. Most of Watson's own later research was done with rats, but his most famous subject was a human baby, Little Albert.

Watson was interested in studying fear in babies. Babies fear loud noises, so Watson decided to use that as his unconditioned stimulus to elicit the response of fear. For a neutral stimulus, Watson could have chosen just about anything, but he selected a live, white mouse. This leads many students to misinterpret the components of Watson's research. The mouse was not the subject; the human baby was the subject. The mouse's role was that of a stimulus. Watson could have just as easily have used a toy mouse or any other object to serve as the initially neutral stimulus.

Watson hid behind a curtain with a metal bar in one hand and a hammer in the other. His assistant led the baby, a boy known as Little Albert, into the room. When he was calm, she let the mouse out. When the baby noticed the mouse, she signaled Watson who then struck the bar with the hammer, making a very loud sound. The baby was frightened and began to cry. The next day, the procedure was to be repeated. Watson took up his place behind the curtain, ready to strike the bar again when he was signaled. His assistant brought the baby into the room, and when he was calm, she released the mouse again. But this time, even before Watson could strike the iron bar with the hammer, the baby began to cry. The white mouse was no longer a neutral stimulus for the baby, but something frightening on its own. A new reflex had been acquired with just one paired association.

(neutral stimulus) *(unconditioned stimulus)* *(organism [PASSIVE])* *(response elicited)*

MOUSE ---------> LOUD NOISE ----> BABY -----> FEAR

after acquisition of new reflex

(conditioned stimulus)	*(organism) [PASSIVE]*	*(response) (elicited)*
MOUSE ---------->	BABY ----->	FEAR

Later in life, Watson gave up academic psychology and accepted a position with an advertising agency. His strategy was similar to the logic of classical conditioning: pair the name of the product (perhaps a neutral stimulus) with another stimulus (one that the consumer already responds to, such as an attractive spokesperson).

(neutral stimulus)	*(unconditioned) stimulus)*	*(organism) [PASSIVE]*	*(response) (elicited)*
PRODUCT LOGO -->	SPORTS STAR --->	VIEWER --->	INTEREST

after acquisition of new reflex

(conditioned stimulus)	*(organism) [PASSIVE]*	*(response) (elicited)*
PRODUCT LOGO ---------->	VIEWER --->	INTEREST

Watson was an advocate of the philosophical position known as **determinism**. He doubted that people really had free will to choose their own behaviors. Whether he was thinking of a lab rat, a baby, or a potential consumer, Watson conceived of a passive organism whose behavior was completely determined by the pattern of stimuli coming in from the environment. He boasted that he could make any healthy newborn into a beggar, thief, or saint, just by varying the conditioning.

Stimulus **generalization** is the tendency of similar stimuli to elicit similar responses. If you were going to adopt one of the dogs from Pavlov's laboratory, you might have the problem of the dog salivating every time your doorbell rang. Someone conditioned like Little Albert might develop stimulus generalization in terms of fearing other white, furry objects: perhaps a toy stuffed bunny, a live white kitten, and even a man with a Santa Claus beard. Stimulus **discrimination** is where the organism learns to respond to a particular stimulus, and not to other stimuli that are similar.

Extinction is a gradual loss of conditioning. Before you adopted one of Pavlov's dogs, you might insist that it be deconditioned. In classical conditioning, this is usually accomplished by massed trials of presenting the conditioned stimulus alone, without being followed by the unconditioned stimulus. With Pavlov's dogs, this would mean ringing the bell without any presentation of food, many times over the day. The

flow of saliva after the bell will diminish as the dog tires of salivating without the food.

Recovery of a reflex refers to reconditioning an organism. For example, suppose you adopted two dogs, one from the pound (a dog who had never been conditioned to salivate at the sound of a bell), and a dog from Pavlov's lab (who had been conditioned, then extinguished with massed trials). Now suppose that you want to condition both dogs to salivate at the sound of the bell, so you ring the bell and follow it with the food. Both dogs can be conditioned to salivate at the sound of the bell, but it will be the dog from the Pavlov lab that will be easier to condition, as it is merely relearning an old habit.

The fear response is difficult to extinguish. Massed presentation of the conditioned stimulus might be effective over time, but the subject will find it terrifying. As we shall see in chapter 11, the favored approach is one of systematic **desensitization**: slowly exposing the relaxed organism to a series of approximations of the feared stimulus. This technique for undoing classically conditioned feared stimuli was not developed by Watson, but only years later by Mary Cover **Jones**.

One of the great ethical concerns raised by Watson's work was the well-being of his human subject. We do not know if Little Albert continued these **phobic** (intense, irrational fear) responses throughout his adult life. We do know that Watson did not report any deconditioning work on his subject.

Classical conditioning pairs two stimuli SS to a passive organism

QUESTION #6.2: What is operant conditioning?

Operant conditioning uses reinforcement. Reinforcement is a stimulus that the organism gets (or gets rid of) after the response has been given. After Watson, many behaviorist psychologists did research on what was called effect-based, **instrumental**, or operant conditioning.

The key difference with the classical conditioning of Pavlov and Watson, and this newer approach was that operant conditioning used an active organism that emitted the response, and then the stimulus was presented to the animal. You have performed some operant conditioning if you taught your pet to do a trick.

(organism) (response) (reinforcement)
(active) (emitted)

PET ----------> DOES TRICK -------> FOOD TREAT

Behaviorist B.F. **Skinner** was one of the major researchers with operant conditioning. He developed specialized cages known as Skinner boxes. These cages made it very easy to study operant conditioning. A Skinner box for a pigeon would have a dispenser that could give the pigeon one food pellet at a time, and also a mechanism to record the pigeon's pecking (the response).

(organism) (response) (reinforcement)
(active) (emitted)

PIGEON ---------> PECK TARGET ------> FOOD PELLET

A Skinner box for a rat would also have a dispenser that could give one food pellet at a time, and a mechanism to record the pressing of a bar by the rat (the response).

(organism) (response) (reinforcement)
(active) (emitted)

RAT ----------> PRESS BAR --------> FOOD PELLET

Skinner was able to identify several factors influencing the organism's learning of a reflex. Timing was important: the longer the delay between the organism's response and the provision of the reinforcement, the harder it was to learn the connection between the two.

QUESTION #6.3: What are the different types of reinforcement?

Reinforcement is the stimulus that the organism receives (or gets rid of) right after emitting a response. In other words, reinforcement is what happens to the organism because of its response.

Reinforcers can be either primary or secondary. **Primary reinforcers are unlearned**: the organism naturally appreciates them. The example given above, food, is a primary reinforcer. The avoidance of pain would be another. In one sense, primary reinforcers in operant conditioning are similar to the unconditioned stimulus used in classical conditioning. Food presented before the response would be an unconditioned stimulus

in classical conditioning. Food presented after the response would be primary reinforcement in operant conditioning.

Secondary reinforcers are those that the organism has had to learn to appreciate. Experience teaches us the value of money, good grades, social approval, and the avoidance of embarrassment. In a sense, secondary reinforcers in operant conditioning are like conditioned stimuli in classical conditioning: the organism has learned to respond to them. All conditioning involves the learning of a new response, but only those cases in which the organism has learned to appreciate the value of the reinforcer can be called secondary reinforcement.

(organism) *(response)* *(reinforcement)*
(active) *(emitted)* *(secondary positive)*

STUDENT --------> STUDIES HARD ----> GETS GOOD GRADES

(organism) *(response)* *(reinforcement)*
(active) *(emitted)* *(secondary positive)*

ATHLETE --------> PRACTICES HARD ---> WINS FIRST PLACE

(organism) *(response)* *(reinforcement)*
(active) *(emitted)* *(secondary positive)*

WORKER ---------> WORKS OVERTIME ---> GETS LARGE PAYCHECK

Reinforcers can also be classified as positive or negative. A **positive reinforcer is a reward**, something that the organism wants and appreciates. Food and pleasure would be primary positive reinforcers. Money, good grades, and social approval would be secondary positive reinforcers, because a person must learn to appreciate the value of those things.

Extinction with positive reinforcement is easy: just remove the reinforcer. If we want to get the pigeon to stop pecking, or the rat to stop pressing the bar, we just turn off the food dispensing mechanism. Human reinforcement is more complicated, especially where some secondary reinforcement may also be involved.

Case Study: Mr. H had a newspaper route when he was just twelve years old. He was able to save up enough money for his first car at age sixteen. He worked his way through college selling and installing chain link fence. After college he became a life insurance agent. He worked very hard and was outstanding in his sales. He then had the capital to purchase other businesses: oil development, cattle, real estate. Now in his 70s he keeps on working, even though he has no need for more money. Perhaps he has been conditioned by secondary reinforcers such as social approval and status. On the other hand, the determinists may be wrong, and people might actually have free will. Mr. H may keep on with his business dealings because he enjoys the excitement of the business

world, and wants to help his customers, employees, and community with his business acumen.

Like Watson, Skinner was a major force on **Behaviorism**, and an advocate of the philosophical doctrine of determinism. Skinner considered the concept of free will to be a mere delusion. He thought that a perfect society could be constructed if we just systematically controlled the positive reinforcers so that every individual would be conditioned to do good, pro-social behaviors. Before he went to graduate school to study psychology, Skinner had spent a year in Greenwich Village trying to make it as a writer. After he had earned his reputation as a serious scientist, Skinner returned to his love of fiction writing, describing a utopian society, *Walden II*, which employed his theories of positive reinforcement. Unlike Huxley's *Brave New World* or Orwell's *1984*, there is no obvious fatal flaw in Skinner's perfect system.

The power of positive reinforcement is not limited to normal adults, rats and pigeons. In mental hospitals, developmentally disabled and schizophrenic patients have their behavior altered by the **behavioral modification** of positive reinforcement. These patients can be trained to turn in their dirty laundry, take their medication, and show up for group therapy by getting rewards such as candy, cigarettes, or various privileges.

(organism) *(response)* *(reinforcement)*
(active) *(emitted)* *(secondary positive)*

PATIENT --------> TURNS IN LAUNDRY ----> GETS CANDY

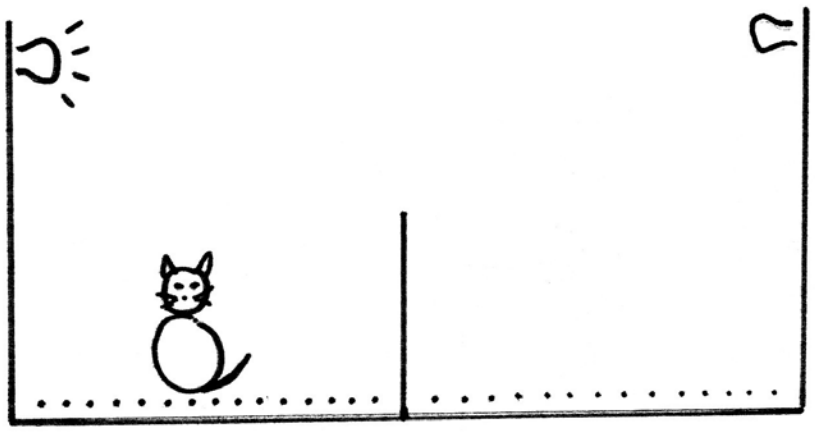
Even invertebrates lacking a real central nervous system (e.g., planaria worms) can be conditioned operantly to make certain motions if reinforced by food.

Negative reinforcement involves the prevention or removal of an aversive stimulus. An aversive stimulus is something that the organism does not like (and serves as a punishment). So, negative reinforcement is the opposite of punishment: **punishment** provides an aversive stimulus, while negative reinforcement would prevent or remove that aversive stimulus. (Skinner preferred positive reinforcement.)

Imagine that a cat (or other organism O) has been placed into a special cage that has a small fence down the middle, separating the two sides of the cage. The cat cannot jump out of the cage, but he can jump over the fence onto the other side of the cage. Each side of the cage has a separate electrifiable grid capable of giving a mild, but unpleasant shock to any organism standing on the grid. The cage also has two little light bulbs in the roof. The light bulb on the left comes on, but this is like a neutral stimulus for the cat, so there is no immediate response. A few seconds later, the grid on the left side of the cage is electrified, presenting the organism with an aversive stimulus. The cat now responds by trying to get away from the shock, and jumps the fence, finding that the grid on the right side of the cage is off. The cat has escaped from the aversive stimulus. A few minutes later, the right light comes on, and a few seconds later, the

right side of the cage becomes electrified. The cat jumps over the fence again to escape the new shock, and lands back over on the left side of the cage, finding that grid has now been turned off. In a short time, the cat will figure out that the lights are a warning of a forthcoming shock, and if the cat jumps fast enough, it can completely avoid being shocked.

Negative Reinforcement in the form of Avoidance conditioning



(organism)	*(aversive stimulus)*	*(escape response)*	*(termination of aversive stimulus)*
cat ---------->	painful electric shock ------>	jumps fence -------->	stops feeling shock

(organism)	*(warning stimulus)*	*(escape response)*	*(prevention of aversive stimulus)*
cat ---------->	light ------->	jumps fence ------->	never gets shocked

Case Study: Let's revisit a previous example: the street dog who was chasing a jogger, but then ran the other way when the jogger pretended to throw a rock. Negative reinforcement could also explain the dog's actions.

(organism)	*(aversive stimulus)*	*(escape response)*	*(termination of aversive stimulus)*
dog ---------->	getting hit by a rock ----->	turns and runs away ---------->	does not get hit by more rocks

(organism)	*(warning stimulus)*	*(escape response)*	*(prevention of aversive stimulus)*
dog ---------->	person making a throwing motion ------>	turns and runs away ---------->	does not get hit by any rocks

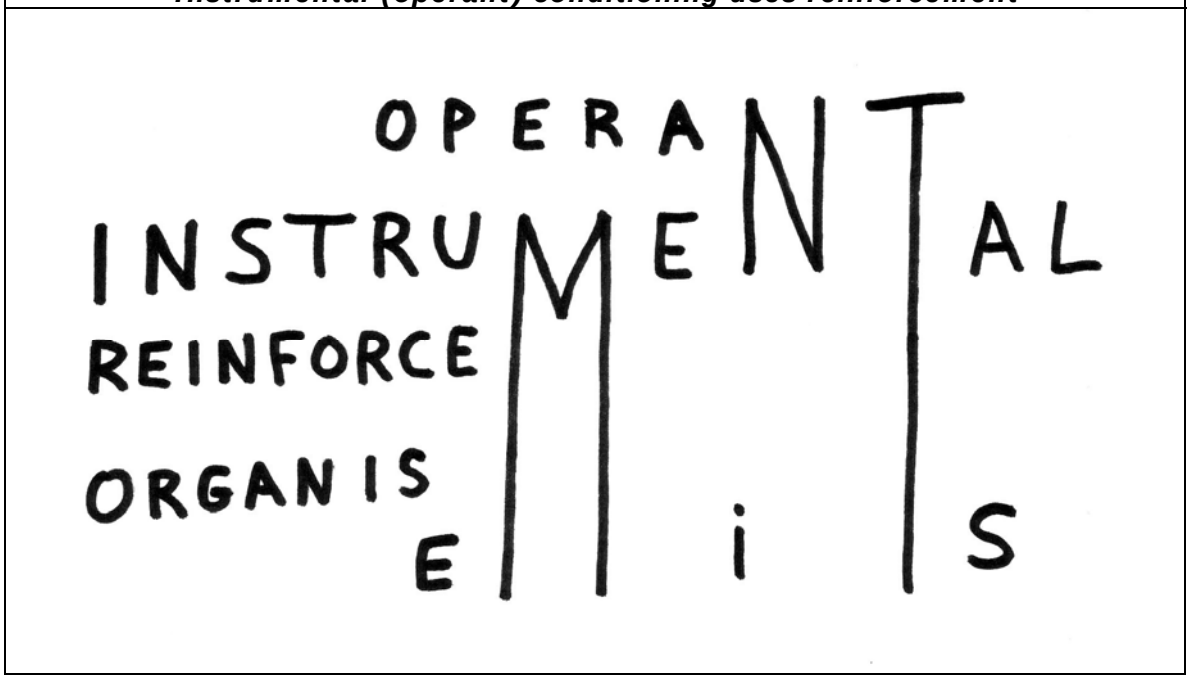
Negative reinforcement can explain about a dozen activities you might engage in each morning before you leave the house. You get on the exercise machine, even though it is boring, in order to get the negative reinforcement of avoiding weight gain. You swallow a large, bitter vitamin pill in order to get the negative reinforcement of reducing your chances of getting ill. You bathe, groom, and dress yourself, to get the negative reinforcement of avoiding embarrassment. As you leave the house, you set the alarm and lock the doors, in order to get the negative reinforcement of not having a burglar come into the house while you are gone.

Forms of reinforcement		
	Positive (provide a reward)	**Negative** (remove an aversive S)
Primary	Food Pleasure	Take away Pain
Secondary	Money Points Praise	Take away Embarrassment

Negatively reinforced behavior may be harder to extinguish. Suppose we turned off the electrified grids in the cage, but still had the light bulbs come on every once in a while. The cat would not know that the lights will no longer be followed by shocks, and so will continue to

jump. The fact that he is not shocked after the jump, is merely more reinforcement for his jumping behavior. Suppose that your local police became extremely effective in stopping burglaries in your neighborhood, you might not decide to get rid of the alarm, or stop locking your doors. Indeed, you might conclude that the reason you have not been burglarized is because of the precautious responses you have taken. Even when the aversive stimulus is provided after the response, this does not necessarily extinguish the reflex. If your house were burglarized despite your alarm and lock, you would probably conclude that you needed a quicker responding alarm company and bigger locks.

Instrumental (operant) conditioning uses reinforcement



QUESTION #6.4: How can reinforcement be scheduled?

At the beginning of operant conditioning, it may be necessary to reinforce successive approximations of the end response. Suppose that we want to condition a pigeon to peck at a target in its cage. We might have to take over manual control of the food pellet dispenser. We might send the first pellet down the chute when the pigeon first faces the wall containing the target. We might give another food pellet when the pigeon starts to walk toward the wall. We will wait until the pigeon pecks somewhere on the wall before the next pellet is dispensed. Then we will require the pigeon to hit one of the rings of the target before giving another food pellet. Then we can progressively reduce the number of rings in the target until we only reinforce a direct hit on the bull's eye center of the target.

Once an organism has been operantly conditioned, reinforcement does not have to be maintained on a continuous schedule. It can be used intermittently, so that only some of the responses are reinforced, while the majority of the responses go unreinforced.

Case Study: Mr. L watches a lot of television. He knows exactly what he likes: action-filled police dramas and action-filled sporting events. Even when he is watching his favorite programs, or the World Series, if a commercial comes on, or the action gets a little slow, he gets out his channel flipper. Each time he flips to the next channel, that constitutes a response. If such flipping results in his seeing something more interesting, he has been positively reinforced. But most of the time he flips to the next channel, he sees something just as boring as what he flipped away from: another commercial, talking head newscasters, cartoons, women's talk shows, soap operas. He may not be reinforced that often, but he is reinforced often enough to keep on flipping channels. People and animals keep on doing things even when they are reinforced only occasionally.

(organism)	*(response)*	*(reinforcement)*
(active)	*(emitted)*	*(secondary positive)*

TV VIEWER ------> FLIPS CHANNEL ----> GETS BETTER PROGRAM

Intermittent reinforcement can be set up on schedules that are determined by the ratio of the responses, or by the interval of the responses. **Ratio schedules** make the amount of reinforcement proportionate to the number of responses, such that if the organism emits more responses, he will end up getting more reinforcement over the long run. Time **interval schedules** of reinforcement mean that in any given time period, the organism will be reinforced only once, regardless of how many additional responses might be made.

Fixed ratio reinforcement could be set at any ratio, say, five to one. The pigeon might be required to make five pecks at the target in order to get one food pellet. The first four responses made by the pigeon will be ignored, but on the fifth response, a food pellet will be delivered. This will get more responses out of the pigeon than if it were reinforced on a continuous one to one ratio.

There are many human examples of fixed ratio reinforcement, especially in the world of work. Piecework is the practice of varying the worker's pay according to how much the worker does. In agricultural harvesting, fruit pickers are usually paid by the box, and so they pick fast in order to get more money. On some construction projects, workers are paid according to how many loads of bricks are laid, or how many houses are framed. In the clothing industry, some workers are paid by how many pieces of clothing are sewn.

(organism)	*(response)*	*(reinforcement)*
(active)	*(emitted)*	*(secondary positive)*

FRUIT PICKER ---> PICKS FAST -------> GETS MORE MONEY

Variable ratio reinforcement means that the proportion of reinforcers to responses might have a certain average, say five to one, but there is no guarantee that each fifth response will be reinforced. One of the best examples of variable ratio reinforcement is gambling. Imagine a slot machine that takes quarters and pays off dollar jackpots. The machine has been set to a five to one ratio (on the average, taking in five quarters for every dollar paid out, which would return a 25 percent profit to the house). You decide to try your luck, and put in a quarter, hoping to get a dollar back, but nothing happens after you pull the handle. You put in a second quarter, thinking that you can still double your money, pull the handle, but nothing happens. You put in your third quarter, still thinking that you could be money ahead, pull the handle, but nothing happens. You put in your fourth quarter, thinking that you can break even, pull the handle, but nothing happens. You put in your fifth quarter, starting to feel like a sucker because you remember that it is a five to one ratio, and so far you have not beaten those odds. You pull the handle, and expect your jackpot, but you just might be disappointed again. If the machine were set up with fixed ratio reinforcement, you would be guaranteed of getting your jackpot after five pulls, but this is variable ratio: on the average it takes five pulls. That means that some people may win in fewer, but others will be reinforced less often. That is why they call it gambling.

(organism) *(response)* *(reinforcement)*
(active) *(emitted)* *(secondary positive)*

GAMBLER --------> PLACES A BET -----> WINS SOME MONEY

Variable ratio reinforcement schedules are also faced by authors who try to get their books (or articles or poems or screen plays) published. Imagine that you write a novel, then send it to a book publisher. It is rejected by the first publisher, so you send it to another, and it is rejected there too. Finally, you try a third publisher, and this time it is accepted for publication. You receive a royalty contract, a large monetary advance, and invitations from talk shows. There was no guarantee that the third publisher would accept the book. You might have had to send it to five, or ten, or a hundred, and even then realize that most books are not published. But occasionally some new authors get through, and that is enough reinforcement to keep them writing and submitted the books to publishers.

(organism) *(response)* *(reinforcement)*
(active) *(emitted)* *(secondary positive)*

AUTHOR --------> SUBMITS BOOK -----> GETS BOOK CONTRACT

Yet another example comes from the world of commission sales. The organism is a car salesman. The response he is supposed to make is to greet a potential customer, go on a test drive, and write up a deal that he then takes to management. If a sale can be negotiated and financed, the salesman will be paid a commission (a positive reinforcer). An old rule of thumb in auto sales is that you have to

present yourself to twenty customers for every sale you get. Some times (around Christmas) might be a little slower, and then some times (during a factory rebate) might be a little better, but the salesman never knows if the next customer will be one who ends up saying "just looking" or the one who drives out with a new car.

(organism) *(response)* *(reinforcement)*
(active) *(emitted)* *(secondary positive)*

SALESMAN -------> PRESENTATION -----> GETS SALES COMMISSION

Fixed interval schedules mean that there would be a rigid time period (say an hour) during which only one response will be reinforced. Imagine that the pigeon in the Skinner box is getting too fat. Putting him on ratio reinforcement would give him more exercise, but putting him on interval reinforcement would be a diet. We will give the pigeon a maximum of one food pellet per hour. The very first time it pecks the target during the hour, one food pellet is dispensed. No additional pecks will be reinforced until the next time period commences. The closest human example of fixed interval reinforcement would be hourly pay. Regardless of how much work the person does in that hour, the pay for showing up will be the same.

Variable interval reinforcement means that the time period may fluctuate, although it may average a certain length of time. Fishing is one example of variable interval reinforcement. Suppose you go up to the lake each Saturday morning, and spend about four hours on the water fishing. You catch an average of four fish, so that means you are getting about one fish per hour. However, this is a variable schedule so the reinforcement is not guaranteed: you cannot look at your watch and say "It has been 58 minutes, so I better get ready for my first fish." On a good day, the interval between catches might be short. Indeed, you might catch all four fish in your first hour. On a bad day, you might end up with no fish at all.

(organism) *(response)* *(reinforcement)*
(active) *(emitted)* *(secondary positive)*

FISHERMAN ------> FISHES 4 HOURS ---> CATCHES SOME FISH

Another example of variable interval reinforcement would be calling up a friend on the phone and trying to get through. You know that your friend is usually on the phone for about ten minutes before she ends the conversation and a new call can get through to her. If you call her and get a busy signal, you might hang up and call again in a minute and be lucky to catch her. Or sometimes you can try several calls during an hour and keep on getting a busy signal because she is having unusually long and frequent conversations on the phone.

(organism) *(response)* *(reinforcement)*
(active) *(emitted)* *(secondary positive)*

CALLER ---------> PLACES PHONECALL -> CALL GETS THROUGH

A beggar on a busy street works under a variable interval schedule. His begging behavior may be to look sad, draw attention to his disability, say religious things, offer to work for money, sing or play a musical instrument, or be accompanied by an animal. He may average a "donation" every ten minutes, but he cannot predict when the next one is coming: thirty seconds? three hours?

(organism) *(response)* *(reinforcement)*
(active) *(emitted)* *(secondary positive)*

BEGGAR -------> PRESENTATION -----> GETS DONATIONS

Examples of Reinforcement Schedules

	FIXED	**VARIABLE**
Ratio (determined by number of responses)	Piecework	Gambling Commission sales
Interval (determined by time period)	Hourly wage	Fishing Getting through on the phone

Advantages of Reinforcement Schedules

	FIXED	**VARIABLE**
Ratio (determined by number of responses)	High rates of response	High rates of response Low rates of Extinction
Interval (determined by time period)	Lower fatigue and stress	Low rates of Extinction

These schedules offer different advantages. In general, ratio schedules get higher rates of response than do interval schedules. Variable schedules tend to resist the extinction produced by non-reinforcement because variable schedules are the least predictable. As any gambler, author, salesman, or fisherman can tell you, there will be some long dry periods when "the luck runs cold." Eventually, the luck will turn around and some money will be made (but in the long run, most gamblers lose more than they win). Perhaps the greatest advantage of fixed hourly pay is that it removes the stress of unpredictable compensation, and allows the worker to focus on quality. Perhaps the major reason why so many careers involve the fixed interval of hourly wage or monthly salary is that it is difficult to measure and reinforce many work-related responses.

Schedules of reinforcement					
Schedule		*Examples*	*High rates of response*	*Resistance to extinction*	*Levels of stress and fatigue*
Fixed	**Ratio**	Piecework	Excellent	Fair	Fair
Fixed	**Interval**	Hourly wage	Fair	Fair	Good
Variable	**Ratio**	Gambling	Excellent	Excellent	Poor
Variable	**Interval**	Fishing	Fair	Excellent	Fair

Indeed, we must always be careful when using positive reinforcement that we end up getting the behavior that we really wanted. Some companies have given up piecework when they found that the workers quickly assembled shoddy units. Some retailers have found that commission sales leads to high pressure tactics that drives away the customers and gives the firm a bad reputation. One rural district in India decided to try to control the cobra population by offer a bounty to villagers for each snake, dead or alive, brought in.

Intended Result

(organism) *(response)* *(reinforcement)*
(active) *(emitted)* *(secondary positive)*

VILLAGERS -------> CATCH SNAKES -----> TURN THEM IN FOR BOUNTY

At first the program seemed quite successful. Hundreds of snakes were turned in. The officials were certain that a large reduction in the snake population would result. The next year even more snakes were turned in, and the number increased geometrically the following year, and the officials wondered how they would get enough to pay all these bounties, and they were amazed that there had been so many snakes to begin with. Then one of the hunters admitted that it was a lot easier to raise the snakes than to catch them.

Actual Result

(organism) *(response)* *(reinforcement)*
(active) *(emitted)* *(secondary positive)*

VILLAGERS -------> RAISE SNAKES -----> TURN THEM IN FOR BOUNTY

Here is a summary of the main differences between classical and operant conditioning.

	CLASSICAL	**OPERANT**
Major figures	Watson, Pavlov	Skinner
Subjects	Dogs (Pavlov) Baby (Watson)	Rats, Pigeons
Organism is	Passively anticipating a stimulus	Actively emitting a response
Stimulus is	Paired before a response (NS / UCS)	Presented after the response
Role of stimulus	Elicits the response	Reinforces the response
Generalization	To similar stimuli	To similar responses
Extinction	Due to presenting CS without UCS	Due to Non-reinforcement of response
Resistance to Extinction is Greatest when	UCS was intense (e.g., Little Albert)	The schedule is Variable (e.g., gambling)

QUESTION #6.5: What is punishment?

Punishment is the provision of an aversive stimulus, presenting the organism with something that it does not want to happen. Punishment is not the same as negative reinforcement (which prevents or removes an aversive stimulus).

Punishment is employed in order to reduce a specific response by the organism. Punishment can be **effective if it is sufficiently intense, is consistently applied, and immediately follows the response**. The longer the time lag between responses and punishment, the less likely the organism will connect the two. Telling a toddler "wait until your father gets home" is a bad discipline strategy for several reasons. The delay breaks the connection between the punishment and the bad act which the mother or baby sitter may wish to suppress. Assigning discipline exclusively to the father (or any one adult) may cause the child to associate punishment with that individual rather than her own behavior.

Another limitation to certain forms of punishment is that termination may constitute a negative reinforcement for whatever the organism was

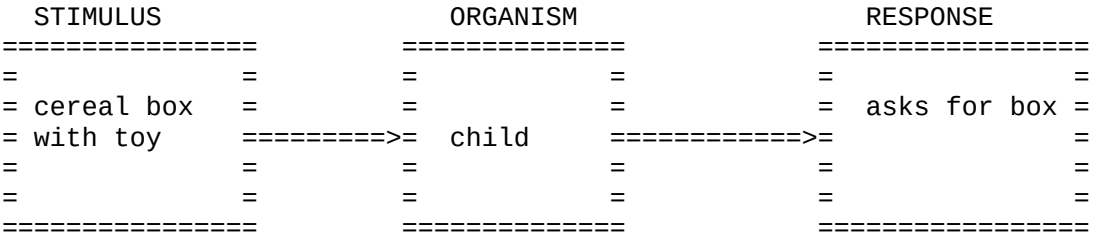
doing just prior to termination. A five year old boy was placed in a chair facing the corner for a timeout by his sitter. She had intended to leave him there for about five minutes, but she got distracted making lunch. After about seven minutes, the boy said "Is it time yet?" The sitter looked at her watch and agreed that he could go back and play. On the next occasion for a time out, the boy started asking "Is it time yet?" just a couple of minutes into his time out. He had been negatively reinforced for his questioning.

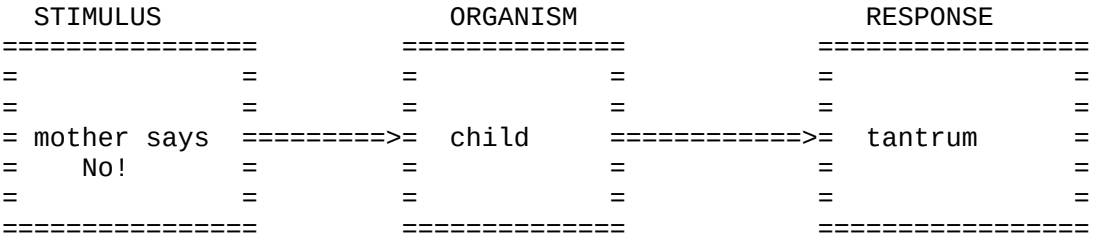
(organism) *(response)* *(reinforcement)*
(active) *(emitted)* *(secondary negative)*

BOY ----------> "Is it time yet?"---> TIME OUT PERIOD ENDS

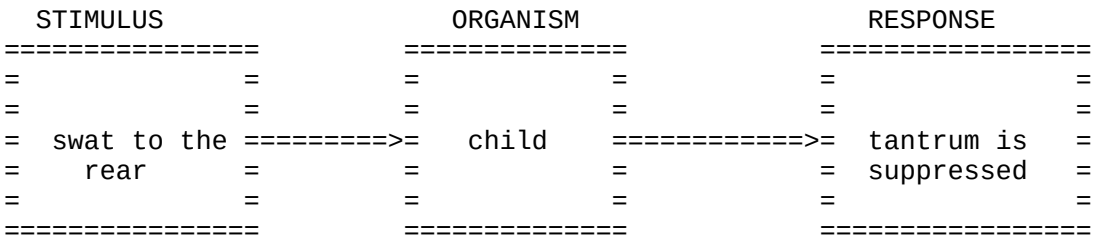
Even when punishment is effective in suppressing a response, it does not necessarily weaken the underlying habit. "When the cat is away, the mice will play." If a child has associated the risk of punishment with the presence and vigilance of a parent, she might conclude that she just has to be more careful not to get caught.

One alternative to punishment is distraction. Small children may throw a tantrum because they want something right now, and have little capacity for self-restraint or delayed gratification. Imagine this situation in the supermarket. A three year old boy in a shopping cart sees a cereal carton with a toy he has seen advertised on television. He asks for it, but the mother says no, so he responds with a tantrum.

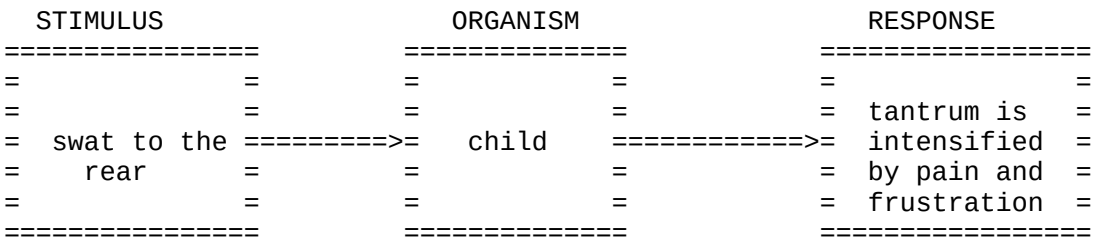


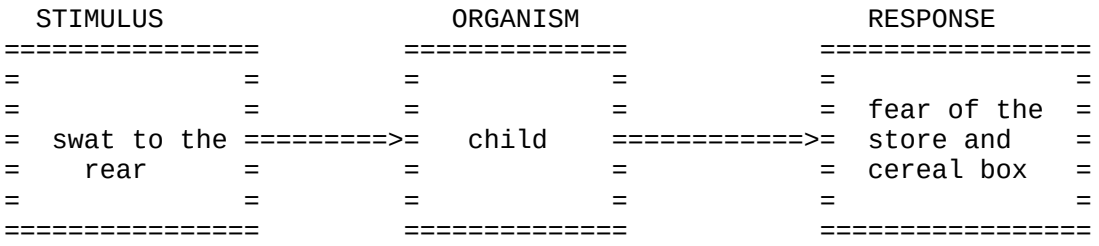


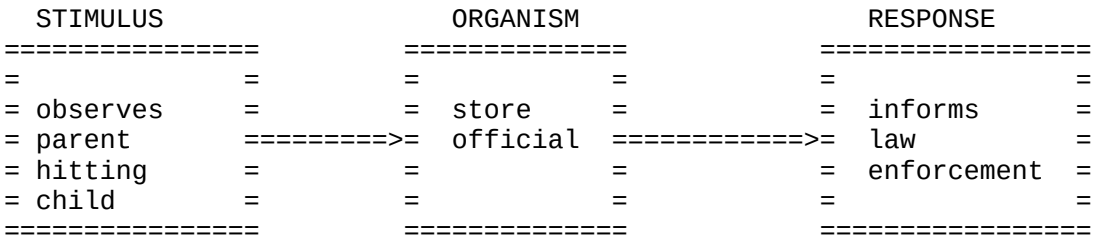
Many “old fashioned” parents think that quick punishment is the best tactic at this point.



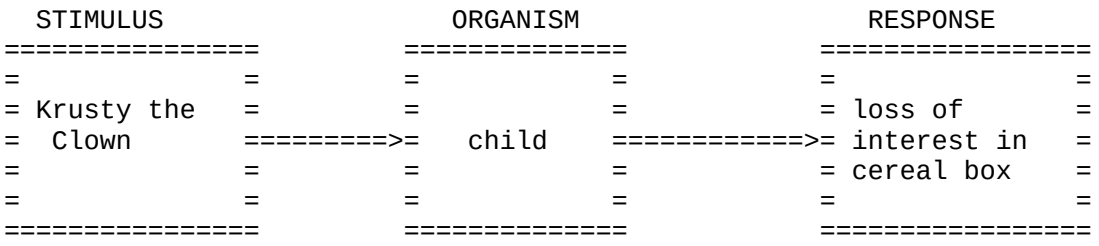
This might work, but here are some other possible outcomes.







One alternative especially appropriate for subjects with limited attention spans (e.g., young children and dementia patients) is distraction. The connection between the initial stimulus (the cereal box) and the child's interest will be short lived if one stimulus can be replaced by another. One mother distracted her little girl, a young fan of the Simpsons cartoon series, by saying "Oh, look, there is Krusty the Clown, let's try to catch him." When the little girl looked around and said "Where is Krusty?" the mother responded, "Well, you know Krusty does not like the sound of children crying."



The worst thing that a parent could do in the above situation would be to give the child the cereal box after a tantrum has already emerged. That merely provides positive reinforcement for the tantrum. Many parents rationalize their giving in, thinking, "Well, just occasionally" but that only serves to schedule the reinforcement on a variable schedule, which will make it most difficult to extinguish later on.

(organism) *(response)* *(reinforcement)*
(active) *(emitted)* *(secondary positive)*

CHILD ----------> TANTRUM ----------> GETS THE CEREAL BOX

Here is a summary of the differences between positive and negative reinforcement, punishment, and non-reinforcement.

Different forms of learning

	PROVIDED	**REMOVED**
REWARD	Positive reinforcement *Increases R*	Non-reinforcement Extinguishes *Decreases R*
AVERSIVE STIMULUS	Punishment Suppresses *Decreases R*	Negative Reinforcement *Increases R*

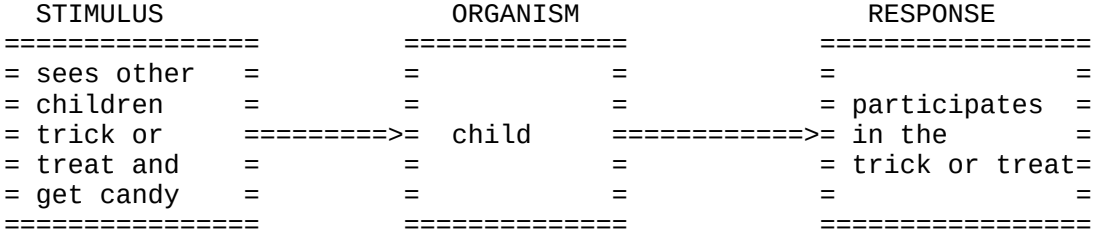
So, here is a guide as to what to use.

In order to	*Use*	*Which means*
Increase behavior	Positive reinforcement	Give reward After behavior
Increase behavior	Negative reinforcement	Withdraw aversive S After behavior
Decrease behavior (suppress habit)	Punishment	Give aversive S After behavior
Decrease behavior (weaken habit)	Extinction via Non-reinforcement	Give no reward After behavior

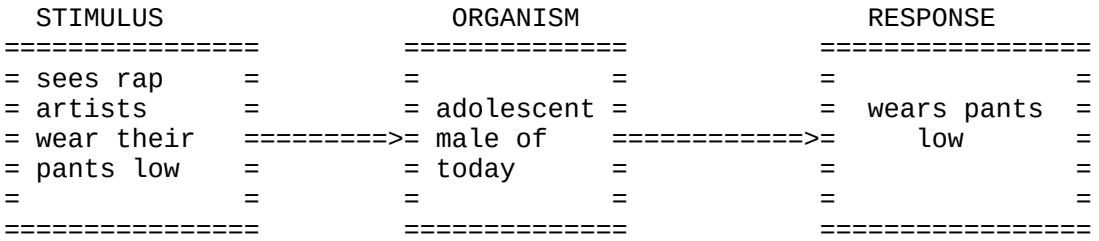
QUESTION #6.6: What are other forms of learning?

Modeling is where the subject observes another organism doing something, and then imitates that behavior. This is also known as **vicarious** or imitative learning. The idea of "monkey see, monkey do" has been around a long time, but Albert **Bandura** has been one of the pioneer researchers in this area.

Several factors influence whether a subject will choose to model his own behavior on that observed in another person. One is whether the subject observes the other organism being reinforced (or punished) for the behavior. One little girl was all dressed in her Halloween costume, but she was shy about going to a stranger's door and saying "Trick or Treat." When she saw the other kids getting candy, she overcame her shyness.

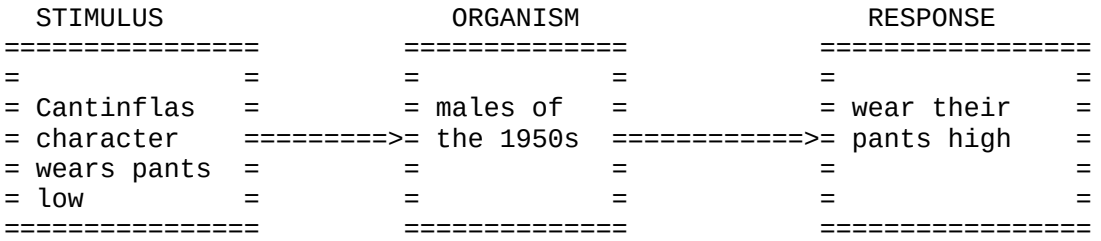


Another factor is whether the subject regards the model as a high status figure. Over the past decade, hip hop music artists have worn their pants low, exposing their abdomens or boxer underwear. This has become a fashion mode for many young men.

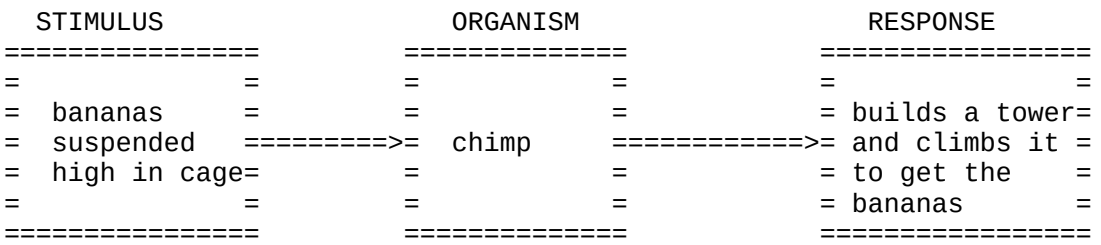


Fifty years ago the most famous actor in Mexico, Cantinflas, portrayed a character with low pants in many popular films. But this character

was portrayed as being a comic figure, clumsy, poor, and socially inept. Anyone who wore his pants low at school in Mexico would be teased by the other students.



Another form of learning is **cognitive** problem solving. This works with organisms with highly developed cerebra. Rather than waiting for some reinforcement before acting, the organism predicts the future consequences (reinforcement) of its behavior. One chimpanzee was shown some bananas at the top of the cage. There were some cardboard boxes in the cage. He figured out how he could build a tower out of the boxes and then climb that tower to get the bananas.



The **transfer of training is where old learning impacts on new**. The organism may develop a new insight about how to apply old skills or strategies to new problems. When similar stimuli call for similar responses, old learning can facilitate new. Many pilots who have learned to fly on propeller planes find that many of their skills transfer to flying jet aircraft. When picking up a new language (like German) after one has already learned English, similar words will be learned most easily.

New stimulus (German)	**Old response (English)**
Mann	Man
Haus	House
Buch	Book
Ja	Yes

But when the new stimulus calls for a very different kind of response (e.g., flying a helicopter after flying a plane) some subjects might find that the old learning gets in the way, interfering with the new skills.

New stimulus (German)	Old response (English)
Elf	Eleven
Wand	Wall
Gift	Poison

When studying Portuguese after mastering Spanish, many students find that reading the new language is easy, because so many Portuguese words look like similar words in Spanish. However, when learning to speak Portuguese, many Spanish speakers find that learning the different sounds is made more difficult because of the tendency to try to go back to the more familiar sounds of Spanish.