Classical (Pavlovian) conditioning involves learning an association between two stimuli. The person or animal learns that when one stimulus, the conditioned Stimulus (CS), occurs, a second stimulus, the unconditioned stimulus (US), will follow, regardless of what s/he does. The learned response to the Conditioned Stimulus is the conditioned response (CR). That conditioned response appears to prepare the subject for the effect of the Unconditioned Stimulus and often resembles the unconditioned response (UR), which the Unconditioned Stimulus elicits (triggers).

Instrumental conditioning involves learning the association between a response and its consequences (what happens immediately after that response). E. L. Thorndike studied this process, often called "trial and error" learning, at the end of the 19th century. (As B. F. Skinner later pointed out, "trial and success" learning is a more accurate description.) Based on his studies of chicks and cats, Thorndike proposed the law of Effect. This law states that the "strength" of a response increases when SATISFIER promptly follows it. A satifier is something an animal or person consistently approaches and does nothing to avoid. Response "strength" can be operationally defined in several ways: rate of a response (number of responses per minute); speed or latency of a response, the probability that the response happens, etc.

B. F. Skinner was the most forceful and influential advocate of instrumental conditioning and its importance in everyday behavior. He and his associates and followers applied the concepts of instrumental conditioning to problems ranging from animal training to education, treatment of psychological problems, behavioral management of mentally retarded people, and industrial management. Skinner used the term operant conditioning, which is slightly different from instrumental conditioning, but the difference can be ignored. Link to tutorials on behavior analysis developed by Cambridge Center for Behavioral Studies.

Instrumental conditioning requires that a response must occur before it can be conditioned. For example, to train a rat to press a lever, the rat must emit (make) a lever press before a reinforcer can be delivered to strengthen that response. Because of this, instrumental conditioning looks like what people call voluntary behavior, though conscious control is not necessarily involved. People can be conditioned to make responses without being aware of the relation between their responses and the consequence that follows it.

For example, a hungry pigeon must peck at the target, before it gets food to reinforce (make stronger) that pecking response. Although the pigeon’s behavior looks very much like that produced by autoshaping described in Exercises asgn3a and c, it is based on a different procedure. Figure 1-3d shows the sequence of events on the first reinforced of instrumental conditioning and Pavlovian conditioning by autoshaping.

Q1. Mark each example with P if it is an example of Pavlovian conditioning or with I if it is an example of instrumental conditioning. [Examples assume male gender; females can switch to female gender.]

P I A. wearing an aftershave scent that your girlfriend says she likes
P I B. starting to salivate more when you see your tasty dinner coming
P I C. flinching to lightning before you hear the loud thunder
P I D. picking fruit to earn $1 for every 10 boxes picked
P I E. your girlfriend's cologne scent elicits (triggers) a warm emotion in her absence
P I F. putting on your baseball cap backwards to gain your friends' acceptance
In humans, classical conditioning is easiest to show in emotion. For example, after one or two trips to the dentist, seeing and sitting in the dentist chair are associated with dental drill, scraper, and probe on your teeth and gums. These unpleasant stimuli reliably trigger body reactions characteristic of pain, like flinching. Seeing and sitting in the dentist chair reliably predicts that the drill, the scraper, and the pick will follow. Your body quickly learns to make similar reactions to the dental chair as it does to the painful sensory stimuli that the dental tools produce.

Match the parts of the dentist chair example with the terms below

1. unconditioned response (UR) 2. unconditioned stimulus (US) 3. conditioned stimulus (CS) 4. conditioned response (CR)

Q2A. flinching and other body reaction to dental drill, scraper, etc., on the teeth
Q2B. the dental drill, scraper, etc., on your teeth
Q2C. seeing the dental chair and dental tools
Q2D. body reactions triggered by seeing the dental chair and dental tools

Instrumental conditioning is learning about the consequences of your actions. The consequence of an action is often described as contingent on (depending on) doing that action. The upper part of Figure 1-3d (see above) illustrates instrumental conditioning, because getting food is contingent upon pecking the key. The food appears only after the bird makes the appropriate response. The lower part of Figure 1-3d illustrates Pavlovian conditioning, presenting the food is not contingent on anything the pigeon does. It always follows the predictive signal, regardless of what the bird does.

Q3. You have to do well enough in your courses to earn a C average (2.0 on a 4-point scale) or better in order to come back to school next semester. The contingent consequence in this example is
A. passing all your courses with at least a C average
B. coming back to school next semester
C. getting a GPA below 2.0
D. emitting a response that is the appropriate behavior
E. the course you take this semester

Memorize the following definitions; you will need them later. When a response is followed promptly and consistently by some consequence, the strength or probability of that response changes, depending on what kind of consequence it is. Change in strength or probability of a response is measured by comparing it with a baseline called operant level. Skinner defined operant level as the rate or strength of a behavior when it can be done without restriction and any consequence.

Three kinds of consequences can follow a response:
! consequences that have no effect on the preceding response, as in habituation.
! consequences that increase the strength of the preceding response.
" presenting something (pleasant) that increases the strength of the preceding response is called positive reinforcement.
" removing something (unpleasant) that increases the strength of the preceding response is called escape or avoidance learning.
! consequences that decrease the strength of the preceding response.
" presenting something (unpleasant) that decreases the strength of the preceding response is called punishment.
" removing something (pleasant) that decreases the strength of the preceding response is called time out or response cost.

This exercise and the next deal with positive reinforcement. Exercise asgn3f deals with the effects of other kinds of consequences: escape or avoidance, punishment, and response cost (time out).

Memorize this! Something is a reinforcer for a behavior ONLY if it increases the strength or probability of that behavior above operant level.

Suppose Mom makes letting Billy go out to play contingent upon cleaning up his room. The consequence (going out to play) does not happen until Billy emits (does) the behavior. Billy must clean up his room (response) before he is allowed to go out (contingent consequence). He must make the response that will produce the reinforcing consequence of getting to go out. No stimulus elicits (triggers) the behaviors involved in cleaning the room. In this example, the opportunity to go out to play is (assumed to be) a positive event for Billy. Getting to go out is contingent upon making the response of cleaning up room. If this contingency is kept up
consistently, and if the rate or strength of room cleaning increases, then getting to go outside served as a positive reinforcer.

*Rewards and reinforcers are not the same thing.* Rewards are properties of stimuli; rewards are (intended to be) attractive. Reinforcers are events that strengthen the immediately preceding response. Properly used, a reward serves as a reinforcer. Note the crucial phrase: properly used.

Q4. [Mark EACH item True (T) or False (F)] In instrumental conditioning, positive reinforcement will occur (or has occurred) when a positive consequence

T F A. promptly follows that response.  
T F B. elicits (triggers) that response.  
T F C. becomes available on making that response.  
T F D. provides a signal to make that response.  
T F E. strengthens the immediately preceding response (whatever it may be).

Q5. Richard Feynman, the Nobel Prize winning physicist, was also known as an excellent teacher. His teaching skills appeared early when he taught his little sister math by letting him pull his hair when she was right. In this example, getting the problem correct was the _____ and the reinforcer was _____.

A. Pavlovian conditioned response; Conditioned Stimulus  
B. instrumental conditioned response; pulling the hair  
C. Reinforcer; conditioned response  
D. Pavlovian conditioned response; learning the math problems

The operational definition reinforcement is clear: A reinforcer is anything that increases the strength of the immediately preceding response. The theoretical definition has been a subject of considerable controversy. Near the beginning of the century, Thorndike originally described a positive reinforcer as a satisfier, an event that the subject approaches and does nothing to avoid.

In the 100 years that followed Thorndike’s definition of satisfiers, several hypotheses about the process underlying reinforcement have been proposed, but only in the past 30 years have researchers described something approaching a satisfactory model. Skinner largely sidestepped the question.

In the 40s and 50s, drive reduction was the dominant theory of reinforcement. According to this theory a reinforcer has to be something that reduces a body need or drive - basic processes like hunger, thirst, warmth, etc., which keep us alive. Such reinforcers were called "primary" reinforcers, because they were supposed to be basic to all reinforcement.

However, it is obvious that many things serve as effective reinforcers even though they do not reduce a drive. Even rats learn mazes when the only thing that happens at the end of the maze is that they are lifted out and put back in their homes. Drive reduction theorists responded to this problem by invoking learning: Reinforcers that do not directly reduce a drive are learned (secondary, conditioned) reinforcers.

Rewards are not necessarily reinforcers. In the example about Billy, going out to play is (probably) a reward because Billy goes out to play a lot. But it is not a reinforcer, until it increases Billy's rate of cleaning his room. For example, suppose Billy has a stubborn streak. He decides he will NOT be bossed around. So he stays in his room but refuses to clean it up, even though he really wants to go out.

Learned or secondary reinforcers gain reinforcing properties by association with a drive reducing primary reinforcer through Pavlovian conditioned. One example is a clicking sound or flashing light that occurs when a rat presses a lever for food. Once that sound or light reliably predicts the primary reinforcer of food, it can be used to reinforce a response (Hull, 1953). According to this explanation, a $20 bill is a reinforcer because it can be used to buy food and drink. Of course, this explanation ignores the fact that much of our money is spent on things other than food or even basic shelter.

Drive reduction theory reflected the kind of experiment on learning done at that time. Rats and pigeons were made hungry or thirsty. Bits of food or sips of water were quite successful in producing instrumental conditioning. Drive reduction theory also reflected the desire among many psychologists to be accepted as full-fledged natural scientists. Drive reduction theory tried to link psychology to physiology and to evolutionary biology.

But much of people and animals do is not obviously related to biological drive reduction, either directly or indirectly. People have parties, go to movies, listen to music, do crafts, choose jobs based on interest rather than earnings. Monkeys will learn an instrumental response in which the only reinforcer is a peek at an interesting scene. Pictures of other monkeys are especially good reinforcers. Dogs learn responses of sitting and heeling with the only consequence being a
pat or hug or a stick thrown for them to chase and retrieve. These are probably some form of social reinforcement, because they are much more obvious in social animals, like dogs, than in non-social animals, like cats.

Mark each item as related to primary, learned, or some form of social reinforcement.

1. primary reinforcer
2. learned (secondary, conditioned) reinforcer
3. other, probably social, reinforcer

Q6A. a signal light that predicts availability of water can reinforce a new response
Q6B. patting a dog, as a reinforcer for learning to sitting on command
Q6C. drinking Gatorade to relieve water and salt loss after working outside and sweating a lot

Several alternative theories have been proposed. Premack proposed a Response Strength theory. It states that a weaker response will get stronger when doing it provides access to doing a stronger one.

Premack measured the operant level of pairs of responses and showed that the weaker response (the one with the lower operant level) can be strengthened, if it is followed by the chance to make the stronger one, regardless of what responses they are (Premack, 1959, 1965).

For a hungry rat, eating is much more probable than running in a running wheel, so obviously the weaker running response can be strengthened if it earns the opportunity to make higher strength eating response. But what about a sated (full) rat? The strength of eating response is very low, so the strength of running is considerably higher. If Premack’s rule is correct, then you should be able to get a sated (full) rat to eat, if eating gives the rat the opportunity to run. This is exactly what happens.

Premack’s theory departs from earlier ideas about reinforcement in a very basic way. It tells us that reinforcers are not a special class of events. The chance to make any response can serve as a reinforcer, as long as its operant level is higher than the operant level of response to be reinforced. This is an important feature for at least two reasons:

1. It connects reinforcement to the ongoing flow of behavior, which means that reinforcement is always active.
2. It explains why the reinforcing value of events changes, sometimes very quickly. This is very important. It tells us that events intended as reinforcers in everyday circumstances must be chosen with care, to be sure that they can work as reinforcers in the situations in which they will be used (Timberlake and Farmer-Dougan, 1991).

Q7. [Mark EACH item True (T) or False (F)]

A. getting to play the guitar can be used to reinforce studying
B. getting to play the guitar can be used to reinforce playing basketball
C. getting to play basketball can be used to reinforce studying

Timberlake and Allison (1974) proposed a small but very important revision to Premack’s idea. They proposed a Response Deprivation theory: Any event held below operant level can serve as a reinforcer, even if it was less probable than the response it was supposed to strengthen. When the two ideas were directly compared, the Timberlake-Allison model was supported. Link to a description of one experiment showing this.

In practice, the two theories advise us to do the same thing to find a reinforcer: They both tell us to look for something that has a high operant level, something that occurs often in the absence of any restriction. Premack’s Response Strength theory says that access to making such a response will be a reinforcer because it is stronger (have higher operant level) than almost any response you might wish to condition (strengthen). Timberlake and Allison’s Response Deprivation theory says that responses with a high operant level are easy to hold way below operant level.

Match the following explanations of the following statement with the model of reinforcement it fits best. A sip of water will serve as a reinforcer for a thirsty rat because ___.

1. drive reduction
2. Premack
3. Timberlake & Allison

Q8A. it reduces thirst drive.
Q8B. it is easy to hold drinking below its operant level.
Q8C. operant level of drinking is very high.
An excellent source on the principles and practical applications of instrumental conditioning (or behavior theory as the psychologists who use it would say) is a little book by Karen Pryor called "Don't Shoot the Dog" Bantam, 1985. To go to a website related to this book and its author, click HERE.

Asgn3e -- REINFORCEMENT IN INSTRUMENTAL CONDITIONING:
Consequences Change Behavior

Many responses rarely or never occur before conditioning. Their operant level is effectively zero. To condition such responses, you use a process called shaping. Shaping involves reinforcing successive approximations to the final desired response. At first, the subject receives reinforcement for any response s/he makes that is a bit closer to the final desired performance. When this response begins to appear reliably, then the criterion (~decision rule) for delivering a reinforcer is tightened: the response must be closer to the final response. This procedure is repeated until the subject is so close to the final desired response that s/he accidentally makes it and gets a reinforcer.

Shaping is like the children's game of Hot and Cold. One child leaves the room, and an object is hidden. The rest of the children guide the child to the hiding place by applauding as s/he gets closer. In the same way, shaping involves guiding the subject toward some target behavior. S/he earns reinforcement as s/he makes responses closer to the target behavior. S/he gets no reinforcement as s/he makes responses further from that behavior, so such responses extinguish. This procedure strengthens responses closer the target behavior and weaken responses that are not. The range of responses narrows down toward responses that finally reach the target behavior.

Occasionally the media pick up a story about a rat that someone trained to do a complex sequence of tasks, no step of which occurs naturally. For example, there's a video that shows rats playing "basketball" with a ping pong ball. It shows several rats divided into two "teams." They don't work together as teams, though. Each rat tries to pick up the ball and dunk it into their "team's" hoop.

They were trained to do this by shaping, which went something like this:

! First each rat was trained to approach the ball by giving it food every time it got a bit closer to the ball.
! Next, the food appeared only when the rat touched the ball.
! Then only when the rat touched it with one paw.
! Then only when the rat touched it with both paws.
! Then only when the rat pushed it toward the hoop lying on the floor.
! Then only when the rat lifted the ball maybe 1/4 inch from the floor to get it into the hoop.
! Then only when the rat lifted the ball into the hoop as it was raised in small steps to 8 inches (standard rat basketball height).

The last step was the target performance. It was achieved by a series of successive approximations: closer and closer to that target performance. The Science Museum in Louisville, KY, had a display of rats doing this.

Q1. A psychiatric patient (P) had not spoken for years. A therapist (T) reestablished social speech this way:

The therapist (T) held up a stick of gum (which P liked) till P looked toward it. T then gave P the gum. Soon P looked at the gum as soon as T held it up. Then P had to move his lips before T gave P the gum. After lip movement promptly occurred, T required P to make a sound to get gum. Next, he had to say "gum," then "gum please." Finally social speech was established. T reestablished social speech by _____ it.

A. teaching  B. shaping  C. reinforcing successive approximations to the target behavior
D. B and C are both correct  E. A, B, and C are all correct
Instrumental conditioning is a very effective method of changing behavior, especially when you have enough control over consequences. Most simple examples use young children, retarded individuals, and others whose environments are controlled mostly by others.

The principle works just as well with adults, but examples are harder to find that are as clear. Normal adults usually have much more control over their lives and have many different sources of reinforcement that are often interchangeable. For example, if Pepsi raises its price, but Coke doesn't, you can switch to Coke. Or peer approval can replace parental approval, or vice versa. The process of consequences affecting preceding behavior holds just as well.

Q2. [Apply behavior modification principles to this question.] Dr. Knox is a marriage counselor who uses behavioral modification principles. Dr. Knox needs clients to keep accurate records of the problem behaviors they are working on (because accurate records are an essential feature of behavior modification). So Dr. Knox refunds part of his fee for every session the couple brings in a complete set of records. This way Dr. Knox __.
A. strengthens record-keeping by positive reinforcement
B. makes the refund depend on bringing in good records
C. is teaching the couple cooperation to overcome their conflicts.
D. finds out whether money or the marital relation is more important
E. A and B are both correct.
F. A, B, C and D are both correct.

To be an effective reinforcer, a rewarding consequence must follow promptly the response to be strengthened. Delaying the reward even for a few seconds can wipe out the reward's effectiveness as a reinforcer (Grice, 1948; Mazur, 1997). Often, delays in getting the reward are inevitable, but they are easily bridged by a signal. For example, when a hungry rat presses a lever to earn food, the sound of food delivery bridges the few seconds between the lever press and actually getting the food.

Immediate consequences are far more effective than are delayed ones, even when you know the delayed consequences are coming. Many ordinary behavior problems occur because a behavior's immediate consequences are positive, though their long-term consequences may be very negative. The short-term positive consequences will win, unless somehow the long-term negative consequences can somehow be moved up close in time to the behavior. One obvious example is weight control. The extra piece of pie with ice cream is very positive when you eat it, but becomes negative three days later when it shows up on the bathroom scale. “Thirty seconds in your mouth, 30 years on your waistline.”

Many other examples illustrate the dominating influence of immediate consequences. So-called “safer sex” practices (e.g., use of a condom) decrease the chance of spreading sexually transmitted diseases, like AIDS. Because their benefits are quite remote at the time of sexual activity, many people often ignore them. The immediate consequences are too much of a nuisance or unromantic. The future protective value is lost because it is far in the future.

The opposite happens too. People avoid doing tasks they don't like. The immediate gain of avoiding something unpleasant beats out the later cost in stress and negative mood, when the task must be done in a rush. For example, some of you have put off doing your laundry until you are completely out of clothes that are clean enough to wear. You have to do it, though you would much rather be going out with your friends. A recent study (Tice & Baumeister, 1997) showed that undergraduates who procrastinated in handing in assignments reported less stress and illness early in the semester but more near the end of the semester. They also received lower grades on the assignments on which they procrastinated.

Q3. Jim spends his extra time in the week before his history exam playing basketball with his friends rather than studying the assignment for the next test. This reflects __.
A. failure to recognize and understand long-term negative consequence
B. failure to respond to immediate consequences
C. immediate consequences beating out delayed consequences
D. negative reinforcement being weaker than positive reinforcement
Q4. A lawyer is bothered by his habit of correcting other people's grammar, but he can't break the habit. He knows it offends and gets embarrassed by it. His psychologist friend advises him to burn a $10 bill as soon as he catches himself doing this. He stops after burning one bill. This reflects __. [Why did the lawyer quit?]

A. strengthening a good habit by bringing a positive consequence up close to it
B. eliminating positive consequence of the behavior
C. breaking a bad habit by bringing a negative consequence close to it
D. that positive reinforcement is weaker than negative reinforcement

After they have been established, **extinction can weaken and remove instrumental conditioned responses.** The process parallels extinction in Pavlovian (classical) conditioned responses. To extinguish an instrumental conditioned response, simply omit the reinforcer. The first reaction is a brief increase in response strength or rate, reflecting frustration from not getting the expected reward. Then the response strength declines until it is at or below the operant level before training.

Q5. Barnaby likes to show off in front of his friends, because it gains their attention. After a while his antics get "old," and his friends want him to stop. Barnaby's showing off is ___, which his friends can remove by ___.

A. a nuisance; telling him to stop
B. an instrumental conditioned response; extinguishing it
C. a Pavlovian conditioned response; making fun of him when he shows off
D. a response followed by reinforcement (attention); ignoring him when he shows off
E. B and D are both correct
F. C and D are both correct

**Persistence of Instrumental Behavior**

Instrumental behavior is often quite persistent. Persistent behavior often depends on reinforcement. Specific schedules (~patterns) of reinforcement produce especially stable behavior. Sometimes behaviors are intrinsically motivated (intrinsic = integral or inseparable part of). They simply occur often without apparent external reinforcing consequences. The rest of this exercise describes these processes.

**Schedules of Reinforcement**

Most experiments on instrumental conditioning have been done using hungry or thirsty rats or pigeons. This makes a bit of food or a sip of water effective reinforcers. These reinforcements are delivered on some kind of schedule, which defines which correct responses are followed by the reinforcer. Training starts on a schedule called "continuous" reinforcement: every response is reinforced. On this schedule, the rats or pigeons become satiated ("full": "have enough") after about 50 responses, so they stop responding for the food or water.

**Schedules of Intermittent (or partial) reinforcement** prevents satiation because they reinforce only a small fraction of the subject's (correct) responses. The two basic kinds of schedules are ratio schedules and interval schedules. Ratio schedules reinforce every nth response (every 2nd, 5th, 8th, 20th, etc. response). Interval schedules reinforce the first response after a specified amount of time has passed since the last reinforcement (first response after 5 sec., 10 sec. 28 sec., etc. has passed).

B. F. Skinner (1956) discovered this (then) surprising effect by accident. Early in his career, Skinner began his study of lever pressing by rats for food. One Saturday, he did not have enough food pellets made to last the weekend. He wanted to keep up the daily training of the rats, but making pellets was a long, tedious task. (In the 1930's researchers made almost everything for themselves. Now they buy most of their supplies and equipment from commercial manufacturers.) So he decided to spread out the remaining pellets by reinforcing only the first response that occurred after one minute had passed since the last reinforcer had been delivered.

To his surprise, not only did his supply of pellets last, but the pressing behavior became stronger, steadier, and much more resistant to extinction, not weaker and less regular as one might expect. This accidental finding became a powerful research tool in behavioral analysis because it generates predictable behavior, which remains quite stable over long periods of time. This stability permits detailed study of individual subjects rather than averaging data from several subjects. Pharmaceutical companies have used this procedure to help identify potentially useful psychological active medications. For example, a signal that predicts a brief shock normally suppresses rats' normally steady responding for food reinforcement until after the shock has been delivered. Potential antianxiety drugs decrease or abolish this suppression.
Figure 1-3e shows the response rates (responses/minute) on fixed and variable forms of the two basic schedules: ratio and interval. The X-axis shows time. Y-axis shows cumulative responses (cumulative = added up, as in cumulative grade point; GPA is cumulative grade point divided by cumulative [total] hours). Each type of schedule generates its own shaped curve to generate the highest rate of reinforcement.

Fixed schedules deliver reinforcement on a constant (fixed) ratio or interval, e.g., for the 20th response or for the first response after 30 seconds have passed since the last reinforcement. Variable schedules deliver reinforcement on a schedule that varies around an average value (after every 5th, 10th, 20th or 50th response with an average of 20 responses, or after every 4th, 12th, 28th or 54th second with an average of 30 seconds).

Some schedules produce very steady rates of responding for many hours (the variable interval schedule in Figure 1-3e). Others produce very high rates of responding (ratio schedules in Figure 1-3e). Others produce highly predictable variations in response rate (the fixed interval schedule in Figure 1-3e).

Link to more about different types of reinforcement schedules.

Q6. Once an instrumental conditioned response is established, reinforcing it a small fraction of the times __.
A. is called intermittent (or partial) reinforcement
B. makes that response continue much longer without any reinforcement at all
C. shows different patterns of responding (in time) on different types of schedules to maximizes reinforcement
D. makes the response easier to extinguish
E. A, B, & C are all correct

Q1. An exam question asks how to extinguish 2-year-old Charles's crying when he is put to bed for the night. A student wrote that the parents should go to Charles every other night, then every fourth night, then every 8th night. This procedure is not a good one because it
T F Q1A. does not include punishment.
T F Q1B. makes it harder for Charles to tell the difference between the intermittent schedule and extinction.
T F Q1C. is a schedule of partial (intermittent) reinforcement for crying.
T F Q1D. increases resistance of crying to extinction.
T F Q1E. makes extinction less aversive (unpleasant) by decreasing the frustration it produces.
T F Q1F. changes the effect of frustration from aversive to positive.

Two processes contribute to the strong resistance to extinction. First, it is hard to detect the change from intermittent reinforcement to non-reinforcement. The switch from continuous reinforcement to extinction is quite obvious. But the switch from intermittent reinforcement to extinction is hard to notice. Subjects do not expect reinforcement after most responses, so they cannot tell when extinction has started.

Second, intermittent reinforcement greatly reduces frustration from not getting an expected reward produces. Extinction is frustrating, and frustration is aversive (see asgn4x). When you learn to make a response for a reinforcement, you learn to expect that reinforcement. In extinction, the expected reinforcement fails to occur, which fits the proper definition of frustration (failing to receive an expected goal or reward). Therefore, each response during extinction is punished, which acts to suppress it. On an intermittent schedule of reinforcement, you learn not to expect reinforcement after most responses. Therefore, responses that don't produce reinforcement are not punished, so responding continues.

Q7. A response reinforced on only a small fraction it occurs becomes harder to extinguish because __.
A. it is hard to tell when the schedule changes from a few reinforcement to no reinforcements at all
B. the aversive effects of not getting expected reinforcements is extinguished
C. the subject just gets in the habit of responding
D. A & B are both correct
The power of intermittent reinforcement appears outside the controlled laboratory setting. One well-documented example is a famous study done in the 1920's at Western Electric's Hawthorne plant in Chicago. Industrial psychologists wanted to find out what kind of working conditions would improve productivity. They took a small group of employees and set up their jobs in a special area. They changed all kinds of things: increased the lighting, decreased it, changed working arrangements and returned them to the original, etc. No matter what they did, productivity improved. This result was interpreted as reflecting worker morale. If management is interested in workers and their working conditions, then workers' productivity increases.

The Hawthorne study has been re-evaluated, and a big confound was identified (Parsons, 1974). The employees' earning in the Hawthorn study were based a lot on the number of parts they finished. This is a "fixed ratio" schedule of reinforcement, which produces high rates of responding. On a fixed ratio schedule, reinforcement is delivered after the Nth response. N can be any number. This schedule produces high rates of responding, because the faster responses occur, the more the total earnings. This effect of the fixed ratio schedule probably explains the "Hawthorne effect" better than the worker morale idea. The story is quite a bit more complicated. Link to more about the Hawthorne study.

Q8. The first explanation of steadily improving output under all sorts of changes in working conditions was improved worker morale. An alternative interpretation was in terms of instrumental conditioning, because ___.

A. the study was planned to show that reinforcement increased production
B. workers could increase their total pay by working faster
C. each new change in working conditions served to relieve boredom
D. the workers wanted to reinforce management for showing interest

Economics is another place that the principles of behavioral change due to its consequences have turned up. Instrumental conditioning can model many basic ideas in economics. This For example, amount of reinforcement can model wages earned; the amount of responding the subject must do to earn reinforcement can model price. Recent Nobel prizes in economics have been awarded for this kind of work. To see a brief description of one award for experimental economics.

Studies on individual rats and humans working for reinforcements have demonstrated economic principles known only from theory or inferred indirectly from aggregate (grouped) economic data. A new disciple is emerging, called behavioral economics, which uses the parallels between economic theory and reinforcement theory to understand both better.

For example, the Demand Law in economics relates the price of a "good," say cookies, the total consumption of that good (total number of cookies sold), and the total revenue from the sale of the good (total amount of money spent to buy cookies). The Demand Law states that total revenue is highest when price and consumption are intermediate. This relationship is also predicted from an extension of the response deprivation model of reinforcement, which describes the performance of a hungry rat pressing a lever for a food pellet (Allison & Timberlake, 1975). This model was described in exercise asgn3d.

In this model, "price" is modeled by the number of presses the rat must make to earn a food pellet, which varies one to say 50. The number of presses required to get a pellet is the "price" of the "good" (the food pellet). The revenue that the good (food pellets) generates is modeled by the total number of lever presses the rat makes. Total consumption is modeled by the total number of pellets earned.

In Figure 2-3e the blue dots show the number of pellets earned (consumption) plotted against revenue (total number of presses). Each dot represents the total number of pellets earned at a specific price (number of presses required to earn one pellet).

The total quantity consumed is highest (upper left blue dot) at the lowest price (fewest presses), but it produces the least revenue (total number of presses). A very high price results in low consumption and low total revenue (lower left blue dot). An intermediate price generates the maximum revenue, confirming the prediction of the Demand Law (Allison, 1993).
Secondary or Conditioned reinforcement is another process that increases stability of behavior. Pavlovian conditioning produces secondary reinforcement: associating a neutral signal, like a tone or light, with reinforcement. Secondary reinforcers have properties like those of primary ("unlearned") reinforcers. A secondary reinforcer can slow extinction and can reinforce a new learned response.

Secondary reinforcers following responses bridge the time gap between the responses and the primary reinforcers. This effect occurs unintentionally in (almost) all instrumental learning, and it is very useful for conditioning a new response. For example, when food is used as a reinforcement to train a secondary response, the hungry animal responds seconds before it can get and eat the food reinforcer. However, the food dispenser normally makes a noise, which becomes a secondary reinforcer because it predicts the food. It serves to bridge the interval between making the response and getting the food. With a secondary reinforcer, the time gap between responding and reinforcement can be quite long. Without it, the gap must be kept very short. One early study (Grice, 1948) carefully excluded secondary reinforcers. A delay of more than half a second greatly weakened the effectiveness of the primary (food) reinforcer as summarized in Figure 3-3e.

Q9. Sara trains her cat to come when she makes a clicking sound by giving the cat her dinner while she makes the clicking sound. The clicking sound serves as a(n)
A. intermittent or partial reinforcer  B. drive reducer  C. drive inducer  D. secondary (learned) reinforcer  E. A and D are both correct

Link to Clicker Training Basics, a site about a method that applies learned or secondary reinforcers to everyday situations. A clicker sound is established as a secondary reinforcer, which clicker training calls a marker signal.

Learned helplessness is an effect of punishment which increases the persistence of NOT responding in new situations. Seligman ((Miller & Seligman, 1975; Maier & Seligman, 1976) have proposed that this phenomenon is a model of important features of depression. Link to a brief description of learned helplessness.

Intrinsically motivated behaviors

Intrinsically motivated behaviors (intrinsic = integral or inseparable part of) are ones that are very persistent, but apparently without any extrinsic reinforcer (extrinsic = external, outside, separate) to maintain it. They have high operant levels. Things that people (and other animals) spend a lot of time doing without any extrinsic reinforcement are intrinsically motivated. Some people practice playing the piano because they enjoy doing it. Others play basketball or run or sing, just for the fun of it. No obvious extrinsic reinforcer maintain such activities. For example, juvenile play is intrinsically motivated. The young of almost all mammals (including humans) spend a lot of time and energy playing, without any obvious extrinsic reward. The bigger the brain and the more complex the social organization, the more play the of a species young show.

Under some conditions, rewards for an intrinsically motivated behavior appear to weaken that behavior. Lepper et al., (1973) tested the effects of giving rewards to children for a new activity in their preschool classroom: coloring with pens on artists’ paper. They assigned the children who spent the most time at this activity during the baseline observation period to one of three conditions. They told one group of children that some of them would get a “good player award” (in fact, all got the reward), which they apparently found quite attractive. They gave the “good player awards” unexpectedly to another group. The group was the third baseline control. These children neither expected nor received any awards. Lepper et al. then tested the children individually for six minutes and gave the reward (if they were in the first two groups) at the end of the session. Several days later Lepper et al. gave the children the pens again and recorded the amount of time they spent coloring with the pens. Children in the group that knew they would get “good player awards” spent the pens less than did the other two groups. In addition, judges who did not know which experimental treatment the children received rated the quality of their drawings lower. This result seems to show that the extrinsic (external) reward had undermined the intrinsic motivation for coloring with the pens. Other studies have reported a similar effect of rewards. Lepper et al called this phenomenon the overjustification effect.
On the basis of findings like those described above, many people have concluded that rewards cannot be used to strengthen creativity or other complex behaviors. They urge that rewards not be used as tools to improve performance (e.g., Kohn, 1993). They specifically target behavior modification, the approach to changing behavior that B. F. Skinner developed and popularized. This approach is based on Skinner's work with reinforcement to change operant behavior (his version of instrumental conditioning). To popularize it, Skinner wrote a novel Walden Two (1948), which described a Utopian community based on principles of behavior modification.

Q10. Children in the good player group knew in advance that they would get a "good player award" after using the coloring pens. The "good player awards" _____ [Hint: what is the definition of reward? of reinforcement?]
A. were rewards  
B. were reinforcers  
C. induced the children to play with the coloring pens more a week later  
D. induced the children to play with the coloring pens less a week later  
E. A and D are both correct  
F. A, B, and C are all correct

Lepper et al. (1973) explained the effect they found in terms of social attribution theory. According to this theory, the children who expected reward for coloring with the pens [subconsciously] attributed (explained to them-selves) their performance to that expected reward. Therefore they attributed their pleasure in coloring with the pens at least partly to the extrinsic reward. For this reason, they attributed less of their coloring activity to its intrinsic enjoyment. This lower attribution showed up as the decreased coloring time and quality during the test period. Cognitive Evaluation theory (E. Deci & R. Ryan, 1985) proposes a somewhat different explanation: rewards for doing tasks reduce intrinsic motivation by decreasing a person's feeling of self-determination.

The latter explanation is a direct descendent of the Romantic view of human nature, which derives from the views of Rousseau (a Swiss-French philosopher who lived at the end of the 18th century). Rousseau's ideas were an important source of the ideals of individualism, freedom, and self-determination that are central to much of Western thought. Anything that restricts these ideals is presumed to be bad. To many people, the idea that you can be "led by the nose" with rewards contradicts these ideals. So they were pleased to have support for their beliefs from these research studies that appeared to show that reward decreases performance. The idea that reward reduces performance has had widespread influence. It is the basis for the idea that rewards in education, workplace, and other setting is harmful to performance, especially skilled and creative performance. Teachers, managers, and others are advised to avoid using them (e.g., Kohn, 1993).

Match explanation of this hypothetical (not real) example to the theory it fits: Joey is praised for how well he draws. He draws less because he decides
Q11A. he must be drawing just to get the praise.  
Q11B. the reward is making him draw, and he doesn't like to be made to do things.

1. Social attribution theory  
2. Cognitive evaluation theory

Eisenberger and Cameron (1996) reviewed the research literature to see what could be concluded about the effects of rewards and reinforcers on intrinsically motivated behavior. The literature as a whole shows an average effect for 96 studies was about zero. Further analysis shows that verbal praise properly used as reinforcement has a reliable positive effect on performance, if it is given when the desired response occurs or gets stronger. Tangible (literally touchable) rewards (like money) decrease performance, but only if it is given independently of performance.

Money does, in fact, work. My spouse learned the multiplication tables by receiving a penny (a penny bought some-thing in those days) for every five problems in a row she got right. She learned so quickly that her mother increased the number of problems she had to get correct to 25 before getting her reinforcement. This method can work for more creative activities as well. A newspaper columnist described how his wife paid their daughter for some minutes of practicing the violin. The daughter quickly improved to the point that practice became intrinsically motivated, and she has continued to play the violin. The rewards in these two examples were successful reinforcers because they were given only after a minimum level of performance was achieved. My guess is that the two people involved had enough ability that they could perform the tasks successfully without excessive effort.
Eisenberger and Cameron explore further the effects of reward on creativity. Although several studies reported decreased creativity following reinforcement, these studies did not follow the basic principles of reinforcement theory:

1. Use reinforcement to shape specifically the behaviors you want to strengthen.
2. Reinforce consistently the behaviors you want to strengthen.

When these two basic rules are followed, measures of creativity improve. The bottom line is that depression of intrinsically motivated behavior by extrinsic rewards happens only when conditions are not appropriate for reinforcement to occur.

Recall that reward and reinforcement are not the same thing. Reward is a property of a stimulus. Rewards are things that are attractive (at least what you believe). Reinforcement is the effect of a consequence on the preceding behavior. Rewards are often reinforcers, but only under appropriate conditions. When these conditions are met, performance of intrinsically motivated behavior increases. Link to review the properties of reinforcement (the first and last part are most relevant), or go to the last past of asgn3d.

Q12, If Eisenbarger and Cameron are correct, rewards depress intrinsically motivated behavior because they
A. are not compatible with the behaviors they were trying to strengthen
B. are not used in a way that made them reinforcers
C. are not strong enough to overcome the effects of intrinsic reinforcement
D. reverse the effects of intrinsic reinforcers to make them punishers

Nothing in the educational procedures that can be derived from cognitive evaluation theory or from social attribution theory necessarily contradict the processes of reinforcement. In fact, they can be used as guides for finding more effective and more stable reinforcers.

For example, perception of free choice among alternatives is quite desirable for most people, which is what Cognitive Evaluation and Social Attribution theories predict. Most people prefer to have (or believe they have) free choice among several alternatives. They don't like being restricted to one choice, even if that one choice is the one they prefer to the other alternatives in a free choice situation. For example, most people will prefer to shop at a store that provides wide selection, over on that provides a limited selection, even if both offer the items they actually pick. This preference, like any other, can serve as reinforcement, if the contingencies between responding and perception of free choice are arranged properly.

The effects of free choice have been tested in the laboratory. In one study, a group of children received a drawing game to do. Another group was subtly persuaded to choose the drawing game from among several other activities. When tested later, the children who thought they had had a choice (but really had been persuaded to choose the drawing game) spent more time doing that game than did the children who had no choice.

Even pigeons seem to prefer to have a choice, even when it doesn't make any difference. They prefer a display of three green lit keys, which signal that responding on them can earn reinforcement, and one red lit key, which signals that responding on it cannot earn reinforcement. The only difference in the two situations is the number of keys one which responding earns reinforcement. No more reinforcement is earned. This suggests that the pigeons do prefer something like (the appearance of) choice.

To show this effect Catania & Sagvolden, 1980) trained pigeons to discriminate between single keys lit with red or with green light. They were reinforced for pecking at a green- lit key and were extinguished for pecking at a red key. The lights were then presented on four keys, one lit with one color and the other three with the other color. The birds were taught to turn on the colored lights by pecking on of two other keys that were lit with white light. The white key on the left made three keys light up red and one light up green. The white key on the right turned on three green lights and one red light. Responding on a green key was equally effective in getting food reinforcement whether three or only one green key was available. Nevertheless, the birds soon developed a preference for the right key, which presented three green-lit keys rather than just one.
Asgn3f -- INCREASING OR DECREASING THE STRENGTH OF A BEHAVIOR

Two kinds of events can be contingent (dependent) on making a response:

! The event can be positive (+): the subject approaches it and does nothing to escape or avoid it.
! The event can be negative (-) or aversive: the subject tries to escape or avoid it and does nothing to approach it.

Earning $10 is an example of a positive (+) event; a loud, grating, high-pitched sound like a fingernail scraping on a chalkboard, is an example of an aversive or negative (-) event.

Two things can be done with such events:

! They can be presented after a response.
! They can be removed after a response.

So a response can have four possible consequences [Memorize and understand the following!]:

! Getting something positive is called positive reinforcement, if, and only if it increases strength or probability of the preceding response.
! Removing something positive is called response cost or time out, if, and only if it decreases the strength or probability of the preceding response.
! Getting something aversive (unpleasant) is called punishment, if it, and only if decreases the strength or probability of the preceding response.
! Removing (or avoiding) something aversive (unpleasant) results in escape and avoidance learning. (Many psychologists call this negative reinforcement, but unfortunately others use negative reinforcement to mean punishment. Many students in introductory psychology classes also want to use negative reinforcement to mean punishment. Therefore, the term "negative reinforcement" will not be used at all.)

Figure 1-3f is another way of summarizing these four ideas.

Some people find it difficult how something negative can be used to strengthen a behavior. The following example may help. Suppose you start working out and after your workout, your muscles feel very sore. Eventually you notice that stretching the muscles relieves the soreness (no one explained that you needed to stretch your muscles). So you start stretching when the muscles start feeling sore, rather than after the soreness builds up. Soon you stretch when you start exercising before the muscles even begin to get sore. You learn to make the stretching response earlier and earlier because it decreases and eventually prevents muscle soreness (= removes or prevents something unpleasant).

Match each of the following with the most appropriate name

Q1A. sending Roy to sit in an empty closet for misbehaving on the playground
Q1B. jumping out of the shower when the water gets scalding hot because the toilet flushes
Q1C. getting chewed out by the boss in front of your peers
Q1D. Getting a commission for each sale you make

1. positive reinforcement  2. escape, avoidance  3. response cost (time out)  4. punishment

The word Reinforcement in both ordinary English and psychological jargon means strengthening. If the word "reinforcement" is used alone, without positive or negative, it means positive reinforcement.

Punishment and response cost both decrease response strength, but response cost removes something pleasant, whereas punishment delivers something unpleasant.

Response consequences (also called contingent events) may not fit quite so neatly into one or the other category. There are two sources of confusion.

! First, sometimes it is not clear what response changes. Is a response being decreased (e.g., eating less to lose weight) or its opposite (e.g., not eating) being increased? In general, think of increases in behavior as evidence of positive
reinforcement or escape and avoidance, and think of decreases in behavior as evidence of time out (response cost) or punishment.

Second, sometimes it is not clear whether a consequence is presenting an unpleasant event or removing a pleasant one. Is a big fine for overdue reserve material delivering something negative (punishment) or losing something positive --the use of the money (response cost)? In general, a consequence is punishment if the consequence itself is unpleasant (getting hurt because you didn’t use a power drill right). It is a response cost, if the consequence produces something else that is unpleasant. (The main bad thing about paying a fine is the loss of use of the money, not the loss of the money itself.)

Mark each of the following with the most appropriate descriptive label. [These are idealized examples. Escape, avoidance, and especially punishment rarely are as efficient as these examples suggest.]

Q2A. Maritza increases brushing her teeth to three times a day so she won't get cavities.
1. punishment 2. escape, avoidance 3. response cost or time out

Q2B. Geoff stops drinking alcohol because he takes a medication that makes him very sick if he does drink.
[Response = drinking; consequence = getting sick]

Q2C. 4-year-old Mack stops using the toaster after getting burned trying to take a hot piece of toast out.
[Response = using toaster; consequence = getting burned]

Q2D. Ingrid loses e-mail privileges because she repeatedly sent junk e-mail to an e-mail distribution list she was not authorized to use.

There is one more kind of consequence for an instrumental conditioned response, which you have met before: extinction. [Memorize and understand the following!] Extinction involves withholding (no longer delivering) the reinforcing event (the consequence) after the conditioned response occurs.

A hungry pigeon trained to peck at a key for access to food, will peck steadily at the key as long as food follows the pecks. If you withhold the positive event (food) that was contingent on making the pecking response, then the pecking response declines and finally stops entirely; the pecking response has been extinguished.

Q3. Two-year-old Charles starts crying after he is put down to sleep for the night. Papa comes running to check on him and finds nothing wrong. Charles stops crying when he appears. Soon crying occurs every night and more and more promptly after Charles is put down to sleep. Charles' crying is an instrumental conditioned response reinforced by attention from Papa. To extinguish this kind of instrumental crying, Papa should ___. [Use only the technical definition of extinction to answer this question.]

A. threaten to spank Charles when he starts crying
B. turn off night light in Charles' room
C. put several of his toys in the bed to distract Charles
D. stop coming when Charles starts crying
E. wait for three minutes before coming to Charles

The preceding material describes three separate ways to weaken a response: punishment, response cost, and extinction. People often use "punishment" for all three. This is inappropriate, because the three methods operate in different ways, have different side effects, and are appropriate under different conditions.

Punishment is most appropriate when a behavior must be inhibited (stopped) immediately. Punishment has an immediate effect, but over time it often wears off. Punishment has several bad effects. It inhibits all behaviors, making it hard to learn new, more acceptable behaviors. It can be quite reinforcing to the person doing the punishment, so s/he may use it inappropriately. Finally punishment can teach the person being punished to try to control other people by aggression and punishment.

Mark misbehaves in gym class. Match each of the following things that the gym teacher might do to reduce misbehavior with the procedure it illustrates.

1. extinction  2. response cost (time out)  3. punishment

Q4A. have Mark do 30 pushups
Q4B. send Mark to a remote corner of the gym away from his friends
Q4C. prevent Mark from getting the attention his misbehavior usually gets
Punishment is the hardest of the three methods to use effectively, yet too often it is the one many people try first. It has several problems. Among the more important ones are the following:

1. Weak or inconsistent punishment is not effective. For example, Dan misbehaves in class. The teacher sometimes ignores, sometimes scolds, sometimes puts Dan in detention. Dan is very likely to continue misbehaving.

2. Consistent scolding may not work because it is not negative enough in a particular situation or for a particular person. Suppose Dan's misbehavior increases following scolding. If it does, then the scolding, by definition, is serving as a positive reinforcer. You can make a good guess why: scolding may earn Dan attention (which most people like) and increase his prestige with the group he hangs out with.

Remember: Something you believe is a punishment may not work as a punishment. The only way you know that something is a punisher is to see whether it suppresses the preceding behavior. Whether or not you think is unpleasant is a good clue to its ability to punish. You still have to show that it suppresses the behavior that precedes it before you know it is, in fact, a punisher. Furthermore, something may be a punisher in one situation but not in another.

There are several good rules to follow when using punishment. They are built around a basic principle. **Punish the response, not the person.** This means that punishment should be given only in direct relation to the response to be suppressed. Specific expressions of this principle include:

1. **Punish consistently.** EVERY time the response occurs.
2. **Use the full intensity of punishment** that is appropriate from the beginning: don't increase the strength of punishment gradually.
3. **Never follow punishment with positive reinforcement.** This can make the punisher into a signal for reward. Pavlov (1927) reported an observation which shows why the last two points are important. He wanted to find out whether electric shock could be used as a CS. He started with very weak shock, which just tingled a bit, as predicting food, and gradually increased the intensity as the CR was established. Eventually the shock was strong enough to burn the skin, but the dog just stood there salivating in anticipation of the meat.

**Use extinction in association with punishment.** Most responses that occur at a high rate are maintained by some reinforcer. This must be eliminated for punishment to work well.

Provide a competing response that earns positive reinforcement. If the subject learns to make the more desirable competing response, s/he cannot make the punished response. For example, it is quite difficult to hit your little sister while you are bouncing a ball off the side of the garage or the back fence.

Q5. To reduce the strength of a behavior, you must include_____, because most behaviors are maintained by reinforcement.

A. punishment  B. negative reinforcement  C. aversive (unpleasant) consequences  D. extinction  E. A, B and C are both correct  F. A, B, C and D are all correct

Q6. If an aversive (unpleasant, negative) event promptly follows a response, we expect that response to _____, because delivering an aversive event is supposed to _____ the response it follows. If, instead, the strength of that response increases, then by definition that "aversive" event must be acting as a _____.

A. decrease; punish; positive reinforcer  B. decrease; punish; negative reinforcer  C. increase; motivate escape for; positive reinforcement  D. decrease; extinguish; punishment
Which of the following principles of punishment does each of the following examples violate?

Q7A. Mom gives Teddy a cookie to calm his crying after a spanking
Q7B. Dad beats Devon for a past misdeed when he’s not doing anything wrong
Q7C. Mom fails to punish Jill for being late when she isn’t up to a fight
Q7D. School only punishes unexcused absence and does not reinforce attendance

1. Punish promptly and only for a specific behavior
2. Punish every occurrence of a behavior
3. Never follow punishment with a positive event
4. Provide a competing response that earns positive reinforcement
5. Use extinction with punishment

Instrumental conditioning, like classical (Pavlovian) conditioning, shows discrimination and generalization. In instrumental conditioning, discriminative stimuli serve as signals for when a response will earn a reinforcement and when it won’t. More generally, a discrimination has been established when the subject behaves differently in the presence of two different stimuli.

In the simplest form of discrimination, a positive signal, S+, indicates that the trained response will earn reinforcement. A negative signal, S-, indicates that the trained response will not earn reinforcement. So any response made in its presence will extinguish.

For example, a rhesus monkey can be trained to press a plastic panel for bits of banana-flavored food while the panel has a red light on it. When the red light goes off, pressing the panel no longer yields the food. The monkey soon learns to press only when the red light appears on the panel.

Further testing of the monkeys demonstrated that they can make discriminations between colors that are very close to each other. When tested with the same equipment, humans performed slightly better than the monkeys. In addition the monkey’s maximum sensitivity (absolute threshold) for light at different wave lengths was only slightly higher than humans’ sensitivity. The slightly better performance of humans probably reflects better attention (DeValois, 1965).

Q1. [Mark EACH item True (T) or False (F)] The rhesus monkey presses the red-lit panel but does not press the unlit panel. This is a discrimination: Which of the following are features of this discrimination?

T F A. the monkey presses the red-lit panel and doesn't press the unlit panel
T F B. the monkey knows that pressing the red-lit panel earns food, whereas pressing the unlit panel doesn't earn food.
T F C. the red light serves as an S+ signaling that food reinforcement can be earned
T F D. responding to the red-lit panel continues to be reinforced, whereas pressing the unlit panel is extinguished.
T F E. absence of the (red) light signals that no food reinforcement is available
T F F. the monkey responds differently to the lit and the unlit panel

Generalization refers to responding to a new stimulus as if it were the same as a previously established S+. If 2-year-old Rollo calls all adult men "Daddy," he has generalized the word from his father to all adult males. When he learns to apply "Daddy" only to his father and "man" to adult males, Rollo shows discrimination.

Uncle Al, his father's brother, comes to visit. Because they look similar, Rollo sometimes calls Uncle Al "Daddy." This is again a generalization. It also illustrates the use of generalization to determine what looks similar to a subject. If a subject generalizes to a new stimulus, that new stimulus must somehow be similar to the S+.
Q2. After the monkey has learned to discriminate between red and green, it is tested with an orange light and a yellow light. It responds almost as well to the orange as to the red S+. Its response to the yellow is about half way between its response to the red S+ and the green S-. These results indicate that the monkey

A. sees all colors as similar to each other
B. behaves as if it sees orange as more similar to red than is yellow
C. cannot discriminate orange from red or yellow from either green or red
D. generalizes more from red to orange than to yellow
E. B and D are both correct

Instrumental and classical conditioning are forms of associative learning. They are the basis of habits, which seem unrelated to higher-level thought processes needed for insightful learning. Insight appears related to conscious thinking, because insight seems to solve problems by sudden changes in behavior following apparently random activity. It is as if a person who solves a problem by insight works over the problem in his/her mind while behaving randomly, until s/he suddenly discovers the solution. In contrast, most habits develop gradually by trial and success.

At the end of the 19th century Thorndike tested the role of insight in problem solving. He put cats in a box that required moving two different latches to open the door on the box. His cats showed no evidence of sudden, apparently insightful discovery of the solution. They appeared to solve the problem by accident while moving about the box. With repeated trials the cats learned to open the box more and more quickly. The final performance looked like insight, but it was a habit built on instrumental conditioning.

Q3. In the experiment described in above, the pigeons consistently made errors on only one photo. It showed a scene with no person in it, but the pigeons still responded to it. Careful inspection of the picture showed that there was, in fact, a person it. The pigeons had responded correctly, but the experimenters had incorrectly assigned that picture to the “no person” group of pictures. This fact supports the idea that the pigeons were using the concept correctly because

A. they discriminated between this picture and all the other pictures with people in them
B. they kept responding to that picture though these responses were never reinforced.
C. this picture did not produce generalization to pictures in the new set.
D. the pigeons showed they had better eyesight than did the experimenter.

Wolfgang Kohler started the modern scientific investigation of insight while he was detained on an island off the African coast during World War I. He studied the behavior of chimpanzees faced with problems of getting some tempting fruit placed out of reach.

In one problem the chimpanzee could reach fruit only by piling one box on top of another and climbing up on top. After some apparently random activity, the chimpanzee abruptly moved one box directly under the fruit, piled the other on top of it, and climbed up to reach the fruit. In another problem, the chimpanzee could reach fruit with a long pole created by fitting together two shorter ones. Again the solution seemed to appear suddenly after some random activity. The apparently sudden solution suggests some kind of sudden mental reorganization which can be described as “insight” into the solution. The chimpanzee seemed to “get the idea,” which then guided it to a solution.
Q4. Associative learning and insight appear to be quite separate processes because associative learning ______. In contrast, insight ___.
A. involves learning associations between specific stimuli and responses; represents the discovery or application of an idea or rule
B. requires motivation and reinforcement; does not require motivation and reinforcement
C. does not require memory; requires memory
D. usually develops slowly; seems to appear suddenly
E. A and D are both correct
F. A, B, C, and D are all correct

Later research indicates that sudden solutions to problems are based at least partly on experience with the parts of the solution. chimpanzees without such experience show little evidence of insightful responses. Better controlled evidence on the relation between extended experience and insightful solutions to problems comes from research on learning sets or "learning to learn" by harlow (harlow & harlow, 1949; harlow, 1949).

Harlow trained monkeys to discriminate between pairs of objects. The S+ object covered a raisin; the S- object had nothing. However, the monkeys got only a few trials, often six, before getting a new pair of objects. again, one was S+; the other S-. the trials with an object pair is a set. the table below illustrates the task. Note that a previous S- can be used later as S+ and vice versa.

Q5. In learning sets (learning to learn) the monkeys cannot learn a simple associate habit between choosing an object and getting a raisin because
A. each pair of objects is presented for only six trials, not enough to learn such an association well
B. objects may be reused with the same or the opposite sign and paired with the same or a different object
C. the monkeys require insight to figure out that the sets (object pairs) change every six trials
D. A and B are both correct

Figure 1-3g shows the results of such an experiment. It plots percent correct on each of the six trials for groups of 20 sets (object pairs) tested at the beginning, middle, and end of training. the monkeys got over 300 different object pairs.

On the first eight object pairs the monkeys show only a small increase in percent correct over the six trials. they do not have time to learn the association between picking the S+ object and reinforcement. With additional problems, performance improved. the monkeys were always at chance on the first trial, as they had to be for a new pair of objects. But by the middle of training (trials 101-200), they were well above chance on the last five trials of a set. On the last 55 sets (object pairs), they were almost perfect.

The performance at the end of training cannot be based on simple association between picking S+ and reinforcement. the stimuli changed too often, an S+ in an earlier object pair could become S- on a later pair.

This performance seems to require that the monkey use an abstract rule: win stay; lose shift. This means that, if by chance the monkey picks S+ (it "wins" a raisin), then it stays with that object for the remaining five trials. if the choice on the first trial happens to be S- (it "loses"), then the monkey shifts to the other object.
The results indicate that the monkey must have some ability at abstract thought. The solution to the problem is like a problem in inductive reasoning. Inductive reasoning requires the observer to figure out a general rule from several individual cases or examples. This is what these monkeys did.

The monkeys developed this apparent "insight" based on instrumental discrimination learning. This suggests that simple learning and thinking are not independent psychological processes. Rather, the learning links thinking to discrimination learning.

Q6. The data in the figure suggest that the monkeys had discovered the rule, *win stay; lose shift*, by the time they had tried 250 object pairs. What feature in the data suggest this?

A. after training, the monkeys go from chance on the first trial with a new pair of objects to nearly perfect on the second trial

B. it requires insight to figure out the rule: *win stay; lose shift*

C. the monkeys suddenly find the rule and go from near chance performance to almost perfect performance over about 150 -200 object pairs.

D. performance on trial 6 is almost always better than on trial 2