Our perception of Figure10.6 as three pairs of straight lines illustrates the law of proximity, or nearness: Things that are near each other appear to be grouped together.

10.2.3.5 Law of Common Region

Figure 10.7

Elements that are within the same region of space appear to be grouped together. Even though the circles inside the ovals are farther apart than the circles that are next to each other in neighboring ovals, we see the circles inside the ovals as belonging together. This occurs because each oval is seen as a separate region of space. Notice that in this example common region overpowers proximity. Because the circles are in different regions, they do not group with each other, as they did in Figure, but with circles in the same region.

10.2.3.6 Law of Uniform Connectedness

The principle of uniform connectedness states: A connected region of visual properties, such as lightness, color, texture, or motion, is perceived as a single unit.

Figure 10.8

10.2.3.7 Law of Synchrony

The principle of synchrony states: Visual events that occur at the same time are perceived as belonging together.

10.2.3.8 Law of Common Fate

The law of common fate states: Things that are moving in the same direction appear to be grouped together. Thus, when you see a flock of hundreds of birds all flying together, you

tend to see the flock as a unit, and if some birds start flying in another direction, this creates a new unit (Figure). Notice that common fate is like synchrony in that both principles are dynamic, but synchrony can occur without movement, and the elements don't have to change in the same direction as they do in common fate.

10.2.3.9 Law of Meaningfulness or Familiarity

According to the law of familiarity, things that form patterns that are familiar or meaningful are likely to become grouped together.

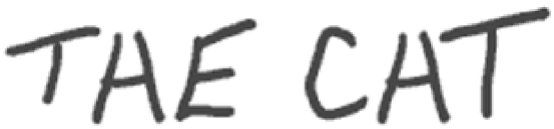
10.3 Learning-Based Inference: The Nurture of Perception

In 1866, Hermann von Helmholtz pointed out the important role of learning (or nurture) in perception. His theory of learning-based inference emphasized how people use prior learning to interpret new sensory information. Based on experience, the observer makes inferences — guesses or predictions—about what the sensations mean. This theory explains, for example, why you assume a birthday party is in progress when you see lighted candles on a cake: You have learned to associate cakes, candles, and birthdays.

Ordinarily, such perceptual inferences are fairly accurate. On the other hand, we have seen that confusing sensations and ambiguous arrangements can create perceptual illusions and erroneous conclusions. Our perceptual interpretations are, in effect, hypotheses about our sensations. For example, babies learn to expect that faces will have certain features in fixed arrangements (pair of eyes above nose, mouth below nose, etc.). In fact, we so thoroughly learn about faces in their usual configuration that we fail to "see" facial patterns that violate our expectations, particularly when they appear in an unfamiliar orientation. According to the theory of learning-based inference, the most important factors include the context, our expectations, and our perceptual set.

10.3.1 Context and Expectations

Once you identify a context, you form expectations about what persons, objects, and events you are likely to experience. To see what we mean, take a look at the following:



It says THE CAT, right? Now look again at the middle letter of each word. Physically, these two letters are exactly the same, yet you perceived the first as an H and the second as an A. Why? Clearly, your perception was affected by what you know about words in English. The context provided by T__E makes an H highly likely and an A unlikely, whereas the reverse is true of the context of C__T. Here's a more real-world example: You have probably had difficulty recognizing people you know in situations where you didn't expect to see them, such as in a different city or a new social group. The problem, of course, is not that they looked different but that the context was unusual: You didn't expect them to be there. Thus, perceptual identification depends on context and expectations as well as on an object's physical properties.

10.3.2 Perceptual Set

Another way learning serves as a platform from which context and expectation exert an influence on perception involves perceptual set —which is closely related to expectation. Under the influence of perceptual set, we have a readiness to notice and respond to certain stimulus cues—like a sprinter anticipating the starter's pistol. In general, perceptual set involves a focused alertness for a particular stimulus in a given context. For example, a new mother is set to hear the cries of her child. Likewise, if you drive a sporty red car, you probably know how the highway patrol has a perceptual set to notice speeding sporty red cars. Often, a perceptual set leads you to transform an ambiguous stimulus into the one you were expecting. To experience this yourself, read quickly through the series of words that follow in both rows:

FOX; OWL; SNAKE; TURKEY; SWAN; D?CK

BOB; RAY; DAVE; BILL; TOM; D?CK

Notice how the words in the two rows lead you to read D?CK differently in each row.

The meanings of the words read prior to the ambiguous stimulus create a perceptual set. Words that refer to animals create a perceptual set that influences you to read D?CK as "DUCK." Names create a perceptual set leading you to see D?CK as DICK.

10.3.3 Cultural Influences on Perception

Which of the following three items go together: chicken, cow, grass?

An American is more likely to group chicken and cow together, because they are both animals. But a Chinese, will more likely to put the latter two together, because cows eat grass. In general, says cross-cultural psychologist Richard Nisbett, Americans tend to put items in categories by abstract type rather than by relationship or function. Nisbett and his colleagues have also found that East Asians typically perceive in a more holistic fashion than do, that is, the Asians pay more attention to, and can later recall more detail about, the context than do Americans.

Specifically, when looking at a scene, people raised in America tend to spend more time scanning the “figure,” while those raised in China usually focus more on details of the “ground”. “The Americans are more zoom and the East Asians are more panoramic,”. Such distinctions are now even showing up as subtle differences on scans comparing brain activity of Asians and Americans on simple perceptual judgment tasks. Cross-cultural psychologists have pointed to still other cultural differences in perception. Consider, for example, the famous Ponzo illusion, based on linear perspective depth cues (Figure 10.9).

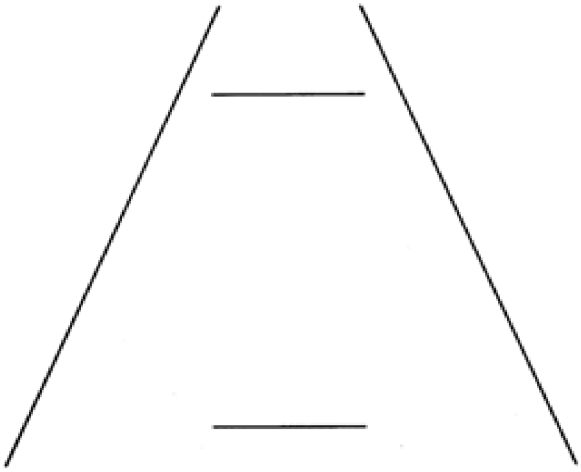


Figure 10.9

In your opinion, which bar is longer: the one on top or the one on the bottom? In actuality, both bars are the same length. Research shows, however, that responses to these figures

depend strongly on culture-related experiences. Most readers of this book will report that the top bar appears longer than the bottom bar, yet people from some cultural backgrounds are not so easily fooled.

This may be because, the world you have grown up in probably included many structures featuring parallel lines that seemed to converge in the distance: railroad tracks, long buildings, highways, and tunnels. Such experiences leave you vulnerable to images, such as the Ponzo illusion, in which cues for size and distance are unreliable.

But what about people from cultures where individuals have had far less experience with this cue for distance? Research on this issue has been carried out on the Pacific island of Guam, where there are no Ponzo like railroad tracks. There, too, the roads are so winding that people have few opportunities to see roadsides “converge” in the distance. People who have spent their entire lives on Guam, then, presumably have fewer opportunities to learn the strong perceptual cue that converging lines indicate distance. And, sure enough—just as researchers had predicted—people who had lived all their lives on Guam were less influenced by the Ponzo illusion than were respondents from the mainland United States. That is, they were less likely to report that the top line in the figure was longer. These results strongly support the argument that people’s experiences affect their perceptions.

10.4 Perceptual constancy

Perception helps to adapt to a complex and ever changing environment. Perceptual constancy is the tendency to perceive aspects of the world as unchanging despite changes in the sensory input we receive from them.

10.4.1 Size constancy

One form of perceptual constancy is size constancy, the tendency to interpret an object as always being the same size, regardless of its distance from the viewer (or the size of the image it casts on the retina). So if an object that is normally perceived to be about 6 feet tall appears very small on the retina, it will be interpreted as being very far away.

10.4.2 Shape constancy

Another perceptual constancy is the tendency to interpret the shape of an object as constant, even when it changes on the retina. This shape constancy is why a person still perceives

a coin as a circle even if it is held at an angle that makes it appear to be an oval on the retina. Dinner plates on a table are also seen as round, even though from the angle of viewing they are oval.

10.4.3 Brightness constancy

A third form of perceptual constancy is brightness constancy, the tendency to perceive the apparent brightness of an object as the same even when the light conditions change. If a person is wearing black pants and a white shirt, for example, in broad daylight the shirt will appear to be much brighter than the pants. But if the sun is covered by thick clouds, even though the pants and shirt have less light to reflect than previously, the shirt will still appear to be just as much brighter than the pants as before—because the different amount of light reflected from each piece of clothing is still the same difference as before.

10.5 Depth perception

The capability to see the world in three dimensions is called depth perception. It's a handy ability because without it you would have a hard time judging how far away objects are. Depth perception develop very early in infancy, if it is not actually present at birth. People who have had sight restored have almost no ability to perceive depth if they were blind from birth. Depth perception, like the constancies, seems to be present in infants at a very young age.

Various cues exist for perceiving depth in the world. Some require the use of only one eye (monocular cues) and some are a result of the slightly different visual patterns that exist when the visual fields of both eyes are used (binocular cues).

10.5.1 Monocular cues

Monocular cues are often referred to as pictorial depth cues because artists can use these cues to give the illusion of depth to paintings and drawings.

1. Linear perspective: When looking down a long interstate highway, the two sides of the highway appear to merge together in the distance. This tendency for lines that are actually parallel to seem to converge on each other is called linear perspective. It works in pictures because people assume that in the picture, as in real life, the converging lines indicate that the "ends" of the lines are a great distance away from where the people are as they view them.

2. Relative size: The principle of size constancy is at work in relative size, when objects that people expect to be of a certain size appear to be small and are, therefore, assumed to be much farther away. Movie makers use this principle to make their small models seem gigantic but off in the distance

3. Overlap: If one object seems to be blocking another object, people assume that the blocked object is behind the first one and, therefore, farther away. This cue is also known as interposition.

4. Aerial (atmospheric) perspective: The farther away an object is, the hazier the object will appear to be due to tiny particles of dust, dirt, and other pollutants in the air, a perceptual cue called aerial (atmospheric) perspective. This is why distant mountains often look fuzzy, and buildings far in the distance are blurrier than those that are close.

5. Texture gradient: If there are any large expanses of pebbles, rocks, or patterned roads (such as a cobblestone street) nearby, go take a look at them one day. The pebbles or bricks that are close to you are very distinctly textured, but as you look farther off into the distance, their texture becomes smaller and finer. Texture gradient is another trick used by artists to give the illusion of depth in a painting.

6. Motion parallax: The next time you're in a car, notice how the objects outside the car window seem to zip by very fast when they are close to the car, and objects in the distance, such as mountains, seem to move more slowly. This discrepancy in motion of near and far objects is called motion parallax.

7. Accommodation: A monocular cue that is not one of the pictorial cues, accommodation makes use of something that happens inside the eye. The lens of the human eye is flexible and held in place by a series of muscles. The discussion of the eye the earlier lesson mentioned the process of visual accommodation as the tendency of the lens to change its shape, or thickness, in response to objects near or far away. The brain can use this information about accommodation as a cue for distance. Accommodation is also called a "muscular cue."

10.5.2 Binocular cues

As the name suggests, these cues require the use of two eyes.

1. Convergence:

Convergence, refers to the rotation of the two eyes in their sockets to focus on a single object. if the object is close, the convergence is pretty great (almost as great as crossing the eyes). If the object is far, the convergence is much less. Hold your finger up in front of your nose, and then move it away and back again. That feeling you get in the muscles of your eyes is convergence.

2. Binocular disparity:

Binocular disparity is a scientific way of saying that because the eyes are a few inches apart, they don't see exactly the same image. The brain interprets the images on the retina to determine distance from the eyes. If the two images are very different, the object must be pretty close. If they are almost identical, the object is far enough away to make the retinal disparity very small. You can demonstrate this cue for yourself by holding an object in front of your nose. Close one eye, note where the object is, and then open that eye and close the other. There should be quite a difference in views. But if you do the same thing with an object that is across the room, the image doesn't seem to "jump" or move nearly as much, if at all. In spite of all the cues for perception that exist, even the most sophisticated perceiver can still fail to perceive the world as it actually is.

10.6 Perceptual illusions

An illusion is a perception that does not correspond to reality: People think they see something when the reality is quite different. Another way of thinking of illusions is as visual stimuli that "fool" the eye. (Illusions are not hallucinations: an illusion is a distorted perception of something that is really there, but a hallucination originates in the brain, not in reality.)

Sometimes illusions are based on early sensory processes, subsequent processing, or higher level assumptions made by the brain's visual system. We've already discussed one visual illusion (previous lesson), color afterimages, which are due to opponent-processes in the retina or lateral geniculate nucleus (LGN) of the thalamus after light information has been detected by the rods and cones. Another post detection, but still rather early, process has been offered for yet another illusion.

10.6.1 Muller-Lyer illusion

One of the most famous visual illusions, the Müller-Lyer illusion, is shown in Figure 10.10.

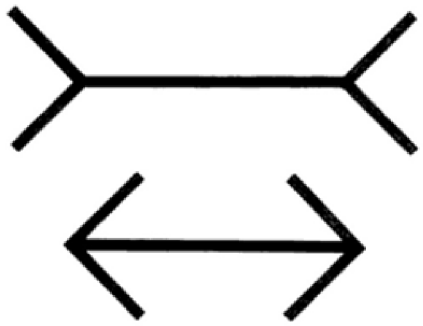


Figure 10.10

The distortion happens when the viewer tries to determine if the two lines are exactly the same length. They are identical, but one line looks longer than the other. (It's always the line with the angles on the end facing outward.) The explanation is that most people live in a world with lots of buildings. Buildings have corners. When a person is outside a building, the corner of the building is close to that person, while the walls seem to be moving away (like the line with the angles facing inward). When the person is inside a building, the corner of the room seems to move away from the viewer while the walls are coming closer (like the line with the angles facing outward). In their minds, people "pull" the inward-facing angles toward them like the outside corners of a building, and they make the outward-facing angles "stretch" away from them like the inside corners of the room

10.6.2 The moon illusion

Another common illusion is the moon illusion, in which the moon on the horizon appears to be much larger than the moon in the sky. One explanation for this is that the moon high in the sky is all alone, with no cues for depth surrounding it. But on the horizon, the moon appears behind trees and houses, cues for depth that make the horizon seem very far away. The moon is seen as being behind these objects and, therefore, farther away from the viewer. Because people know that objects that are farther away from them yet still appear large are very large indeed, they "magnify" the moon in their minds—a misapplication of the principle of size constancy. This explanation of the moon illusion is called the apparent distance hypothesis.

10.6.3 Illusions of motion

Sometimes people perceive an object as moving when it is actually still. One example of this takes place as part of a famous experiment in conformity called the autokinetic effect. In this effect, a small, stationary light in a darkened room will appear to move or drift because there are no surrounding cues to indicate that the light is not moving. Another is the stroboscopic motion seen in motion pictures, in which a rapid series of still pictures will seem to be in motion. Many a student has discovered that drawing little figures on the edges of a notebook and then flipping the pages quickly will also produce this same illusion of movement. Another movement illusion related to stroboscopic motion is the phi phenomenon, in which lights turned on in sequence appear to move. For example, if a light is turned on in a darkened room and then turned off, and then another light a short distance away is flashed on and off, it will appear to be one light moving across that distance. This principle is used to suggest motion in many theatre marquee signs, flashing arrows indicating direction that have a series of lights going on and off in a sequence, and even in strings of decorative lighting, such as the “chasing” lights seen on houses at holiday times.

10.7 Conclusion

Perception involves the organization and interpretation of sensory messages into a meaningful experience. The laws of organization are specified by the Gestalt psychologists and they include proximity, similarity, good continuation, closure, and common fate. The major function of the perceptual system is to achieve perceptual constancy- to keep the appearance of objects the same inspite of large changes in the stimuli received by the sense organs. The major constancies are brightness, shape and size. Illusions are perceptual experiences that do not conform to physical reality.

10.8 Summary

Perception is the knowledge-based interpretation of sensations. Much of this interpretation takes place automatically, but sometimes conscious effort is required to translate sensations into meaningful experience. Our perceptual systems automatically discriminate figure from ground. They also automatically group stimuli into patterns on the basis of the Gestalt principles of proximity, similarity, continuity, closure, texture, simplicity, common fate, and three others known as synchrony, common region, and connectedness. The perception of distance, or depth perception, depends partly on stimulus cues and partly on the physical structure of the visual

system. Stimulus cues include relative size, height in the visual field, interposition, linear perspective, reduced clarity, light and shadow, and textural gradients. Cues based on the structure of the visual system include convergence of the eyes (the fact that the eyes must move to focus on the same object), binocular disparity (the fact that the eyes are set slightly apart), and accommodation (changes in the shape of the lenses as objects are brought into focus). The perception of motion results, in part, from the movement of stimuli across the retina. Expanding or looming stimulation is perceived as an approaching object. Movement of the retinal image is interpreted along with information about movement of the head, eyes, and other body parts, so that one's own movement can be discriminated from the movement of external objects. Stroboscopic motion is a movement illusion arising when a series of slightly different still images is seen in rapid succession. Because of perceptual constancy, the brightness, size, and shape of objects are seen as constant despite changes in the sensations received from those objects. Size constancy and shape constancy depend on the relationship between the retinal image of the object and the knowledge-based perception of its distance. Brightness constancy depends on the perceived relationship between the brightness of an object and its background. Size illusions are distortions of reality that result when principles of perception are applied inappropriately. Many illusions are caused by misreading depth cues and by evaluating stimuli in the context of their surroundings.

10.9 Key words

:: Binocular cues

Cues that require the use of two eyes.

:: Brightness constancy

The tendency to perceive the apparent brightness of an object as the same even when the light conditions change

::Depth perception

The ability to see the world in three dimensions

:: Figure and Ground

A figure is simply a pattern or image that grabs our attention. Everything else becomes ground, the backdrop against which we perceive the figure

:: Gestalt theory

Emphasizes how we organize incoming stimulation into meaningful perceptual patterns

:: Illusion

Perception that does not correspond to reality

:: Law of Common Fate

Things that are moving in the same direction appear to be grouped together

::Law of Common Region

Elements that are within the same region of space appear to be grouped together

:: Law of Good Continuation

Tendency to prefer smoothly connected and continuous figures to disjointed ones

.::Law of good figure or the law of simplicity(Pragnanz)

Every stimulus pattern is seen in such a way that the resulting structure is as simple as possible.

:: Law of Meaningfulness or Familiarity

Things that form patterns that are familiar or meaningful are likely to become grouped together

::Law of Proximity (Nearness)

Things that are near each other appear to be grouped together.

::Law of Similarity

Tendency to perceive things as belonging together because they share common features

:: Law of Synchrony

Visual events that occur at the same time are perceived as belonging together.

:: Law of Uniform Connectedness

A connected region of visual properties, such as lightness, color, texture, or motion, is perceived as a single unit

:: Learning-based inference

Emphasizes learned influences on perception

:: Monocular cues

Pictorial depth cues

::Perceptual constancy

The tendency to perceive aspects of the world as unchanging despite changes in the sensory input

:: Shape constancy

The tendency to interpret the shape of an object as constant, even when it changes on the retina

:: Size constancy

The tendency to interpret an object as always being the same size, regardless of its distance

10.10 Check your progress

1. Which of the following words does NOT describe perception

(a) A passive process

(b) A psychological process

(c) No direct contact with the physical world

(d) Using sense organs

2. The Gestalt psychologists produced a series of principles. Some of the most significant principle include

(a) Grouping, clusters, contrast

(b) Figure and ground, grouping, closure

(c) Figure and ground, grouping, clusters

(d) None of the above

3. The tendency to complete an incomplete figure to (mentally) fill in the gaps and to perceive them as whole is called

(a) Figure

(b) Grouping

(c) Ground

(d) Closure

4. The perception process demonstrates the integration of our

(a) Physiology, environment and conscious self

(b) Conscious self, unconscious self and physiology

(c) Environment, conscious self and unconscious self

(d) Unconscious self, physiology and environment

10.11 Answers to check your progress

1. a
2. b
3. d
4. b

10.12 Model questions

1. Describe the process of perception as a series of steps.
2. What is the role of higher-level or “cognitive” processes in perception?
3. Describe the Gestalt laws of perception.

LESSON - 11
LEARNING – CLASSICAL CONDITIONING

Preview

In the previous chapter key features of perception was highlighted. With regards to its laws and also illusions was discussed. In this chapter the concept of learning will be introduced. The first method of conditioning called classical conditioning will be discussed in detail. The principles and factors that influence classical conditioning will also be explored.

Learning Objectives

After studying this chapter you will be able to:

- Understand the concept of learning.
- Understand conditioning and its types.
- Understand the early experiments of classical conditioning.
- Understand the principles of classical conditioning.
- Understand the factors that influence classical conditioning.
- Understand to flow of ideas from Pavlov to Watson and the emergence of Behaviorism.

Plan of Study

11.1 Introduction To Learning

In everyday sense, learning often refers to formal methods of acquiring new knowledge or skills, such as learning in the classroom or learning to play the flute. In Psychology, however, the topic of learning is much broader. Psychologists formally define learning as a process that produces a relatively enduring change in behaviour or knowledge as a result of an individual's experience. As the result of experience, you acquire new behaviors or modify old behaviors so as to better cope with your surroundings.

In this broad sense of the word learning occurs in every setting not just in classrooms. And, learning takes place at every age. Father the psychological study of learning is not limited to humans. From alligators to zebras, learning is an important aspect of the behaviour of virtually all animals.

Much of this chapter will focus on a very basic form of learning called conditioning. Conditioning is the process of learning associations between environmental events and behavioural responses. This description may make you think conditioning has only a limited application to your life. Suppose however that at the beginning of your next Psychology class your instructor announced, “There is a surprise test today, put all your books on the floor and take out a pencil and a clean sheet of paper.”Would you feel a twinge of anxiety? If you did it would be an example of the power of conditioned learning. You've learned to feel anxious when you hear the word test.

From simple actions, like answering the telephone, to more complex skills, like programming a cell phone, much of your everyday behaviour reflects learning through conditioning. There are two basic types of conditioning –classical conditioning and operant conditioning. Classical conditioning explains how certain stimuli can trigger an automatic response. And, as you will see in the following chapters, operant conditioning is useful in understanding how we acquire New, voluntary actions. Finally, we will also consider the process of observational learning or how we acquire New behaviors by observing the actions of others.

11.2 Introduction To Classical Conditioning

One of the major contributors to the study of learning was not a psychologist bit a Russian physiologist who was awarded a Nobel Prize for his work on digestion. Ivan Pavlov was a brilliant scientist who directed several research laboratories in St. Petersburg, Russia, at the

turn of the twentieth century. Pavlov's involvement with Psychology began as a result of an observation he made while investigating the role of saliva in digestion, using dogs as his experimental subjects.

In order to get a dog to produce saliva, Pavlov (1904) put food on the dog's tongue. After he had worked with the same dog for several days in a row, Pavlov noticed something curious. The dog began salivating before Pavlov put the food on its tongue. In fact, the dog began salivating when Pavlov entered the room or even at the sound of his approaching footsteps. But salivating is a reflex –a largely involuntary automatic response to an external stimulus. The dog should salivate only after the food was presented not before. Why would the reflex occur before the stimulus was presented? What was causing this unexpected behaviour?

If you own a dog, You've probably observed the same basic phenomenon. Your dog gets excited and begins to sooner when you shake a box of dog biscuits, even before you've given him a doggie treat. In everyday language, your pet has learned to anticipate food in association with some signal – namely, the sound of dog biscuits rattling in a box.

Pavlov abandoned his research on digestion and devoted the remaining 30 years of his life to investigating different aspects of this phenomenon. Let's look at what he discovered in more detail.

11.3 Principles of Classical Conditioning

The process of conditioning that Pavlov discovered was the first to be extensively studied in psychology. Thus, it's called classical conditioning. Also called respondent conditioning or Pavlovian conditioning, classical conditioning deals with behaviours that are elicited automatically by some stimulus. Elicit means draw out or bring forth that is the stimulus doesn't produce a new behaviour but rather causes an existing behaviour to occur.

Classical conditioning always involves some kind of reflexive behaviour. Remember, a reflex is a relatively simple, unlearned behaviour, governed by the nervous system. In Pavlov's original studies of digestion, the dogs salivate reflexively when food was placed on their tongues. But when the dogs began salivating in response to the sight of Pavlov or to the sound of his footsteps, a new, learned stimulus elicited the salivary response. This, in classical conditioning, a new stimulus-response sequence is learned.

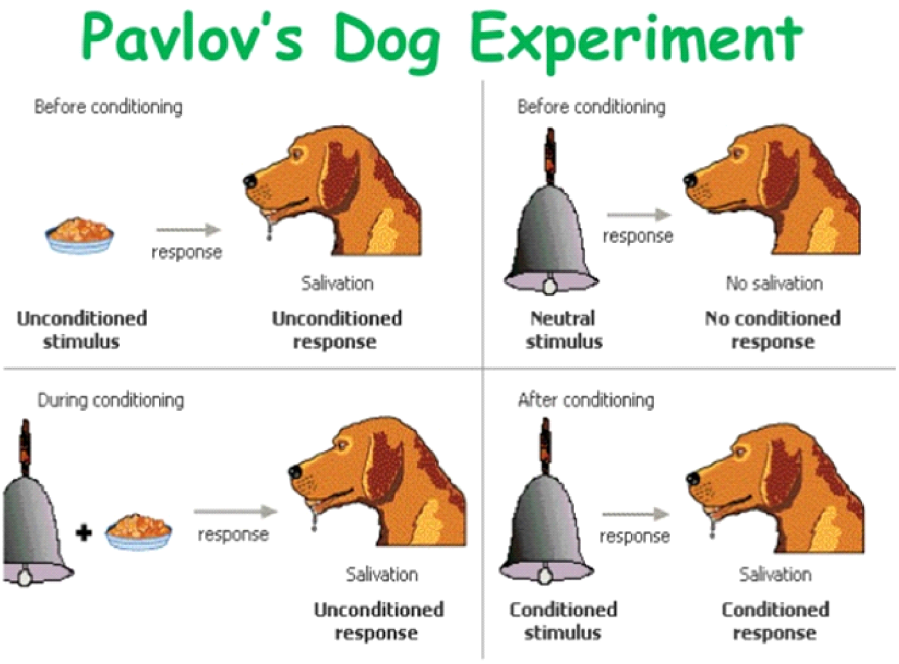
How does this kind of learning take place? Essentially, classical conditioning is a process of learning an association between two stimuli. Classical conditioning involves pairing a neutral stimulus (e.g., the sight of Pavlov) with an unlearned natural stimulus (food in the mouth) that automatically elicits a reflexive response (the dog salivates). If the two stimuli (Pavlov + Food) are repeatedly paired, eventually the neutral stimulus (Pavlov) elicits the same basic reflexive response as the natural stimulus (food) – even in the absence of the natural stimulus. So, when the dog in the laboratory started salivating at the sight of Pavlov before the food was placed on its tongue, it was because the dog had formed a new, learned association between the sight of Pavlov and the food.

Pavlov used special terms to describe each element of the classical conditioning process. The natural stimulus that reflexively produces a response without prior learning is called the unconditioned stimulus (abbreviated UCS). In this example, the unconditioned stimulus is the food in the dog's mouth. The unlearned, reflexive response is called the unconditioned response (or UCR). The unconditioned response is the dog's salivation.

To learn more about his discovery, Pavlov (1927) controlled the stimuli that preceded the presentation of food. For example, in one set of experiments, he used a bell as a neutral stimulus – neutral because dogs don't normally salivate to the sound of a ringing bell. Pavlov first rang the bell and then gave the dog food. After this procedure was repeated several times, the dog began to salivate when the bell was rung, before the food was put in its mouth. At that point, the dog was classically conditioned to salivate to the sound of a bell alone. That is, the dog had learned a new association between the sound of the bell and the presentation of food.

Pavlov called the sound of the bell the conditioned stimulus. The conditioned stimulus (or CS) is the stimulus that is originally neutral but comes to elicit a reflexive response. He called the dog's salivation to the sound of the bell the conditioned response (or CR), which is the learned reflexive response to a previously neutral stimulus.

Classical conditioning terminology can be confusing. You may find it helpful to think of the word conditioned as having the same meaning as "learned". Thus, the "conditioned stimulus" refers to the "learned stimulus", the "unconditioned response" refers to the "unlearned response", and so forth.



It's also important to note that in this case the unconditioned response and the conditioned response describe essentially the same behavior – the dog's salivating. Which label is applied depends on which stimulus elicits the response. If the dog is salivating in response to a neutral stimulus that was not acquired through learning, the salivation is an unconditioned response. If, however, the dog has learned to salivate to a neutral stimulus that doesn't normally produce the automatic response, the salivation is a conditioned response.

11.4 Factors That Affect Conditioning

Over the three decades that Pavlov (1928) spent studying classical conditioning, he discovered many factors that could affect the strength of the conditioned response. For example, he discovered that the more frequently the conditioned stimulus and the unconditioned stimulus were paired, the stronger was the association between the two.

Pavlov also discovered that the timing of the stimulus presentations affected the strength of the conditioned response. He found that conditioning was most effective when the conditioned stimulus was presented immediately before the unconditioned stimulus.

Pavlov (1927) also noticed that once a dog was conditioned to salivate to a particular stimulus, new stimuli could also elicit the conditioned salivary response. For example, Pavlov conditioned a dog to salivate to a low-pitched tone. When he sounded a slightly higher-pitched tone, the conditioned salivary response would also be elicited. Pavlov called this phenomenon stimulus generalization. Stimulus generalization occurs when stimuli that are similar to the original conditioned stimulus also elicit the conditioned response, even though they have never been paired with the unconditioned stimulus.

Just as a dog can learn to respond to similar stimuli, so it can learn the opposite – to distinguish between similar stimuli. For example, Pavlov repeatedly gave a dog some food following a low-pitched tone. The dog learned to distinguish between the two tones, salivating to the high-pitched tone but not to the low-pitched tone. This phenomenon, stimulus discrimination, occurs when a particular conditioned response is made to one stimulus but not to other similar stimuli.

Here's an example of stimulus generalization versus discrimination. Recall our example of dog who drools (the CR) when he hears the rattling sound (the CS) of dog biscuits in the box. If your dog also drools one day when you shake a box of goldfish crackers as you pour them in a serving bowl, stimulus generalization has taken place. Eventually, your dog learns that to distinguish between one sound that predicts the delivery of a doggie treat (the rattling dog biscuits) and you shake the box of dog biscuits, but he doesn't when you shake the box of crackers. At this point, stimulus discrimination has taken place.

Once learned, can conditioned responses be eliminated? Pavlov (1927) found that conditioned responses could be gradually weakened. If the conditioned stimulus (the ringing bell) was repeatedly presented without being paired with the unconditioned stimulus (the food), the conditioned response seemed to gradually disappear. Pavlov called this process of decline and eventual disappearance of the conditioned response extinction.

Pavlov also found that the dog did not simply return to its unconditioned state following extinction. If the animal was allowed a period of rest (such as a few hours) after the response was extinguished, the conditioned response would reappear when the conditioned stimulus was again presented. This reappearance of a previously extinguished conditioned response after a period of time without exposure to the conditioned stimulus is called spontaneous recovery. The phenomenon of spontaneous recovery demonstrates that extinction is not unlearning. That is, the learned response may seem to disappear, but it is not eliminated or erased.

11.5 The Founding of Behaviorism

John B. Watson

Over the course of three decades, Pavlov systematically investigated different aspects of classical conditioning. Throughout this process, he used dogs almost exclusively as his experimental subjects. Since Pavlov believed he had discovered the mechanism by which all learning occurs, it seems ironic that he had very little to say about applications of classical conditioning to human behavior. This irony is less puzzling when you understand that Pavlov wanted nothing to do with the newly established science of psychology. Why?

At the beginning of the twentieth century, psychology's early founders had defined the field as the scientific study of mind. They advocated the use of introspective self-reports to achieve two fundamental goals: describing and explaining conscious thought and perceptions. Because the early psychologists wanted to study subjective states of consciousness, Pavlov did not see psychology as an exact or precise science, like physiology or chemistry. As Pavlov (1927) wrote, " It is still open to discussion whether psychology is a natural science or whether it can be regarded as a science at all."

At about the same time Pavlov was conducting his systematic studies of classical conditioning in the early 1900s, a young psychologist named John B. Watson was attracting attention in the United States. Watson, like Pavlov, believed that psychology was following the wrong path by focusing on the study of subjective mental processes. In 1913, Watson directly

challenged the early founders of psychology when he published a landmark article entitled "Psychology as the Behaviorist Views It." With the publication of this article, Watson founded a new school, or approach, in psychology, called behaviorism. Watson strongly advocated that psychology should be redefined as the scientific study of behavior. As he later (1924) wrote, "Let us limit ourselves to things that can be observed, and formulate laws concerning only those things. Now what can we observe? We can observe behavior – what the organism does or says."

But having soundly rejected the methods of introspection and the study of consciousness, the young Watson was somewhat at a loss for a new method to replace them. By 1915 when Watson was elected president of the American Psychological Association, he had learned of Pavlov's research. Watson (1916) embraced the idea of the conditioned reflex as the model he had been seeking to investigate and explain human behavior.

Watson believed that virtually all human behavior is a result of conditioning and learning – that is, due to past experiences and environmental influences. In championing behaviorism, Watson took his views to an extreme, claiming that neither talent, personality nor intelligence was inherited.

11.6 Summary

- Learning is defined as a relatively enduring change in behavior or knowledge that is due to past experience.
- Conditioning is the process of learning associations between environmental events and behavioral responses
- Ivan Pavlov, a Russian physiologist, discovered the principles of classical conditioning while studying the digestive system of dogs.
- Classical conditioning deals with reflexive behaviors that are elicited by a stimulus and results from learning an association between two stimuli.
- Factors that affect the strength of the conditioned response include the frequency with which the conditioned and unconditioned stimuli are paired and the timing of the stimulus presentations.
- John B. Watson defined psychology as the scientific study of behavior and founded behaviorism. According to Watson, all human behavior is a result of conditioning and learning.

11.7 Keywords

Learning: A process that produces a relatively enduring change in behavior or knowledge as a result of past experience.

Conditioning: The process of learning associations between environmental events and behavioral responses.

Classical Conditioning: The basic learning process that involves repeatedly pairing a neutral stimulus with a response-producing stimulus until the neutral stimulus elicits the same response; also called respondent conditioning or Pavlovian conditioning.

Unconditional Stimulus (UCS): The natural stimulus that reflexively elicits a response without the need for prior learning.

Unconditioned Response (UCR): The unlearned, reflexive response that is elicited by an unconditioned stimulus.

Conditioned Stimulus (CS): A formerly neutral stimulus that acquires the capacity to elicit a reflexive response.

Conditioned Response (CR): The learned, reflexive response to a conditioned stimulus.

Stimulus Generalization: The occurrence of a learned response not only to the original stimulus, but to other, similar stimuli as well.

Stimulus Discrimination: The occurrence of a learned response to a specific stimulus, but not to other, similar stimuli.

Extinction: The gradual weakening and apparent disappearance of conditioned behavior. In classical conditioning, extinction occurs when the conditioned stimulus is repeatedly presented without the unconditioned stimulus.

Spontaneous Recovery: The reappearance of a previously extinguished conditioned response se after a period of time without exposure to the conditioned stimulus.

Behaviorism: School of psychology and theoretical viewpoint that emphasizes the scientific study of observable behaviors, especially as they pertain to the process of learning.

11.8 Check Your Progress

For each of the following examples, use the diagram below to help identify the neutral stimulus, UCS, UCR, CS and CR.

1. When Cindy's four-month-old infant cried, she would begin breast-feeding him. One evening, Cindy went to a movie with her husband, leaving her baby at home with a sitter. When an infant in the theater began to cry, Cindy experienced the "let-down" reflex, and a few drops of milk stained her new silk blouse.

During Conditioning:

Neutral stimulus + UCS UCR

(a) _____ + (b) _____ (c) _____

After Conditioning:

Conditioned Stimulus(CS) Conditioned Response (CR)

(d) _____ (e) _____

2. Nine months after two planes hit the World Trade Center, exploded, and demolished, and demolished Ken's New York City neighborhood, Ken still flinches every time he hears a low-flying jet overhead.

During Conditioning:

Neutral stimulus + UCS UCR

(a)_____ + (b) _____ (c)_____

After Conditioning:

Conditioned Stimulus (CS) Conditioned Response (CR)

(d) _____ (e) _____

3. After swimming in the lake near his home one day, Frank emerged from the water covered with slimy, blood sucking leeches all over his legs and back. He was revolted as he removed the leeches. Now, every time he passes the lake, Frank shudders in disgust.

During Conditioning:

Neutral stimulus + UCS UCR

(a)_____ + (b) _____ (c)_____

After Conditioning:

Conditioned Stimulus (CS) Conditioned Response (CR)

(d) _____ (e) _____

4. Every time two-year-old Jodie heard the door bell ring, she raced to open the front door. On Halloween night, Jodie answered the doorbell and encountered a scary monster with nine flashing eyes. Jodie screamed in fear and ran away. Now Jodie screams and hides whenever the doorbell rings.

During Conditioning:

Neutral stimulus + UCS UCR

(a)_____ + (b) _____ (c)_____

After Conditioning:

Conditioned Stimulus (CS) Conditioned Response (CR)

(d) _____ (e) _____

11.9 Answers To Check Your Progress

1. (a) baby crying; (b) nursing baby; (c) let-down reflex, breast milk flow; (d) baby's cry; (e) let-down reflex, breast milk flows.
2. (a) sound of plane; (b) explosion; (c) flinching, fear; (d) sound of plane; (e) flinching, fear.

3. (a) lake; (b) leeches; (c) disgust; (d) lake; (e) disgust
4. (a) doorbell; (b) scary monster; (c) fear; (d) doorbell; (d) fear.

11.10 Model Questions

1. Define Learning.
2. What is classical conditioning? Explain the principles of classical conditioning.
3. What are the factors that influence classical

LESSON 12
OPERANT CONDITIONING

Preview

In the previous chapter the concept of learning was introduced. An elaborate explanation of the pioneering research in the role of salivation in digestion carried out by Ivan Pavlov that highlighted not digestion but the principles of learning was discussed. The varied factors that influence classical conditioning was discussed. Conclusively, also a journey from Pavlov to Watson and the emergence of Behaviorism was explored. In this chapter the concept of operant conditioning will be introduced. An elaborate discussion of reinforcement and punishment and their types will be done. The concept of discriminative stimuli and shaping and maintaining behavior will also be explored.

Learning Objectives

After studying this chapter you will be able to:

- Understand the concept of operant conditioning.
- Understand reinforcement and illustrate the types of reinforcement
- Understand punishment and its types
- Understand effective and ineffective methods of punishment.
- Understand shaping and maintaining behavior

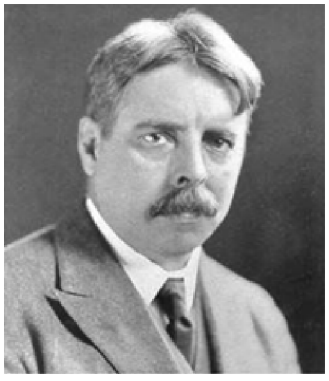
Plan of Study

12.1 Introduction To Operant Conditioning

Classical conditioning can help explain the acquisition of many learned behaviors, including emotional and physiological responses. However, recall that classical conditioning involves reflexive behaviors that are automatically elicited by a specific stimulus. Most everyday behaviors don't fall into this category. Instead, they involve nonreflexive, or voluntary actions that can't be explained with classical conditioning. Raising your hand in class, formatting a computer diskette, operating a vending machine, spiking a volleyball over the net, combing out a child's wet hair, hailing a cab- these are just a few quick examples of the enormous range of non-reflexive, or voluntary, behaviors that people perform every day.

The investigation of how voluntary behaviors are acquired began with a young American psychology student named Edward L. Thorndike. A few years before Pavlov began his extensive studies of classical conditioning. Thorndike was using cats, chicks and dogs to investigate how voluntary behaviors are acquired. Thorndike's pioneering studies helped set the stage for the later work of another American psychologist named B.F. Skinner. It was Skinner who developed operant conditioning, another form of conditioning that explains how we acquire and maintain voluntary behaviors.

12.2 Thorndike and the Law of Effect



Edward Thorndike

Edward L. Thorndike was the first psychologist to systematically investigate animal learning and how voluntary behaviors are influenced by their consequences. At the time, Thorndike was only in his early twenties and a psychology graduate student. He conducted his pioneering studies to complete his dissertation and earn his doctorate in psychology. Published in 1898, Thorndike's dissertation, titled Animal Intelligence: An Experimental Study of the Associative Processes in Animals, is the most famous dissertation ever published in psychology. When Pavlov later learned of Thorndike's studies, he expressed admiration and credited Thorndike with having started objective animal research well before his own studies of classical conditioning.

Thorndike's dissertation focused on the issue of whether animals, like humans, use reasoning to solve problems. In an important series of experiments, Thorndike (1898) put hungry cats in specially constructed cages that he called "puzzle boxes". A cat could escape the cage by some simple act, such as pulling a loop or pressing a lever that would unlatch the cage door. A plate of food was placed just outside the cage, where the hungry cat could see and smell it.

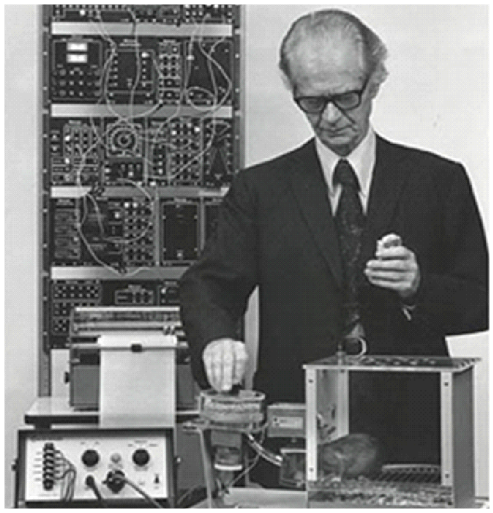
Thorndike found that when the cat was first put into the puzzle box, it would engage in many different, seemingly random behaviors to escape. For example, the cat would scratch at the cage door, claw at the ceiling, and try to squeeze through the wooden slats. Eventually, however, the cat would accidentally pull on the loop or step on the lever, opening the door latch and escaping the box. After several trials in the same puzzle box, a cat gradually took less and less time to get the cage door open. Thorndike carefully recorded the time of each trial and plotted the data to create a "time-curve" that depicted the rate of the cat's learning.

Assessing his results, Thorndike (1898) concluded that the cats did not display any humanlike insight or reasoning in unlatching the puzzle box door. Instead, he explained the cats' learning as a process of trial and error. Thorndike actually preferred the phrase "trail and success" to emphasize the relationship between actions and their consequences. Over the course of many trials, the cats gradually learned to associate certain responses with successfully escaping the box and gaining the food reward. According to Thorndike, these successful behaviors became "stamped in" so that a cat was more likely to repeat these behaviors when placed in the puzzle box again. Unsuccessful behaviors were gradually eliminated.

On the basis of his observations, Thorndike (1911) eventually formulated the law of effect: Responses followed by a satisfying state of affairs" are "strengthened" and more likely to

occur again in the same situation. Conversely, responses followed by an unpleasant or annoying state of affairs are “weakened” and less likely to occur again.

12.3 Burrhus Frederick Skinner and the Search for “Order in Behavior”



B.F. Skinner

From the time he was a graduate student in psychology until his death, the famous American psychologist B.F. Skinner searched for the “lawful processes” that would explain “order in behavior”. Skinner was a staunch behaviorist. Like Watson, Skinner strongly believed that psychology should restrict itself to studying only phenomena that could be objectively measured and verified – outwardly observable behavior and environmental events.

Skinner (1974) acknowledged the existence of what he called “internal factors,” such as thoughts, expectations, and perceptions. However, Skinner believed that internal thoughts, beliefs, emotions, or motives could not be used to explain behavior. These fell into the category of “private events” that defy direct scientific observation and should not be included in an objective, scientific explanation of behavior.

Along with being influenced by John Watson’s writings, Skinner greatly admired Pavlov’s work. Skinner acknowledged that Pavlov’s classical conditioning could explain the learned association of stimuli in certain reflexive responses. But classical conditioning was limited to existing behaviors that were reflexively elicited. Skinner (1979) was convinced that he had

“found a process of conditioning that was different from Pavlov’s and much more like most learning in daily life”. To Skinner the most important form of learning was demonstrated by new behaviors that were actively emitted by the organism, such as the active behaviors produced by Thorndike’s cats in trying to escape the puzzle boxes.

Skinner (1953) coined the term operant to describe any “active behavior that operates upon the environment to generate consequences.” In everyday language, Skinner’s principles of operant conditioning explain how we acquire the wide range of voluntary behaviors that we perform in daily life.

12.4 Reinforcement

In a nutshell, Skinner’s operant conditioning explains learning as a process in which behavior is shaped and maintained by its consequences. One possible consequence of a behavior is reinforcement. Reinforcement is said to occur when a stimulus or an event follows an operant and increases the likelihood of the operant being repeated. Notice that reinforcement is defined by the effect it produces – increasing or strengthening the occurrence of a behavior in the future.

12.4.1 Positive and Negative Reinforcement

There are two forms of reinforcement: positive reinforcement and negative reinforcement. Both increase future behavior, but they do so in different ways. It’s easier to understand these differences if you note at the outset that Skinner did not use the terms positive and negative in their everyday sense of meaning “good” and “bad” or “desirable’ and “undesirable”. Instead, think of the words positive and negative in terms of their mathematical meanings. Positive is the equivalent of a plus sign (+), meaning that something is added. Negative is the equivalent of a minus sign (-), meaning that something is subtracted or removed. If you keep that distinction in mind, the principles of positive and negative reinforcement should be easier to understand.

Positive reinforcement involves following an operant with the addition of a reinforcing stimulus. In positive reinforcement situations a response is strengthened because something is added or presented. Everyday examples of positive reinforcement in action are easy to identify. Here are some quick examples:

- A rat presses a lever (the operant) and receives a food pellet (the reinforcing stimulus).

- You reach your sales quota at work (the operant) and you get a bonus check (the reinforcing stimulus).

In each example, if the addition of the reinforcing stimulus has the effect of making you more likely to repeat the operant in similar situations in the future, then positive reinforcement has occurred. It's important to point out that what constitutes a reinforcing stimulus can vary from person to person, species to species, and situation to situation.

Negative reinforcement involves an operant that is followed by the removal of an aversive stimulus. In negative reinforcement situations, a response is strengthened because something is being subtracted or removed. Remember that the word negative in negative reinforcement is used like a mathematical minus sign (-).

Aversive stimuli typically involve physical or psychological discomfort that an organism seeks to escape or avoid. Consequently, behaviors are said to be negatively reinforced when they let you either (1) escape aversive stimuli that are already present or (2) avoid aversive stimuli before they occur. That is, we're more likely to repeat the same escape or avoidance behaviors in similar situations in the future.

Many students find the concept of negative reinforcement confusing until they realize just how common it is in everyday life. Here are some examples of negative reinforcement involving escape or avoidance behavior:

- You switch on the air conditioning (the operant) to escape the summer heat (the aversive stimulus).
- You get to class on time (the operant) to avoid being scolded (the aversive stimulus) by your instructor.

In each example, if escaping or avoiding the aversive event has the effect of making you more likely to repeat the operant in similar situations in the future, then negative reinforcement has taken place.

12.4.2 Primary and Conditioned Reinforcers

Skinner also distinguished two kinds of reinforcing stimuli: primary and conditioned. A primary reinforce is one that is naturally reinforcing for a given species. That is, even if an individual has not had prior experience with the particular stimulus, the stimulus or event still

has reinforcing properties. For example, food, water, adequate warmth, and sexual contact are primary reinforcers for most animals, including humans.

A conditioned reinforcer, also called a secondary reinforce, is one that has acquired reinforcing value by being associated with a primary reinforce. The classic example of a conditioned reinforce is money. Money is reinforcing not because those flimsy bits of paper and little pieces of metal have value in and of themselves, but because we've learned that we can use them to acquire primary reinforcers and other conditioned reinforcers. Awards, frequent-flyer points, and college degrees are just a few other examples of conditioned reinforcers.

Sometimes there are many links in the association between a conditioned reinforce and a primary reinforce. You can't plunk your college diploma down on the counter to purchase a loaf of bread at the grocery store, but your college degree can lead to a job that provides you with money to exchange or the primary reinforce of food. The respect of your peers and the approval of your instructors or managers can be powerful conditioned reinforcers. Conditioned reinforcers can be as subtle as a smile, a touch, or a nod of recognitions.

12.5 Punishment

Positive and negative reinforcement are processes that increase the frequency of a particular behavior. The opposite effect is produced by punishment. Punishment is a process in which a behavior is followed by an aversive consequence that decreases the likelihood of the behavior being repeated. Many people tend to confuse punishment and negative reinforcement, but these two processes produce entirely different effects on behavior. Negative reinforcement always increases the likelihood that an operant will be repeated in the future. Punishment always decreases the future performance of an operant.

12.5.1 Punishment By Application

Skinner (1953) identified two types of aversive events that can act as punishment. Punishment by application, also called positive punishment, involves a response being followed by the presentation of an aversive stimulus. The word positive in the phrase positive punishment signifies that something is added or presented in the situation. In this case, its an aversive stimulus. Here are some everyday examples of punishment by application:

- An employee wears jeans to work (the operant) and is reprimanded by his supervisor for dressing inappropriately (the punishing stimulus).

- You make a comment (the operant) in your workgroup meetings, and a co-worker responds with a sarcastic remark (the punishing stimulus).

In each of these examples, if the presentation of the punishing stimulus has the effect of decreasing the behavior it follows, then punishment has occurred. Although the punishing stimuli in these examples were administered by other people, punishing stimuli also occur as natural consequences for some behaviors. Inadvertently touching a hot iron, a live electrical wire, or a sharp object (the operant) can result in a painful injury.

12.5.2 Punishment By Removal

The second type of punishment is punishment by removal, also called negative punishment. The word negative indicates that some stimulus is subtracted or removed from the situation. In this case, it is the loss or withdrawal of a reinforcing stimulus following a behavior. That is, the behavior's consequence is the loss of some privilege, possession, or other desirable object or activity. Here are some everyday examples of punishment by removal:

- After he speeds through a stop sign and broadsides a school bus (the operant), a person's driver's license is suspended (loss of reinforcing stimulus).
- A student fails two classes (the operant) and loses his financial aid (loss of reinforcing stimulus).

In each example, if the behavior decreases in response to the removal of the reinforcing stimulus, then punishment has occurred.

12.5.3 Effective Punishment

It's important to stress that, like reinforcement, punishment is defined by the effect it produces. In everyday usage, people often refer to a particular consequence as a punishment when, strictly speaking it's not. Why? Because the consequence has not reduced future occurrences of the behavior.

Skinner (1953) as well as other researchers have noted that several factors influence the effectiveness of punishment. For example, punishment is more effective if it immediately follows a response than if it is delayed. Punishment is also more effective if it consistently, rather than occasionally, follows a response. Though speeding tickets and prison sentences are commonly referred to as punishments, these aversive consequences are inconsistently applied and often

administered only after a long delay. Thus, they don't always effectively decrease specific behaviors.

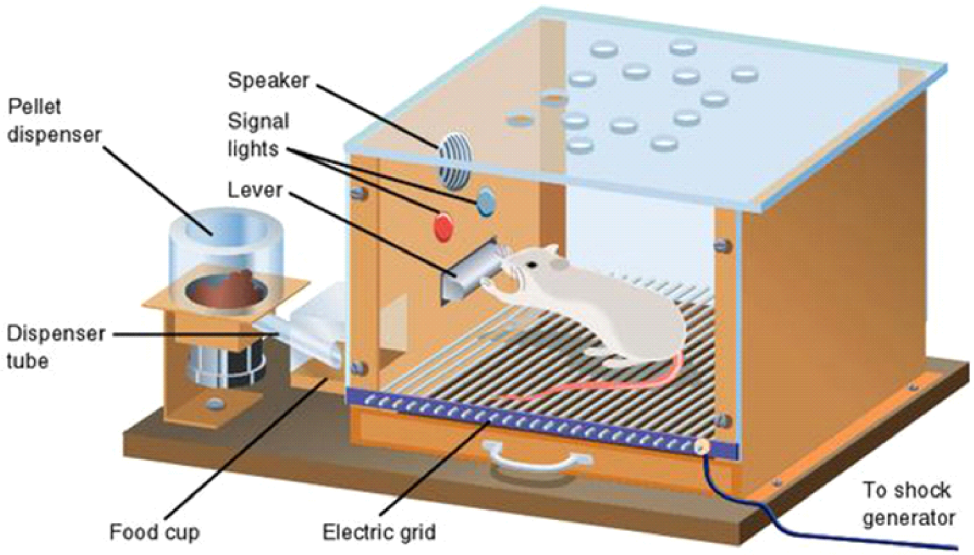
12.5.4 Drawbacks of Punishment

Even when punishment works, its use has several drawbacks. First, punishment may decrease a specific response, but it doesn't necessarily teach or promote a more appropriate response to take its place. Second, punishment that is intense may produce undesirable results, such as complete passivity, fear, anxiety, or hostility. Finally, the effects of punishment are likely to be temporary. A child who is sent to her room for teasing her little brother may well repeat the behavior when her mother's back is turned. As Skinner (1971) noted, "Punished behavior is likely to reappear after the punitive consequences are withdrawn.

12.6 Shaping and Maintaining Behavior

To scientifically study the relationship between behavior and its consequences in the laboratory, Skinner invented the operant chamber, more popularly known as the Skinner box. An operant chamber is a small cage with a food dispenser. Attached to the cage is a device that automatically records the number of operants made by an experimental animal, usually a rat or pigeon. For a rat, the typical operant is pressing a bar; for a pigeon, it is pecking at a small disk. Food pellets are usually used for positive reinforcement.

SKINNER BOX



When a rat is first placed in a Skinner box, it typically explores its new environment, occasionally nudging or pressing the bar in the process. The researcher can accelerate the rat's bar-pressing behavior through a process called shaping. Shaping involves reinforcing successively closer approximations of a behavior until the correct behavior is displayed. For example, the researcher might first reinforce the rat with a food pellet whenever it moves to the half of the Skinner box in which the bar is located. Other responses would be ignored. Once that response has been learned, reinforcement is withheld until the rat moves even closer to the bar. Then the rat might be reinforced only when it touches the bar. Step by step, the rat is reinforced for behaviors that correspond ever more closely to the final goal behavior – pressing the bar.

Skinner believed that shaping could explain how people acquire a wide variety of abilities and skills – everything from tying shoes to operating sophisticated computer programs. To illustrate, consider how parent s can use shaping to teach a toddler to dress herself. At first they might praise her for simply picking up a shirt, and then for managing to pull it over her head. Once that step is mastered, she would be reinforced only when she poked her head and arms through the appropriate shirt holes. Eventually praise is forthcoming only when, as a preschooler, she picks out clothes that match, or when, as an adolescent, she chooses an outfit that doesn't mortify her parents.

12.6.1 The Partial Reinforcement Effect: Building Resistance to Extinction

Once a rat had acquired a bar-pressing behavior, Skinner found that the most efficient way to strengthen the response was to immediately reinforce every occurrence of bar pressing. This pattern of reinforcement is called continuous reinforcement. In everyday life, of course, it's common for responses to be reinforced only sometimes – a pattern called partial reinforcement. For example, practicing your basketball skills isn't followed by putting the ball through the hoop on every shot. Sometimes you're reinforced by making a basket, and sometimes you're not.

Now suppose that despite all your hard work, your basketball skills are dismal. If practicing free throws was never reinforced by making a basket, what would you do? You'd probably eventually quit playing basketball. This is an example of extinction. In operant conditioning, when a learned response no longer results in reinforcement, the likelihood of the behavior being repeated gradually declines.

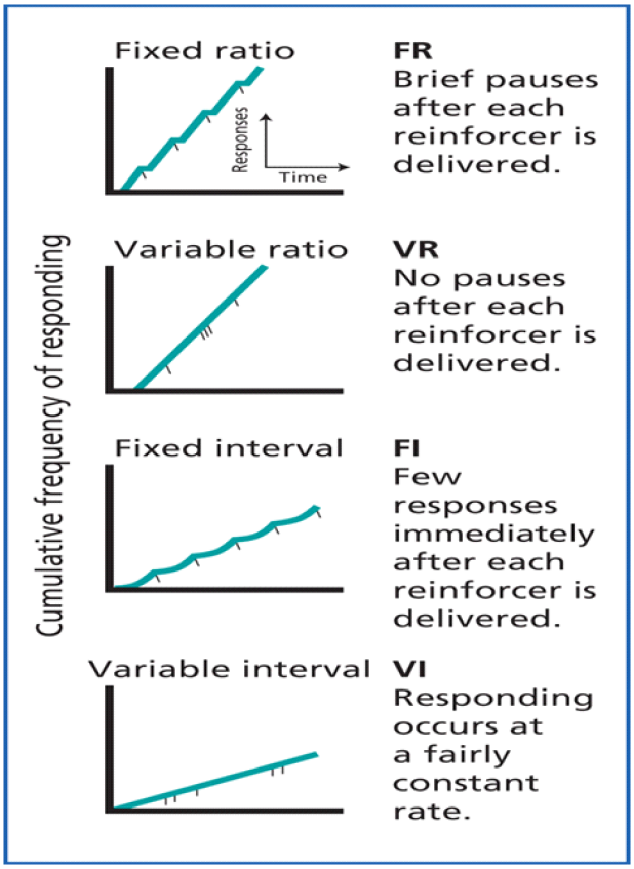
Skinner (1956) first noticed the effects of partial reinforcement when he began running low on food pellets one day. Rather than reinforcing every bar press, Skinner tried to stretch out his supply of pellets by rewarding responses only periodically. He found that the rats not only continued to respond, but actually increased their rate of bar pressing.

One important consequence of partially reinforcing behavior is that partially reinforced behaviors tend to be more resistant to extinction than are behaviors conditioned using continuous reinforcement. This phenomenon is called the partial reinforcement effect. For example, when Skinner shut off the food dispensing mechanism, a pigeon conditioned using continuous reinforcement would continue pecking at the disk 100 times or so before the behavior decreased significantly, indicating extinction. In contrast, a pigeon conditioned with partial reinforcement continued to peck at the disk thousands of times! If you think about it, this is not surprising. When pigeons, rats or humans have experienced partial reinforcement, they've learned that reinforcement may yet occur, despite delays and nonreinforced responses, if persistent responses are made.

In everyday life, the partial reinforcement effect is reflected in behaviors that persist despite the lack of reinforcement. Gamblers may persist despite a string of losses, writers will persevere in the face of repeated rejections slips, and the family dog will continue begging for the scraps of food that it has only occasionally received at the dinner table in the past.

12.6.2 The Schedules of Reinforcement

Skinner (1956) found that specific preset arrangements of partial reinforcement produced different patterns and rates of responding. Collectively, these different reinforcement arrangements are called schedules of reinforcement.



Fixed-Ratio Schedule (FR)

With a fixed ratio (FR) schedule, reinforcement occurs after a fixed number of responses. For example, a rat might be on a 25-to-1 fixed-ratio (abbreviated FR-25), meaning it has to press the bar 25 times in order to receive one food pellet. Not surprisingly, shaping is usually needed to get a rat to the point at which it will press the bar 25 times in order to get one food pellet. The rat may start on continuous reinforcement, followed by an FR-2 schedule, then an FR-4 schedule and so on.

Fixed-ratio schedules typically produce a high rate of responding that follows a burst-pause-burst pattern. The rat displays a burst of bar pressing, receives a pellet of food, pauses briefly, then displays another burst of responding. In everyday life, the fixed-ratio schedule is reflected in any activity that requires a precise number of responses in order to obtain

reinforcement. Piecework – work for which you are paid for producing a specific number of items, such as being paid $1 for every 100 envelopes you stuff- is an example of an FR-100 schedule.

Variable-Ratio Schedule (VR)

With a variable-ratio (VR) schedule, reinforcement occurs after an average number of responses, which varies from trial to trial. For example, a rat on a variable-ratio- 2-schedule (abbreviated VR-20) would be reinforced after an average of 20 responses. But the rat might have to press the bar 25 times on the first trial before being reinforced and only 15 times on the second trial before reinforcement. Although the number of responses required on any specific trial is unpredictable, over repeated trials the ratio of responses to reinforceers works out to be the predetermined average.

Variable-ratio schedules of reinforcement produce high, steady rates of responding with hardly any pausing between trials or after reinforcement. Why do variable-ratio schedules produce such persistent responses? One explanation is that although it's impossible to predict which responses will result in reinforcement, the more responses that are made, the greater the likelihood of reinforcement. The combination of these two factors can make some behaviors, such as gambling "addictive" for some people. Gambling is the classic example of a variable-ratio schedule in real life. Each spin of the roulette wheel, toss of the dice, or purchase of a lottery ticket could be the big one, and the more often you gamble, the more opportunities you have to win.

Fixed –Interval Schedule (FI)

With a fixed-interval (FI) schedule, a reinforce is delivered for the first response emitted after the preset time interval has elapsed. A rat on a two-minute fixed-interval schedule would receive no food pellets for any bar presses made during the first two minutes, whether it pressed the bar twice or 100 times. But the first bar press after the two-minute interval has elapsed would be reinforced.

Fixed-interval schedules typically produce a pattern of responding in which the number of responses tends to increase as the time for the next reinforce draws near. Long pauses in responding after reinforcement are especially common when the fixed interval is large. For example, a rat conditioned at an FI-10 minutes schedule may go for several minutes without pressing the bar. But as the end of the 10-minute interval draws near, bar pressing steadily increases until reinforcement occurs.

Daily life contains examples if reinforcement that follows a very similar pattern to the laboratory example of fixed-interval reinforcement. For instance, if your instructor gives you a test every four weeks, your studying behavior would probably follow the same pattern of responding as the rat's bar pressing behavior. As the end of the four-week interval draws near, studying behavior increases. After the test, studying behavior drops off until the end of the next four-week interval draws near. The same effect can occur with an employee's annual performance review. As the time for the performance review gets closer, the employee's productive behaviors (the operant) tend to increase.

Variable-Interval Schedule (VI)

On a variable-interval (VI) schedule, reinforcement occurs for the first response emitted after an average amount of time has elapsed, but the interval varies from trial to trial. In other words, the length of time that must pass before a particular reinforcement is delivered is unpredictable, but over a series of trials, it works out to a predetermined average. A rat on a VI-30 seconds schedule might be reinforced on trial 1 for the first bar press after only 10 seconds have elapsed, for the first bar press after 50 seconds have elapsed on trial 2, and for the first bar press after 30 seconds have elapsed on trial 3. This works out to an average of one reinforce every 30 seconds.

Generally the unpredictable nature of variable-interval schedules tends to produce moderate but steady rates of responding, especially when the average interval is relatively short. In daily life, we experience variable interval schedules when we have to wait for events that follow an approximate, rather than a precise schedule. Trying to connect to the internet via a dial-up model during peak usage hours in one example. When you encounter a busy signal you periodically try connecting because you know that at some point you'll be able to access the network. However, it's impossible to predict exactly when your attempt to connect to the network (the operant response) will be reinforced (the modem squeals and you hear the familiar, "Welcome! You've got mail!"). on a variable-interval schedule, reinforcement depends on the passage of time rather than on the number of responses. Thus, a moderately steady rate of responses will pay off in the long run.

12.7 Summary

- Edward Thorndike investigated the learning of active behaviors and formulated the law of effect.

- B.F. Skinner's operant conditioning principles explain how operants, or new, voluntary behaviors are acquired.
- Operant conditioning explains learning as a process in which behavior is shaped and modified by its consequences.
- Reinforcement increases the likelihood of an operant being repeated.
- In positive reinforcement, a response is strengthened because a reinforcing stimulus is added or presented.
- In negative reinforcement, a response is strengthened because an aversive stimulus is subtracted or removed.
- Reinforcers may be primary reinforcers of conditioned reinforcers.
- Punishment decreases the likelihood of an operant being repeated.
- Two forms of punishment are punishment by application and punishment by removal.
- As a method of controlling behavior, punishment has many drawbacks.
- New behaviors can be acquired through the process of shaping.
- An operant chamber, or Skinner box, is often used to study the acquisition of new behaviors by laboratory animals.
- Once acquired, behaviors are maintained through continuous reinforcement of partial reinforcement.
- Schedules of reinforcement include the fixed-ratio (FR), variable-ration (VR), fixed-interval (FI), and variable-interval (VI) schedules.

12.8 Keywords

Law of effect: Learning principle proposed by Thorndike that responses followed by a satisfying effect become strengthened and are more likely to recur in a particular situation, while responses followed by a dissatisfying effect are weakened and less likely to recur in a particular situation.

Operant: Skinner's term for an actively emitted (or voluntary) behavior that operates on the environment to produce consequences.

Operant Conditioning: The basic learning process that involves changing the probability of a response being repeated by manipulating the consequences of that response; also called Skinnerian conditioning.

Reinforcement: The occurrence of a stimulus or event following a response that increases the likelihood of that response being repeated.

Positive Reinforcement: A situation in which a response is followed by the addition of a reinforcing stimulus, increasing the likelihood that the response will be repeated in similar situations.

Negative Reinforcement: A situation in which a response results in the removal, avoidance, or escape from an aversive stimulus, increasing the likelihood that the response will be repeated in similar situations.

Primary Reinforcer: A stimulus that is naturally or inherently reinforcing for a given species, such as food, wates, or other biological necessities.

Conditioned Reinforcer: A stimulus that has acquired reinforcing value by being associated with a primary reinforce, also called a secondary reinforce.

Punishment: The presentation of a stimulus or event following a behavior that acts to decrease the likelihood of the behavior's being repeated.

Punishment by Application: A situation in which an operant is followed by the presentation or addition of an aversive stimulus; also called positive punishment.

Punishment by Removal: A situation in which an operant is followed by the removal or subtraction of a reinforcing stimulus; also called negative punishment.

Operant Chamber or Skinner Box: The experimental apparatus invented by B.F. Skinner to study the relationship between environmental events and active behaviors.

Shaping: The operant conditioning procedure of selectively reinforcing successively closer approximations of a goal behavior until the goal behavior is displayed.

Continuous Reinforcement: A schedule of reinforcement in which every occurrence of a particular response is reinforced.

Partial Reinforcement: A situation is which the occurrence of a particular response is only sometimes followed by a reinforcer.

Extinction: The gradual weakening and disappearance of conditioned behavior. In operant conditioning, extinction occurs when an emitted behavior is no longer followed by a reinforcer.

Partial Reinforcement Effect: The phenomenon in which behaviors that are conditioned using partial reinforcement are more resistant to extinction than behaviors that are conditioned using continuous reinforcement.

Schedules of Reinforcement: The delivery of a reinforce according to a present pattern based on the number of responses or the time interval between responses.

Fixed-Ratio (FR) Schedule: A reinforcement schedule in which as reinforce is delivered after a fixed number of responses has occurred.

Variable-Ratio (VR) Schedule: A reinforcement schedule in which a reinforce is delivered after a average number of responses, which varies unpredictably from trial to trial.

Fixed-Interval (FI) Schedule: A reinforcement schedule in which a reinforce is delivered for the first response that occurs after a fixed-time interval has elapsed.

Variable-Interval (VI) Schedule: A reinforcement schedule in which a reinforce is delivered for the first response that occurs after an average time interval, which varies unpredictably from trial to trial.

12.9 Check Your Progress

PART:A

Identify the operant conditioning process that is being illustrated in each of the following examples. Choose from: positive reinforcement, negative reinforcement, punishment by application and punishment by removal.

1. Feeling sorry for a woman on the side of the road, Howard offered her a ride. The woman robbed Howard and stole his car. Howard no longer picks up women because of _____.

2. As you walk out of the shoe store at the Super Mall and turn toward another store, you spot a person whom you greatly dislike. You immediately duck back into the shoe store to avoid an unpleasant interaction with him. Because _____ has occurred, you are more likely to take evasive action when you encounter people you dislike in the future.

PART : B

Indicate which of the following schedules of reinforcement is being used for each example: variable interval (VI); fixed interval (FI); variable ratio (VR); fixed ration (FR).

1. _____A keypunch clerk is paid $1 for every 100 correct accounting entries made on the computer.
2. _____ Miguel works 40 hours a week in an office and gets paid every Friday afternoon.
3. _____ On the average, the campus shuttle bus passes the library about once every hour.

12.10 Answers To Check Your Progress

PART:A

1. Punishment by removal
2. Negative reinforcement

PART: B

1. Fixed ratio
2. Fixed interval
3. Variable interval.

12.11 Model Questions

1. Define operant conditioning
2. Define punishment. Discuss the different types of punishment.
3. Explain the schedules of reinforcement.

LESSON - 13
OBSERVATIONAL AND COGNITIVE LEARNING

Preview

In the previous chapter we discussed about the evolution of operant conditioning from the law of effect to reinforcements and punishments. Key contributions of Thorndike and B.F. Skinner were considered. An elaborate consideration of the types of reinforcements and punishments were discussed. A clear depiction of how a voluntary behavior can be shaped using varied schedules of reinforcements were also discussed. In this chapter we will consider the famous contribution of Albert Bandura: “observational learning”; also other cognitive aspects of learning in both classical and operant conditioning will be discussed.

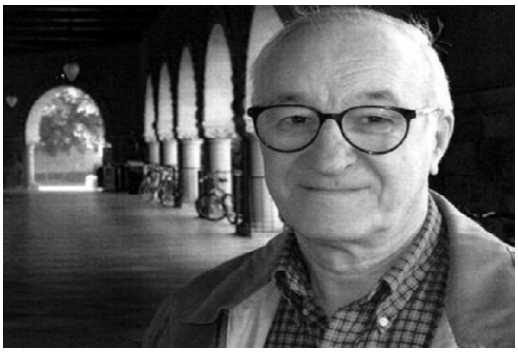
Learning Objectives

After studying this chapter you will be able to:

- Understand the theory of observational learning.
- Understand the cognitive aspects of classical conditioning.
- Understand the cognitive aspects of operant conditioning.

Plan of Study

13.1 Observational Learning



Albert Bandura

Classical conditioning and operant conditioning emphasize the role of direct experiences in learning, such as directly experiencing a reinforcing or punishing stimulus following a particular behavior. But much human learning occurs indirectly, by watching what others do, then imitating it. In observational learning, learning takes place through observing the actions of others.

Albert Bandura is the psychologist most strongly identified with observational learning. Bandura (1974) believes that observational learning is the result of cognitive processes that are actively judgmental and constructive, not merely “mechanical copying”. To illustrate his theory, let’s consider his famous experiment involving the imitation of aggressive behaviors (Bandura, 1965). In the experiment, four-year-old children separately watched a short film showing an adult playing aggressively with a Bobo doll- a large, inflated balloon doll that stands upright because the bottom is weighted with sand. All the children saw the adult hit, kick and punch the Bobo doll in the film.

However, there were three different versions of the film, each with a different ending. Some children saw the adult reinforced with soft drinks, candy and snacks after performing the aggressive actions. Other children saw a version in which the aggressive adult was a punished for the actions with a scolding and a spanking by another adult. Finally, some children watched a version of the film in which the aggressive adult experienced no consequences.

After seeing the film, each child was allowed to play alone in a room with several toys, including a Bobo doll. The playroom was equipped with a one-way window so that the child’s behavior could be observed. Bandura found that the consequences the children observed in the film made a difference. Children who watched the film in which the adult was punished were

much less likely to imitate the aggressive behaviors than were children who watched either of the other two film endings.

Then Bandura added an interesting twist to the experiment. Each child was asked to show the experimenter what the adult did in the film. For every behaviors they could imitate, the child was rewarded with snacks and stickers. Virtually all the children imitated the adult's behaviors they had observed in the film, including the aggressive behaviors. The particular version of the film the children had seen made no difference.

Bandura (1965) explained these results much as Tolman explained latent learning, which will be discussed in the next section. Reinforcement in not essential for learning to occur. Rather, the expectation of reinforcement affects the performance of what has been learned.

Bandura (1986) suggests that four cognitive processes interact to determine whether imitation will occur. First, you must pay attention to the other person's behavior. Second, you must remember the other person's behavior so that you can perform it at a later time. That is you must form and store a mental representation of the behavior to be imitated. Third, you must be able to transform this mental representation into actions that you are capable of reproducing. These three factors: attention, memory and motor skills – are necessary for learning to take place through observation.

Fourth, there must be some motivation for you to imitate the behavior. This factor is crucial to the actual performance of the learned behavior. You are more likely to imitate a behavior if there is some expectation that doing so will produce reinforcement or reward.

13.2 Cognitive Aspects of Classical Conditioning

According to Pavlov, classical conditioning occurs simply because two stimuli are associated closely in time. The conditioned stimulus (the bell) precedes the unconditioned stimulus (the food) usually by no more than a few seconds. But is it possible that Pavlov's dogs were learning more than the mere association of two stimuli that occurred very close together in time?

To answer that question, let's begin with an analogy. Suppose that on your way to class you have to go through a railroad crossing. Every time a train approaches the crossing, warning lights flash. Being rather intelligent for your species, after a few weeks you conclude that the flashing lights will be quickly followed by a freight train barreling down the railroad tracks. You've learned an association between the flashing lights and an oncoming train, because the lights are a reliable signal that predict the presence of the train.

Now imagine that a friend of yours also has a cross train tracks but at a different location. The railroad has had nothing but problems with the warning lights at that crossing. Sometimes the warning lights flash before a train roars through, but sometimes they don't. and sometimes they flash when no train is coming. Does your friend learn an association between the flashing lights and oncoming trains? No, because here the flashing lights are an unreliable signal – they seem to have no relationship to a train's arrival.

Psychologist Robert A Rescorla demonstrated that classically conditioned rats also assess the reliability of signals, much like you and your friend did at the different railroad crossings. In Rescorla's 1968 experiment, one group of rats heard a tone (the conditioned stimulus) that was paired 20 times with a brief shock (the unconditioned stimulus). A second group of rats experienced the same number of tome-shock pairing, but this group also experienced an additional 20 shocks with no tone.

The Rescorla tested for the conditioned fear response by presenting the tone alone to each group of rats. According to the traditional classical conditioning model, both groups of rats should have displayed the same evels of conditioned fear. After all, each group had received 20

tone-shock pairings. However, this is not what Rescorla found. The rats in the first group displayed a much stronger fear response to the tone than did the rats in the second group. Why?

According to Rescorla (1988), classical conditioning depends on the information the conditioned stimulus provides about the unconditioned stimulus. For learning to occur, the conditioned stimulus must be a reliable signal that predicts the presentations of the unconditioned stimulus. For the first group of rats, that was certainly the situation. Every time the tone sounded, a shock followed. But for the second group, the tone was an unreliable signal. Sometimes the tone preceded the shock, and sometimes the shock occurred without warning.

Rescorla concluded that the rats in both groups were actively processing information about the reliability of the signals they encountered. Rather than merely associating two closely paired stimuli, as Pavlov suggested, the animals assess the predictive value of stimuli. Applying this interpretation to classical conditioning, we can conclude that Pavlov's dogs learned that the bell was a signal that reliably predicted that food would follow.

According to this view, animals use cognitive processes to draw inferences about the signals they encounter in their environments. To Rescorla (1988), classical conditioning "is not a stupid process by which the organism willy-nilly forms associations between any two stimuli that happen to co-occur." Rather, his research suggests that "the animal behaves like a scientist, detecting causal relations among events and using a range of information about those events to make the relevant inferences." (Rescorla, 1980).

13.3 Cognitive Aspects of Operant Conditioning

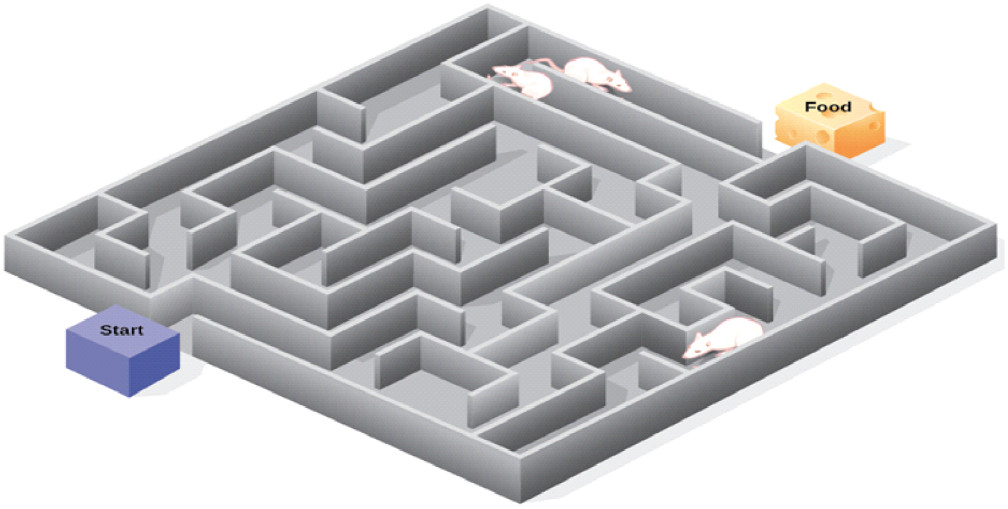
In Skinner's view, operant conditioning did not need to invoke cognitive factors to explain the acquisition of operant behaviors. Words such as expect, prefer, choose and decide could not be used to explain how behaviors were acquired, maintained, or extinguished. Similarly, Thorndike and other early behaviorists believed that complex, active behaviors were no more than a chain of stimulus-response connections that has been "stamped in" by their effects.

However not all learning researchers agreed with Skinner and Thorndike. Edward C. Tolman firmly believed that cognitive processes played an important role in learning of complex behaviors – even in the lowly laboratory rat. According to Tolman, although such cognitive processes could not be observed directly, they could still be experimentally verified and inferred by careful observation of outward behavior.

Much of Tolman's research involved rats in mazes. When Tolman began his research in the 1920s, many studies of rats in mazes had been done. In a typical experiment, a rat would be placed in the "start" box. A food reward would be put in the "goal" box at the end of the maze. The rat would initially make many mistakes in running in the maze. After several trials, it would eventually learn to run the maze quickly and with very few errors.

But what had the rats learned? According to the traditional behaviorists, the rats had learned a sequence of responses, such as "first-corner-turn left; second corer- turn left; third corner turn right" and so on. Each response was associated with the "stimulus" of the rat's position in the maze. And the entire sequence of response was "stamped in" by the food reward at the end of the maze.

Tolman (1948) disagreed with that view. He noted that several investigators had reported as incidental findings that their maze-running rats had occasionally taken their own shortcuts to the food box. In one case, an enterprising rat had knocked the cover off the maze, climbed over the maze well and out of the maze, and scampered directly to the food box. To Tolman, such reports indicated that the rats had learned more than simply the sequence of responses required to get to the food. Tolman believed instead that the rats eventually built up, through experience, a cognitive map of the maze a mental representation of its layout.



Tolman challenged the prevailing behaviorist model on another important point. According to Thorndike, for example, learning would not occur unless the behavior was "strengthened", or

“stamped in”, by a rewarding consequence. But Tolman showed that this was not necessarily the case. In a classic experiment, three groups of rats were put in the same maze once a day for several days. For group 1, a food reward awaited the rats at the end of the maze. Their performance in the maze steadily improved; the number of errors and the time it took the rats to reach the foal box showed a steady decline with each trial. The rats in group 2 were placed in the maze each day with no food reward. They consistently made many errors, and their performance showed only slight improvement. The performance of the rats in group 1 and 2 was exactly what the traditional behaviorist model would have predicted.

Now consider the behavior of the rats in group 3. These rats were placed in the maze with no food reward for the first 10 days of the experiment. Like the rats in group 2, they made many errors as they wandered about the maze. But, beginning on day 11, they received a food reward at the end of the maze. There was a dramatic improvement in group 3’s performance from day 11 to day 12. Once the rats had discovered that food awaited them at the end of the maze, they made a beeline for the goal. On day 12, the rats in group 3 ran the maze with very few errors, improving their performance to the level of the rats in group 1 that had been rewarded on every trial!

Tolman concluded that reward – or reinforcement – is not necessary for learning to take place. The rats in group 3 had learned the layout of the maze and formed a cognitive map of the maze simply be exploring it for 10 days. However, they had not been motivated to demonstrate that learning until a reward was introduced. Rewards, then, seem to affect the performance of what has been learned rather than learning itself. To describe learning that is not immediately demonstrated in over behavior, Tolman used the term latent learning. From these and other experiments, Tolman concluded that learning involves the acquisition of knowledge rather than simply changes in outward behavior.

13.4 Summary

- Albert Bandura systematically investigated how new behaviors could be acquired through observational learning.
- Observational learning involves the cognitive processes of attention, memory, motor skills, and motivation.
- Robert Rescorla demonstrated that classical conditioning involves learning the relations between events and assessing the reliability of signals.

- Edward Tolman's research on cognitive maps and latent learning demonstrated the involvement of cognitive processes in learning active behaviors.

13.5 Keywords

Observational Learning: Learning that occurs through observing the actions of others.

Cognitive Map: Tolman's term that describes the mental representation of the layout of a familiar environment.

Latent Learning: Term coined by Tolman to describe learning that occurs in the absence of reinforcement but is not behaviorally demonstrated until a reinforce becomes available.

13.6 Check Your Progress

Identify the process and the psychologist who contributed the process in the following questions:

1. When Brittany's grandmother gave her a toy broom, the two-year old immediately tried to sweep the floor with it.

   Process: _____ Psychologist: _____

2. Lisa transfers to a new college and spends her first few days on campus getting oriented. A week later she decides to have lunch at the college cafeteria. Although she has never eaten there before, she has no problem finding it.

   Process: _____ Psychologist: _____

13.7 Answers To Check Your Progress

1. Process: Observational learning Psychologist : Albert Bandura
2. Process: Latent Learning Psychologist: Edward L. Tolman

13.8 Model Questions

1. Discuss the cognitive aspects of classical conditioning
2. Write a short note on latent learning
3. Explain Albert Bandura's theory of observational learning in detail.

LESSON - 14
INTRODUCTION TO MEMORY

Preview

In the previous chapter we considered the cognitive aspects of learning. The theory of reliability of signals that tends to be cognitively processed was discussed. Also the concept of latent learning and Tolman's extensive research experiments were discussed. The concept of observational learning contributed by Albert Bandura was also discussed in detail. In this chapter we will discuss the stage model of memory in detail and also discuss the various types of memory and its contributions to our sense of self and the world around us.

Learning Objectives

After studying this chapter you will be able to:

- Understand the three stages of memory and how their functions are related.
- Understand the nature and functions of the three stages of memory
- Understand the role of the varied types of memory

Plan of Study

14.1 Introduction To Memory

Memory refers to the mental processes that enable us to acquire, retain and retrieve information. Rather than being a single process, memory involves three fundamental processes: encoding, storage, and retrieval.

Encoding refers to the process of transforming information into a form that can be entered and retained by the memory systems. Storage is the process of retaining information in memory so that it can be used at a later time. Retrieval involves recovering the stored information so that we are consciously aware of it.

14.2 The Stage Model of Memory

One very influential model, the stage model of memory, given by Atkinson and Shiffrin (1968), is useful in explaining the basic workings of memory. In this model, memory involves three distinct stages: sensory memory, short-term memory and long-term memory. The stage model is based on the idea that information is transferred from one memory stage to another. Each memory stage is thought to differ in terms of the following:

- Capacity: How much information can be stored?
- Duration: How long the information can be stored?
- Function: What is done with the stored information?

A detailed explanation of the varied stages of the stage model of memory will now be explored in the remaining sections of this chapter.

14.3 Sensory Memory

Has something like this ever happened to you? You're engrossed in a suspenseful movie video. From another room, a family member calls out, "Where'd you put the phone book?" You respond with, "What?" Then, a split second later, the question registers in your mind. Before the other person can repeat the question, you reply, "Oh, it's on the kitchen counter."

You were able to answer the question because your sensory memory registered and preserved the other person's words for a few fleeting seconds – jus long enough for you to recall what had been said to you while your attention was focused on the movie. Sensory memory stores a detailed record of a sensory experience, but only for a few fleeting seconds at the most.

The first stage of memory is called sensory memory. Sensory memory registers a great deal of information from the environment and holds it for a brief period of time. After a few seconds or less, the information fades away.

14.3.1 The Duration of Sensory Memory

The characteristics of visual sensory memory was first identified largely through the research of psychologist George Sperling in 1960. In his experience, Sperling flashed the images of 12 letters on a screen for one-twentieth of a second. The letters were arranged in four rows of three letters each. Subjects focused their attention on the screen and immediately after the screen went blank, reported as many letters as they could remember.

On average, subjects could report only 4 or 5 of the 12 letters. However, several subjects claimed that they had actually seen all the letters but that the complete image had faded from their memory as they spoke, disappearing before they could verbally report more than 4 or 5 letters.

Based on this information, Sperling tried a simple variation on the original experiment. He arranged the 12 letters in three rows of 4 letters each. Then, immediately after the screen went blank, he sounded a high-pitched, medium-pitched or low-pitched tone. If the subjects heard the high-pitched tone, they were to report the letters in the top row; the medium pitched tone signaled the middle row; and the low-pitched tone signaled the bottom row. If the subjects actually did see all the letters, Sperling reasoned, then they should be able to report the letters n a given row by focusing their attention on the indicated row before their visual memory faded.

This is exactly what happened. If the tone followed the letter display is under one-third of a second, subjects could accurately report about three of the four letters in whichever row was indicated by the tone. However, if the interval between the screen going blank and the sound of the tone was more than one-third of a second, the accuracy of the reports decreased dramatically. By the time one second had elapsed, the image in the subject's visual sensory memory had already faded beyond recall.

This classic experiment demonstrated that our visual sensory memory holds great deal of information very briefly, for about half a second. This information is available just long enough for us to pay attention to specific elements that are significant to us at that moment. This meaningful information is then transferred from the very brief storage of sensory memory to the somewhat longer storage of short-term memory.

14.3.2 Types of Sensory Memory

Memory researchers believe there is a separate sensory memory for each sense – vision, hearing, touch, smell, and so on. Of the different senses, however visual and auditory sensory memories have been the most thoroughly studied. Visual sensory memory is sometimes referred to as iconic memory, because it is brief memory of an image, or icon. Auditory sensory memory is sometimes referred to as echoic memory a brief memory that is like an echo.

Researchers have found slight differences in the duration of sensory memory for visual and auditory information. Your visual sensory memory typically holds an image of your environment for about one-quarter to one-half second before it is replaced by yet another overlapping snapshot. This is easy to demonstrate. Quickly wave a pencil back and forth in front of your face. Do you see the fading image of the pencil trailing behind it? That's your visual sensory memory at work. It momentarily holds the snapshot of the environmental image you see before it is almost instantly replaced by another overlapping image.

Your auditory sensory memory holds sound information a little longer, up to a few seconds. This brief auditory sensory trace for sound allows you to hear speech as continuous words, or a series of musical notes as a melody, rather than as disjointed sounds. It also explains why you are able to "remember" something that you momentarily don't "hear," as in the example of the family member asking you where the phone book is.

An important function of sensory memory is to very briefly store sensory impressions so that they overlap slightly with one another. Thus, we perceive the world around us as continuous, rather than as a series of disconnected visual images or disjointed sounds.

14.4 Short-Term, Working Memory

You can think of short-term memory, or working memory, as the "workshop" of consciousness. It is the stage of memory in which information transferred from sensory memory and information retrieved from long-term memory become conscious. When you recall a past event or mentally add two numbers, the information is temporarily held and processed in your short-term memory. Your short-term memory also allows you to make sense out of this sentence by holding the beginning of the sentence in active memory while you read the rest of the sentence. Thus, working memory provides temporary storage or information that is currently being used in some conscious cognitive activity.

14.4.1 The Duration of Short-Term Memory

Information in short-term memory lasts longer than information in sensory memory, but its duration is still very short. At best, you can hold most types of information in short-term memory up to about 30 seconds before it's forgotten. However, information can be maintained in short-term memory longer than 30 seconds if it is rehearsed, or repeated, over and over. Because consciously rehearing information will maintain it in short-term memory, this process is called maintenance rehearsal. For example, when you look up an office number on a building directory, you use maintenance rehearsal to maintain it in short-term memory until you reach the office. Information that is not actively rehearsed quickly fades, or decays, from short-term memory.

14.4.2 The Capacity of Short-Term Memory

Along with having a relatively short duration, short-term memory also has a relatively limited capacity. George Miller (1956) described the limits of short-term memory in a classic paper entitled "The Magical Number Seven, Plus or Minus Two." Miller found hat the capacity of short-term memory is limited to about seven items, or bits of information, at one time. So it's no accident that local telephone numbers are seven digits long. This seven-item limit to short-term memory seems to be universal.

So what happens when your short term memory store is filled to capacity? New information displaces, or bumps out, currently held information. Maintenance rehearsal is one way to avoid the loss of information from short-term memory. By consciously repeating the information you want to remember, you keep it active in short-term memory and prevent it from being displaced by new information.

Although the capacity of your short term memory is limited, there are ways to increase the amount of information you can hold in short-term memory at any given moment. This can be done through a process called chunking – the grouping of related items together into a single unit. But to do so, chunking also often involves the retrieval of meaningful information from long-term memory.

14.5 Long-Term Memory

Long-term memory refers to the storage of information over extended periods of time. Technically, any information stored longer than the roughly 30-second duration of short-term

memory is considered to be stored in long-term memory. So, a long-term memory can be recalling what you were doing 5 minutes ago or 10 years ago. In terms of maximum duration, some long-term memories can last a lifetime.

Compared with the limited bits of information that can be stored in sensory memory and short-term memory, the amount of information that can be held in long-term memory is limitless.

14.5.1 Encoding Long-Term Memories

One very important function that takes place in short-term memory is encoding, or transforming the new information into a form that can be retrieved later. Elaborative rehearsal, which involves focusing on the meaning of information to help encode and transfer it to long-term memory is used to encode information into LTM. With elaborative rehearsal, you relate the information to other information you already know. That is, rather than simply repeating the information over and over to yourself, you elaborate on the new information in some meaningful way. Elaborative rehearsal significantly improves memory for new material. This point is especially important for students, because elaborative rehearsal is a helpful strategy. If you elaborated in the information in some meaningful way, you would be more likely to recall it. First, applying information to yourself, called the self-reference effect, improves your memory for information. Second, the use of visual imagery, especially vivid images, also enhances encoding.

Why should elaborative rehearsal be a more effective way of encoding new information than maintenance rehearsal? Psychologist Fergus Craik and Robert Lockhart (1972) proposed that the level at which new information is processed determines how well the new information will be encoded and remembered. Craik and Lockhart's approach to understanding the relationship between coding processes and memory is called the levels-of-processing framework.

According to the levels-of-processing framework, information processed at a "deeper" level is more likely to be remembered than information processed at a "shallow" level. Deep processing involves processing the meaning of the new information, rather than its more superficial characteristics. According to this framework, simple repetition, or maintenance rehearsal, would represent shallow processing of information. In contrast, elaborative rehearsal would represent deep processing of material.

The fact that deep processing results in more effective encoding and better memory of new information has many practical applications for students. How can you process new information at a deep, rather than a shallow, level? You can do the following:

- Actively question new information
- Think about the implications of information.
- Figure out how new information relates to information you already know.
- Try to generate your own examples of the concept, especially examples from your own experiences.
- Make sure you understand and question the evidence.

Such mental activities promote “deeper” processing and enhance your memory for new information.

14.5.3 Types of Information in Long-Term Memory

There are three major categories of information stored in long-term memory. Procedural memory refers to the long-term memory of how to perform different skills, operations and actions. Typing, riding a bike, running, and making scrambled eggs are all examples of procedural information stored in the long-term memory. Often, we can’t recall exactly when or how we learned procedural information. And usually its difficult to describe procedural memory in words.

In contrast to procedural memory, episodic memory refers to your long term memory of specific events are episodes, including the time and place that they occurred. Your memory of attending a friend’s wedding or your first day ate college would both be examples of episodic memories. Closely related to episodic memory is autobiographical memory, which refers to the events of your life – your personal life history. Autobiographical memory plays a key role in your sense of self.

The third category of long-term memory is semantic memory – general knowledge that includes facts, names, definitions, concepts, and ideas. Semantic memory represents your personal encyclopedia of accumulated data and trivia stored in your long-term memory. Typically, you store semantic memories in long-term memory without remembering when or where you learned the information.

14.5.4 Implicit and Explicit Memory

Long-term memory appears to be composed of separate but interacting subsystems and abilities. What are these subsystems? One basic distinction that has been made is between explicit memory and implicit memory. Explicit memory is memory with awareness – information

or knowledge that can be consciously recollected, including episodic and semantic information. Explicit memories are also called declarative memories, because, if asked, you can “declare” the information.

In contrast, implicit memory is memory without awareness. Implicit memories cannot be consciously recollected, but they still affect your behavior, knowledge, or performance of some task. Implicit memories are also called nondeclarative memories, because you’re unable to “declare” the information. Procedural memories, including skills and habits, typically reflect implicit memory processes.

14.6 Summary

- Memory refers to the mental processes that enable us to acquire, retain and retrieve information.
- Key memory processes are encoding, storage and retrieval.
- The stage model of memory describes human memory as the process of transferring information from one memory stage to another.
- The three stages of memory are sensory memory, short term memory and long term memory.
- Sensory memory briefly stores information about the environment.
- George Sperling discovered that visual sensory memory holds information for about half a second before the information fades.
- There is a separate sensory memory for each sense.
- Visual and auditory sensory memory are the most thoroughly studied.
- Auditory sensory memory lasts up to a few seconds.
- Short term memory also called working memory, provides temporary storage for information transferred from sensory memory and information recalled from long term memory.
- Most information fades from the short term memory within about 30 seconds.
- Maintenance rehearsal keeps information active in short-term memory.
- The capacity of short term memory is limited to about seven items plus or minus two.

- Chunking can be used to increase the amount of information held in short-term memory.
- Long-term memory stores limitless amount of information for extended periods of time.
- Encoding transforms information into a form that can be stored and retrieved later.
- The most effective encoding strategies involve elaborative rehearsal.
- The levels of processing framework suggests that information that is processed deeply will be encoded more effectively.
- Long term memory includes procedural, episodic and semantic memory.
- Explicit memory can be consciously recalled.
- Implicit memories cannot be consciously recalled, but affect behavior or performance.

14.7 Keywords

Memory: The mental processes that enable us to retain and use information over time.

Encoding: The process of transforming information into a form that can be entered into and retained by the memory system.

Storage: The process of retaining information in memory so that it can be used at a later time.

Retrieval: The process of recovering information stored in memory so that we are consciously aware of it.

Stage model of memory: A model describing memory as consisting of three distinct stages: sensory memory, short-term memory and long-term memory.

Sensory Memory: The stage of memory that registers information from the environment and holds it for a very brief period of time.

Short-term memory: The active stage of memory in which information is stored for about 30 seconds.

Long-term memory: The stage of memory that represents the long-term storage of information.

Maintenance Rehearsal: The mental or verbal repetition of information in order to maintain it beyond the usual 30-second duration of short term memory.

Chunking: Increasing the amount of information that can be held in short term memory by grouping related items together into a single unit or chunk.

Elaborative Rehearsal: Rehearsal that involves focusing on the meaning of information to help encode and transfer it to long term memory.

Levels of processing framework: The view that information that is processed at a deeper (more meaningful) level is more likely to be remembered than information that is processed at a shallow (less meaningful) level.

Procedural Memory: Category of long-term memory that includes memories of different skills, operations and actions.

Episodic Memory: Category of long-term memory that includes memories of particular events.

Semantic Memory: Category of long-term memory that includes memories of general knowledge of facts, names and concepts.

Explicit Memory: Information or knowledge that can be consciously recollected; also called declarative memory.

Implicit Memory: Information or knowledge that affects behavior or task performance but cannot be consciously recollected; also called nondeclarative memory.

14.8 Check Your Progress

Comparing The Three Stages of Memory

Identify each of the following descriptions as characteristic of sensory memory (SM), short-term memory (STM), or long-term memory (LTM).

Function

1. Storage of information for later retrieval : _____
2. Brief storage of sensory impressions : _____

3. Temporary storage of new information; interaction with stored information : _____

Duration

4. Potentially permanent : _____
5. Approximately 20 to 30 seconds : _____
6. Approximately ½ to 3 seconds : _____

Capacity

7. Limited capacity of about seven items : _____
8. Large but fleeting capacity : _____
9. Unlimited capacity : _____

14.9 Answers To Check Your Progress

1. LTM
2. SM
3. STM
4. LTM
5. STM
6. SM
7. STM
8. SM
9. LTM

14.10 Model Questions

1. Define memory
2. What are the different types of memory?
3. Discuss the stage model of memory as highlighted by Atkinson and Shiffrin.

LESSON - 15
CONSTRUCTING MEMORIES

Preview

In the previous chapter the concept of memory had been introduced. The stage model of memory highlighting the three stages of memory, namely: Sensory Memory, Short-Term Memory and Long Term Memory was discussed in detail. Significant features like the duration, capacity and function of each of the stages was also considered. In conclusion the distinct types and dimensions of memory was also discussed. In this chapter we will consider the reconstruction and construction of memory. In this chapter we will highlight on the concept of the constructive process of memory. We will further discuss about schemas, memory distortions, source confusion and false memories. A final remark on distortions in eyewitness testimony will also be discussed.

Learning Objectives

After studying this chapter you will be able to:

- Understand memory as a constructive process.
- Understand the role of schemas in memory distortions.
- Understand source confusion and false memories.
- Understand the how distortions in eyewitness testimony tends to occur.

Plan of Study

15.1 Memory as a Constructive Process

Retrieving information from long term memory is not like viewing a digital replay. Our memories are often incomplete or sketchy. We may literally construct (or, as some say, reconstruct) a memory by piecing together bits of stored information in a way that seems real and accurate. Memory construction can be amusing at times. Many of us have a tendency to recall the world through slightly rosy glasses, which helps us feel good about ourselves. However, memory construction can also have serious personal and societal consequences.

15.2 Schemas and Memory Distortions

Since very early in life, you have been actively forming schemas – organized clusters of knowledge and information about particular topics. The topic can be almost anything – an event, an object, a situation, or a concept. For example, consider the schema you have for a typical kitchen. It probably includes food, a refrigerator, a toaster, a sink, cabinets, silverware, and so forth. You started forming your kitchen schema early in life by gradually identifying the common elements first in your own kitchen, then in other people's kitchen.

On the other hand, schemas are useful in forming new memories. Using the schemas you already have stored in long-term memory allows you to quickly integrate new experiences into your knowledge base. Schemas can also contribute to memory distortions.

To illustrate this point, let's try to re-create some of the conditions in an ingenious study by William Brewer and James Treyens (1981). Imagine that you've signed up to participate in a psychology experiment. When you show up at the psychology professor's office for the study, the professor asks you to wait briefly in his office. The professor comes back and escorts you to a different room. After you sit down, you are told the real purpose of the study : to test your memory of the details of the professor's office. Most often subjects remembered, that the office contained books, a filing cabinet, a telephone, a lamp, pens, pencils and a coffee cup. But none of these items were in the professor's office.

Why did the participants in this study erroneously "remember" items that weren't there? When the participants reconstructed their memories of the office they remembered objects that were not in the room but that did fit the schema of a professor's office. Thus, the incorrect details that they thought they remembered were all items that would be consistent with a typical professor's office.

Schemas can also contribute to memory distortions when we learn new information that is inconsistent with previously learned information. In one clever study, subjects read a brief story about “Bob” and “Margie”, a happy, compatible couple engaged to be married. Just before the subjects left the experiment, the experimenter casually mentioned that Bob and Margie broke up and never did get married. When the subjects were later tested for their recall of the written story, they introduced new, inaccurate details to make the story more consistent with the experimenter’s remark. Unknowingly, the subjects had fabricated or distorted details of the story to make it consistent with the experimenter’s remark and with their own schemas about relationships and marriage.

In combination, the office study and the Bob and Margie study underscore several important points. First, they show how the schemas we already hold can influence what we remember. Second, they demonstrate that once a memory is formed, it has the potential to be changed by new information. And third, they demonstrate how easily memories can become distorted. Notice that neither of these studies involved elaborate efforts to get subjects to distort the memories being formed or remembered.

15.3 Source Confusion and False Memories

Memory distortions an also occur because of source confusion, which arises when the true source of the memory is forgotten. One of the most easily forgotten parts of a memory is its source – how, when, or where it was acquired. A false memory is a distorted or inaccurate memory that feels completely real and is often accompanied by all the emotional impact of a real memory. False memories are a result of source confusion. Such false memories can arise when you confuse something that you’ve only imagined, heard about, read about, or seen in a film with something that really happened to you.

15.4 Distortions in Eyewitness Testimony

Given the fallibility of human memory, it’s understandable that precautions are often taken when specific details may be critically important. One important area in which it’s often impossible to take such precautions is eyewitness testimony. The guilt or innocence of people in criminal and civil cases often hinges on the accuracy of witnesses’ memories. Psychologists are well aware of how easily memories can be distorted in the laboratory. If such distortions also occur in real life, they could have serious implications.

Psychologist Elizabeth Loftus, is one of the most widely recognized authorities on eyewitness testimony. Loftus has not only conducted extensive research in this area but has also testified as an expert witness in many high profile cases.

To illustrate how eyewitness testimony can become distorted, let's consider a study that has become a classic piece of research. Loftus had subjects watch a film of an automobile accident; write a description of what they saw, and then answer a series of questions. There was one critical question in the series: "About how fast were the cars going when they contacted each other?" Different subjects were given different versions of that question. For some subjects, the word contacted was replaced with hit. Other subjects were given bumped, collided or smashed. Depending on the specific word used in the question, subjects provided very different estimated of the speed at which the cars in the film were travelling. The subjects who gave the highest speed got smashed. Clearly, how a question is asked can influence what is remembered.

A week after seeing the film, the subjects were asked another series of questions. This time, the critical question was "Did you see any broken glass?" Although no broken glass was shown in the film, the majority of the subjects whose question had used the word smashed a week earlier said "yes". Once again, following the initial memory (the film of the automobile accident), new information (the word smashed) distorted the construction of the memory (remembering broken glass that wasn't really there).

More recently, Loftus and her colleagues demonstrated that subjects can intentionally be led to make inaccurate reports after being exposed to misleading information. This misinformation effect is relatively easy to produce. In one study, subjects watched a series of slides about a burglary in which a screwdriver was a key element. The subjects then read a written account of the event. However, the written account contained misleading information. It referred to a hammer instead of a screwdriver. The subjects were then tested for their memory of the event.

The results? After exposure to the misleading information, about 60 percent of the subjects quickly and confidently said that a hammer, rather than a screwdriver; had been used in the burglary. Subjects were as confident about their fabricated memories as they were about their genuine memories of other details of the original event.

Finally, we don't want to leave you with the impression that it's astonishing that anybody remembers anything accurately. In reality, people's memories tend to be quite accurate for

overall details. When memory distortions occur, they usually involve limited bits of information.

Still, the surprising ease with which bits of memory can become distorted is unnerving. The distorted memories can ring true in our minds and feel just as real as accurate memories. Rather than being set in stone, human memories are more like clay: They can change shape with just a little bit of pressure.

15.5 Summary

- Memories can be distorted by schemas and other preexisting information that we have stored before acquiring a new memory.
- Schemas can also contribute to memory distortions when we learn new information that is inconsistent with previously learned information.
- Source confusion occurs when we either don't remember or misidentify the source of a memory.
- The misinformation effect, schema distortion and source confusion can contribute to inaccuracies in eyewitness testimony.
- Memory tends to be fairly accurate for the general gist of experiences.
- Distorted or false memories can be just as vivid as accurate memories.

15.6 Keywords

Schema : An organized cluster of information about a particular topic.

Source Confusion: A memory distortion that occurs when the true source of the memory is forgotten.

Eyewitness Testimony: Information provided by witnesses to crimes or accidents.

Misinformation Effect: A memory-distortion phenomenon in which a person's existing memories can be altered if the person is exposed to misleading information.

15.7 Check Your Progress

1. Define Schemas.

_____

_____

2. What are the contributions of Elizabeth Loftus to memory?

_____

3. What is a false memory?

_____

4. Define source confusion.

_____

5. Who is an eyewitness?

_____

15.8 Answers To Check Your Progress

1. Refer in text content : 15.2
2. Refer in text content : 15.4
3. Refer in text content : 15.3
4. Refer in text content : 15.3
5. Refer in text content : 15.4

15.9 Model Questions

1. Discuss memory as a constructive process in detail.
2. Elaborate on the role of schemas on memory distortions.

LESSON : 16

FORGETTING AND STRATEGIES TO IMPROVE MEMORY

Preview

In the previous chapter we considered the concept of constructing memories. Also varied aspects like, schemas and source confusion that often leads to false memories was also discussed. Emphasis was also given to understanding the causes of distortions in eyewitness testimony with regards to memory. In this chapter we will consider the concept of forgetting. We will also explore on the various factors that influence forgetting. In conclusion varied strategies to improve memory will be considered.

Learning Objectives

After studying this chapter you will be able to:

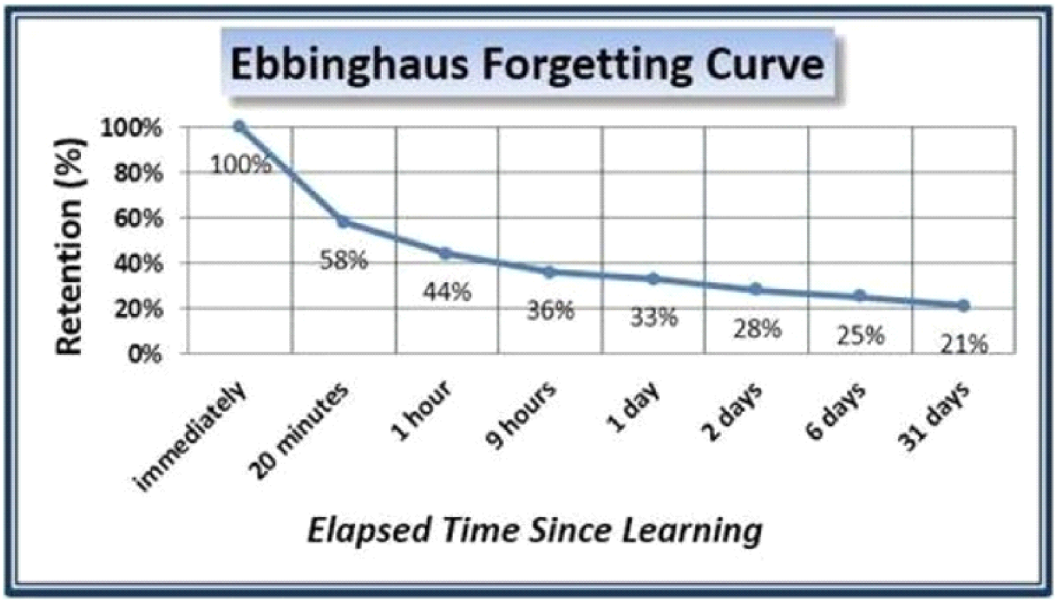
- Understand the concept of forgetting.
- Understand the factors that influence forgetting.
- Illustrate the strategies to improve memory.

Plan of Study

16.1 Introduction To Forgetting

Forgetting is the inability to recall information that was previously available. Forgetting is so common that our lives are filled with automatic reminders to safeguard forgetting important information. Sometimes, of course we want to forget. From the standpoint of a person's psychological well-being, it's probably just as well that we tend to forget the details of unpleasant memories, such as past failures, social embarrassments and unhappy relationships. Even more generally, our minds would be cluttered with mountains of useless information if we remembered every television program, magazine article, billboard or conversation we have ever experienced. So forgetting does have some adaptive values.

16.1.1 Hermann Ebbinghaus : The Forgetting Curve



German psychologist Hermann Ebbinghaus began the scientific study if forgetting over a century ago. His goal was to determine how much information was forgotten after different lengths of time. But he wanted to make sure that he was studying the memory and forgetting of completely new memory. To solve this problem, Ebbinghaus (1885) created new material to memorize : thousands of nonsense syllables. A nonsense syllable is a three-letter combination, made up of two consonants and a vowel, such as WIB or MEP. It almost sounds like a word, but it is meaningless. This study was conducted on himself, and he carefully noted how many times he had to repeat a list of 13 nonsense syllables before he could recall the list perfectly.

Once he had learned the nonsense syllables, Ebbinghaus tested his recall of them after varying amounts of time, ranging from 20 minutes to 31 days. He plotted his results in the now-famous Ebbinghaus forgetting curve.

The Ebbinghaus forgetting curve reveals two distinct patterns in the relationship between forgetting and the passage of time. First, much of what we forget is lost relatively soon after we originally learned it. How quickly we forget material depends on several factors such as how well the material was encoded in the first place, how deeply it was processed, and how often it was rehearsed.

Second, the Ebbinghaus forgetting curve shows that the amount of forgetting eventually levels off. The information that is not quickly forgotten seems to be remarkably stable in memory over long periods of time.

16.2 Factors That Influence Forgetting

Research on forgetting, both in the laboratory and in everyday life, has identified four potential causes of forgetting: encoding failure, interference, motivated forgetting, and decay. Let's consider how each of these causes can help explain instances of forgetting.

16.2.1 Encoding Failure

One of the most common reasons for forgetting is that we never encoded the information into long-term memory in the first place. This phenomenon is called encoding failure. Encoding failure explains why you forget where you put your car keys or a person's name five minutes after meeting her. The information momentarily entered your short term memory, but it was never encoded into long term memory.

16.2.2 Interference Theory

A second reason for forgetting is that memories an interfere with one another. According to the interference theory of forgetting, forgetting is caused by one memory competing with or replacing another memory. the most critical factor is the similarity of the information. The more similar the information is in two memories, the more likely it is that interference will be produced.

There are two basic types of interference. Retroactive interference occurs when a new memory (your new phone number) interferes with remembering an old memory (your old phone number). Proactive interference is the opposite of retroactive interference. It occurs when an

old memory interferes with a new memory. This is a relatively common experience. For example, proactive interference can occur when you get a new car or borrow someone else's car. You want to switch on the headlights, but you keep turning on the windshield wipers. The old memory (the switch's location in your car) interferes with the more recent memory (the switch's location in the new car).

16.2.3 Motivated Forgetting

Motivated forgetting refers to the idea that we forget because we are motivated to forget, usually because a memory is unpleasant or disturbing. In one form of motivated forgetting called suppression, a person makes a deliberate, conscious effort to forget information. Although the person remains aware that a particular event did occur, he or she consciously chooses not to think about it.

There is another form of motivated forgetting that is much more controversial. Repression is motivated forgetting that occurs unconsciously. With repression, all memory of an event or experience is blocked from conscious awareness. Thus, repression is fundamentally different from suppression, in which people know that a particular event happened but intentionally avoid thinking about it.

16.2.4 Decay Theory

According to decay theory , we forget memories because we don't use them and they fade away over time as a matter of normal brain processes. The idea is that when a new memory id formed, it creates a memory trace- a distinct change in brain structure of chemistry. Through disuse over time, the normal metabolic processes of the brain are thought to erode the memory trace. The gradual fading of memories, then, would be similar to the fading of letters on billboards or newsprint exposed to environmental elements such as sunlight.

16.3 Strategies to Improve Memory

1. Focus your attention

Problems in absorbing new information arise when distracting thoughts, background noise and other interruptions sidetrack your attention. It will thus be effective to locate a quiet study space that is free from distractions so you can focus your attention.

2. Commit the necessary time

The more time you spend learning material, the better you will understand it and the longer you will remember it. So don't rely on skimming material the night before a test. Budget enough time to read the assigned material carefully. If you read material faster that you can comprehend it, you not only won't understand the material, you also won't remember it.

3. Space your study sessions:

Distributed practice means that you learn information over several sessions, which gives you time to mentally process and incorporate the information. It's also been shown that sleep, particularly REM sleep, helps consolidate new memories. All-night cram sessions just before an exam are one of the least effective ways to learn new material.

4. Organize the information

We have a strong natural tendency to organize information in long term memory into categories. You can capitalize on this tendency by actively organizing information that you want to remember. Use the chapter headings and subheadings as categories. Under each category, list and describe the relevant terms, concepts and ideas. This strategy can double the amount of information you can recall.

5. Elaborate on the material

In order to remember the information that you study you need to engage in elaborative rehearsal and actively process the information for meaning actively question ne information and think about its implications. Form memory associations by relating the material to what you already know. Try to come up with examples that relate to your own life. React to what you read by writing your comments or questions in the margin of the textbook. Create sentences that accurately use the concept or term.

6. Use visual imagery

Much of the information in this text easily lends itself to visual imagery. Use the photographs and other illustration to help form visual memories of the information. A simple way to make text information visually distinct is to highlight different concepts in different colors.

7. Explain it to a friend

Memory research clearly supports the benefits of explaining new material out loud. After you read a section of material, stop. Summarize what you have read in your mind. When you think you understand it, try to explain the information to a friend or a family member.

8. Reduce interference within a topic

To minimize memory interference for related information, first break the chapter into manageable sections, then learn the key information one section at a time. As you encounter new concepts, compare them with previously learned concepts, looking for differences and similarities. By building distinct memories for important information as you progress through a topic, you are more likely to distinguish between concepts so they don't get confused in your memory.

16.4 Summary

- Forgetting refers to the inability to recall information that was previously available.
- Encoding failure is one cause of forgetting.
- According to interference theory, forgetting results from retroactive and proactive interference.
- Motivated forgetting can result from suppression and repression.
- Decay theory is another explanation for forgetting cause by disuse of information.

16.5 Keywords

Forgetting: The inability to recall information that was previously available.

Encoding failure: The inability to recall specific information because of insufficient encoding for storage in long term memory.

Interference theory: The theory that forgetting is caused by one memory competing with or replacing another.

Retroactive interference: Forgetting in which a new memory interferes with remembering an old memory, backward-acting memory interference.

Proactive interference: Forgetting in which an old memory interferes with remembering a new memory; forward-acting memory interference.

Motivated forgetting: The theory that forgetting occurs because an undesired meory is held back from awareness.

Suppression: Motivated forgetting that occurs consciously.'

Repression: Motivated forgetting that occurs unconsciously.

Decay theory: The view that forgetting is due to normal metabolic processes that occur in the brain over time.

16.6 Check Your Progress

PART : A

Circle the letter of the correct answer

1. Renee asked her husband what his secretary had worn to the office party, and he could not remember. The most likely explanation is:

    a. suppression

    b. encoding failure

    c. the interference effect

    d. he was lying

2. Professor Daniel has many vivid memories of her students from last semester and can recall most of their names. Because of _____, she is having problems remembering her new students' names this semester.

    a. retroactive interference

    b. proactive interference

    c. decay

    d. suppression.

PART : B

Write short notes:

3. Highlight on the contributions of Hermann Ebbinghaus.

_____

4. Name the two different types of motivated forgetting.

_____

5. Define forgetting.

_____

16.7 Answers To Check Your Progress

1. b
2. b
3. Refer in text content : 16.1.1
4. Refer in text content : 16.2.3
5. Refer in text content : 16.1

16.8 Model Questions

1. Define forgetting
2. Explain the factors that influence forgetting in detail.
3. Sketch out strategies to improve memory.

Model Question Paper

Advanced General Psychology- I

Max Marks: 80

Part A 10 x 2 = 20

Answer any TEN questions in 50 words each

1. Define cognitive neuroscience.
2. Mention any four subfields of psychology.
3. What is control group?
4. What is electrical gradience?
5. What do you mean by selective permeability?
6. Mention the names of common neurotransmitters.
7. What is receptor binding?
8. Define selective attention
9. Define learning.
10. What is negative reinforcement?
11. What are the different types of memory?
12. What is forgetting?

Part B 5 x 6 = 30

Answer any FIVE questions in 250 words each

13. Outline the emerging fields in psychology.
14. Bring out the similarities and differences between clinical and counselling psychology.
15. Explain saltatory conduction.
16. Bring out the structure and functions of spinal cord.
17. Trace out the approaches of perception.
18. Bring out the schedules of reinforcement.
19. Explain Observational learning in detail.

Part C 3 x 10 = 30

Answer any THREE questions in 500 words each

20. Discuss the experimental method of psychology.

21. Describe the structure of neuron.

22. Elucidate the process of neuro transmitter action.

23. Describe the structure and functions of forebrain.