

Discovering Psychology: Updated Edition

08 Learning

- 1 01:29:46:07 >> ZIMBARDO: What does playing the flute have in common with working on an assembly line?
- 2 01:29:53:19 (*baby crying*) Why would a baby be scared of a gentle rabbit?
- 3 01:29:59:24 How does a dog learn to operate an elevator?
- 4 01:30:02:17 >> Atta boy, good.
- 5 01:30:03:16 >> Good, good boy.
- 6 01:30:05:08 >> Carefully, very slowly.
- 7 01:30:06:22 >> ZIMBARDO: "Learning," this time on *Discovering Psychology* .
- 8 01:30:46:14 For every animal, the name of the game is survival.
- 9 01:30:52:00 The rules are simple: find food and drink...
- 10 01:31:02:05 find shelter, and avoid predators and hostile environments.
- 11 01:31:10:02 Those who are best equipped to survive and who manage to mate will pass on their genes to the next generation.
- 12 01:31:17:06 This is the true meaning of survival of the fittest.
- 13 01:31:26:23 Fortunately, nature lends a helping hand.
- 14 01:31:30:02 It provides animals with a set of built-in, inherited skills that function at birth or shortly thereafter.
- 15 01:31:37:23 These skills are called reflexes.
- 16 01:31:40:11 Some reflexes, like sucking, provide necessary biological supports.
- 17 01:31:46:01 Other reflexes are ready-made, swift, and simple reactions to stimuli that pose a potential threat.
- 18 01:31:58:29 And nature also provides more complex patterns of reaction, known as fixed-action patterns.

- 19 01:32:05:06 For example, the annual upstream journey of salmon to spawning grounds.
- 20 01:32:10:13 These are sequences of actions triggered automatically by particular environmental and biological events and performed in the same way by every member of a species.
- 21 01:32:20:05 (*geese honking*) These birds will migrate to the same destination at the same time of every year.
- 22 01:32:33:22 When we take a look at animals that are more evolved, we find their behavior is less the replaying of the same-old song and more a series of variations from individual to individual.
- 23 01:32:47:08 The behavior of these animals is more adaptive to changing circumstances because of their capacity for learning.
- 24 01:32:57:13 Learning is the way that a species profits from its experience.
- 25 01:33:02:03 It's the mechanism by which past experience guides future behavior.
- 26 01:33:07:16 This is true for humans as well as other animals.
- 27 01:33:11:23 For humans, learning covers a wide range of activities, from acquiring a different language to studying in school.
- 28 01:33:20:12 >> *Yo hablo* .
- 29 01:33:22:05 >> *Yo hablo* .
- 30 01:33:24:04 >> ZIMBARDO: From playing sports....
- 31 01:33:29:15 to playing the flute.
- 32 01:33:37:19 In the process of learning, an individual's behavior is modified.
- 33 01:33:41:29 He or she acquires new habits, and new ideas are put into practice.
- 34 01:33:47:14 >> Can you mix up all these dry ingredients?
- 35 01:33:49:05 Very carefully.
- 36 01:33:49:26 Very slowly and carefully, okay?
- 37 01:33:51:19 Now while you're doing that, we need a cup...

- 38 01:33:54:10 >> ZIMBARDO: The new behavior can change the environment itself, making it more conducive to the individual's well-being.
- 39 01:34:00:08 >> That looks pretty good, Joshua.
- 40 01:34:04:01 >> ZIMBARDO: Learning allows us to do two important things in the quest for survival: first, to anticipate the future from past experience, and second, to control a complex and ever- changing environment.
- 41 01:34:16:13 (*orchestra playing*) Traditionally, learning has been studied in laboratories like this one using animals as subjects, in part because it's easier to conduct controlled experiments with animals than it is with humans.
- 42 01:34:34:25 And also, because animals are like humans in important ways.
- 43 01:34:38:13 As a result, behavioral psychologists have come up with new views not only of animal behavior, but of human nature as well.
- 44 01:34:47:04 And these views all concern a process that we take for granted -- learning -- because we are all truly born to learn.
- 45 01:34:56:29 Ironically, one of the most important figures in the study of learning, Ivan Pavlov, wasn't concerned with the subject at all, at least not at first.
- 46 01:35:05:28 Pavlov, a noted Russian scientist, won the Nobel Prize for physiology and medicine in 1904.
- 47 01:35:14:06 As this original footage shows, Pavlov was initially interested in digestion and the action of the salivary glands.
- 48 01:35:22:03 By diverting the saliva of dogs into test tubes, he could precisely measure if and how much they salivated during digestion.
- 49 01:35:32:13 When food was presented, the dogs salivated quickly, an inherited salivary reflex.
- 50 01:35:40:11 But over repeated testings, a strange thing happened: the dogs salivated before contact with the food.
- 51 01:35:48:13 Just the sight of the food was enough to stimulate their drooling.

- 52 01:35:52:11 Then, just seeing the food dish or even hearing the footsteps of Pavlov or his assistants was enough to trigger this built-in reflex.
- 53 01:36:03:15 What was going on to elicit this response?
- 54 01:36:06:07 Pavlov decided to find out by systematically varying the stimuli and measuring the dog's reaction.
- 55 01:36:12:26 (*metronome ticking*) Metronomes, lights, and bells were all used as stimuli, and they all worked as stand-ins for the food.
- 56 01:36:22:14 What mattered was not the kind of stimulus that was used, but the fact that it reliably signaled that food was on the way.
- 57 01:36:32:02 Pavlov had discovered a fundamental type of learning called classical conditioning.
- 58 01:36:37:15 An original stimulus elicits an automatic, unlearned response.
- 59 01:36:41:06 Both stimulus and response happen naturally; they are unconditioned.
- 60 01:36:48:05 Then a second, neutral stimulus that never elicits the unconditioned response by itself is introduced just before the presentation of the original stimulus.
- 61 01:37:01:06 (*bell rings*) (*bell rings*) (*bell rings*) If the neutral, or signaling, stimulus is presented alone and response occurs as if the original stimulus was still there, we say that conditioning has taken place.
- 62 01:37:18:16 (*bell rings*) The arbitrary neutral stimulus becomes a conditioned stimulus.
- 63 01:37:22:24 (*bell rings*) The reverse is also true.
- 64 01:37:27:10 Pavlov and others studied the extinction over time of such conditioned responses.
- 65 01:37:32:11 (*bell rings*) When the subject learns that the conditioned stimulus no longer signals a desired event...
- 66 01:37:39:24 (*bell rings*) ...the acquisition process is reversed as the learned connection is gradually weakened.

- 67 01:37:45:08 (*bell ringing repeatedly*) Pavlov's work and the work of those who followed him led to a remarkable conclusion.
- 68 01:37:56:02 And that is, any stimulus an organism can perceive is capable of eliciting any reaction the organism is capable of making.
- 69 01:38:04:13 This means that virtually any sound, sight, or smell can influence the way our muscles tense or relax, our moods fluctuate, or even the way our attitudes are formed.
- 70 01:38:15:26 For instance, if I say "relax" and then do this...
- 71 01:38:19:02 (*pistol firing*) ...you're going to be startled and upset.
- 72 01:38:23:07 After five or six pairing of "relax"...
- 73 01:38:25:14 (*pistol firing*) ...just saying the word "relax" is going to generate a negative response rather than its usual learned reaction.
- 74 01:38:36:09 Classical conditioning can be so powerful, in fact, that it can actually make us sick by suppressing the body's immune system.
- 75 01:38:45:05 The immune system is a complex network of specialized organs and cells that protect the body from disease.
- 76 01:38:52:09 It releases antibodies to destroy or contain dangerous bacteria, viruses, and other invaders.
- 77 01:38:59:19 When the immune system is conditioned not to work, the results can be devastating.
- 78 01:39:06:10 At the University of Rochester Medical School, researcher Robert Ader and his colleague Nicholas Cohen conditioned rats to dislike something they usually like very much: the taste of saccharine-flavored water.
- 79 01:39:21:00 Ader discovered that he had also unintentionally conditioned the rat's immune system to shut down.
- 80 01:39:28:09 >> We were pairing a saccharine- flavored drinking solution with an agent that produced a temporary stomachache in rats, using a drug called cyclophosphamide.
- 81 01:39:42:10 And indeed we found, as we expected, that the more of the saccharine they consumed, the stronger was the aversion to

- the taste of saccharine when it was paired with this drug that made them sick.
- 82 01:39:55:21 Over a month's time, giving these animals repeated exposures to saccharine instead of their usual water, some of the animals died.
- 83 01:40:05:20 Now, this was an experiment in which animals should not have died; there was no reason for them to have died.
- 84 01:40:11:28 And when this happens in an experiment when it's not supposed to, this is troublesome.
- 85 01:40:17:09 You look for a reason why.
- 86 01:40:19:17 It turns out that the drug we were using to induce this taste aversion is a powerful immunosuppressive drug; it suppresses immune responses.
- 87 01:40:30:05 At the same time that we were conditioning the behavioral response, which was avoidance of the saccharine, we were also conditioning the effects of the drug, that is an immunosuppressive response.
- 88 01:40:41:21 Every time the animal was exposed to saccharine there was an aversion response, and there was also a suppression of the immune system.
- 89 01:40:51:07 >> ZIMBARDO: So even the immune system may be influenced by conditioning.
- 90 01:40:55:00 We can learn to become sick and possibly die.
- 91 01:41:00:13 Classical conditioning is not the only kind of conditioning.
- 92 01:41:04:01 While Pavlov had shown the importance of learning relationships between two stimulus events, an American psychologist named Edward Thorndike pioneered the study of another kind of learning around the turn of the century.
- 93 01:41:16:11 Thorndike was interested in how individuals learn solutions to the complex puzzles the world devises.
- 94 01:41:25:07 How do we and other animals learn the habits and new skills that enable us to find our way through life's mazes?
- 95 01:41:38:18 By carefully observing, measuring, and quantifying the performance of experimental animals, Thorndike discovered

the type of learning we call instrumental conditioning.

- 96 01:41:51:12 Thorndike's animals worked by trial and error.
- 97 01:41:56:25 The actions that brought reward -- that is, the actions that were instrumental to achieving a goal -- became learned.
- 98 01:42:04:06 To Thorndike, it's the consequences of what an individual does that most influence the learning process.
- 99 01:42:15:13 Thorndike's Law of Effect states that learning is controlled by its consequences.
- 100 01:42:21:10 Those behaviors followed by good consequences are selected and repeated, while those leading to bad consequences or no consequences at all are not repeated.
- 101 01:42:35:04 Another American psychologist who was greatly influenced by Pavlov was John B. Watson.
- 102 01:42:40:23 Watson believed that learned, observable behavior was the only thing in psychology worthy of scientific study.
- 103 01:42:48:09 He attacked the doctrines of inherited traits and instincts as the cause of behavior.
- 104 01:42:53:02 Instead, he spoke of the unlimited power of conditioning and environmental control to mold the behavior of animals and humans alike.
- 105 01:43:03:28 To study the power of conditioning, Watson used infants as subjects, as you can see in this original footage from the 1920s.
- 106 01:43:12:03 Watson showed that strong emotions could be learned in one situation by conditioning and then generalized; that is, transferred to other similar situations without having to repeat the original conditioning.
- 107 01:43:28:10 Watson and his assistant, Rosalie Rayner, conditioned the infants to fear a white rat they had liked at first.
- 108 01:43:34:27 In this case, they work with an eight-month-old called Little Albert.
- 109 01:43:39:03 Each time the rat was presented, a loud gong was struck, startling the infant.

- 110 01:43:44:15 Soon the appearance of the rat alone was enough to make him cry and become fearful.
- 111 01:43:49:00 This was classical conditioning at work.
- 112 01:43:52:12 When the child crawled away from the rat toward safety, her behavior was rewarded in that her fear was reduced.
- 113 01:43:59:09 Instrumental conditioning was now at work.
- 114 01:44:03:03 Later, when the children saw any stimulus that was similar to the rat -- a rabbit, a dog, a fur coat, a mask -- their learned fear was generalized to all of them.
- 115 01:44:15:26 The once-fearless children were now easily frightened by a host of harmless things.
- 116 01:44:21:09 Watson's pioneering study was controversial because of the way he used children.
- 117 01:44:26:29 Such an experiment could not be conducted today because of strict ethical guidelines governing the treatment of all research subjects, humans and animals.
- 118 01:44:38:08 A few years after the demonstrations, an associate of Watson, Mary Cover Jones, developed techniques for removing naturally-conditioned fears in youngsters.
- 119 01:44:47:04 Jones was the first behavior therapist.
- 120 01:44:53:10 But these techniques came too late for some of Watson's subjects.
- 121 01:44:57:05 Little Albert's fate remains unknown.
- 122 01:45:02:11 Another towering figure in the study of learning was Harvard psychologist B.F. Skinner.
- 123 01:45:07:25 Skinner built upon the ideas of Pavlov, Thorndike, and Watson and was interested in how behavior is influenced by external events in our lives.
- 124 01:45:18:00 For many psychologists, behavior is explained as an effect of internal processes, either mental or neural.
- 125 01:45:25:25 For them, behavior is seen as the outward expression of what's going on inside, but Skinner disagrees.
- 126 01:45:34:01 His research investigates behavior in terms of its relationship

to environmental variables that precede and follow it.

- 127 01:45:42:01 You can think of it as psychology's ABCs: antecedents, behavior, consequences.
- 128 01:45:50:03 In the early 1940s, Skinner began to examine a simple response of an ordinary animal -- a pigeon pecking a disk that was followed by a reinforcer, say a food pellet or some water.
- 129 01:46:02:01 A reinforcer is anything that increases the rate of responding.
- 130 01:46:05:21 >> We can wait for it to turn a little further.
- 131 01:46:08:04 >> ZIMBARDO: The pigeon was kept in a highly-controlled environment that has come to be known as a Skinner box.
- 132 01:46:13:19 And Skinner's version of instrumental conditioning is known as operant conditioning.
- 133 01:46:20:21 >> Well, operant behavior is behavior which operates upon the environment and produces consequences.
- 134 01:46:29:04 And operant conditioning is the change that takes place when those consequences have a particular effect, and we call this effect strengthening or reinforcing.
- 135 01:46:41:16 >> ZIMBARDO: Through operant conditioning, pigeons have been trained to peck at the correct sum of numbers and to perform all kinds of feats.
- 136 01:46:48:23 (*pecking out a tune on piano*) Operant conditioning is one important aspect of learned behavior.
- 137 01:46:59:08 But in Skinner's view of psychology, all learned behavior can be stripped down to the relationship between the behavior, its antecedents, and its consequences.
- 138 01:47:09:01 He believes that any behavior that is followed by a consequence will change in its rate of occurrence in direct relationship to changes in the consequence.
- 139 01:47:20:17 Today, psychologists are pushing the limits of operant conditioning beyond the Skinnerian model.
- 140 01:47:28:06 Behavioral Psychologist Howard Rachlin at the State University of New York looks at ways to enable self-control

by using operant-conditioning methods.

- 141 01:47:39:01 >> Self-control, like everything else, is a little bit of environment and a little bit of genes... like everything.
- 142 01:47:47:28 Self-control is really choosing between a large-but-delayed reward and a smaller-but-more- immediate reward.
- 143 01:47:59:29 A larger reward is more abstract and difficult to put your finger on, like good health.
- 144 01:48:08:15 >> ZIMBARDO: Things like good health or even job satisfaction are often the result of long- term behavior in which delayed gratification was consciously chosen.
- 145 01:48:18:25 Rachlin looks at how patterns of behavior act as a reinforcement for self-control.
- 146 01:48:24:24 Like Skinner, Rachlin also uses pigeons to test his ideas.
- 147 01:48:30:10 >> In the first condition, a pigeon chooses between a small, immediate reward and a larger- but-delayed reward.
- 148 01:48:38:11 If it pecks the green button, it gets a small amount of food right away.
- 149 01:48:43:09 If it pecks the red button, it has to wait a few seconds, but it gets twice as much food by pressing the red button.
- 150 01:48:52:20 Pigeons are very impulsive.
- 151 01:48:54:15 Almost 100% of the time, pigeons will go for the smaller, immediate reward.
- 152 01:49:05:10 In another condition, we'll say to the pigeon, "Instead of pecking the key just once to get that reward, you have to peck the key 15 times."
- 153 01:49:14:24 And when we asked the pigeon to peck the key 15 times to get either reward, it will start pecking the key leading to the larger reward.
- 154 01:49:29:10 So when it only has to peck once, it's right up against the small reward and it takes the small reward.
- 155 01:49:36:00 Whereas when, if you put the pigeon back and it has to peck 15 times, it sees the rewards as they are.
- 156 01:49:43:10 And seeing the rewards as they are, it starts pecking the key

that leads to the larger reward.

- 157 01:49:51:06 >> ZIMBARDO: Rachlin demonstrates that following the 15th peck on the green button, the pigeon receives a small-but-immediate reward of food.
- 158 01:49:59:01 The case is different with the red button.
- 159 01:50:01:11 After the 15th peck on the red button, the pigeon has to wait an additional four seconds, but the reward is larger.
- 160 01:50:09:05 The pigeon chooses the red button leading to the larger, delayed reward, illustrating that a pattern of behavior can reinforce the choices that lead to self-control.
- 161 01:50:20:07 >> The rewards of self-control are very hard to pin down.
- 162 01:50:25:01 They're very hard to isolate.
- 163 01:50:26:18 And they're not simply the sum of a bunch of instants...
- 164 01:50:32:01 (*duo singing*) ...just like listening to a song is not simply the sum of a bunch of notes; it's some abstract relationship.
- 165 01:50:41:20 A song is a certain relationship, and that relationship takes time to occur.
- 166 01:50:47:17 And these rewards are like songs in that sense: they take time to occur, and they're not simply the sum of a bunch of instants.
- 167 01:50:56:06 >> ZIMBARDO: Rachlin believes that recognizing alternatives to a particular behavior helps to change that behavior.
- 168 01:51:03:12 For instance, if we want to stop smoking, it is not enough to take away the cigarettes.
- 169 01:51:07:27 You need to reinforce the potentially larger-but-delayed benefits of not smoking, such as experiencing better health, having more money, and increased social approval.
- 170 01:51:20:14 >> The difference between my view and Skinner is that we not only look at the consequences of the specific act that we might want to change, but also the alternatives.
- 171 01:51:33:06 And we focus on both of those, because sometimes the best way to manipulate a certain behavior is not to work on the

behavior itself but to work on the alternatives.

- 172 01:51:44:08 >> ZIMBARDO: Operant conditioning has been applied in several settings beyond the research laboratories where it was first discovered.
- 173 01:51:52:06 >> These are not mechanical devices.
- 174 01:51:55:25 These are dogs.
- 175 01:51:58:01 That means that they don't always do everything perfectly every time.
- 176 01:52:02:06 >> ZIMBARDO: This promotional film shows a San Diego training program called Canines for Independence.
- 177 01:52:09:20 Using behavioral principles, these dogs have learned to assist in the care of disabled patients.
- 178 01:52:16:01 Desired behaviors are reinforced by means of operant conditioning until the dog learns a new routine in which a complex sequence of responses are chained together.
- 179 01:52:26:27 >> So I got him to jump up on the table.
- 180 01:52:29:04 It took me about... three or four times of telling him what I wanted, and then he got it and handed it to me.
- 181 01:52:36:21 And now he just does it all the time; it's just one command for him to get it.
- 182 01:52:41:12 >> ZIMBARDO: The dogs learn to retrieve objects.
- 183 01:52:45:26 They learn to pull wheelchairs and even push elevator buttons.
- 184 01:52:50:03 >> Switch.
- 185 01:52:51:00 Atta boy, good.
- 186 01:52:51:26 >> Good, good boy.
- 187 01:52:53:09 That was good.
- 188 01:52:54:02 >> I didn't know it was going to be like this when I first started, but after I went through it, it's all come true.
- 189 01:53:01:04 After learning all these commands, everything's...

- 190 01:53:04:00 everything that I've learned, you know, it's working.
- 191 01:53:06:18 It's all working.
- 192 01:53:09:14 >> ZIMBARDO: We've seen some of the ways in which individuals learn how to change their situation.
- 193 01:53:14:17 But what happens if they learn that nothing makes a difference?
- 194 01:53:17:25 What happens if they learn to give up entirely?
- 195 01:53:20:24 Can we use conditioning to overcome such learned helplessness?
- 196 01:53:24:16 Fortunately, the answer for many distressed people is yes.
- 197 01:53:32:26 This woman is undergoing behavior therapy for agoraphobia.
- 198 01:53:37:04 Agoraphobia, the fear of public places, imprisons untold numbers of people, mostly women, in their homes.
- 199 01:53:45:22 >> That's good, just take that deep breath.
- 200 01:53:49:21 That's good.
- 201 01:53:50:12 We're going down one more step.
- 202 01:53:51:22 >> ZIMBARDO: The unique feature of this behavioral therapy is its pragmatic focus on directly changing the problem behavior, the individual's symptoms.
- 203 01:54:01:00 There's no attempt to find out what caused the behavior, only identifying and changing the sources of reinforcement that keep it going in the wrong direction.
- 204 01:54:10:28 The problem is treated by learning to cope with a fearful emotion and by arranging new, positive consequences for the desired behavior.
- 205 01:54:22:22 So learning can be positive and it can be negative.
- 206 01:54:25:21 But whatever we learn, whether it's the reinforcing consequences of our behavior or the futility of our actions, something more than behavior is changed; there's also a change in our knowledge.
- 207 01:54:37:26 And for that knowledge to direct our future actions, it must be remembered, which means somehow it must be registered

in our memory and called into play upon demand.

- 208 01:54:47:26 Learning without memory is impossible; memory without learning is useless.
- 209 01:54:53:07 So next time, we'll look at how we remember and why we forget.
- 210 01:54:56:12 I'm Philip Zimbardo.
- 211 01:55:01:06 [Captioned by The Caption Center WGBH Educational Foundation]
- 212 01:55:37:20 >> *Funding for this program is provided by Annenberg/CPB to advance excellent teaching .*