

Medical Psychology and Sociology: Learning and Memory

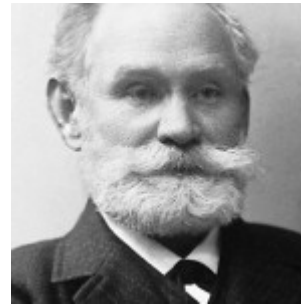
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Why do you decide in favor of certain actions and behavior but not of others? To get to the bottom of this question, psychology has developed a number of learning models. Classical and operant conditioning, learning by self-control, and observational learning are important basics that psychotherapy is based on. The following article contains, in addition to all facts about learning, knowledge about memory and language that is relevant for your exams.



Classical Conditioning: Stimulus Control

This type of conditioning relies on:				
Neutral stimulus (NS)	Unconditioned stimulus (US)	Unconditioned response (UR)	Conditioned stimulus (CS)	Conditioned response (CR)
Initially, does not elicit an intrinsic response	Will elicit an unconditioned response	Not learned, more biological	Originally neutral stimulus that is paired with a US	Learned response to the CS

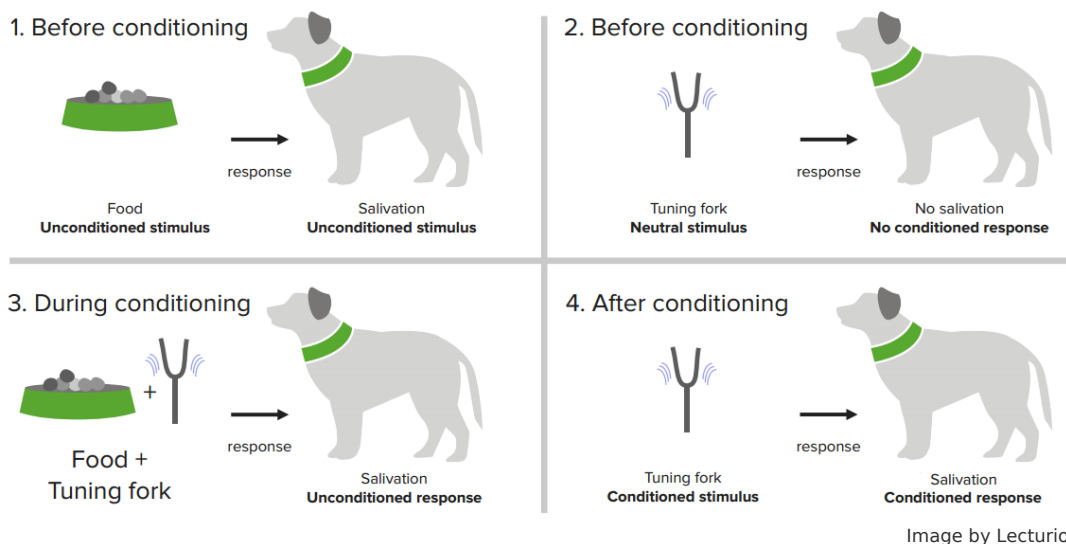


When referring to this term, do physiologist **P.Pawlow** and the dog-bell-saliva-experiment directly cross your mind? The founder of the principle of **classical conditioning** accidentally came across the reaction-stimulus-chain, the so-called **respondent model**. He combined the action of feeding dogs with the sound of a bell and by and by he determined that the dogs already produced saliva by hearing the chime although no food was put in front of them.

The originally unconditioned stimulus (food) that led to an unconditioned reaction (salivation) was combined with a neutral impulse. By and by, this neutral impulse triggered the unconditioned reaction: **The neutral impulse became the conditioned stimulus.**

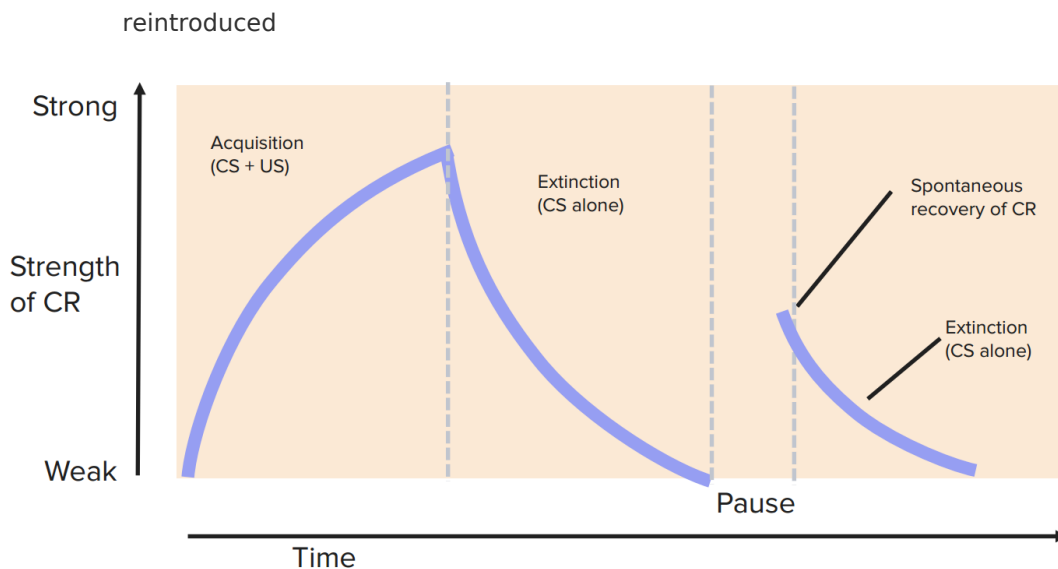
This conditioned reaction can also be deleted (**extinction**) by leaving out the conditioned impulse. If the impulse is set again spontaneously, the deleted reaction can appear again, however in a milder form (**spontaneous recovery**).

If similar impulses release the same reaction, we talk about **stimulus-generalization**. The term **stimulus-discrimination**, however, is used when similar impulses can be distinguished anyway.



The process of classical conditioning includes:

- Discrimination: When the CS is differentiated from other stimuli
- Generalization: Refers to when a stimulus other than the original CS elicits a CR
- Acquisition: Refers to the process of learning the CR
- Extinction: Occurs when the CS and US are no longer paired
- Spontaneous recovery: Is when an extinct CR occurs again when the CS is



Operant Conditioning: Trial and Error



Image: " B.F. Skinner at Harvard" by silly rabbit.
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The US-American psychologist **B.F. Skinner** is inevitably associated with the term of operant conditioning (Skinner-box see below). Operant conditioning describes **the acquisition of stimulus-reaction-patterns**:

How do we adjust our originally spontaneous behavior through reward and punishment?

The following terms are important with **operant conditioning**:

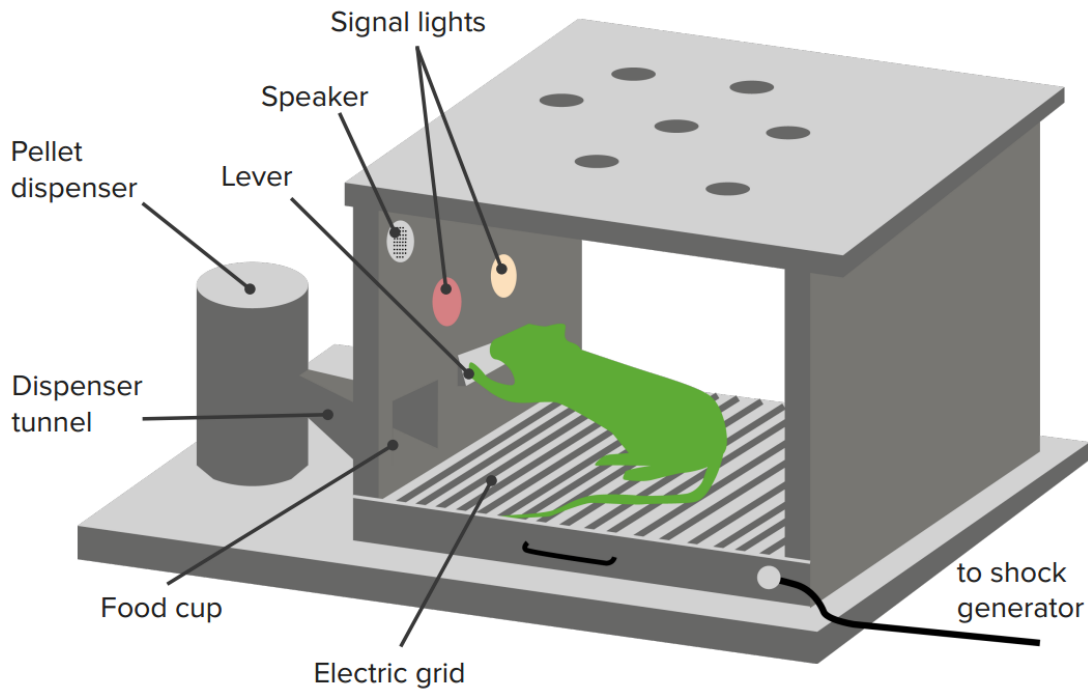
- **Positive reinforcement:** The probability of certain behavior to occur increases through positive reinforcement.
- **Negative reinforcement:** The discontinuation of negative impulses also leads to an increase of incidents.
- **Reinforcement:** positive or negative behavior consequences

Warning:

- **Reinforcement = increase of behavior**, regardless of whether positive or negative reinforcement
- positive and negative are not judgmental
- **Positive: adding** consequences
- **Negative: removing** consequences

Skinnerbox: Equipment for animal testing with a fixed lever. If this is pushed, the rat will

be rewarded with a food pill for its behavior. The behavior of the rat (pushing down the lever) is reinforced and so the action is executed more often. If the animals receive a painful stimulus after pushing the lever, they will stop this behavior after a little while.



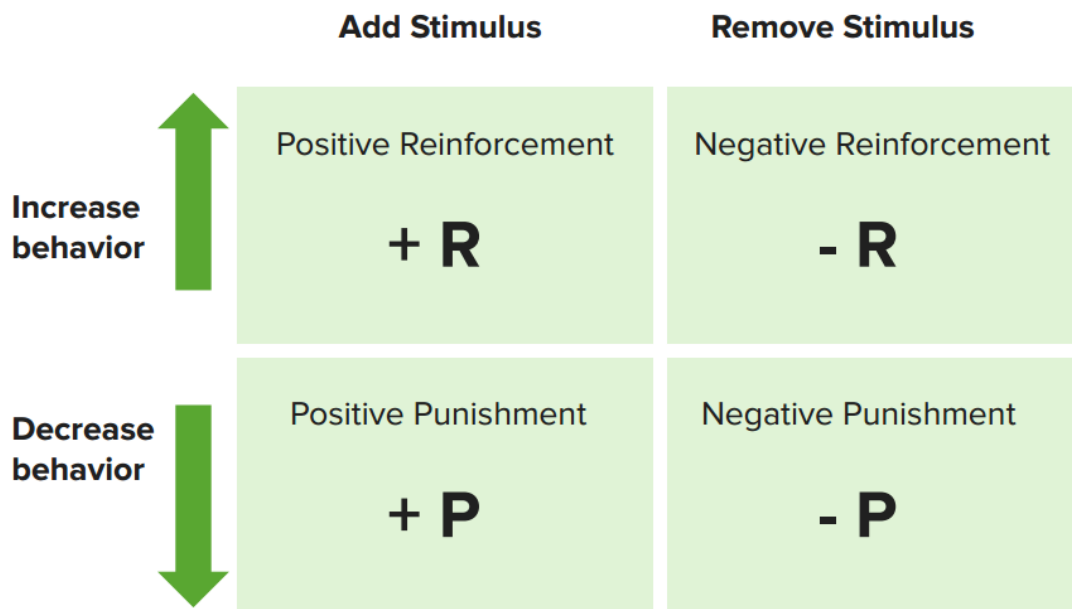
There are four important intermittent reinforcement schedules:

Fixed-ratio schedule	Variable-ratio schedule	Fixed-interval schedule	Variable-interval schedule
Provide reinforcement after a set number of instances of the behavior	Provide reinforcement after an unpredictable number of instances of the behavior (i.e. gambling)	Provided reinforcement after a set period of time that is	Provided reinforcement after an inconsistent period of time

Differentiation of Positive and Negative Reinforcement vs. Punishment

Behavior consequence will be...

	... added	... removed
Positive reinforcement	Positive strengthening (behavior increases)	punishment (behavior decreases)
Negative reinforcement	Punishment (behavior decreases)	Negative strengthening (behavior increases)



Escape and Avoidance Learning	
Escape	Avoidance
Learn how to avoid an aversive stimulus by engaging in a particular behavior	Perform a behavior to ensure the aversive stimuli is not encountered

More important terms and examples of operant conditioning

Term	Definition	Example
Primary reinforcement	Satisfaction of primary needs	Food, sleep, rest
Secondary reinforcement	Linking to primary reinforcement (social, material, etc.)	Praise, admiration, money
Emitted behavior	Spontaneously occurring behavior that can be reinforced	Dog lifts its paw, gets rewarded and repeats behavior
Prompting	Cue through initiating behavior externally	Acquisition of language
Fading	Gradual fading out of the prompts over the course of the conditioning process	Teacher gives tips to get the right answer and reduces the number of tips in the process
Shaping	Stepwise acquisition of complex behavior by rewarding subsequences	Toddler learns to tie shoes
Chaining	Learning complex chains of behavior, usually, the last element is reinforced first	Brushing teeth: toothpaste on the brush, clean various areas, flush, use dental floss, etc.
Premack-principle	Linking of a less favorable activity with a popular one	"First you have to eat the salad, then you'll get the dessert!"

The Reinforcement Plans

Reinforcement plans are consistent relations between behavior and consequence = contingency.

A high contingency is given, when almost every behavior results in a consequence, whereas we speak of low contingency when consequences follow just sometimes.

Continuous reinforcement means that every single desired behavior is strengthened.

Intermittent reinforcement means that just a certain number of all desired behavior is strengthened. A distinction is drawn between ratio plans and interval plans:

Fixed ratio plans	Consequence after fixed rate, e.g. every third time
Variable ratio plans	Consequence after variable rate, e.g. after the second, then the fifth, then the tenth time
Fixed interval plans	Consequence after fixed time interval, e.g. every five minutes
Variable interval plans	Consequence after variable time interval, e.g. after 5, then after 10, then after 15 minutes

Important: While continuous reinforcement leads to fast learning, skills are more resistant to erasing if reinforcement occurs intermittently.

Learning by Understanding: Cognitive Learning

Learning by understanding means that we come to a solution by understanding the circumstances. Hence, the person gets to a solution through pure reflection, not through an outward visible and observable experience. The „**light bulb moment**“ falls in this category of learning by understanding: A sudden flash of inspiration leads to understanding and **solution-oriented behavior** respectively. This approach can then be extrapolated to other situations (example: math problem).

Model-based Learning: Observational Learning

Note: Observational learning is also known as social learning or vicarious learning.

Behavior is learned with **potentially positive or negative consequences** using a model: Other people are observed and their **behavior is imitated** and learned in this manner. Consequently, there's neither reinforcement nor consequences for the observer.

Many pro- and antisocial behaviors become conceivable through observational learning.

Examples:

- Fear of spiders or mice that are conveyed through media and social environment (parents, siblings)
- Xenophobia
- Cooperativeness

Biological processes that affect observational learning

Mirror neurons are found in several brain regions including:

- Premotor cortex
- Primary somatosensory cortex
- Inferior parietal cortex

These neurons fire when a task is performed and/or when that same task is observed. Thought to help us understand the action of others and help us learn through imitation. They are potentially responsible for vicarious emotions such as empathy.

Learning by Self-control

Behaviors are learned by initial model-based learning and operant conditioning. Based on this, we create our own expectation-patterns for ourselves. The intrinsic factors of self-control, self-criticism and self-confirmation now replace outside reinforcement and punishment.

Example: A child is taught that leisure activities can only be enjoyed after achieving something. As an adult such people only take a break if their self-imposed work plan for the day is met, otherwise they do not.

Habituation, De-habituation, and Sensitization

Habituation	Adaptation to a recurrent impulse. The intensity of reaction decreases with repetition. (Though no habituation to pain)	Contact lenses, tactile impulses of clothing
De-habituation	“Weaning from habituation” Recurrence of the reaction after habituation through an interspersed, different impulse	If the permanent siren sound of an ambulance suddenly changes, then we notice the already faded out sound again
Sensitization	Opposite of Habituation. Increase in reaction intensity, which increases with repetition	

Theories of Attitude and Behavior Change

Elaboration likelihood model is a dual process theory describing changes in attitude and behavior.

Key elements of persuasiveness:

Message characteristics	Source characteristics	Target characteristics
Logic and number of key points, length, grammatical complexity	Level of expertise, knowledge, trustworthiness	Of the person receiving the message like self-esteem, intelligence, mood

Elaboration likelihood model

The model proposes two major routes for persuasion:

- **Central route** — people are persuaded by the content of the argument
- **Peripheral route** — focus on superficial or secondary characteristics

People will choose central route only when they are both motivated and not distracted. Processing via central route will have longer-lasting persuasion vs. peripheral route.

Social Cognitive Theory

The social cognitive perspective incorporates elements of cognition, learning, and social

influence. Social cognitive theory is a theory of behavior change that emphasizes the interaction of people and their environment. Social factors, observational learning, and environmental factors can influence attitude change.

A reciprocal determination is an interaction between a person's behavior, personal factors, and environment (situational factors). Three ways that individuals and environments interact:

- Individuals chose their environment which in turn shapes them (i.e. neighborhood, campus)
- Personality shapes how individuals interpret and respond to their environment
- Individuals personality influences the situation to which they then react to

Clinical Reference: Application of Learning Models in Therapies

Step 1: development of fear

Behavior therapy is especially used with an **anxiety disorder** (phobia). **Classical conditioning processes** play a major role in the development of fear, whereas sustainability is achieved by operant conditioning. The linking of stimulus and reaction (such as fear of black cars, winding up in an accident) can be sustained for years through **avoiding the anxiety-inducing stimulus**.

Step 2: analysis of behavior

A therapist would create an analysis of behavior with the **SORCC-Model**. Here with the example of fear of black cars.

SStimulusSight of black cars
OOrganismNegative experience with black cars in childhood
RReactionStrong anxiety, avoidance, stimulus control
CContingencyPower of the connection between R and C
CConsequenceEasing of fear through avoidance (negative reinforcement)
If the therapist makes a clear diagnosis with regard to the circumstances of the fear, he will try to initiate a behavior modification. **Erasing of fear** can be achieved if the affected person confronts the object of fear and recognizes that it doesn't pose any danger. To this end, confrontation therapies are applied.

Step 3: confrontation procedure

Systematic desensitization

The systematic desensitization describes a procedure in **three steps**:

- **Relaxation training:** learning to consciously relax in situations of fear, e.g. with progressive muscle relaxation technique (according to Jacobson)
- **Fear hierarchy:** rank situations depending on the threat level
- **Confrontation in situ or in vivo:** In the relaxed condition, the patient is presented with confrontation situations at various levels of the fear hierarchy until the patient can stay relaxed while being confronted with the object of fear at the highest level.

Flooding

Stimulus saturation is no stepwise process but presents a **sudden, intense confrontation** with the object of fear/situation of fear. Flooding shall prove to the afflicted person that there's no real danger to expect from the stimulus.

Cognition

Cognition is perceived (lat. cognoscere = experience, recognize) as the complex comprising **perception, consciousness, thinking, recognition, and memory.**

Attention and perception

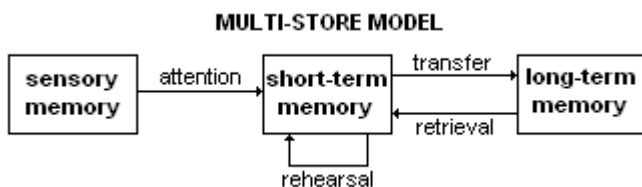
Attention: Heightened vigilance and selective focus of perception, thinking, and action = condition of intense consciousness

Perception: We gain information about outside and the inner world through perception. Exteroception is the term for perception of the environment through the senses and interoception the inner perception of own physiological processes.

Perception can be selective, strengthened, subliminal, or impaired. Perception disorders include:

- **Agnosia:** sensory organs are intact, patient, however, is unable to recognize the perception (e.g. „apple“ is described as a round red thing)
- **Prosopagnosia:** faces can't be recognized

Memory



Memory is able to save information (encoding) and later to reproduce (decoding) or recognize it. We distinguish **sensory memory, short-term and long-term memory.** Keeping information is called retention.

- **Sensory memory** (ultra-short-term memory): visual impulses of the environment are saved in the iconographic memory for one second, auditory information in the echoic memory for two seconds
- **Short-term memory:** „interstation“, a part of the information is taken out of the sensory memory and if necessary transferred to the long-term memory: 7 +/- 2 elements can be kept up to 20 seconds
- **Long-term memory:** retention for minutes to years

Subdivision of the Long-term Memory

Note: The episodic memory is responsible for the knowledge about our own periods of life, the semantic memory is our memory for facts.

Amnesia and Memory Disorders

Most important forms of amnesia

Anterograde amnesia	Memory gaps in the period after the harmful incident (e.g. Polytrauma)
Retrograde amnesia	Memory gaps in the period before the harmful incident
Dissociative amnesia	Sudden inability to remember (mostly upsetting) incidents or information

Most important memory disorders

- **Korsakow-Syndrome:** persistent amnesic disorder caused by alcoholism, marked with extreme confusion, neurologic abnormalities, and **confabulation** (memory gaps are re-recorded with imaginary stories)
- **Dementia:** Loss of brain functions including memory. Reasons of dementia can be alcohol, drug abuse, or brain lesions like strokes. The degenerative disease of **Alzheimer's** makes up the bulk of dementia
- **Perseveration:** Persistence on certain memory contents, repetition of thoughts, language contents (Reason: fatigue, drugs, degenerative)

Speech and Language

We use language for interpersonal communication of thoughts, desires, and feelings and hereby use many symbols. Broca-Area und Wernicke-Area is responsible for language generation and speech comprehension. Central speech disorders are called aphasia. We talk about **global aphasia** if both, speech comprehension and language production are impaired.

	Function	Localization	Aphasia
Broca-Area	Language production	Frontal convolutions of the dominant hemisphere (on the left side for right-handers)	Motor, expressive aphasia (speech comprehension is intact)
Wernicke-Area	Speech comprehension	Parietal frontal lobe of the dominant hemisphere	Sensory, recipient aphasia (speech comprehension is impaired)



Image: "Broca's and Wernicke's Areas" by Phil Schatz. License: [CC-BY 4.0](https://creativecommons.org/licenses/by/4.0/)

Theories of language development

Language acquisition is the process by which children learn to understand and speak their native language. Theories used to explain language development include:

- Nativist theory
- Empiricist theory
- Behaviorist theory

Nativist theory by Noam Chomsky

- Suggests all children have an innate language activation device (LAD)
- LAD is an area of the brain that has a set of universal syntactic rules for all

languages

- Idea was later renamed Universal Grammar (UG)
- LAD provides children with the ability to construct novel sentences using learned vocabulary
- Linguistic input alone is insufficient to explain how they learn language
- Certain rules must be innate in the brain (i.e. nouns, verbs, adjectives)

Empiricist

- General brain processes are sufficient for language acquisition, LAD is not needed
- Child need to be actively engaged in the environment
- Parent or caregiver will interact using child-directed speech (CDS)

Behaviorist theory by B.F. Skinner

- Suggests language acquisition through operant conditioning
- Uses positive reinforcement when imitating stimuli and correct responses

Positive reinforcement accomplishes:

- Conditions infant to make the sound associations with the stimulus
- Encourages imitative behavior

Influence of language on cognition

Language development has three stages:

Stage 3	Understanding of grammar and relationship; "inner speech"
Stage 2	Talking to themselves, experimenting; "egocentric or private speech"
Stage 1	Immersion in "social speech"

Review Questions

The answer key is located below the references.

1. The phenomenon of confabulation is observed with alcohol-addicted patients. What does this term mean?

- A. The patient can't recognize the faces of friends who visit him.
- B. A contrived and incorrect explanation of the differential stimulation of left and right cerebral hemisphere in order to make sense of the contradictory reactions.
- C. Exuberant, uncontrollable language generation with numerous neologisms.
- D. Persistence with one topic with many linguistic and content-related repetitions.
- E. Impaired speech comprehension caused by a lesion of the right brain hemisphere.

2. Following a polytrauma, Mrs. Z. suffers severe memory loss, especially relating to biographic contents. To her husband's amazement, she has no problem listing all 50 states of the USA. Recalling these facts proves that which of Mrs. Z.'s memory form is intact?

- A. Episodic memory
- B. Implicit memory
- C. Non-declarative memory
- D. Procedural memory
- E. Semantic memory

3. A man spends 8 hours a day playing real-time strategy computer games and now wants to stop doing this. He gets rid of his entire computer equipment at the buyback center. Which behavioral therapy technique is he most likely applying?

- A. Exposition
- B. Cognitive restructuring
- C. Self-strengthening
- D. Shaping
- E. Stimulus-control

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Correct answers: 1B, 2E, 3E

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Notes