

Notes on Learning and Cognition – Chapters 5 and 7

Essential Questions:

- *How do psychologists define learning?*
- *How do principles of classical conditioning work to create learning?*
- *In what ways does classical conditioning work in human contexts?*
- *How do principles of operant conditioning work to create learning?*
- *In what ways does operant conditioning work in human contexts?*
- *How do principles of observational learning work to create learning?*
- *In what ways does observational learning work in human contexts?*
- *How are the various principles discussed different and similar?*
- *How do humans think?*
- *In what ways is thinking flawed or constrained? How can people avoid falling for these errors in thinking?*
- *How do humans acquire language?*
- *How do humans use language to communicate ideas?*
- *How is language flawed or constrained? How can people avoid falling for these errors in using language?*

1	Describe the elements of classical conditioning.
2	Apply classical conditioning to different situations.
3	Describe the elements of operant conditioning.
4	Differentiate among the various forms of reinforcement and punishment.
5	Apply elements of operant conditioning to different situations.
6	Describe observational learning.
7	Describe how biology influences learning.
8	Describe how cognition influences learning.
3	Describe the characteristics of language and evaluate the importance of language.
4	Define a concept, explaining why it is useful to problem solving.
5	Differentiate between algorithms and heuristics.
6	Analyze how fixation, confirmation bias, heuristics, overconfidence, framing, and belief perseverance influence the ability to solve problems.

I. Classical Conditioning (Pavlovian conditioning or contiguity model of conditioning)

- . *Learning* – a relatively permanent change in behavior acquired through experience
- . *Classical conditioning* - is the process of leaning by which a previously neutral stimulus comes to elicit an identical or similar response to one that was originally elicited by another stimulus as the result of the pairing or association of the two stimuli
 - 0. Unconditioned stimulus – a stimulus that elicits an unlearned (reflex) response
 - 0. Unconditioned response – an unlearned response to stimulus
 - 0. Neutral stimulus – a stimulus that before conditioning does not produce a particular response
 - 0. Conditioned response – an acquired or learned response to a conditioned stimulus
 - 0. Conditioned stimulus – a previously neutral stimulus that comes to elicit a conditioned response after it has been paired with an unconditioned stimulus

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Phase 1: Before Conditioning		
(a)	US →	UR
(b)	NS →	No response
Phase 2: During Conditioning (acquisition process)		
(c)	NS + US →	UR
Phase 3: After Conditioning [or higher order conditioning]		
(d)	CS →	CR

· *Pavlov's Experiment:*

- 0. Pavlov received the Nobel Prize for his work on digestion (by putting windows into the digestive track he could see what was happening) and this is how he stumbled into his work on learning.

Phase 1: Before Conditioning		
(a)	US → (food)	UR (salivation)
(b)	NS → (bell, tone)	No response
Phase 2: During Conditioning (acquisition process)		
(c)	US + NS → (food + bell)	UR (salivation)
Phase 3: After Conditioning		
(d)	CS → (bell)	CR (salivation)

0. Robert Rescorla

- revised the Pavlovian model to take into account complex circumstances
- Rocco – presented a bell paired with the food 10 times
- Sparky – presented a bell paired with the food five times and without the bell five times
- Contingency model of conditioning states that both dogs would respond the same since they experienced 10 pairings

· *Watson's Experiment (with "Little Albert")*

Phase 1: Before Conditioning		
(a)	US → (noise)	UR (scared feeling)
(b)	NS → (white rat)	No response
Phase 2: During Conditioning (acquisition process)		
(c)	US + NS → (noise + rat)	UR (scared feeling)
Phase 3: After Conditioning		
(d)	CS → (rat)	CR (scared feeling)

· *Key variables in Classical Conditioning*

0. strength –

- the stimulus must be strong enough to illicit a response
- ex. – puff of air in the eye at the eye doctor's office

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- 0. timing –
 - . the neutral stimulus must be paired with unconditioned stimulus close enough in time for the two to be connected
 - . ex. – punishing a dog for an “accident” that happened hours ago
- 0. frequency –
 - . stimuli must be paired often enough to permit pairing
 - . ex – in Pavlov’s experiment, if the bell was sounded only twice chances are the dog would not pair the unconditioned and neutral stimulus
- . *Key terms in Classical Conditioning*
 - 0. Extinction – presenting the CS without US, the CR decreases with every trial until the behavior ceases
 - 0. Spontaneous Recovery – once the behavior is extinguished it can reappear after a rest period
 - 0. Stimulus Generalization – an organism develops a CR to a stimulus that is similar but not identical to the original CS
 - 0. Stimulus Discrimination – process by which an organism learns to respond only to a specific stimulus
- . *Garcia’s Experiment*
 - 0. John Garcia gave animals specific food or drinks and then induced sickness or nausea to *conditioned taste aversion*
 - 0. Results of the experiment:
 - . Taste aversion could be established even if nausea is induced several hours after the food and drink is administered
 - . Not all stimuli can become associated (tried bells and lights with nausea)
 - . Condition taste aversion is known as the **Garcia Effect**

Phase 1: Before Conditioning		
(a)	US → (drugs, radiation)	UR (sickness, vomiting)
(b)	NS → (food)	No response
Phase 2: During Conditioning (acquisition process)		
(c)	US + NS → (drugs, radiation + food)	UR (scared feeling)
Phase 3: After Conditioning		
(d)	CS → (food)	CR (sickness, vomiting)

II. Operant Conditioning

- . *Operant Conditioning* – the process of learning in which the consequences of a response determine the probability that the response will be repeated
- . *Key Concepts in Operant Conditioning*
 - 0. *Reinforcer* - any stimulus or event that increases the probability of the recurrence of the response that preceded it
 - . *positive* – presentation of a stimulus after a particular response in order to increase the likelihood that the response will recur
 - . *negative* – removal of a stimulus
 - . *primary reinforcer* – that has survival value for an organism such as food, water, or the termination of pain
 - . *secondary reinforcer* – any neutral stimulus that initially has no essential value but that becomes rewarding when linked to a primary reinforcer

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- e. *generalized reinforcer* – it can be traded for anything (ex. - money)
- 2. *Punisher* – decreases the likelihood that the behavior targeted will recur
 - a. studies show that punishment alone is a limited in changing behavior and should be used with a reinforcer for better results
 - b. punishment may suppress undesired behavior, but it does not eliminate it
 - c. punishment does not leach new behaviors
 - d. punishment can have undesired consequences
 - e. punishment may become abusive
 - f. punishment may represent a form of inappropriate modeling
- 3. *Chaining* –
 - a. subjects can be taught to perform a number of responses successively in an order to get a reward
 - b. the goal of chaining is to link together a number of separate behaviors into a more complex activity
 - c. *Ex:* running an obstacle course, a child’s bedtime ritual
- 4. *Extinction* – the gradual weakening and elimination of an operant response when it is not reinforced
- 5. *Escape Learning* –
 - a. learning responses that result in escape form an aversive stimulus
 - b. A motorist learns a detour that provides an escape from congested traffic
- 6. *Avoidance learning* –
 - a. learning responses that result in avoidance of adverse stimuli
 - b. a motorist listens to the radio traffic report to avoid a traffic jam

C. Thorndike and the Law of Effect

- 1. Law of Effect: Rewarded behavior is likely to recur.
- 2. Thorndike (who liked working with animals than people) built a “puzzle box” for hungry cats which was a box with a simple task to perform (usually pulling a lever to open the box – food was placed on the outside of the box)
- 3. Instrumental learning: the consequence of the stimulus-response connection was instrumental in shaping behaviors.

D. B.F. Skinner

- 1. “Skinner Box” – a box containing a responding mechanism and a device capable of delivering a positive reinforcer when an animal made a correct choice and a consequence to an animal that made an incorrect choice

<p>www.cs.tcd.ie/research_groups/crite/personal/maclecture.ht</p>	<p>www.hermes-press.com/brainwash1.htm</p>	<p>tiger.coe.missouri.edu/t377/btools.html</p>
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2. “Baby Tender” - Skinner believed in his theory so much that he build and raised his only daughter in a modified “Skinner Box”
3. Shaping – the selective reinforcement of behaviors that gradually approach (approximate) the desired response paired with punishment. Skinner believed this was a way to speed up the learning process

. *Premack Principle*

0. This principle of operant conditioning originally identified by David Premack in 1965.
0. According to the principle, some behavior that happens reliably (or without interference by a researcher), can be used as a reinforcer for a behavior that occurs less reliably
0. Example: most children like to watch TV this behavior happens reliably and parents can use this to get children to do the dishes (“you will not be able to watch TV until the dishes are washed)

. *Key variables in Operant Conditioning*

0. strength,
0. timing,
0. frequency

. *Schedules of Reinforcement*

<u>Schedule of Reinforcement</u>	<u>Definition</u>	<u>Example</u>
fixed-interval	Reinforced after a fixed amount of time	Mail being delivered at a certain time, taking cookies out of the oven at 20 minutes
variable-interval	Reinforce the response after varying intervals	Re-checking e-mail
fixed-ratio	Reinforces behavior after a set number of responses	Paid on a piecework basis – say for every 30 pieces of art submitted
variable-ratio	Provides reinforcers after an unpredictable number of responses	Gambling and fishing

0. *ratio* – reinforced/rewarded behavior every time a behavior is demonstrated or number of responses made (instances of behavior)
0. *interval* – reinforcement every time period that behavior is displayed (having to do with time)
0. *fixed* – learning happens quickly
0. *variable* – learning is more consistent

. *Behavior Modification* – the systematic application of learning principles to strengthen adaptive behavior and weaken maladaptive behavior

0. learning principles into action
0. token economy program – a form of behavior modification in which tokens earned for performing desired behaviors can be exchanged for positive reinforcers

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I. Comparison of classical and operant conditioning

<u>Type of Conditioning</u>	<u>Basis of Learning</u>	<u>Adaptive Value</u>
<i>Classical Conditioning</i>	Association between stimuli	Provides a means of learning to respond to stimuli that signal the occurrence of other stimuli
<i>Operant Conditioning</i>	Association between behavior and consequences	Provides a means of learning behaviors that have rewarding outcomes or that avoid pain or other aversive stimuli

. Biology and Operant Conditioning

- 0. Researchers have found that animals will perform certain behaviors that go against their natural inclinations like rats will not walk backwards.
- 0. Instinctive Drift - researchers discovered a tendency for animals to forgo rewards to pursue their typical patterns of behavior

III. Cognitive Learning

- . *Cognitive Learning* – learning that occurs without the opportunity of first performing the learned response or being reinforced for it.

. Wolfgang Köhler

- 0. experiment with chimpanzees
 - . cage and bananas
 - . room and bananas
- 0. Insight Learning – the process of mentally working through a problem until the sudden realization of a solution occurs

. Tolman and Latent Learning

- 0. Tolman’s Experiment –
 - . Trained rats to run a maze where some were rewarded at the end of the maze and others were not rewarded (the rats which were rewarded learned the maze very quickly)
 - . Cognitive map – a mental representation of an area that helps an organism navigate its way from one point to another
 - . Latent Learning - Learning occurs without apparent reinforcement and that is not displayed until reinforcement is provided

. Observational Learning

- 0. learning by observing and imitating the behavior of others (modeling or social learning theory)
- 0. Bandura and the Bobo doll Experiment
 - . Showed some children films with an adult aggressively punching an inflated doll and other children a film with no aggressive behavior
 - . The children who saw the aggressive film most children were aggressive with the doll when placed in the room with it
- 0. Key variables in observational Learning
 - . Type and power of the model
 - . Learner’s personality and degree of independence
 - . Situation

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IV. Cognition

- . *Cognitive Psychology*
 - 0. the study of the overlapping fields of perception, memory, and thought with an emphasis on how people acquire, transform, and retrieve knowledge
 - 0. thinking: the process of mentally representing and manipulating information
 - 0. metacognition: thinking about thinking
 - 0. mental image – a mental picture or representation of an object or event

- . *Concept Formation*
 - 0. concepts – mental categories for classifying events, objects, ideas on the basis of their common features or properties
 - 0. concept formation – examination of ways people organize and classify events/objects
 - 0. Roshe and prototypes –
 - . When people are presented with “Fuzzy concepts,” they use prototypes to try to classify objects/ideas
 - . Prototype – an abstraction, an idealized pattern of an object or idea that is stored in memory and used to decide whether similar objects or ideas are members of the same class of items
 - . When comparing feathered creatures to a prototypical bird, such as a robin

- . *Problem Solving*
 - 0. the behavior of individuals when confronted with a situation or task that requires insight or determination of some unknown element
 - 0. many researchers try to study thought by examining the results of thinking
 - 0. researchers can ask participants to solve problems and then investigate how the solutions were reached
 - 0. Algorithm –
 - . a step by step set of rules that will always lead to a correct solution to a problem
 - . finding a square root, baking
 - 0. Heuristic –
 - . a rule of thumb for solving problems or making judgments or decisions
 - . a doctor trying to rule out what is wrong with you, cooking
 - 0. Analogies –
 - . a problem-solving strategy that applies knowledge gained from solving similar problems in the past to the problem at hand
 - . Alexander Graham Bell noticed when studying the ear that sounds were transmitted when the membrane (eardrum) vibrated. He applied this knowledge to his design of the telephone.

- . *Creativity* – s quality of thought and problem solving that is generally considered to include originality, novelty, and appropriateness
 - 0. Convergent thinking – the attempt to narrow down the range of alternatives or choices to arrive at the one correct answer to a problem
 - 0. Divergent thinking – the ability to widen the range of possibilities and expanding the options for solutions
 - . Brainstorming – technique that involves considering all possible solutions without making prior evaluative judgments

- . *Decision making* – assessing and choosing among alternatives
- . *Syllogism* – a sequence of statements, or premises (usually two), which are assumed to be true and are followed by a conclusion; the task is to decide whether the conclusion is valid
 - 0. Premise 1: All poodle are dogs
 - 0. Premise 2: All dogs are animals
 - 0. Conclusion: All poodles are animals

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G. Mental Roadblocks to Problem Solving

0. Mental set (or rigidity) – is the tendency to rely on strategies that worked in similar situations in the past but that may not be appropriate to the present situation
 - . Ex - not studying for a test
0. Functional fixedness – is the inability to see that an object can have a function other than its stated or usual one
 - . Ex - raincoat can also be a windbreaker
0. Gambler's Fallacy – is the belief that the chances of an event occurring increase if the event has not recently occurred
0. Belief in small numbers – is where people are willing to draw conclusions from a small sample of people
 - . Ex - political polling
0. Availability Heuristics – the tendency to judge events as more likely to occur when information pertaining to them comes readily to mind
 - . Ex - flying & airplane crashes
0. Representativeness Heuristic – judging a situation based on how similar the aspects are to the prototypes the person holds in his or her mind
 - . Ex - a person may judge a young person as more likely to commit suicide because their prototype of a young person is of a depressed young person
0. Overconfidence – is when people overestimate the soundness of their judgments and the accuracy of their knowledge
 - . Ex - belief that you cannot get pregnant the first time you have sex
0. Confirmation Bias – is the tendency to maintain allegiance to an initial hypothesis or belief system despite strong evidence to the contrary
 - . Ex - smoking
0. Framing – is the tendency for decisions to be influenced by how potential outcomes are phrased
 - . Ex - which explanation would use to explain your date to your parents?

V. **Language**

- . Language – a system of symbols, usually words, that convey meaning and a set of rules for combining symbols to generate an infinite number of messages
 0. grammar – the set of rules governing how symbols in a given language are used to form meaningful expressions
- . Components or Structure of Language
 0. linguistics – is the study of language, including speech sounds, meaning, and grammar
 0. phonemes – are the basic unit of language, single letters and simple combination of letters (b, p, f, th,)
 0. morphemes – are the smallest units of meaning in a language (pre-test-ed = three morphemes)
 0. syntax – are the rules of grammar that determine how words are ordered within sentences or phrases to form meaningful expressions
 0. semantics – is the analysis of the meaning of language, especially of individual words
- . Language Development
 0. Learning theory
 - . Children learn language because it is reinforced
 - . Include both operant conditioning and observational learning

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- 2. Biological theory
 - . *Miller and Chomsky*
 - . *Language Acquisition Device (LAD)* (also known as nativist Theory of language acquisition) - is an Inborn ability to acquire, process, and facilitate language
 - . *Learning Readiness* – all human beings are born with a grammatical capacity and a readiness to produce language
- 0. Milestones in language acquisition:

<i>Age</i> (approximate)	<i>Vocal Activity</i>	<i>Description</i>
Birth	Crying	Crying expresses distress
Two Months	Cooing	Infant begins making cooing sounds (e.g., “aah” and “oooh”)
Six to twelve months	Babbling	Phonemes, the basic units of sound appear
Twelve months	One-word phrases (holophrases)	Baby imitates sounds and can understand some words; begins to say single words <u>Scaffolding</u> – modeling performance while thinking out loud, build on what is known
Eighteen to twenty four months	Two-word phrases or sentences	Vocabulary grows to about fifty words, and baby emits two word phrases or sentences <u>Telegraphic speech</u> – words are left out <u>Overgeneralized speech</u> – wrong tense “I goed”
Twenty four to thirty six months	Complex speech	Sentences become longer and more complex and include plurals and past tense; speech shows elements of proper syntax; vocabulary includes 500 – 850 words

- . *Transformational Grammar*
 - 0. *Noam Chomsky*
 - 0. *Surface Structure* – is the organization of a sentence in its written or spoken form
 - 0. *Deep Structure* – is the underlying meaning of the sentence
- . *Language Studies with Chimpanzees*
 - 0. *Washoe*
 - . *Gardner*
 - . taught to make signs using American Sign Language that stood for words as well as simple concepts
 - 0. *Sarah*
 - . *Premack*
 - . Learned to associate picture symbols (an icon) with the real object
 - . Learned compound sentences, answer simple questions
 - 0. *Lana*
 - . Learned to interact with a computer and demonstrated rudimentary language acquisition
 - 0. *Nim*
 - . *Terrace*
 - . Acquired many words but did not use them in sentences as time went on

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F. Culture and Language

0. Whorf and the Eskimos study

- . *Linguistic Relativity Hypothesis* – is the proposition that the language we use determines how we think about the world and how we perceive the world (also called Whorfian Hypothesis)

0. Rosch and the New Guinea study

- . The tribe had only two words for colors; mili (dark, cool colors) and mola (warm colors)
- . Tribe members were asked to recognize different colors and even though they only had two words for colors, they were able to recognize colors
- . Findings: refuted Whorf's findings

Notes based on information from the following sources:

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