

# Week 1: foundations and themes in cognitive psychology

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Week 1: Foundations & Themes in Cognitive Psychology -Where do nativists think knowledge comes from? Where do empiricists think knowledge comes from? Nativists think knowledge comes from inborn characteristics of the brain, that is we are predisposed to learn certain things. Empiricists think we start out with a blank slate and acquire knowledge through experiences with the world. -What is Behaviorism? What do behaviorists study? What don't behaviorists study? Behaviorism is the idea that the mind cannot be observed and that psychologists should only study things that are observable through behavioral patterns, such as classical/operant conditioning -What was the Cognitive Revolution and what brought it about? The cognitive revolution happened with advancement in technology. The idea was that understanding mental processes that aren't observable are still essential. Advances in computers allowed ways to simulate brain functioning, facilitating the emergence of cognitive psychology. -What is Cognitive Psychology? The study of the internal structures and processes involved in making sense of the environment. (Allow us to think, create representations and make decisions) -What are some examples of cognitive structures and of cognitive processes? What is the difference between structure and process? Structure: Sensory systems (eyes/ears), Attentional Systems, Perceptual Systems, Memory Systems, Language Systems, Response Systems. Processes : Transduction, Excitation/Enhancement, Inhibition/Suppression, Encoding, Elaboration, Retrieval The difference is that Cognitive structures are physical aspects, whereas Cognitive Processes are neuronal processes that aren't physically there. -How do cognitive psychologists study the mind? -What is the Information Processing Model of

Cognition? What are its assumptions? Events happen in a time ordered fashion. Mind processes in sequence of steps and there are unique processes at each step. Assumptions: Stages are sequential, Unique processes at each stage, each stage receives and passes on information. -What is the computer analogy? How does it help us understand the brain and thought? Analogy that the brain is like computer hardware, while the processes in the brain are like the software. -Why is Neuroscience important for understanding thought? -What is serial processing? What is parallel processing? How are they different? Serial processing processes things one at a time, whereas parallel processing processes things simultaneously. -What are the common research paradigms/methods used to study cognitive psychology? Reaction Time studies: measuring the amount of time to complete cognitive tasks Eye tracking studies: evaluation of eye fixation/movement Psychophysics: study relationship between stimuli and the evoked sensations/perceptions. Single Cell studies: measuring how a single cell responds to a particular stimulus Priming studies: evaluate the impact of previously presented stimuli on cognitive process or behavior. Lateralization studies: studies differences between functioning of the 2 brain hemispheres. -What is bottom-up processing? What is top-down processing? Bottom up: driven by stimulus itself without any preconceived idea to interpret it. Top down: controlled by an expectation or prior knowledge. -What is automatic processing? What is controlled processing? Automatic processing: executed without conscious intent, unaffected by demands on attentions, runs to completion. (such as reading) Controlled processing: executed with conscious intent, affected by demands on attention, easily disrupted, requires effort. (such as learning

how to read) -What is distributed processing? What is localized processing?

Week 2: Cognitive Neuroscience, Laterality, & Cognitive Disorders -What is the object of cognitive neuroscience research? Study the brain structures and processes involved in mental activities. -What are the benefits of studying cognitive psychology and neuroscience together? Map out cognitive processes, understand neurons and how brain structure changes and relating these structure changes to specific brain functions. -What (3) functions do neurons serve? Receive information from other neurons, integrate the information and transmit the signals to other neurons or muscles. -How do neurons communicate? Action potentials release neurotransmitter that binds with other neurons, telling it to either send another signal to other neurons or to inhibit the action potential from continuing to other neurons -What are the three main parts of a neuron and what are their functions? Dendrites receive information from the previous neuron. Cell Body integrates this information and sends it down the axon during an action potential Terminal buttons release the neurotransmitters to be received by the next neuron -What is an action potential? What triggers an action potential? It is when the neuron fires, sending the message down the axon so it can release the N. T to the next neuron. It is triggered with enough excitation which happens when the neuron depolarizes and reaches threshold of -55mV (this opens ion channels along the axon) -How do single neurons represent information? How do groups of neurons represent information? -How is information permanently represented in the brain? Long term potentiation: when neurons that communicate often become more sensitive to receiving messages from each other. This is how learning occurs.

(cells that fire together wire together) -What/where are the that structures make up the hindbrain? What are their functions? Medulla: Controls vital functions like heart rate, breathing Pons: Being awake/arousal. Relays info to cortex/subcortical structures. Cerebellum: Coordinated movement, balance and higher order cognition like procedural memory, language production (fluency) and emotion functions. -What/where are the subcortical structures and their functions? Located within the hemispheres below the cortex Striatum: movement Thalamus: sensory relay Hippocampus: forming new memories Amygdala: primal emotional responses (fear, anger) Hypothalamus: Basic survival drives (fighting, fleeing, eating, mating) - What/where are the lobes of the brain and what processes to they control? Frontal Lobe: primary motor cortex controls movement. Prefrontal cortex involved in impulse control, logic/reasoning, long term planning, cultural norms. Parietal Lobe: Somatosensory cortex registers sense of touch. There's more cortical area for areas with most sensitivity (face, fingers) Also involved in spatial relationships (where things are physically) Occipital lobe: Primary visual cortex--info goes here first then gets passed into other areas of the Occipital lobe Temporal Lobe: Primary auditory cortex (hearing) and language comprehension and verbal memory. -What do superior, inferior, anterior, posterior, dorsal, and ventral refer to? The location of specific brain areas. Superior/Dorsal = top. Anterior= front Posterior = back Inferior/Ventral = bottom -What kind of information is dominant in the left hemisphere, and in the right hemisphere? Language is dominant in the left hemisphere, and spatial location is dominant in the right hemisphere -How do the two hemispheres of the brain communicate? Through contralateral

connections. The right side of the body is controlled by the left side of the brain. Information from both hemispheres get passed by the corpus callosum. -What is a split-brain patient? What information can they verbalize? What information can they draw? Someone who has their corpus callosum separated. They verbalize whatever went through the left/language hemisphere (right eye). They will draw what they see from the left eye. - What are the different types of brain imaging technologies? What kind of information does each provide? 1. EEG & ERP - used to record neuron events. Used to detect sleep patterns. Looks like waves . Continuous recording of neural activity. Excellent temporal resolution. Poor spatial resolution. 2. CT Scans - 180 degree x-ray. Not much resolution but examin structure. 3. PET Scans - Patients drink radioactive isotope which then allows us to see the structure of the brain. 4. MRI - uses magnetic field to get brain scans. Is just a picture but a high resolution of the structure of the brain. 5. fMRI - functional magnetic resonance imaging. Tracks blood oxygenation. Infer areas of the brain active in cognitive processes, very slow though. Measures magnetic fields generated by neural activity. Excellent temporal resolution. Good spatial resolution. -What does contralateral mean? How does it apply to the brain? Taking place or originating in a corresponding part on an opposite side. It applies to the brain in the sense that we use both hemispheres of the brain. -What are brain lesions? What causes them? Do they have consequences for processing? A lesion is a loss of tissue in the brain. Can be caused by stroke, anoxia, head trauma, ischemia, cerebral hemorrhage etc. consequences for damage depends on where in the brain the damage occurred. Most commonly affected areas are: planning and control,

perception and attention, language, and memory are affected -What determines if/how well we recover from brain lesions? Lesion location, size of damage, and age. -What disorders arise from lesions to the frontal lobes? What disorders arise from lesions to the parietal lobes? What disorders arise from lesions to the language areas (frontal and temporal)?

1. Frontal Lobes - deficit in short term memory, deficits in strategic long term memory, deficits in inhibitory control, decision making.
2. Parietal Lobes - visual agnosia, prosopagnosia (can't recognize faces), capgras syndrome (think everyone is a doppelganger), visual neglect(ex. only draws half of the picture. happens in the RH so they neglect everything in the LH).
3. Language - Anomia (no word recognition), Broca's, Wernicke's (can make speech but it doesn't make sense), Conduction (connects Broca's and Wernicke's).
4. Memory - Retrograde (can't remember people, places, events), Anterograde (cannot form new memories).

Week 3: Sensation, Attention, & Perception -What is sensation? What is perception? What is the difference between the two?

Sensation - The transduction of physical energy into neural impulses.

Perception - The organization and interpretation of sensory signals.

Difference is one is actual neural firing and the other is an interpretation and organization of it. -What senses do we have?

1. Chemical (olfaction, gustation)
2. Somatic senses (touch, temperature, pain, kinesthetic)
3. Audition (hearing)
4. Vestibular sense (balance and accelerations)
5. Vision.

-What is a sensory threshold? What is a Just Noticeable Difference? How do we measure these in people?

1. Absolute - minimum level of energy needed for detection. Response criterion varies from individual to individual.
2. Just-noticeable-differences (JND) - Weber-Fechner law: smallest deen two stimuli.

Ex. weight in one hand how much difference does it need to be to detect it. -

What is Signal Detection Theory? Why is it important for understanding sensitivity? Method for detectable difference between separating the sensitivity of an observer from his/her response bias. Manipulate presence or absence of signal. It helps us understand where to draw the line on hearing sensitivity. -

What is a hit? What is a miss? What is a false alarm? What is a correct rejection? Hit - You heard a signal and detected a signal. Miss - There was a signal but you didn't detect it. False Alarm - Said there was a signal but there wasn't one. Correct rejection - There was no signal and you didn't detect a signal. -What is a response criterion? What happens to hits and false alarms with a lax response criterion? What happens to hits and false alarms with a strict response criterion? Response criterion is where you draw the line on you hearing sensitivity. How sure do you have to be before you say yes that the sounds was there. We have to pay attention to when people are right about the signal and when they were wrong about the signal. A lot of hits and false alarms with a lax criterion. Strict, not as many hits or false alarms. -How does attention mediate between sensation and perception? -What is sensory memory? How many sensory memory systems do we have? A temporary memory for sensory information that lasts a short amount of time until attention picks up certain information. We have a memory system for each sense. -Is the capacity of sensory memory relatively large or small? the partial report procedure suggests that capacity it quite large. -Is the duration of sensory memory relatively short or long-lived? relatively short lived -What is iconic memory? How do we measure it? Visual memory. Measured by the whole-report procedure (letters flash quickly and participant writes down the



letters they saw) -What is echoic memory? How do we measure it? Is echoic or iconic memory more long-lived? Auditory memory, measured by selectively probing one channel when information has been received from 3 different orientations. Echoic memory is more long-lived because we process language -Is information lost from sensory memory due to decay, interference, or both? -What directs visual attention? -How does Broadbent's filter theory propose auditory attention works? only the information attended to goes into perception. Too much sensory information causes a bottleneck. -How does Treisman's attenuation theory propose auditory attention works? what you attend to goes through but other things come through at a lower level as they get pushed down/degraded -How does Deutsch & Deutsch's late selection theory propose auditory attention works? All the information gets to perception, the filter happens at the response. -Which theory has the most empirical support? What is this empirical support? Attenuator theory. Support from dichotic listening task, monitoring correct detection. 87% correct detection in shadowed ear from the study -How much attention do automatic processes require? How much attention do controlled processes require? automatic processes require very little attentional resources. Controlled processes require more attention. -Can a controlled process become an automatic process? How? Controlled process can be something we are learning, like how to read. At first this is very effortful. Once we learn how to do it, it becomes automatic. -What is the problem with doing more than one controlled task at a time? They both require demands on attention, makes it hard to do -Is automatic processing always most desirable? No, it is difficult to monitor automatic processes for errors, and the environment can

trigger an automatic process even though its inappropriate for the situation.

Week 4: Pattern Recognition -What is constructive perception? What is direct perception? Constructive: building up a perception based on previous experience/knowledge. Direct: Rely on the actual feature of the stimulus itself -What causes sensory illusions? The fact that we rely on heuristics to tell us how information typically works. -What is the Gestalt Theory about perception/pattern recognition? Stimuli work together to be more than their component parts. Theory that we are built to put individual pieces together into something meaningful. -What are the Gestalt Laws of Organization? Proximity: brain groups things that are closer together Similarity: Brain groups things that are similar in nature (shape, size, color) Continuity: seeing continuous lines Closure: closing in on an object to make it whole Common fate: group together things that move in the same direction or same rate - What is a canonical perspective? Where do canonical perspectives come from? We mentally represent patterns through permanent memories of the most representational view (ex: if we draw a cup, it is most likely drawn from a side view because this is the most common view from experience) -How does bottom-up info guide pattern recognition? How does top-down info guide pattern recognition? Which do we use? bottom up: the parts of the pattern initiate pattern recognition top down: recognition of the whole pattern leads to recognition of the component parts Bottom and Top processing happens simultaneously, however one process can be more dominant in certain tasks. -How does template matching theory claim we recognize patterns? What are the pros/cons of this theory? We create mental " templates" that are specific and true to form representations to store in

memory. We rely on this template for recognition of an object (like a dictionary) pros: simple cons: storage and search takes too long -How does prototype theory claim we recognize patterns? What are the pros/cons of this theory? More flexible version of a template, less rigid information, a more abstract representation of something with general features (ex: Betty Crocker images per decade) pros: flexible, empirical support cons: not very specific, hard to come up with specific predictions to test -How does distinctive feature theory claim we recognize patterns? What are the pros/cons of this theory? Focus on individual/distinctive features that combine together to create an object by starting with the whole object and decomposing it into parts. (ex: the letter A is composed of 2 lines with a crossbar, we recognize it no matter what angle) pros: straight forward, compatible with biological evidence cons: characterizing distinctive features -How does geon theory claim we recognize patterns? What are the pros/cons of this theory? All objects can be decomposed into basic 3D shapes. When we perceive an object, we break it apart by the 3D geons that its comprised of and then we match it to something familiar in memory to determine what it is. Pros: straight forward and specific cons: cannot identify scenes, only objects. -Does context affect pattern recognition? What empirical evidence supports this? -Do we recognize faces and scenes as a whole pattern, a collection of features, or both? What empirical evidence supports this?