9.00 – Fall 2001 - MidTerm Study Guide
Week 1 – Introduction
Lecture 1, Gray Chapters 1 &2, HTMW 3-21
Note – Inspiration for the organization of this outline can be found in Gray pg. 3

I.   Psychology is a set of questions: *How do we solve...*

The Scene Analysis Problem
Motor control – Why are there no wheels in nature
What is common sense?
Why do fools fall in love?

II.   Psychology is a set of theories and procedures for asking and answering questions
- Fact – An objective statement based on direct observation that reasonable observers agree is true
- Theory – An idea that is designed to explain existing facts and make predictions about new facts
- Hypothesis – Prediction about new facts that is made from a theory

Three Dimensions to Research
A.   Research Design
   i.   **Experiment** – A systematic manipulation of one or more *independent variables* to observe changes in *dependent variables* (Affects of treatment on depression)
   ii.   **Correlational Studies** – Observation or measurement of two or more variables to find a relationship among them (Televised violence and aggressive behavior)
   Correlation can identify lawful relationships but do NOT tell us in any way whether a change in one variable is the cause of a change in the other
   iii. **Descriptive Studies** - Description of the behavior of an individual or set of individuals without systematically investigating relationships between the variables
   (% of mental disorders in a given community)
B.   Research Settings –
   i.   **Lab Study** – Facilitates researcher's ability to collect data or control conditions. Unnatural setting may influence behavior
   ii.   **Field Study** – Any research conducted in a setting other than the lab. Difficult to control
C.   Data Collection Methods –
   i.   **Self-report** – Questionnaires, interviews. Validity limited by subjects ability to report accurately their own behaviors
   ii.   **Observation** –Natural observation, tests. Limited by time, disruption of behaviors, unnatural

Statistics
- Variablity – degree to which numbers in a set differ from one another or the mean
- Standard deviation – measure of difference between individual score and the mean
- Correlation coefficient – strength and direction of a relationship between two variables

III. Psychology is a product of history
Philosophy
A.   Dualism – Human beings have 2 distinct entities – a material body and an immaterial soul.
     Descartes (1596-1650) – Only 'thought' belonged to the soul
B.   Materialism – (Hobbes 1600s) The soul is a meaningless concept. Nothing exists but matter and energy
C.   Empiricism – (Locke, Hume 1700's) – All human knowledge derives from sensory experience
Physiology
A.   Reflexology – All human actions can be understood as a reflex
B.   Localization of Function (Broca 1861; Flourens 1824)– Specific parts of the brain serve specialized functions in the control of mental experiences and behaviors
Darwin and Theory of Natural Selection – late 1800s
Psychology
A.   Wundt – (1800s) Mental processes, as products of nervous system, take time which can be measured
B.   Structuralism– (Tichener) Identify structures of the mind through *elementary* conscious experience
C.   Functionalism – (James) To understand an element of the mind, focus on its purpose and function
D.   Gestalt – (Late 1800s) The mind must be understood as an organized whole, not individual parts
E.   Behaviorism – (Watson, Skinner) The proper study of the mind is observable behavior
Modern Cognitive Psychology
A.   Piaget – (1896-1980) Behavior in terms of internal mental constructs
B.   Chomsky – (1928-) Language must be understood as a system of mental rules

Lecture 2 – Major approaches to Psychology I and II: Freud (Psychoanalysis) and Skinner (Behaviorism).

"Oh no, I have a 9.00 exam on Thursday, and it is very **impotent** for my grade!" -- a *Freudian Slip*

Terms associated with Freud

Ego	Phallic Symbols	Libido	"Anal" (-ly retentive)	Repression	Displacement
Id	Father Figure	Oral Stage	"Oral Fixation"	Denial	Intellectualization
Superego	Irrationality	Anal Stage	Oedipal Complex	Reaction-formation	
Conscious		Phallic Stage	Penis Envy	Projection	Psychotherapy
PreConscious	Fixation	Genital Stage	[Importance of Early	Rationalization	Free Association
Unconscious	Regression	Hydraulic Model	Childhood]	Sublimation	Freudian Slips

Terms Associated with Behaviorism

Stimulus	Classical Conditioning		Operant Conditioning	Schedules of Reinforcement
Response	Unconditioned Stimulus/Response		Reinforcement	Stimulus Generalization
Reinforcer	Conditioned Stimulus/Response		Successive Approximations	Stimulus Discrimination
	Pavlov		Equipotentiality	

Note: Fewer terms partly because more parsimonious theory.

Freud (1826-1939) – Enormous scope of theories, covering nearly all of human thought and behavior in well-organized but overly complex and often irrefutable (thus unscientific) way. Mostly focused on the invisible and unmeasurable, such as the unconscious. In contrast and opposition, as we will see below, Skinner's **Behaviorism** focused solely on the overt and measurable (responses). Modern CogSci has vindicated some of Freud's approaches (relating psychology to neurophysiology to evolution) though much specifics and especially strong positions have been debated and/or refuted.

Libido, the general energy derivative of all the power of sexual instincts that drive Darwinistic evolution by selection, which energy is purported to drive all of the nervous system and the psychology it supports.

Components of self: **Ego** ("I", reality, delay of gratification. Controls Id with Libido energy)
                                          Id (pleasure principle, indulgence, gratification of desire, uninhibited)
                                          Superego (conscience, anxiety, adoption of parents' rules)

Defense strategies of Ego: Denial, Repression, Reaction-formation

Primary Process Thinking – related to the Id, infant-like thoughts. Freud tried to tease out the voice of the Id through his psychoanalysis because he believed it would reveal true motivation. He always put more importance on unconscious. This includes (Freudian) interpretation of dreams, discussion of "phallic symbols" and father figures (and other symbolization – usually about sex and parents, and sometimes both!), Freudian slips, free association, neuroses based on Freudian stages.

Freudian Psychosexual Stages – Putative developmental epochs where the libido energy is focused on one (sexual) body part. If person does not advance beyond this stage (s)he is "fixated" there, with predictable adult behavior. Eg, someone fixated at **anal stage** may be anally retentive ("anal" – one of Freud's ideas that is very strong in popular 'psychology') or anally expulsive (messy).
      Fixation at the earlier **oral** stage can lead to adult character problems along the dependence dimension. Of course parents are blamed here – early weaning leads to over-independence and late weaning over-dependence.
      Passage through the **phallic stage** has symptoms that are gender-specific but both revolving around the penis (feminist criticism): boys have castration anxiety and Oedipal complexes, while girls develop penis envy. Unresolved girls supposedly date older men and may dominate, while boys who didn't pass thru phallic stage get their choice ☺! – homosexuality, asexuality, heterosexual promiscuity.

Criticisms of Freud – Unparsimonious (profoundly complex and convoluted). Untestable (hidden, unmeasurable entities). Unfalsifiable – Even if could quantify penis envy, record repression, and run a gel for rationalization (!), theory covers itself, such as how phallic fixation predicts all possible sexual dysfunctions; or a person debunking idea that he desires his mother could be accused of "denial," then upon logical argumentation perhaps "rationalization," and upon blaming Freudian for twisted theories: "projection!"

Behaviorism – BF Skinner. See above for list of terms. Fewer terms. Perhaps more scientific theory – more parsimonious. Fewer axioms and concepts to explain entire range of human behavior. Critics say too few.

Context: Reduction – absolute pendulum swing from Freudian psychology with all its complex, hidden entities. Behaviorism did not even deal with abstractions such as feelings, emotions, intentions (which it said to be emergent, perhaps noise created by the processing of stimuli to generate responses). Reduced and simplified to scientifically measurable and controllable entities of stimuli and responses, modulated by reinforcers (rewards). Strong version of model requires these to be external – need something overt to be measured. Goal is to get out of the head, and look solely at actions. Also allows study of animals – don't need (human-only, and fallible) report of mental state. Actions (behavior) does all the reporting necessary.
Context: not "in the blood" but response to environment. Movie "trading places" is based on Behaviorism – child (or in this case adult) is a product of the successive responses to the environmental stimuli presented to him, and the learned response patterns that result from reinforcement.

Behaviorists say behavior is learned by **Classical Conditioning** or **Operant Conditioning**.

Classical Conditioning – creating a conditioned response (CR) to stimulus (CS) by associating this stimulus with an already-existing stimulus (UCS) that commands an already-existing response (UCR). That is, exploit the existence of an UCR to an UCS (for instance salivation response to meat-presentation stimulus). Then couple the new stimulus, such as a bell (which will become the CS) to the UCS. The animal will give the response in the presence of the combined CS and UCS during training. Then all of a sudden, remove the UCS (the pre-associated meat-presentation stimulus) and just leave the bell. This still results in salivation which is terms a CR because it is now "conditioned" by the experiment to result from the bell, which is now the "conditioned" stimulus (CS). How does animal learn original association, if it is not "built-in" ? →

Operant Conditioning – generate a world with latent stimulus-reward pair ("if you press this lever, you will escape" or "if you study these notes, you will do better on the exam"). By kinetics, animal tries all the options, and its learning mechanisms do the work of computing the trends – strengthening the associations that lead to favorable outcomes. Soon, animal (eg you) learns to study the notes, or press the lever! From observable behavior point of view (remember intentions, desires are not part of Behaviorism), note-reading and lever-pressing behavior goes up markedly over time, and all non-note-reading and non-lever-pressing behaviors go down. Successive approximations.

Positive/Negative Punishment/reward. Positive=add, negative=take away. Reward = when 'correct' behavior. Punishment = when 'incorrect'. Example: positive punishment ("add" + "when incorrect") – actively punish for wrong behavior, eg spanking when child talks to strangers. **Negative Reinforcement** = ("take away" + "when correct") – remove an undesirable condition upon correct behavior, eg Stop quizzes at beginning of class when student start doing better.

Schedules of reinforcement – Fixed versus Variable, Ratio versus Interval.

Can pure behaviorism explain all human behavior?
Can behaviorism and conditioning explain creative expression, such as in Language? (Chomsky)
What about single-chance stimuli (man with gun)? – no time to learn associations – you will be killed.
Behaviorism responds by abstracting the stimuli (danger) and response (compliance), but this is just a way of giving behaviorist names to emotions and intentions and therefore brings down the theory. Meta strings. Not overt and measurable.

CogNeuro study guide

1. Some history

๏Descartes' **dualism**: two things in the world, body and mind:
  ๏**mind** - causes behaviour without being caused by anything; mind is an immaterial
    entity that is injected into the infertilised ovum at conception
  ๏**body** - controlled by mind
๏**problems** for dualism:
  ๏how does the mind interact with the body (causes it to do something) ?
  ๏evidence that mind / soul is tightly tied to physical details of body (brain): effects of
    stroke, surgery

2. The cognitive neuroscience approach

๏the mind is what the brain does (mind and brain NOT separate entities)
๏thinking is **information processing** by neurons
๏how did the brain develop the way it did ? -> evolution (cf. the material there)

3. Ways of localising brain function

๏**brain damage** with selective behavioural impairments as consequence - e.g aphasia,
  amnesia, split-brain patients
๏**behavioural tests**: dichotic / dichoptic presentation, dual-task (IF tasks use same
  mechanisms THEN interference ELSE no interference)
๏**neuroimaging** (PET, fMRI)
๏disruptive **electrocortical stimulation** (e.g. during neurosurgery)
๏**Wada-test**: use sodium amytal to block out activity of one cerebral hemisphere

4. Cognition = neural computation

๏**cognition** (language, thinking, perception, memory) = **neural computation** (cf.
  material on neurons and neural computation)
๏study mind's **data structures**: Posner's experiment (lecture slides, HTMW, p. 89)

Evolution

Is it possible for a blind, 'random' process of accrual to create the complex engineering solutions exemplified by organisms?

Subproblem 1: How could multiple interacting parts emerge? It is no good to have half an eye.
Subproblem 2: Could design emerge at all without a designer? The blind watch-maker problem.

Creationsism
- 1: complex designs did not emerge, but were created whole
- 2: there was a designer.

Natural selection
- Animals compete for survival in the environment. The conditions of the environment determine the conditions, or **selection criteria**, on the animals' survival.
- Populations contain natural **variation**, from spot mutations, copying errors, and heterozygocity in genes. Sometimes natural variation produces a feature that increases the chances of its (and its offprings') survival in the current environment. Over time and changes in the environment, the population characteristics shift to maximise the beneficial features.
- Isolated groups of one species may adapt to different conditions, and so diverge into multiple distinct species.

- E.g. Eyes did not develop in neat halves. Some light sensitivity can increase survival rates over no light sensitivty. In each generation, the individuals with greater sensitivity and acuity of response to light survive in larger numbers than their blind counterparts.

Evolution and Psychology
- The evolutionary-psychology attitude: to understand the brain (or any feature of human behaviour), think about what it evolved *for*. This is also known as **reverse engineering**.
- The *reason* for the development of a structure is its **ultimate explanation**. This is distinct from the **proximal explanation**, which deals with the current mechanism and function of the structure.

Ethics & politics of biology of mind
Lecture 5. Gray ch. 2; ch. 3: 90-97, ch. 6: 202-203. HTMW ch. 1: 44-56.

Learning is crucial to understanding the mind
- genome cannot code *all* information in brain
- differences exist across *cultures* (not necessarily ethnic groups)
- *learning* and *practice* exist in animals including humans

Genes are crucial to understanding the mind (e.g. sexual orientation)
- innate machinery *allows learning*
- different *species* have different behavior
- there are *universals* in human nature (e.g. homosexuality exists across cultures)
- some of human nature remains robust in *novel* environments (e.g. homosexuality oppressed)
- genes help to structure *brains* (e.g. hypothalamic nucleus)
- differences in intelligence, personality have a *heritable* component (e.g. twin studies)

Heritability
- measures genetic *differences*
- may only *indirectly* reflect genes
- depends on the amount of existing *environmental* variation
- *within* groups is unrelated to that *between* groups
- measured by comparing twins or siblings, or by pedigrees
- applies to most individual differences, including IQ, personality, and life outcomes

Sociobiological findings
- *human communities*: moderately large with multiple adults of both sexes
- *nepotism*: applies to child rearing, collaborations, violence, patriotism
- *mating patterns*: most cultures practice(d) a mixture of polygyny and monogamy
- *male violence*: often caused by sexual jealousy

Lessons from **evolutionary psychology**
- genes *indirectly* influence behavior
- psychology reflects biological survival and reproductive *fitness* in earlier environments
- behavior should be interpreted in its *natural context*
- evolutionary relationships (phylogenetics) justify cross-species *comparison*

Politics of genetics and evolution
- *race*: a recent, superficial and genetically minor division
- *sex*: related to small average differences in specific abilities, not general intelligence
- *eugenics*: biologically insignificant, totalitarian, likely biased, infringes on rights

Naturalistic fallacy
- *hereditarian* beliefs and *social Darwinism*
- *justification* of incarceration, inequality, capitalism

Deterministic fallacy
- neither genes nor environment are *sole determinant* of behavior
- personal *responsibility* for behavior changes behavior (Law of Effect)

The Brain

The nervous system is divided into two parts:

Peripheral Nervous System

1) Set of nerves that connect the central nervous system (brain and spinal cord) to the body's sensory organs, muscles, and glands. Two components: sensory and motor.
2) The peripheral motor system consists of two parts:
    i. skeletal motor system
    ii. autonomic nervous system
        1. sympathetic: responds to stressful situations – "fight or flight"
        2. parasympathetic: performs energy conserving and growth-promoting functions.

Central Nervous System (2 components)

1) **Spinal Cord**: organizes reflexes, contains sensory and motor tracts which relay and reorganize information to and from the brain.
2) **Brain**:
    a. Subcortical structures:
        i. *Brainstem* (controls reflexes, breathing, heartbeat), *Thalamus* (relays information between the brainstem and the cortex), *Cerebellum* (controls rapid, complex movements), *Basal Ganglia* (important for sequencing and timing of slower, deliberate movements)
        ii. Limbic System is composed of: *hippocampus* (crucial for memory formation), *hypothalamus* (regulates internal environment of the body)
    b. Cortex (know figure 5.9 in Gray, p 155):
        i. Four lobes: Frontal, Occipital, Parietal, Temporal
            1. The Primary Visual Cortex (V1) is in the Occipital Lobe. The information from the <u>left</u> visual field (<u>not</u> the left eye!) crosses the optic chiasm and enters the <u>right</u> visual area. The visual cortex is organized topographically, which means that neurons that are near one another in V1 will receive input from cells that are near one another in the retina.
                a. After V1, visual information is processed in two pathways:
                    i. The WHAT pathway (lesion in temporal lobe causes loss of ability to discriminate between two objects)
                    ii. The WHERE pathway (lesion in parietal cortex causes loss of spatial abilities)
            2. The Primary Somatosensory Area is located in the Parietal lobe and is <u>topographically organized (Gray p156)</u>.
            3. The Primary Motor Area is located in the Frontal Lobe and is also <u>topographically organized</u>.
                a. The premotor and supplementary motor areas are involved in planning and initiating movements.

Damage to the Brain Causes Specific Deficits

Split Brain Syndrome Lesion: Corpus Callosum; Deficit: Left and right hemispheres are no longer connected, so information presented only to one hemisphere cannot be accessed by the other. Example: An object is shown to a patient in his left visual field and it is sent to his right hemisphere only (remember, the optic chiasm is not cut). Because it is the left hemisphere that is specialized for language, the patient cannot say what the object is.

Hemineglect Lesion: Parietal Lobe; Deficit: a part of the body or a part of the world is ignored.

Prosopagnosia Lesion: IT cortex (Temporal Lobe); Deficit: loss of ability to recognize faces.

Broca's Aphasia Lesion: Broca's Area (left Frontal Lobe); Deficit: labored speech characterized by short sentences containing mostly nouns and verbs, patients have speech comprehension.

Wernicke's Aphasia Lesion: Wernicke's Area (left Temporal Lobe); Deficit: fluent speech lacking nouns and verbs, patients lack language comprehension and production.

Prefrontal Damage The Frontal and Prefrontal cortices are important for short term memory, decision making and social intelligence. Lesions in the Frontal Lobe cause profound changes in personality, patient becomes unable to make decisions, hold a job, control his temper (remember Phineas Gage!).

Neurons and Neural Computation

Topics and Key words to understand:

- Neurons
  - Significance/importance
  - Structures and functions of typical eukaryotic motor neuron
  - Resting potential
  - Action potential
  - Synaptic transmission
  - Types/differences between neurons
  - Neuronal basis for learning and memory
  - How hormones and drugs interact with the nervous system
  - General mechanisms underlying psychoactive drugs

- Visual System
  - Structures and functions of human eye
  - Color vision
    - Trichromatic theory
    - Opponent-process theory
  - Lightness contrast
    - On- and off- receptive-fields
    - Orientation selectivity
    - Spatial frequency

- Neuronal Computation
  - McCulloch & Pitts' "integrate and fire" neurons
  - Building logic gates from computational neurons
  - Basic perceptron learning
  - Visual System
    - Bottom-up versus top-down influences (pattern completion)
    - Local versus distributed representations
    - Lateral inhibition
      - Center-surround
      - Mach bands
      - Herring grid
      - Simultaneous lightness contrast
    - Opponent-process theory
      - Simultaneous color contrast
    - Habituation
      - Color aftereffects
      - Motion aftereffects

Lecture 8 - Perception 1: 3D Structure from 2D Projections

Importance of Illusions / Inherent Ambiguity of Perception

Parts of the Eye -- optic nerve, fovea, blind spot, retina, lens, iris, cornea, pupil

light → ganglion cell(to optic nerve) – amacrine cell – bipolar cell – horizontal cell - rods & cones - back of eye

size constancy – monster illusion, Ponzo illusion, Ames room, moon illusion
shape constancy

Depth cues
monocular
- shading / differential lighting
- relative image size for familiar objects
- texture gradient
- linear perspective
- interposition / occlusion
- position relative to the horizon
- motion parallax

binocular – binocular disparity
- binocular convergence (aiming the eyes at the same spot)
- binocular parallax or disparity (stereo)

Motion perception
- frame of reference
- moon-cloud illusion

Parts of visual system – retina, optic nerves, optic chiasm, visual areas of the thalamus

stereoscopic illusion – one picture to each eye, each with different vantage point.

Why stereoscopes are hard to see – coupled accommodation and convergence

Ways of decoupling accommodation and convergence
- free fusion
- Wheatstone Stereoscope
- Brewster's Stereoscope (view master)
- color anaglyph (red & green glasses)
- polarizer anaglyph
- virtual reality

The correspondence problem – what points to match up in each eye
- wallpaper autosterograms
- random pattern autostereograms

Random dot stereograms show
- brain does not need to recognize whole object in each eye to solve correspondence problem
- brain solves correspondence problem just using bits of texture
- sees object with "cyclopean" eye

Random- Dot Autostereogram
(magic eye)
- wallpaper stereogram + random-dot stereogram

Helmholtz – **Unconscious Inference theory**

Gibson – **Direct perception theory**
- higher-order stimuli

Lecture 9: Perception II—Scene Analysis

VISUAL
-The problem: recovering 3D structure from 2D image on retina (eye)
-Gestalt Laws of Grouping
> Proximity, Similarity, Closure, Good Continuation, Common Fate (Common Movement, or moving together), Connectedness, Good Form

-Figure-Ground Segregation
> Figure – the part of the image to which attention is directed, or that is considered foreground
> Ground – the part of the image that is considered background
> Reversible Figures—either side of a contour could be seen as figure or ground.
> Example: face-vase illusion

-Illusory Contours
-Scene analysis is affected by both top-down and bottom-up influences
> Bottom-up – information coming directly from the senses
> Top-down – information coming from "higher" mental functions, such as memory

-Shape recognition cannot be solved through single templates
-Three potential shape recognition theories:
> Multiple templates
> Mental transformations (before template)
> Object-centered reference frames

-Steve's method of testing theories of shape recognition:
> Train subjects on novel (not previously seen) objects shown only in a few fixed orientations. Then test the subject's recognition of these objects in these and other orientations. The subjects are faster with trained views and nearby views.

-Potential frames of reference for object recognition:
> Object centered
> Retina (eye) centered
> Head centered
> Body centered
> Geo (earth) centered

-Miscellaneous terms to know:
> illusory contours , recognition by components, geon, distinctive features

AUDITORY
-The problem: determining the causal sources (soundmakers) – which frequencies
> belong together?
-Miscellaneous terms to know:
> outer ear, middle ear, inner ear, auditory canal, eardrum, hammer, anvil, stirrup, oval window, outer duct, inner duct, basilar membrane, hair cells, tectorial membrane, cochlea.

> pitch, frequency, auditory streaming simultaneous and sequential grouping, apparent continuity, wave superposition

Lecture 10; Gray 9, pp. 257-279, 302-313; Gray 9; HTMW 2, pp. 211-233, 266-284

Topic 1: Attention
Though the brain processes a large amount of information in an automatic and obligatory manner, only a subset of this information is selected for further processing and for *consciousness*. The term attention refers to those processes that select information for controlled/conscious processing. In contrast to preattentive or non-conscious processes, attentional processes are slower and require control.

Key ideas:
Top down vs. bottom up processes
Parallel vs. serial processes
Feature-integration theory
Primitive sensory features
Feature search vs. conjunction search
Generalized model of attention
Automatic vs. controlled processing
Early-selection theories
Late-selection theories
Cocktail-party phenomenon
Shadowing experiments
Dichotic listening experiments
Filter theories
Tests of selective viewing
Effects of unattended stimuli
Automaticity and obligatoryness
Goodale's demonstration of a conscious perception deficit

Study exercise: In movies, often small items change on the set or even on the actors themselves from take to take. A glass may change position on the table or a door may be open that was previously closed. Even the best film editing can not rid a movie of these little gliches. Despite this fact, few but the most highly trained film editors will notice the mistakes. Account for these facts with the theories and experiments from this section.

Topic 2: Memory
Memory is central to cognition. The ability of the mind to rely on previously encountered information to guide behavior is crucial to the adaptive functioning of an animal. Memory, however, is not unitary but is made up of functionally distinct systems.
Key ideas:
The modal model
Rehearsal
Encoding
Retrieval
Iconic memory
Echoic memory
Working memory
Phonological loop
Visuospatial sketchpad
Central executive
Visual imagery and the brain
Different types of encoding (e.g. rote and elaborate, etc…)
Chunking
Forgetting function
Retroactive vs proactive interference
Retrieval cues
Association (contiguity vs. similarity)
Encoding specificity

Context-dependent learning
State-dependent learning
False memory
Construction vs. reconstruction
Schema and script
Hypnosis and false memory
Implicit vs. explicit memory
Declarative, semantic, episodic, and procedural memory
Perceptual vs. conceptual priming
Retrograde vs anterograde amnesia
Habit

Study exercise: Construct the taxonomy of memory. Define each taxeme in terms of its relationship to other types of memory at its same level (e.g. semantic vs episodic). Then provide the data you have encountered that provide evidence for each of these distinctions.

Topic 3: Consciousness
Consciousness is used in psychology to mean two things. It can simply refer to any processes or representations to which a person has verbal access or is aware. In the second and more difficult sense, it can refer to the subjective sensation of thought.

Key Ideas:
Hard vs. easy problem of consciousness
5 major theories of consciousness
Behaviorism
Computation
Neural reductionism
Quantum gravity
Cognitive limitations

Study Exercise: For each of the 5 theories, write down what it accounts for and what its limitations are.

Lecture #11
Concepts and Reasoning

I. Concepts

Concepts enable us to categorize experiences. Categories help us to relate current experiences to prior knowledge, and to infer general relationships from experienced episodes.

Two kinds of categories:
1. Classical Categories (a.k.a. Aristotelian, all-or-none, or rule-governed categories)
    Theory: Concepts are definitions in the head; lists of necessary and sufficient features.
    Example: *grandmother* = female parent of a parent
    Evidence: We can determine category membership of novel examples (e.g. ten zillion is EVEN)
    Problems: Some category members share no common properties (GAME: baseball and solitaire?)
        Some category members seem 'better' than others (FRUIT: apple vs. olive?)
2. Family Resemblance Categories
    Theory: Concepts have no necessary features; features are more or less typical of category members.
    Example: *grandmother* = kindly, grey-haired, cookie-dispensing old woman
    Evidence: Subjects classify prototypical category members faster than marginal members.
    Problems: Hard to categorize prototype-defying members. (Tina Turner is a grandmother.)
        Some categories are clear-cut, definitional. (EVEN NUMBER: divisible by two)

Proposed Solution to Categorization Problems: We can use both classical and family resemblance categories.

Hierarchical structure of categories:
Superordinate Category: Animal
Basic Level Category: Dog (Level at which objects share many properties *and* permit generalization.)
Subordinate Category: Labrador

II. Reasoning

Two kinds of reasoning:
1. Deductive Inference: From general to specific
    Advantages: Certainty possible; Content-independent algorithms
    Pitfalls: Ill-posed problems; Content-dependence effects; Mental set effects
2. Inductive Inference: From specific to general
    Advantages: Enables us to categorize, i.e. to predict properties of unseen from seen examples
    Pitfalls: Probabilistic, so certainty impossible; Susceptible to biases: confirmation bias, availability bias, representativeness bias, underuse of base rates (see Bayes' Theorem)

Are we bad intuitive statisticians?
    It doesn't look good for *h. sapiens*: Gambler's Fallacy; Conjunction Fallacy
    But are these really fallacies?   Randomness is rare; typicality matters!

It depends how you define *probability*:
    Subjectivist probability: How confident are you in the outcome of a single event?
    (Mathematically incalculable: Linda either is or isn't a bank teller! Relies on stereotypes.)
    Frequentist probability: What proportion of events will have a given outcome in the long run?
    (People pretty good at reasoning about frequencies. Rephrasing question can improve judgements: "Consider 100 people like Linda…")

Lecture 12: Language - Gray 10, pp. 391-396; Gray 11, pp. 427-438

Components of Language

Duality of patterning: memorized symbols and combinatorial grammar

Syntax – word order

- Hierarchical grouping (structural ambiguity)
- Transformations

Morphology – How words are put together from morphemes
- Languages with fewer restrictions on word order express more with morphology (e.g., Walpiri)

Phonology
- Language specific sound regularities (*bluck* vs. *krechtz*)
- Adjustment rules (How underlying sounds get pronounced in light of phonetic context)

Language Interfaces

- Speech comprehension and the illusion of segmentation
- Pragmatic vs. analytic language

Biological basis for language

Neural – Aphasics and linguistic savants (e.g., Williams Syndrome)

Articulatory – Source-filter model, how are articulators are manipulated?

Language and Thought

- Linguistic Determinism vs. Linguistic Relativity

Reasons to think language does not equal thought
- Much of thought is non-verbal (e.g., mental imagery)
- Perceptual universals (e.g., color perception similar though color terms may not identify different colors)
- Abstract thought in animals
- People without language

Reasons to think language does influence thought
- Development difference of arithmetical abilities cross-culturally
differs in ways that parallel language differences in English vs. Asian languages
- Sexism and the Generic man
- Disrupting verbal habits can help to evade functional fixedness
- Bilinguals: Different languages evoke different schemata.

Development of Language

Innate equipment for language
- Anatomical, neural, attentional, maturational plans; universal grammar (LAD)
- Social environment (LASS, parentese)

Speech perception and early speech production
- Affinity for mother's voice,
- Development of ability to discriminate speech sounds in native language
- Stages of cooing and babbling in hearing and deaf children

Word learning
- Children generally can infer meaning from a single incidental exposure and rate of acquisition is rapid.
- Logical problem of word learning (overextending or underextending reference)
- Link novel words with novel referents, use knowledge of grammar, and social cues to learn words (among other constraints)

Grammar Learning
- Evidence for early acquisition of word order
- Evidence for rule acquisition
- Creolization of pidgin languages (example of Nicaraguan Sign Language)
- Critical period hypothesis

Non-human apes learning language
- Ways in which resulting language resembles human language
- Ways in which it is different