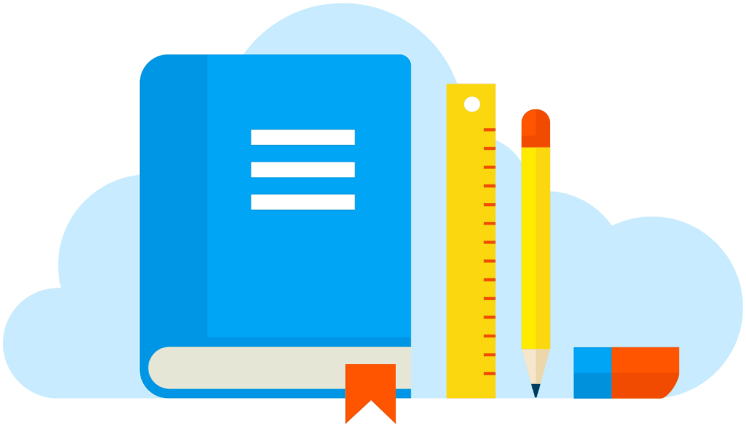

AP Psychology

Daniel M. Goldstein

Psychology's History and Approaches

Psychology's History

Psychology's Roots

Prescientific Psychology

- **empiricism** - the view that knowledge originates in experience and that science should, therefore, rely on observation and experimentation

Thinking About the Mind's Structure

- **structuralism** - used introspection to reveal the structure of the human mind

Thinking About the Mind's Function

- **functionalism** - explored how mental and behavioral processes function - how they enable the organism to adapt, survive, and flourish
- **experimental psychologists** - the study of behavior and thinking using the experimental method

Psychological Science Develops

- **behaviorism** - the view that psychology (1) should be an objective science that (2) studies behavior without reference to mental processes
    - most psychologists today agree with (1) but not with (2)
- **humanistic psychologists** - a historically significant perspective that emphasized the growth potential of healthy people
- **cognitive neuroscience** - the interdisciplinary study of the brain activity linked with cognition
    - includes perception, thinking, memory, and language
- **psychology** - the science of behavior and mental processes

Psychology's Big Issues and Approaches

Psychology's Biggest Question

- **nature-nurture issue** - the longstanding controversy over the relative contribution that genes and experience make to the development of psychological traits and behaviors
- **natural selection** - the principle that, among the range of inherited trait variations, those contributing to reproduction and survival will most likely be passed on to succeeding generations

Psychology's Three Main Levels of Analysis

- **levels of analysis** - the differing complementary views, from biological to social-cultural levels of analysis
- **biopsychosocial approach** - an integrated approach that incorporates biological, psychological, and social-cultural levels of analysis
- **behavioral psychology** - the scientific study of observable behavior, and its explanation by principles of learning
- **biological psychology** - the scientific study of the links between biological (genetic, neural, hormonal) and psychological processes
- **cognitive psychology** - the scientific study of all the mental activities associated with thinking, knowing, remembering, and communicating
- **evolutionary psychology** - the study of the evolution of behavior and mind, using principles of natural selection

- **psychodynamic psychology** - a branch of psychology that studies how unconscious drives and conflicts influence behavior, and uses that information to treat people with psychological disorders
- **social-cultural psychology** - the study of how situations and cultures affect our behavior and thinking

Psychology's Subfields

- **psychometrics** - the scientific study of the measurement of human abilities, attitudes, and traits
- **developmental psychology** - a branch of psychology that studies physical, cognitive, and social change throughout the life span
- **educational psychology** - the study of how psychological processes affect and can enhance teaching and learning
- **personality psychology** - the study of an individual's characteristic pattern of thinking, feeling, and acting
- **social psychology** - the scientific study of how we think about, influence, and relate to one another
- **industrial-organizational (I/O) psychology** - the application of psychological concepts and methods to optimizing human behavior in workplaces
    - **human factors psychology** - explores how people and machines interact and how machines and physical environments can be made safe and easy to use
- **counseling psychology** - a branch of psychology that assist people with problems in living and in achieving greater well-being
- **clinical psychology** - a branch of psychology that studies, assesses, and treats people with psychological disorders
- **psychiatry** - a branch of medicine dealing with psychological disorders
- **community psychology** - a branch of psychology that studies how people interact with their social environments and how social institutions affect individuals and groups

Research Methods: Thinking Critically With Psychological Science

The Need for Psychological Science

Did We Know It All Along? Hindsight Bias

- **hindsight bias** - the tendency to believe, after learning an outcome, that one would have foreseen it

Overconfidence

- humans are overconfident

Perceiving Order in Random Events

- if someone flipped a coin 6 times, which of the following sequences would be most likely?
    - HHHTTT
    - HTTHTH
    - HHHHHH
- most people believe choice B but all are equally likely
- hindsight bias, overconfidence, and our tendency to perceive patterns in random events often lead us to overestimate our intuition

The Scientific Method and Description

The Scientific Method

- **theory** - an explanation using an integrated set of principles that organizes observations and predicts behaviors or events
- **hypothesis** - a testable prediction
- **operational definition** - a carefully worded statement of the exact procedures used in a research study
    - this allows for replication

- we can test our hypothesis in several ways:
    - *descriptive* methods describe behaviors
        - case studies
        - surveys
        - naturalistic observations
    - *correlational* methods associate different factors
    - *experimental* methods manipulate variables to discover their effects

Description

The Case Study

- **case study** - a descriptive technique in which one individual or group is studied in depth

Naturalistic Observation

- **naturalistic observation** - observing and recording behavior in naturally occurring situations without trying to manipulate and control the situation

The Survey

- **survey** - a technique for ascertaining the self-reported attitudes or behaviors of a particular group, usually by questioning a representative, random sample of the group

Wording Effects

- subtle changes to the wording of survey can have major effects on the results

Random Sampling

- **sampling bias** - a flawed sampling process that produces an unrepresentative sample
- **population** - all those in a group being studied, from which samples may be drawn
- **random sample** - a sample that fairly represents a population because each member has an equal chance of inclusion

Correlation and Experimentation

Correlation

- **correlation** - a measure of the extent to which two variables change together
- a negative correlation means they relate inversely

Illusory Correlations

- **illusory correlation** - the perception of a relationship where none exists

Experimentation

- **experiment** - a research method on which an investigator manipulates one or more factors to observe the effect on some behavior or mental process
- **experimental group** - in an experiment, the group exposed to the treatment
- **control group** - in an experiment, the group not exposed to the treatment
- **random assignment** - assigning participants to experimental and control groups by chance
    - this minimizes preexisting differences between the groups
- **double-blind procedure** - an experimental procedure in which both the research participants and the research staff are blind about whether the research participants have received the treatment or a placebo

Independent and Dependent Variables

- **independent variable** - the experimental factor that is manipulated
- **dependent variable** - the outcome factor

Statistical Reasoning in Everyday Life

Descriptive Statistics

- **histogram** - bar graph depicting a frequency distribution

Measures of Central Tendency

- **mode** - the most frequently occurring score

- **mean** - the arithmetic average
- **median** - the middle score
- **skewed distribution** - a representation of scores that lack symmetry around the average value

Measures of Variation

- **range** - the difference between the highest and lowest scores in a distribution
- **standard deviation**

Inferential Statistics

- **inferential statistics** - numerical data that allow one to generalize the probability of something being true of a population

Biological Bases of Behavior

Biological Psychology and Neurotransmission

Neural Communication

Neurons

- **neuron** - a nerve cell
    - *cell body* and its branching fibers
- **dendrites** - a neuron's branching extensions that receive messages and conduct impulses towards the cell body
- **axon** - the neuron extension that passes messages through its branches to other neurons
- **myelin sheath** - a fatty tissue layer segmentally encasing the axon of some neurons
    - enables vastly greater transmission speed as neural impulses hop from one to the other
    - if it degrades, *multiple sclerosis* results
- neurons transmit messages when stimulated by signals from our senses or when triggered by chemical signals from neighboring neurons
    - in response, a neuron fires an impulse called the **action potential** - a brief electrical charge that travels down its axon
- the fluid outside an axon's membrane has mostly positively charged ions; a resting axon's fluid interior has mostly negatively charged ions
    - axon's surface is *selectively permeable*
- when the neuron fires, the neuron is *depolarized*
- **refractory period** - a period of inactivity after a neuron has fired
- *excitatory* and *inhibitory*
- **threshold** - the level of stimulation required to trigger a neural impulse
- **all-or-none response** - a neuron's reaction of either firing or not firing

How Neurons Communicate

- **synapse** - the junction between the axon tip of the sending neuron and the dendrite or cell body of the receiving neuron

    - *synaptic cleft* - the tiny gap at this junction
- when an action potential reaches the axon's end, it triggers the release of **neurotransmitters** - chemical messengers that cross the synaptic gaps between neurons
    - when released by the sending neuron, neurotransmitters travel across the synapse and bind to the receptor sites on the receiving neuron
- **reuptake** - a neurotransmitter's reabsorption by the sending neuron

How Neurotransmitters Influence Us

- *acetylcholine (ACh)* - enables muscle action, learning, and memory
- *dopamine* - influences movement, learning, attention, and emotion
    - oversupply linked to schizophrenia
    - undersupply linked to tremors and decreased mobility in Parkinson's disease
- *serotonin* - affects mood, hunger, sleep, and arousal
    - undersupply linked to depression
- *norepinephrine* - helps control alertness and arousal
    - undersupply can depress mood
- *GABA* - a major inhibitory neurotransmitter
    - undersupply linked to seizures, tremors, and insomnia
- *glutamate* - a major excitatory neurotransmitter; involved in memory
    - oversupply can overstimulate the brain
        - produces migraines or seizures
- **endorphins** - "morphine within" - natural, opiate-like neurotransmitters linked to pain control and to pleasure

How Drugs and Other Chemicals Alter Neurotransmission

- **agonist** - a molecule that, by binding to a receptor site, stimulates a response
- **antagonists** - a molecule that, by binding to a receptor site, inhibits or blocks a response

The Nervous and Endocrine System

The Nervous System

- **nervous system** - the body's speedy, electrochemical communication network, consisting of all the nerve cells or the peripheral and central nervous systems
- **central nervous system** - the brain and spinal cord
- **peripheral nervous system** - the sensory and motor neurons that connect the central nervous system to the rest of the body
- **nerves** - bundled axons that form neural "cables" connecting the central nervous system with muscles, glands, and sense organs
- **sensory neurons** - neurons that carry incoming information from the sensory receptors to the brain and spinal cord
- **motor neurons** - neurons that carry outgoing information from the brain and spinal cord to the muscles and glands
- **Interneurons** - neurons within the brain and spinal cord that communicate internally and intervene between the sensory inputs and motor outputs

The Peripheral Nervous System

- **somatic nervous system** - the division of the peripheral nervous system that controls the body's skeletal muscles
- **autonomic nervous system** - the division of the peripheral nervous system that controls the glands and the muscles of the internal organs
    - **sympathetic nervous system** - the division of the autonomic nervous system that arouses the body
        - stressful situations
    - **parasympathetic nervous system** - the division of the autonomic nervous system that calms the body
        - conserves energy

The Central Nervous System

- *neural networks* - clusters in neurons based on their job
- *spinal cord* - a two-way highway connecting the peripheral nervous system and the brain

- **reflexes** - a simple, automatic response to a sensory stimulus
    - knee-jerk response

The Endocrine System

- **endocrine system** - the body's "slow" chemical communication system; a set of glands that secrete hormones into the bloodstream
- **hormones** - chemical messengers that are manufactured by the endocrine glands
- slower than nervous system, but outlasts
- **adrenal glands** - a pair of endocrine glands that secrete epinephrine and norepinephrine
- *fight-or-flight* response - a surge of energy
- **pituitary gland** - the endocrine system's most influential gland

Studying the Brain, and Older Brain Structures

The Tools of Discovery: Having Our Head Examined

- **lesion** - tissue destruction
    - natural or experimental
- **electroencephalogram** - an amplified recording of the waves of electrical activity sweeping across the brain's surface
- **CT scan** - a series of X-ray photographs taken from different angles and combined by a computer into a composite representation of a slice of the brain
- **PET scan** - a visual display of brain activity that detects where a radioactive form of glucose goes while the brain performs a given task
- **MRI** - a technique that uses magnetic fields and radio waves to produce computer-generated images of soft tissue
    - **fMRI** - a technique for revealing bloodflow and, therefore, brain activity

Older Brain Structures

The Brainstem

- **brainstem** - responsible for automatic survival functions
    - **medulla** - the base of the brainstem; controls heartbeat and breathing

    - *pons* - coordinates movement
    - a crossover point for nerves

The Thalamus

- **thalamus** - the brain's sensory control center
    - directs messages to the sensory receiving areas in the cortex and transmits replies to the cerebellum and medulla

The Reticular Formation

- **reticular formation** - a nerve network that travels through the brainstem and thalamus and plays an important role in controlling arousal

The Cerebellum

- **cerebellum** - functions include processing sensory input, coordinating movement output and balance, and enabling nonverbal learning and memory

The Limbic System

- **limbic system** - neural system
    - associated with emotion and drives

The Amygdala

- **amygdala** - linked to emotion

The Hypothalamus

- **hypothalamus** - directs eating, drinking, body temperature; helps govern endocrine system via pituitary gland; linked with emotion and reward

The Cerebral Cortex

- **cerebral cortex** - interconnected neural cells covering the cerebral hemispheres
    - the body's ultimate control and information processing center

Structure of the Cortex

- **glial cells** - cells in the nervous system that support, nourish, and protect neurons
- each hemisphere's cortex is subdivided into *lobes*, separated by *fissures* (folds)

- **frontal lobes** - involved in speaking and muscle movements and in making plans and judgements
- **parietal lobes** - receives sensory input for touch and body position
- **occipital lobes** - visual fields
- **temporal lobes** - auditory areas

Functions of the Cortex

Motor Functions

- **motor cortex** - controls voluntary movements

Sensory Functions

- **somatosensory cortex** - registers and processes body touch and movement sensations

Association Areas

- **association areas** - areas of the cerebral cortex that are not involved in primary motor or sensory functions
    - learning, remembering, thinking, speaking

The Brain's Plasticity

- **plasticity** - the brain's ability to change by reorganizing after damage

Brain Hemisphere Organization and the Biology of Consciousness

Our Divided Brain

Splitting the Brain

- **corpus callosum** - large band of neural fibers connecting the two brain hemispheres and carrying messages between them
    - HEART experiment

Right-Left Differences in the Intact Brain

- perceptual tasks (brain waves, bloodflow, glucose consumption) increase activity in right hemisphere
- speaking or calculating increases activity in left hemisphere

The Biology of Consciousness

- **consciousness** - our awareness of ourselves and our environment

Cognitive Neuroscience

- **cognitive neuroscience** - the interdisciplinary study of the brain activity linked with cognition
    - perception, thinking, memory, language

Dual Processing: The Two-Track Mind

- **dual processing** - the principle that information is often simultaneously processed on separate conscious and unconscious tracks

Behavior Genetics: Predicting Individual Differences

Genes: Our Code for Life

- **behavior geneticists** - the study of the relative power and limits of genetic and environmental influences on behavior
    - study effects of heredity and **environment**
- **chromosome** - threadlike structures made of DNA molecules that contain the genes
- **DNA** - a complex molecule containing the genetic information that makes up the chromosomes
- **genes** - the biochemical units of heredity that make up the chromosomes
    - segments of DNA
- **genome** - the complete instructions for making an organism

Twin and Adoption Studies

- **identical twins** - twins who develop from a single fertilized egg that splits in two
    - genetically identical
- **fraternal twins** - twins who develop from separate eggs

The New Frontier: Molecular Genetics

- **molecular genetics** - the subfield of biology that studies the molecular structure and function of genes

Heritability

- **heritability** - the proportion of variation among individuals that we can attribute to genes

Gene-Environment Interaction

- **epigenetics** - the environmental influences on gene expression that occur without a DNA change

Evolutionary Psychology: Understanding Human Nature

- **evolutionary psychology** - the study of evolution of behavior and the mind, using principles of natural selection
- **natural selection** - the principle that, among the range of inherited trait variations, those contributing to reproduction and survival will most likely be passed on

Natural Selection and Adaptation

- **mutations** - a random error in gene replication that leads to a change

Sensation and Perception

Basic Principles of Sensation and Perception

- **sensation** - the process by which our sensory receptors and nervous system receive and represent stimulus energies from our environment
- **perception** - the process of organizing and interpreting sensory information, enabling us to recognize meaningful objects and events
- Types of processing
    - **bottom-up processing** starts at the sensory receptors and works up to higher levels of processing
    - **top-down processing** constructs perception from the sensory input by drawing on our experience and expectation

Selective Attention

- **selective attention** - the focusing of conscious awareness on something specific
    - *cocktail party effect* - your ability to attend to only one voice among many (while also being able to detect your own name in the crowd)

Selective Attention and Accidents

- multitasking increases the risk of accident

Selective Inattention

- **inattentional blindness** - failing to see visible objects when our attention is directed elsewhere
- **change blindness** - failing to notice changes in the environment
    - i.e magicians

Transduction

- **transduction** - converting one form of energy into another
- All of our senses:
    - *receive* sensory stimulation, often using specialized receptor cells
    - *transform* that stimulation into neural impulses
    - *deliver* the neural information to our brain
- **psychopsychics** - the study of relationships between the physical characteristics of stimuli, such as their intensity, and our psychological experience of them

Thresholds

Absolute Thresholds

- **absolute threshold** - the minimum stimulation needed to detect a particular stimulus 50% of the time
- **signal detection theory** - predicts how and when we detect the presence of a faint stimulus (signal) amid background stimulation (noise)
    - detection depends partly on a person's experience, expectations, motivation, and alertness
        - i.e. exhausted parents will notice subtle sounds made by a newborn, but not loud sounds
- **subliminal** - below one's absolute threshold for conscious awareness
    - i.e. stimuli you cannot detect 50% of the time
- under certain conditions, you can be affected by stimuli so we that you don't consciously notice them
- **priming** - the activation, often unconsciously, of certain associations, thus predisposing one's perception, memory, or response

Difference Thresholds

- **difference threshold** - the minimum difference between two stimuli required for detection 50% of the time
    - jnd - just noticeable difference
    - i.e. if you add 1 ounce to a 10-ounce weight, you will detect the difference; add 1 ounce to a 100-ounce weight and you probably will not
- **Weber's law** - the principle that, to be perceived as different, two stimuli must differ by a constant minimum percentage (rather than a constant amount)
    - i.e. the lights have to differ by 8%, weight by 2%, tones by 0.3%

Sensory Adaptation

- **sensory adaptation** - diminished sensitivity as a consequence of constant simulation
    - i.e. a bad smell in a room that you don't notice after a while
- our eyes don't follow sensory adaptation because they are constantly moving
- offers an important benefit: freedom to focus on *informative* changes in our environment without being distracted by background chatter
- i.e. cuts in a TV show grab our attention - failing to see visible objects when our attention is directed elsewhere
- change blindness - failing to notice changes in the environment
    - i.e. magicians

Influences on Perception

- **perceptual set** - a mental predisposition to perceive one thing and not another

Context Effects

- your brain can work backwards
    - ---eel is on a wagon
    - ---eel is on an orange

Emotion and Motivation

- when feeling sad, it's more likely to hear *mourning* than *morning*

Vision

- our eyes receive light energy and transduce (transform) it into neural messages that our brain then processes into what we consciously see

The Stimulus Input: Light Energy

- when you look at a bright red tulip, what strikes you eyes is not particles of the color red but pulses of electromagnetic energy
- two physical characteristics of light help determine our sensory of them
    - **wavelength** - the distance from the peak of one light or sound wave to the peak of the next
        - this determines the color's **hue** - the color we experience
            - i.e. the tulip's red petals and green leaves
    - **intensity** - the amount of energy in a light or sound wave, which we perceive as brightness or loudness as determined by the wave's amplitude

The Eye

- light enters the eye through the *cornea*, which protects the eye and bends light to provide focus
- then light passes through the **pupil**, a small adjustable opening

    - surrounding the pupil is the **iris**, a colored muscle that dilates or constricts in response to light intensity

- behind the pupil is a **lens** that focuses incoming light rays into an image on the **retina**, a multilayered tissue on the eyeball's inner surface

    - the retina contains receptor rods and cones and process visual information

- **accommodation** - the process by which the eye's lens changes shape to focus near or far objects on the retina

The Retina

- **rods** - retinal receptors that detect black, white and grey; necessary for night vision
- **cones** - retinal receptor cells that are concentrated near the center of the retina and that function in daylight or in well-lit conditions; they detect fine details and color
- **optic nerve** - the nerve that carries neural impulses from the eye to the brain

    - made up of *bipolar cells* and *ganglion cells*
    - thalamus distributes this information

- **blind spot** - the point at which the optic nerve leave the eye, creating a "blind" spot because there are no receptor cells there
- **fovea** - the central focal point in the retina, around which the eye's cones cluster

Visual Information Processing

- information processing begins in the retina's neural layers

    - these layers pass along electrical impulses and help encode and analyze sensory information

- then information goes to your bipolar cells, ganglion cells and their axons

    - this makes up the optic nerve to your brain

Feature Detection

- **feature detectors** - nerve cells in the brain that respond to specific features of the stimulus, such as shape, angle, or movement
    - receive information from individual ganglion cells in the retina
    - these cells pass information to other cortical areas, where *supercell clusters* respond to more complex patterns

Parallel Processing

- **parallel processing** - the processing of many aspects of a problem simultaneously; the brain's natural mode of information processing for many functions, including vision

Color Vision

- **Young-Helmholtz trichromatic theory** - the theory that the retina contains three different color receptors - one most sensitive to red, one to green, one to blue - which, when stimulated in combination, can produce the perception of any color
    - people who are colorblind just don't have one of those colors
- **opponent-process theory** - the theory that opposing retinal processes (red-green, yellow-blue, white-black) enable color vision
    - i.e. some cells are stimulated by green and inhibited by red; others are stimulated by red and inhibited by green

Visual Organization and Interpretation

Visual Organization

- **gestalt** - an organized whole
    - integrating pieces of information into meaningful wholes

Form Perception

Figure and Ground

- **figure-ground** - the organization of the visual field into objects (*figures*) from their surroundings (*ground*)

Grouping

- **grouping** - the perceptual tendency to organize stimuli into coherent groups

Proximity

- seeing 3 sets of 2 lines instead of 6 lines

Continuity

- smooth patterns instead of discontinuous ones

Closure

- filling gaps

Depth Perception

- **depth perception** - the ability to see objects in three dimensions although the images that strike the retina are two dimensional
    - allows us to judge distance
    - **visual cliff** experiment with the baby

Binocular Cues

- **binocular cues** - depth cues that depend of the use of two eyes
- **retinal disparity** - binocular cue for perceiving depth
    - the greater the disparity, the greater the depth

Monocular Cues

- **monocular cues** - depth cues available to either eye alone

Motion Perception

- shrinking objects are retreating, enlarging objects are approaching
- large objects appear to move more slowly than smaller objects

- **phi phenomenon** - an illusion of movement created when two or more adjacent lights blink on and off in quick succession

Perceptual Constancy

- **perceptual constancy** - perceiving objects as unchanging even as illumination and retinal images change

Color and Brightness Constancies

- **color constancy** - perceiving similar objects as having consistent color, even if changing illumination alters the wavelengths reflected by the object
- *brightness constancy* - perceiving something as having constant brightness
- *relative luminance* - the amount of light an object reflects relative to its surroundings

Shape and Size Constancies

- *shape constancy* - perceiving the form of familiar objects as constant
- *size constancy* - perceiving objects as having a constant size, even when distance between them varies

Visual Interpretation

Experience and Visual Perception

Perceptual Adaptation

- **perceptual adaptation** - the ability to adjust to an artificially displaced or inverted visual field

Hearing

- **audition** - the sense or act of hearing
- our hearing is highly adaptive

The Stimulus Input: Sound Waves

- the *amplitude* of sound waves determines their *loudness*
- their length (**frequency**) determines the **pitch**

    - long waves have low frequency (low pitch)
    - short waves have high frequency (high pitch)
- we measure sounds in *decibels*
    - 0 decibels is the absolute threshold
    - every 10 decibels is a tenfold increase in sound intensity
        - normal conversation (60 decibels) is 10,000x more intense than whispers (20 decibels)

The Ear

- process that transforms vibrations into nerve impulses begins in outer ear
- *outer ear* channels the waves through the auditory canal to the *eardrum*
- in the **middle ear** - the chamber between the eardrum and cochlea - the tiny bones (the *hammer*, *anvil*, and *stirrup*) pick up the vibrations and send them to the **cochlea** - a snail shaped tube in the **inner ear**
- the incoming vibrations cause the cochlea's membrane (the *oval window*) to vibrate, jostling the fluid that fills this tube
    - this motion caused ripples in the *basilar membrane*, bending the *hair cells* lining its surface
        - hair cell movement triggers impulses in adjacent nerve cells
            - axons of those cells form the *auditory nerve* which sends neural messages (via the thalamus) to the *auditory cortex* (in the temporal lobe)
- **sensorineural hearing loss** - hearing loss caused by damage to the cochlea's receptor cells or to the auditory nerves

- **conduction hearing loss** - hearing loss caused by damage to the mechanical system that conducts sound waves to the cochlea
- **cochlear implant** - a device for converting sounds into electrical signals and stimulating the auditory nerve through electrodes threaded into the cochlea

Perceiving Loudness

- neighboring hair cells also respond

Perceiving Pitch

- **place theory** - links the pitch we hear with the place where the cochlea's membrane is stimulated
- **frequency theory** - the rate of nerve impulses traveling up the auditory nerve matches the frequency of a tone

The Other Senses

Touch

- sense of touch is a mix of senses for:
    - pressure
    - warmth
    - cold
    - pain

Pain

Understanding Pain

Biological Influences

- there's no one type of stimulus that triggers pain
- *nociceptors* - sensory receptors that detect hurtful temperatures, pressure, or chemicals

- **gate-control theory** - the theory that the spinal cord contains a neurological "gate" that blocks pain signals or allows them to pass on to the brain
    - the "gate" is opened by the activity of pain signals traveling up small nerve fibers and is closed by activity in larger fibers or by information coming from the brain
- when we are distracted from pain (a psychological influence) and soothed by the release of naturally pain killing *endorphins* (a biological influence), our experience of pain diminishes
- *phantom limb sensations* - when the body misinterprets the spontaneous central nervous system activity that occurs in the absence of normal sensory input
    - amputees may feel pain or movement in nonexistent limbs
- *tinnitus* - phantom sounds/ringing in the ears

Controlling Pain

- treatable both physically and psychologically
    - drugs
    - surgery
    - acupuncture
    - electrical stimulation
    - massage
    - exercise
    - hypnosis
    - relaxation training
    - thought distraction

Taste

- sweet indicates energy source

- salty indicates sodium essential to physiological processes
- sour indicates potentially toxic acid
- bitter indicates potential poisons
- umami indicates protein
- taste is a chemical sense

Smell

- also known as *olfaction*
- chemical sense
- olfactory receptor cells are in the nasal cavity
    - bypass thalamus
- good experiences are linked with a particular scent

Body Position and Movement

- **kinesthesia** - the system for sensing the position and movement of individual body parts
- **vestibular sense** - the sense of body movement and position, including balance
- *semicircular canals* and *vestibular sacs* contain fluid that moves when your head rotates and tilts

Sensory Interaction

- **sensory interaction** - the principle that one sense may influence another
    - smell of food influences taste
- **embodied cognition** - the influence of bodily sensations, gestures, and other states on cognitive preferences and judgements
    - feeling something warm makes you socially warmer
    - social exclusion literally feels cold

States of Consciousness

Understanding Consciousness and Hypnosis

Defining Consciousness

- **consciousness** - our awareness of ourselves and our environment

Hypnosis

- **hypnosis** - a social interaction in which one person responds to another person's suggestions that certain perceptions, thoughts, or behaviors will spontaneously occur

Frequently Asked Questions About Hypnosis

- ***Can anyone experience hypnosis?***
    - To some extent
- ***Can hypnosis enhance recall of forgotten events?***
    - No, we don't store all of our memories
- ***Can hypnosis force people to act against their will?***
    - An experiment done shows that they don't
- ***Can hypnosis be therapeutic?***
    - *hypnotherapists* try to help patients harness their own healing powers
    - **posthypnotic suggestion** - a suggestion, made during a hypnosis session, to be carried out after the subject is no longer hypnotized; used by some clinicians to help control undesired symptoms and behaviors
        - alleviates headaches, asthma, and stress-related skin disorders
- ***Can hypnosis relieve pain?***
    - Yes

Explaining the Hypnotized State

Hypnosis as a Social Phenomenon

- advocates of the *social influence theory of hypothesis* believe that hypnosis reflects our attention spotlight and interpretations as well as social influence
- while people think they are being hypnotized, they will act hypnotized

Hypnosis as Divided Consciousness

- **dissociation** - a split in consciousness, which allows some thoughts and behaviors to occur simultaneously with others
    - when hypnotized to put your hand in ice water, it will be cold but won't hurt
        - hypnosis dissociated pain stimulus

Sleep Pattern and Sleep Thoughts

Biological Rhythms and Sleep

- 90 minute sleep cycle

Circadian Rhythm

- **circadian rhythm** - the biological clock; regular bodily rhythms that occur on a 24-hour cycle
    - in the morning, body temperature rises, then peaks, then dips, then drops
    - when pulling an all nighter you will feel most groggy in the middle of the night but reenergized the next morning

Sleep Stages

- **REM sleep** - rapid eye movement sleep; a recurring sleep stage during which vivid dreams commonly occur
- **alpha waves** - the relatively slow brain waves of a relaxed, awake state
- **sleep** - periodic, natural loss of consciousness resulting from a coma, general anesthesia, or hibernation
- NREM-1 - first stage of sleep
    - you being to have **hallucinations** - false sensory experiences
- NREM-2 - second stage of sleep
    - *sleep spindles* - bursts of rapid, rhythmic brain-wave activity
    - you are now clearly asleep
- NREM-3 - third stage of sleep
    - deep sleep
    - **delta waves** - the large, slow brain waves associated with deep sleep

REM Sleep

- after an hour of sleep you leave **NREM** (non-rapid eye movement) **sleep**
- you return to NREM-2 sleep and then REM sleep
    - heart rate rises, breathing becomes rapid and irregular, eyes dart around, genitals get aroused regardless of if the dream is sexual (this is where “morning wood” comes from)
        - the beginning of a dream
    - brain’s motor cortex is very active, brainstem blocks messages
        - this paralyzes you
            - *sleep paralysis* is when this lingers

What Affects Our Sleep Patterns?

- sleep patterns are genetically and culturally influenced
- **suprachiasmatic nucleus (SCN)** - a pair of cell clusters in the hypothalamus that controls circadian rhythm
    - in response to light, SCN causes the pineal gland to adjust melatonin production, thus modifying our feelings of sleepiness

Sleep Theories

- ***Sleep protects***
    - a species’ sleep pattern tends to suit its ecological niche
- ***Sleep helps us recuperate***
    - helps restore and repair brain tissue and resting neurons
- ***Sleep helps restore and rebuild our fading memories of the day’s experiences***
    - sleep consolidates our memories
- ***Sleep feeds creative thinking***
- ***Sleep supports growth***
    - during deep sleep, the pituitary gland releases a growth hormone

Sleep Deprivation, Sleep Disorders, and Dreams

Sleep Deprivation and Sleep Disorders

Effects of Sleep Loss

- sleepy, drained of energy, feel terrible
- WE CAN REPAY OUR SLEEP DEBT
- less satisfied with your life
- predicts depression
    - REM helps protect against depression
- makes you fatter
    - increases *ghrelin*, a hunger-arousing hormone; decreases *leptin*, a hunger-suppressing hormone
    - increases cortisol, a stress hormone that stimulates the body to make fat
- suppresses immune cells
- slows reactions and increases visual errors

Major Sleep Disorders

- **insomnia** - recurring problems in falling or staying asleep
- **narcolepsy** - uncontrollable sleep attacks
- **sleep apnea** - temporary cessation of breathing during sleep and repeated momentary awakenings
    - associated with obesity
- **night terrors** - high arousal and an appearance of being terrified
    - unlike nightmares, night terrors occur during NREM-3 sleep
- *sleepwalking* and *sleeptalking* - childhood disorders, runs in families
    - NREM-3 disorder

Dreams

What We Dream

- **dream** - a sequence of images, emotions, and thoughts passing through a sleeping person's mind

Why We Dream

1. ***To satisfy our own wishes***
    - **manifest content** - storyline of dream
    - **latent content** - underlying meaning
2. ***To file away memories***
    - *information-processing* - dreams help sift, sort, and fix the day's experiences
3. ***To develop and preserve neural pathways***
4. ***To make sense of neural static***
5. ***To reflect cognitive development***
    - the complexity in images and storyline in dreams matures as we mature
    - **REM rebound** - the tendency for REM sleep to increase following REM sleep deprivation

Psychoactive Drugs

Tolerance and Addiction

- **psychoactive drug** - a chemical that alters perceptions and moods
- increased use of a drug leads to **tolerance** where a larger dose is required to get the same effect from a drug
- upon stopping a drug's use, a frequent user will likely experience **withdrawal**
    - a person experiencing withdrawal may feel physical pain and strong cravings
    - pain and cravings are signs of physical dependence – a strong indication of addiction.
- stress-relieving drugs may create psychological dependence
    - here, the mind thinks it needs the drug (though the body doesn't react to being cut off)
- drug **addiction** is a compulsive craving despite consequences to use
    - physical symptoms often accompany an addiction

Types of Psychoactive Drugs

- *depressants*, *stimulants*, *hallucinogens*

Depressants

- depressants are sometimes called “downers” because they slow down the body
    - calm neural activity and slow body functions
    - ex. alcohol, barbiturates (tranquilizers), opiates

Alcohol

- alcohol has many effects…
    - it lowers inhibitions (it’s a “*disinhibitor*”)
    - an “inhibition” is our common sense that tells us, “Maybe I shouldn’t do that.” Alcohol turns this common sense off
        - this means that when drinking, we’ll do things that we normally would NOT do

Slowed Neural Processing

- it slows processing speed. We react slower, think slower, and speech is slurred
    - slows sympathetic nervous system

Memory Disruption

- it disrupts memory and impairs judgment
    - impairs the growth of synaptic connections

Reduced Self-Awareness and Self-Control

- it cuts self-awareness and self-control
    - this is why people who are “down in the dumps” (like they just got fired) often turn to alcohol – it takes their minds off of themselves.
        - It’s impacted by the person’s expectations. This means that people have ideas about how people act while drinking (even if they only think they’ve been drinking). This expectation shapes their behavior.

Expectancy Effects

    - it correlates with risky sex
        - this means that drinking alcohol and risky sex go together – they co-relate

Barbiturates

- **barbiturates** produce about the same effects as alcohol
    - larger doses can cause impaired memory, judgment, or death

Opiates

- **opiates** are drugs derived from opium, such as morphine, codeine, or heroin
- opiates cause one's pupils to dilate, slows breathing, and creates sluggishness
- they leave the person craving more, but tolerance means a person would need higher doses for the same effect
- withdrawal results if a person stops using them

Stimulants

- **stimulants** are sometimes called "uppers" because they speed up the body
    - excites neural activity and speeds up body functions
- stimulants cause the pupils to dilate, one's pulse and breathing rates to increase, energy and confidence to increase, and appetite to drop
- cutting out a stimulant result in fatigue, headaches, crankiness, or depression
- caffeine is the world's most common psychoactive drug
    - it usually lasts about 3-4 hours
    - regular use results in tolerance
    - stopping it can result in withdrawal symptoms of fatigue and headaches

Nicotine

- **nicotine** is very common
- it's estimated that 10,000 people worldwide die from smoking per day
    - if a teen started smoking, then smoked until he died, he'd have a 50% chance that the smoking killed him
- tolerance results, so smokers must smoke more for the same effect
- withdrawal results when a person tries to quit, including cravings, insomnia, anxiety, and crankiness

- nicotine starts to take effect after only 7 seconds of being smoked
    - it is as addictive as heroin or cocaine
- it triggers the neurotransmitters epinephrine and norepinephrine

Cocaine

- **cocaine** produces a fast (but short) high and is followed by depression
- the good feeling result from a rush of dopamine, serotonin, and epinephrine
- reuptake is blocked by the cocaine
    - thus the neurons are left depleted which results in a “crash” (depression)

Methamphetamine

- **meth** stimulates the release of the neurotransmitter dopamine, which naturally improves your mood
- meth can permanently drop your natural dopamine levels
    - This leaves you depressed
- meth is highly addictive and very dangerous

Ecstasy

- **MDMA** (**Ecstasy**) is both a stimulant and a mild hallucinogen
- it starts the release of dopamine, but also releases serotonin and blocks its reuptake
- MDMA takes about an hour to “kick in” then lasts about 3 to 4 hours
- a major negative effect is dehydration
    - this can lead to overheating and death
- another major negative is that natural serotonin production can be permanently damaged which can lead to permanent depression

Hallucinogens

- **Hallucinogens** create perception without sensory input (the definition of “hallucination”)

LSD

- **LSD** is a powerful and dangerous psychedelic drug
- LSD users sense extraordinary shapes, colors, etc.
- it acts in the same way a subtype of serotonin acts

- typical experiences are: geometric images, a tunnel or funnel image, past emotional experiences, and a feeling of mind-body separation
    - these same “symptoms” are typical of people who experienced “**near-death**”
    - oxygen deprivation yields these same results

Marijuana

- marijuana contains the active ingredient **THC**
- it acts like alcohol in that it relaxes, it’s a disinhibitor (you do things you normally wouldn’t), and can give a “high” feeling
- unlike alcohol (which the body rids after hours), THC lingers for a month or more
    - frequent users can thus get the same effect on less than infrequent users.
- marijuana increases sensations (sight, sound, etc.)
- it impairs your judgment and your memory

Learning

How We Learn and Classical Conditioning

How Do We Learn?

- **learning** - the process of acquiring new and relatively enduring information or behaviors
- we learn by *association*
- **habituation** - an organism's decreasing response to a stimulus with repeated exposure to it
- **associative learning** - learning that certain events occur together
- *conditioning*
    - *classical conditioning* - associate 2 stimuli and thus anticipate events
    - *operant conditioning* - associate a response and its consequence
- **cognitive learning** - the acquisition of mental information, whether by observing events, by watching others, or through language
    - *observational learning* - learning from others' experiences

Classical Conditioning

Pavlov's Experiments

- isolated a dog in a small room, measured his saliva, presented food and blew meat powder
- **neutral stimuli (NS)** - a stimulus that elicits no response before conditioning
- just before presenting food, Pavlov sounded a tone
    - eventually the dog salivated to the sound of the tone alone
- **unconditioned response (UR)** - an unlearned- naturally occurring response to an unconditioned stimulus
    - the drooling
- **unconditioned stimulus (US)** - a stimulus that unconditionally - naturally and automatically - triggers a response
- **conditioned response (CR)** - a learned response to a previously neutral stimulus
    - salivation in response to a tone

- **conditioned stimulus (CS)** - an originally irrelevant stimulus that, after association with an unconditioned stimulus, comes to trigger a conditioned response
    - the tone

Acquisition

- **acquisition** - the initial stage, when one links a neutral stimulus and an unconditioned stimulus so that the neutral stimulus begins triggering the conditioned response
- **higher-order conditioning** - a procedure in which the conditioned stimulus in one conditioning experience is paired with a new neutral stimulus, creating a second conditioned stimulus
    - an animal that has learned that a tone predicts food might then learn that a light predicts the tone and begin responding to the light alone

Extinction and Spontaneous Recovery

- **extinction** - the diminishing of a conditioned response
    - occurs when a US doesn't follow a CS
- **spontaneous recovery** - the reappearance, after a pause, of an extinguished conditioned response

Generalization

- **generalization** - the tendency, once a response has been conditioned, for stimuli similar to the conditioned stimulus to elicit similar responses

Discrimination

- **discrimination** - the learned ability to distinguish between a conditioned stimulus and stimuli that don't signal an unconditioned stimulus
    - responded to a certain tone and not other tones

Pavlov's Legacy

- *many other responses to many other stimuli can be classically conditioned in many other organisms*
- *a process such as learning can be studied objectively*

Applications of Classical Conditioning

- former drug users often feel a craving when they are again in the drug using context
    - with people or in places they associate with previous highs
- when a particular taste accompanies a drug that influences immune responses, the taste by itself may come to produce an immune response

Operant Conditioning

Operant Conditioning

- **operant conditioning** - a type of learning in which behavior is strengthened if followed by a reinforcer or diminished if followed by a punisher

Skinner's Experiments

- **law of effect** - Thorndike's principle that behaviors followed by favorable consequences become more likely, and that behaviors followed by unfavorable consequences become less likely
- **operant chamber** - (aka Skinner Box) a chamber containing a bar or key that an animal can manipulate to obtain a food or water reinforcer
    - attached devices record the animal's rate of bar pressing or key pecking
    - **reinforcement** - any event that *strengthens* the behavior that follows

Shaping Behavior

- **shaping** - procedure in which reinforcers guide behavior towards closer and closer approximations of the desired behavior
    - *successive approximations* - rewarding responses that are even closer to the desired response
- **discriminative stimulus** - a stimulus that elicits a response after association with reinforcement

Types of Reinforcers

- **positive reinforcement** - increasing behaviors by presenting positive reinforcers

    - positive reinforcer - any stimulus that, when *presented* after a response, strengthens the response
- **negative reinforcement** - increasing behaviors by stopping or reducing negative stimuli
    - negative reinforcer - any stimulus that, when *removed* after a response, strengthens the response
    - negative reinforcement isn't punishment

Primary and Conditioned Reinforcers

- **primary reinforcers** - an innately reinforcing stimulus
    - eating food when hungry
- **conditioned reinforcers** - a stimulus that gains its reinforcing power through its association with a primary reinforcer
    - aka *secondary reinforcer*
    - good grades, money

Immediate and Delayed Reinforcers

- humans respond to delayed reinforcers
    - paychecks
- immediate gratification beats delayed gratification
    - having unprotected sex beats the delayed gratification of no STDs and not getting pregnant

Reinforcement Schedules

- **reinforcement schedules** - a pattern that defines how often a desired response will be reinforced
- **continuous reinforcement** - reinforcing the desired response every time it occurs
    - learning occurs rapidly
    - extinction happens just as rapidly
- **partial (intermittent) reinforcement** - reinforcing a response only part of the time
    - results in a slower acquisition of a response
    - much greater resistance to extinction
- **fixed-ratio schedules** - reinforces a response only after a specified number of responses
    - "free coffee for every 10 coffees purchased"

- **variable-ratio schedules** - reinforces a response after an unpredictable number of responses
    - slot machine
- **fixed-interval schedules** - reinforces a response only after a specified time elapses
    - on the day that your package is supposed to be delivered, you check the website more often than any other day
- **variable-interval schedules** - reinforces a response at unpredictable time intervals
    - rechecking your email to see if you got a response
- response rates are higher when reinforcement is linked to a number of responses (a ratio schedule) rather than to time (an interval schedule)
- responding is more consistent when reinforcement is unpredictable (a variable schedule) than when it is predictable (a fixed schedule)

Punishment

- **punishment** - an event that tends to *decrease* the behavior that it follows
    - *positive punishment* - administer an aversive stimulus
        - spray water on a barking dog
        - give a ticket for speeding
    - *negative punishment* - withdraw a rewarding stimulus
        - take away a teen's driving privileges
- physical punishment has a lot of drawbacks

Operant Conditioning's Applications, and Comparison to Classical Conditioning

Applications of Operant Conditioning

At School

- teachers can use shaping techniques to guide students' behaviors
- teachers can use electronic adaptive quizzing to provide ultimate feedback

In Sports

- coaches can build players' skills and self-confidence by rewarding small improvements

At Work

- managers can boost productivity and morale by rewarding well-defined and achievable behaviors

At Home

- parents can reward desired behaviors but not undesirable ones

For Self-Improvement

- stating our goals, monitoring frequency of desired behaviors, gradually reducing rewards as behaviors become habitual

Contrasting Classical and Operant Conditioning

- both are forms of *associative learning*
- both involve *acquisition, extinction, spontaneous recovery, generalization* and *discrimination*
- through classical conditioning, we associate different stimuli we do not control, and we respond automatically
    - **respondent behavior** - behavior that occurs as an automatic response to some stimulus
- through operant conditioning, we associate our own behaviors that act on our environments to produce rewarding or punishing stimuli
    - **operant behavior** - behavior that operates on the environment, producing consequences

Biology, Cognition, and Learning

Cognition's Influence on Conditioning

Cognitive Processes and Operant Conditioning

Latent Learning

- **cognitive map** - a mental representation of the layout of one's environment
- **latent learning** - learning that occurs but is not apparent until there is an incentive to demonstrate it

Insight Learning

- **insight** - a sudden realization of a problem's solution

Intrinsic Motivation

- **intrinsic motivation** - a desire to perform a behavior effectively for its own sake
- **extrinsic motivation** - a desire to perform a behavior to receive promised rewards or avoid threatened punishment

Learning and Personal Control

- **coping** - alleviating stress using emotional, cognitive, or behavioral methods
- **problem-focused coping** - attempting to alleviate stress directly
    - by changing the stressor or the way we interact with that stressor
- **emotion-focused coping** - attempting to alleviate stress by avoiding or ignoring a stressor and attending to emotional needs related to one's stress reaction

Learned Helplessness

- **learned helplessness** - the hopelessness and passive resignation an animal or human learns when unable to avoid repeated aversive events

Internal Versus External Locus of Control

- **external locus of control** - the perception that chance or outside forces beyond our personal control determine our faith
- **internal locus of control** - the perception that you control your own faith

Depleting and Strengthening Self Control

- **self control** - the ability to control impulses and delay short-term gratification for greater long-term rewards

Learning by Observation

- **observational learning** - learning by observing others
    - also called *social learning*
- **modeling** - the process of observing and imitating a specific behavior

Mirrors and Imitation in the Brain

- **mirror neurons** - frontal lobe neurons that some scientists believe fire when performing certain actions or when observing another doing so
    - the brain's mirroring of another's action may enable imitation and empathy

Applications of Observational Learning

Prosocial Effects

- **prosocial** - positive, constructive, helpful behavior
    - opposite of antisocial behavior