Introductory Psychology – Unit 1

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Definition of Psychology

The scientific study of mind, brain and behavior as products of genetic predispositions and experience.

Scientific: Usually an empirical approach primarily based upon observable phenomenon (things we either can, or can attempt to, objectively measure). Advances in technology continually open up more areas to direct observation, study, and experimentation. Yet some phenomena remain more elusive, what are referred to as subjective experiences such as our sense of self and our own thought processes. We have unique perceptions of the world around us, emotional reactions, personal memories, dreams, and so forth. Gaining insight into the nature of these phenomena requires different methods, such as trained introspection. Beyond these, some of the more esoteric or metaphysical questions pertaining to psychology such as the concept of personal identity, the nature of the psyche, the existence of the soul, free will vs. determinism, inner truths, and so on remain largely within the realm of philosophical inquiry.

Behavior: Historically this has referred to directly observable actions. These largely have been interpreted in terms of control by external stimuli (cues, rewards, punishments). But current technology is opening up whole new areas of observable behavior, that of the biochemical and physiological processes underlying these actions.

Brain: Ultimately the brain and nervous system underlie and control our thoughts and behaviors. We are continually gaining new insights into what areas of the brain govern particular functions and abilities. Modern technology such as PET and MRI scans allows us to observe and model the activity of the living brain. By these methods we can trace the blood flow and glucose utilization in various areas of the brain while performing certain tasks. More than 200 neurotransmitters and neuromodulators have been identified. Continuing research into their sites of action and functional roles provide information about normal functioning, as well as aiding in the development of drug therapies for neurological conditions and mental illness.

Mind: Despite a great deal of focus on behavior at various levels, we also have a sense of being. Few people conceive of themselves, their consciousness, as little more than biochemical reactions occurring within the confines of the nervous system. And it seems to most people that we're doing more than simply reacting to various environmental stimuli. We have subjective experiences, as we are consciously aware of our emotions and thought processes. We not only recall what is stored in memory, we may re-experience events. And our dreams are often a world of experience all their own. So there is a sense of self or what might be called the psyche. And all of these subjective experiences are part of our psychological functioning and deserving of study. In modern times these have been explored by way of psychophysics, trained introspection, and cognitive psychology. As already stated, there are further areas related to psychology that remain part of philosophy *for the present*.

Genetic Predispositions: What we're born with, capacities, faculties, potential. These may or may not achieve full expression, depending upon general factors such as nutrition, and specific factors such as triggering events. So a genetic (hereditary) predisposition often is not a sufficient determining factor in respect to a particular condition.

Experience: Overall life and times, cultural differences, and so on comprise half of our personal histories. The historical period in which an individual lives shapes the life experience. This must be understood when interpreting the psychologies of people from past eras. And we must understand that the current era provides a unique perspective as well. We've grown up in a vastly different world than people of the past, one in which change has become greatly accelerated. No one alive today precedes the telephone (1876), light bulb (1879), automobile (1886), movies (1890s), radio (1894) or airplanes (1903). Few precede broadcast television (1927), jet aircraft (1939) or antibiotics (1940s). Most people were born after the introduction of psychoactive drugs (1950s), chemical birth control methods (1960s), electronic calculators (1970s), ATMs (1980s), personal computers (1980s), DVDs (1990s), digital phones (1990s), smart phones (2000s) and tablet computers (2010s). These technologies shape the way people live from day to day. And along with all of these technological changes there have been major world events that have profoundly shaped the way those in past eras, and those today, view the world and their place in it. World wars and economic upheavals have had tremendous impact.

Consider that since AIDS was introduced to Europe and North America (1982) it has profoundly affected views regarding sexuality. And the mid-1990's was the beginning of an unprecedented increase in body art (tattoos and piercings) and elective cosmetic surgeries (breast implants, collagen and Botox injections). Obviously this changes the importance and role of body image in the conception of the self. The current century has brought us an ever-expanding communications network by way of both the Internet and digital phones. This allows inexpensive and easy interaction with people all over the world. So there will be less cultural isolation, which is certain to have an effect on peoples' perspectives. But we will still be bound to different cultural perspectives based upon ethnic heritage, religion, family upbringing and so forth that define things like gender roles and acceptable conduct. The other half of one's personal history is comprised of a unique collection of personal experiences based on all the people, places and events that have impacted us personally over the course of life. Together both of these components make up the context of our lives. How one deals with them, and how one adapts to them, come to shape the individual's psychological functioning.

History of Psychology

Modern human beings, such as we are today, first emerged around 100,000 years ago (perhaps less). In the beginning the main focus was tied to survival, that of both the individual and the species. The important things to learn and pass on would be very basic knowledge. Knowing what plants were edible, where they were to be found, and their growing seasons would provide the dietary staples. Knowledge of animal migrations and hunting skills provided additional food supplies, as well as leather, oil, and other animal by-products (bones, teeth, and horns for tools). The harnessing of fire would allow for cooking and preserving food. As the inventive capacities of early humans continued to develop improved spearheads, cutting tools, devices for lifting and transporting materials, and so forth were produced. As time progressed humans would learn about the medicinal benefits of various plants. There is also evidence of an early medical practice known as *trephination* that may have been used to treat headache, epilepsy, or mental illness. People would come to learn about astronomical movements to better predict growing seasons and herd migrations, as well as to determine direction when traveling. The development of agriculture would make it possible for some individuals to work solely on adding to the knowledge base. Better astronomical knowledge would provide increasingly valuable information for predicting not only growing seasons and migrations, but also weather patterns. And to make this possible mathematics and some system of record keeping would need to be developed (eventually leading to written language). Refined astronomical knowledge, of course, can be quite impressive when predicting things like solicits and eclipses. And so it was that religion came into play as a source of power. The next questions to be considered had to do with the nature of the universe and the driving force behind it (God and creation), death (the supernatural and whether there's an afterlife?), and codes of conduct and morality.

Roots of Psychology: It took a long time before people began contemplating themselves, and the various aspects of the human condition beyond the idea of just proper conduct. But that was the beginning of philosophy. People began questioning the nature of the self, what can people know, how can and do they come to know it, what defines truth, and so forth. Philosophy was a secular approach to not just knowing about the universe (as was the case in religion), but to actually understanding it, as well as understanding the role humans might have in the grand scheme of things. As such philosophy originally covered all possible topics and areas of inquiry. Then as various specialized branches of philosophy developed they splintered off to become separate areas of knowledge and study, among the first to do so were cosmology and physiology/medicine. And so it has been the tradition ever since, with psychology being one of the most recent offshoots (end of 19th century). So for much of human history psychology has been studied as a part of philosophy. Some additional insights were provided by physiology/medicine. These are the roots of modern psychology. Although there was a good deal of overlap, these two traditions had vastly different approaches with respect to the best and most reliable sources of knowledge and understanding.

Approaches to Seeking Knowledge: Intellectual inquiry ultimately is aimed at finding an understanding of the true nature of things. The two main approaches that have been used are known as nativism (rationalism) and empiricism. Both views have very specific tenants regarding the best way of addressing a question and conducting research, what the best sources of information are, and how we can come to understand things. Investigations into psychological phenomenon have utilized and benefited from both approaches.

Nativism - This approach is based upon the idea of *a priori* knowledge. It assumes we are born with innate ideas and capacities, as well as a certain amount of knowledge. Introspection (internal reflection and contemplation) is the means to obtaining the purest form of understanding. There is a great deal of reliance on subjective experience. Our senses are prone to error and illusion. Thus they can lead to false conclusions. This was, and is the route taken by those looking at psychology in terms of the mind as well as certain metaphysical concepts such as the psyche, spirit, or soul. Plato was one of the first to embrace this approach.

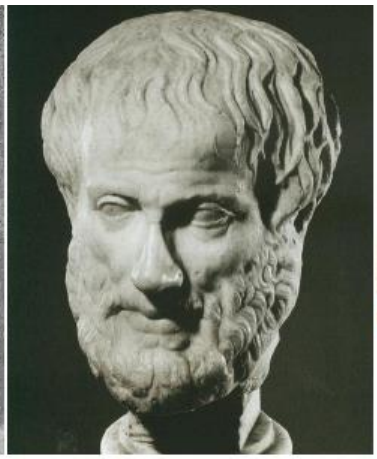
Thought experiments are part of the nativistic approach. The idea is that we can find the answer to a problem by applying logic given certain basic laws are known. And so we can determine how some process takes place based on *how it has to work* given accepted physical laws. Much of the early work regarding the nervous system and perceptual processing relied on this method. Often the conclusions reached were later proven to be quite accurate when technical advances made direct measurements possible.

Empiricism - This opposing approach is based upon the idea of *a posteriori* knowledge. It assumes that all we will ever know comes from without and that we are born with a completely clear consciousness. Sensation and experience (observation) are the means to obtaining the purest form of understanding. There is a great deal of reliance on systematic observation and experimentation. Only that which is subject to mutual observation and shared experience is considered to be reliable. This was, and is the route taken by those looking at psychology from a more physically based perspective emphasizing observable behavior as well as the underlying anatomy and biochemistry. However, for much of the early period of history any form of dissection was considered sacrilege. Inferences about anatomy and biochemistry had to be made based upon what could be observed from injuries and illnesses. Hippocrates and Aristotle were among the first to embrace this approach.

In the area of psychology the empirical approach led to searching for the physical correlate of the mind as well as the physical factors responsible for our various personality predispositions and mental faculties. This, in turn, led to the use of physical treatments for psychological maladies.


Plato


Hippocrates


Aristotle


Galen

Plato (437-375 B.C.)

Proposed the concept of *Dualism*, two levels of general reality. He believed that there are two types of substance and two realms of existence. There is a universe of ideals (forms) juxtaposed to the less important physical universe (only mere representations of the ideal forms). The mind is part of the universe of ideals. So the mind exceeds and goes beyond the substance of the body. It is ultimately independent of the body and will survive the body. However, although we were originally at one with the universe of ideals and had knowledge of the true nature of all things that changes when we are born. The physical body puts limitations on the mind, inhibiting our ability to recall our experience of the true nature of things (the ideals). These limitations cause misperceptions, illusions, and deceptions. We must struggle to rediscover our knowledge of the true nature of reality. We do so by means of introspection.

The concept of *Monism* developed as a reaction to Plato's dualism. It is generally associated more with empiricism, though no one individual is credited with conceiving it. Monism states that there is only one reality, the physical universe. And so the mind is rooted in the physical substance of the body. Of course, this view is really quite harsh in that it provides little room for God, the metaphysical, or an afterlife. And the way to gain true knowledge of the nature of reality is by careful, systematic observation of the physical world.

Plato also developed the theory of the *tripartite* nature of the psyche (mind or soul.). By this account there is a conflict between the *Appetite* (basic instincts, drives, hedonistic desires) and *Reason* (ideal form of the self, ultimate vision or goal, capacity for thought and logic) that is mediated by the *Spirit* (ego, conscious mind, the person or self). And so the spirit consciously works to channel our mostly unconscious appetites, and uses reason to do so. Note: This was the basis of Sigmund Freud's later conception of the Id (appetite), Ego (spirit), and Superego (reason).

Hippocrates (460-375 B.C.)

Brain is the basis of mind (seat of the soul). Seizures and personality changes are tied to brain injury. Proposes theory of bodily humors.

Aristotle (384-322 B.C.)

Heart is the basis of mind (seat of the soul). Brain injury does not always lead to death, but heartbeat determines if one is alive. Adopts theory of bodily humors and ties it to his cosmology: earth, air, fire, and water. Also develops a theory of memory based upon various *forms of association* (law of contiguity, law of effect).

Galen (130-200 A.D.)

Early Roman Empire physician who extensively elaborated upon the concept of *Bodily Humors* (Animal Spirits, Vital Fluids) in the book *On the Temperaments*. Various personality predispositions and mental states were associated with particular humors.

Blood - Warm, red, sweet and so associated with best of human qualities including courage, generosity, cheerfulness, and an overall good nature.

Phlegm - Mucous, snot, lymph fluid (burns), and sweat which are essentially cold, colorless, odorless and so associated with qualities such as being apathetic, unemotional, aloof, cold, and uncaring.

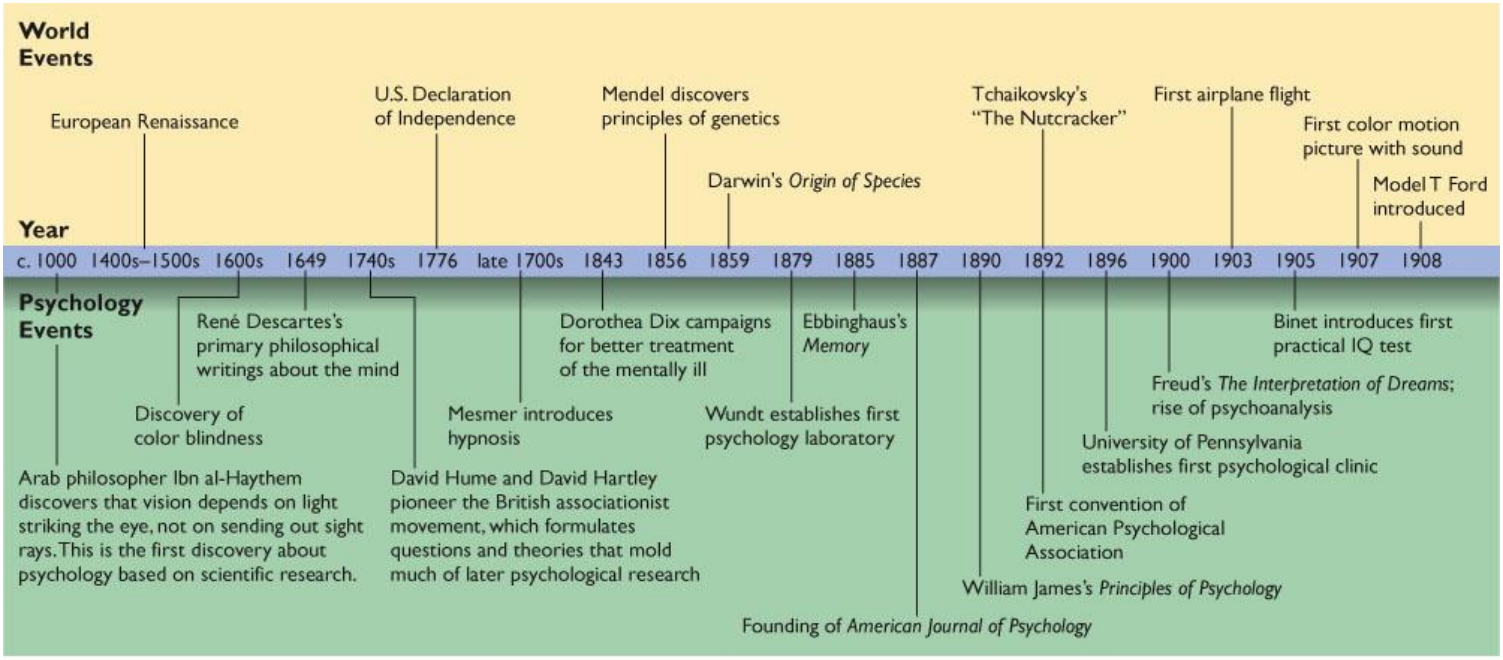
Yellow Bile - Urine, vomit, and other digestive enzymes which are yellow/orange, acidic, caustic and so associated with qualities such as impulsivity, irritability, being overly aggressive, competitive, combative, nasty, and quick-tempered.

Black Bile - Feces and diarrhea, which are dark in color, smell of rot, putridity, decay. Reminds one of death and decay. So associated with regret, remorse, sadness, melancholy, and depression.

Inspires physical treatments based on assumption of fluid excesses such as bloodletting and various forms of purging. Unpleasant treatments lead to patients claiming improvement (if they survived).

Middle Ages: Bodily humors and vital fluids continues to be the dominant approach in medicine. Begin to classify specific diseases of the mind. In addition, weaknesses of will and lack of character strength are also considered as causes of some mental illness. Medical treatment for those with serious mental illness consists of little more than imprisonment in asylums.

Medieval Church: Heaven and Hell. Divine and demonic forces thought to be influencing human affairs. Mental aberrations were thought to be due to demonic possession or witchcraft. *The Witch's Hammer*. Harsh methods employed to drive out evil influences.



Renaissance: More travel and less isolationism leads to consideration of alternative perspectives and greater tolerance for non-traditional ideas. New technologies emerge such as the printing press and lenses for telescopes and microscopes. There is a greater capacity for the dissemination of information and wider latitude in the sciences. New avenues of study and experimentation develop and become accepted. Vesalius pioneers the study of anatomy by dissection. There is also a new freedom of expression in the arts as well as a desire for greater accuracy (3-dimensional painting and woodcuts beginning with Alfred Durer and other Dutch Masters).

Descartes (1596-1650)

By meditation and introspection arrives at *Cogito, ergo sum*. Proposes that this is the great inner truth from which all knowledge can be derived, as one cannot be deceived in this. The human mind is separate from the body and operates on a different plane, merely interacting with the physical body by way of animal spirits through the pineal gland and nervous system. This allows for the movement and manipulation of objects in the physical universe.

Use of dissection leads to discovery of the nervous system and the *reflex arc* (sensory neuron to spinal cord to motor neuron, with possible override by way of inter-neurons). Animals and the human body function at a physically mechanistic level (believed to be mere hydraulics).

Hobbes (1588-1679)

Humans are basically self-centered, acquisitive, greedy, brutish, and cruel. From birth we quickly learn to put ourselves above all other concerns. There is no state of innocence, and civilization forces us to act in acceptable ways to ensure greater protection and security for all.

Locke (1632-1704)

We are all born with a clear consciousness devoid of any content. There is no innate information, as the mind is a *tabula rasa*. All knowledge and ideas are ultimately the result of sensation and objective experience.

Leibniz (1646-1716)

Mind necessarily exists prior to experience, and so interprets experience and acts to organize information. Elaborates the concept of the *unconscious*, mostly in terms of perception and stimulation below the level of conscious sensory awareness (the limen - *e.g.* the unconscious detection of a single drop of rain).

Hume (1711-1776)

Total skepticism is necessary to true understanding. Nothing is certain. So we should question everything. And we must be careful to avoid making far-reaching assumptions and conclusions. For science this means that nothing can ever be proven with absolute certainty. However, the greater the body of evidence supporting a particular theory the greater the confidence we can have in that theory.

Kant (1724-1804)

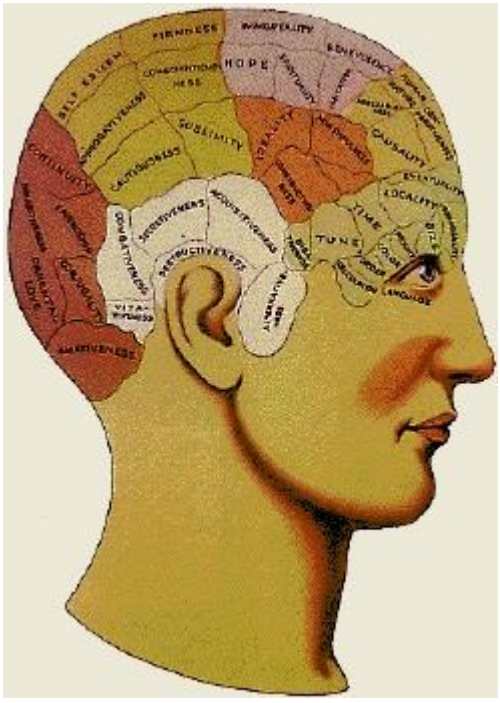
Categories of the Mind. There are innate capacities and pre-dispositions that each of us use which shape how the sensory input we receive is interpreted. By its nature the mind imposes order on what we experience, so the

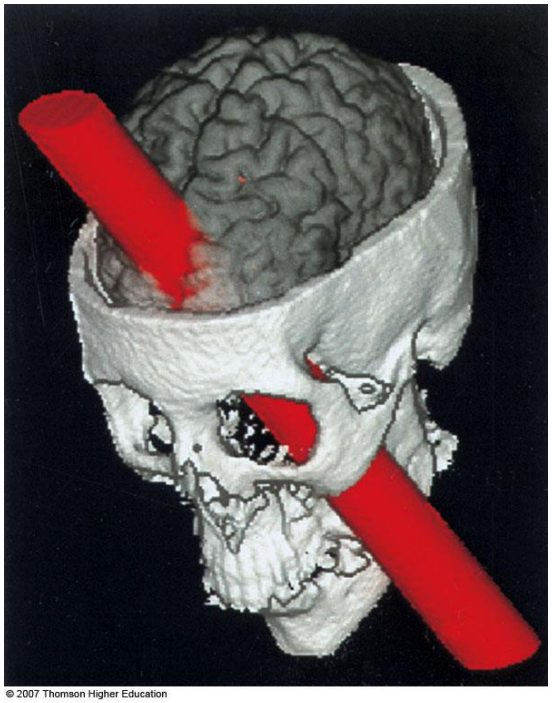
very act of being aware of something alters it. We can only experience the world as a product of how the mind processes the information coming to it. So there is a necessary difference between sensation and perception, between objective and subjective experience. This challenges many assumptions of both how and what we are able to understand.

Mesmer (1734-1815)
Hypnosis, claimed he had power over the electrical energies of the mind. By this method one could control and command an individual by way of the unconscious mind.

Pinel (1745-1821)
Working with mentally ill elaborates on least four types of psychological pathology: mania, melancholy, dementia, and idiocy. Also proposes possible inherited factors in mental illness. Initiates more human treatment of the mentally ill.

19th Century: Beginnings of organic chemistry results in synthesis of urea (1834), calling into question the nature of vital fluids. Experiments with electricity lead to early speculation that the neural impulse may be electrical in nature. However, by the end of the century research had revealed it to be a biochemical process involving the transfer of electrically charged ions. There was also speculation regarding the organization of the brain and the nature of our perceptual experiences. The big question concerning the organization of the brain was whether it worked as a unified whole or whether different areas were responsible for specific functions. By the 20th century the accumulated evidence clearly supported the latter view, referred to as *localization of function*. Perceptual research focused on the relationship between physical events in the environment and our subjective experiences of them. By the end of the century researchers were also exploring how sensory information was encoded, sent to the brain, and interpreted. All of this interest in psychological research and theory during the 19th century resulted in psychology separating away from philosophy and becoming a separate discipline on its own. And looking to be cutting edge a number of newly established colleges and universities (especially in the United States) made it a point to set up psychology departments to attract interested students.





Franz Gall and **Spurzheim** (1800's)
First to develop the concept of localization of function within the brain. Although that basic tenant is quite sound their specific application is not and leads to the pseudo-science of phrenology.

Johannes Muller (1838)
Doctrine of Specific Nerve Energies - All nerves relay information by the same form of energy, an electrical impulse of some sort. The source of stimulation (no matter how stimulated) determines our subjective experience or perception. Thus, mechanical stimulation of the retinal cells produces visible phenomena (pressure phosphemes).

Phineas Gage (1848)
Injured when a 3 1/2 foot metal rod was blasted through his skull and brain. Left eye injured and blinded, both frontal lobes of brain damaged. Major personality changes followed, leading to the conclusion that those areas of the brain specifically governed higher levels of personality, such as responsibility, morality, and good character. His case provided early evidence that the concept of localization of function was correct.

E. H. Weber (1795-1878)
Began work in psychophysics in an attempt to determine the nature of the relationships between various objective physical phenomenon and the subjective inner experiences of them. Studied difference thresholds and formulated Weber's law to explain his just noticeable difference findings in 1834.

Gustav Fechner (1801-1887)
Carried on Weber's work in psychophysics. Studied perceptual thresholds and just noticeable differences. Wrote *Elements of Psychophysics* (1860). Formulated Fechner's law describing the mathematical relationships between changes in physical intensity of various stimuli and the perceived changes in intensity experienced (usually not a one to one correspondence). A prime example is the inverse square law: If you reduce the distance of a light source from an observer by one half the light is perceived as four times as bright ($1/D^2$).

Vichow (1858)
Publishes *Theories of Cellular Pathology*. Medicine changes its focus and abandons the concept of bodily humors altogether.

Broca (1861)
Discovered area bordering between frontal (near motor cortex) and temporal lobes of brain responsible for the production of speech. Localization of function.

Wernicke (1874)
Discovered area in upper temporal lobe of brain specific to the organization and interpretation of speech (that allow one to make sense of verbal material and form sensible utterances). Localization of function.

Hermann von Helmholtz (1821-1894)
Proposed the *trichromatic* theory of color vision, and worked out what the maximum sensitivities of the retinal pigments would of necessity have to be for our given capacity to distinguish colors. By similar means he

arrived at the *resonance/place* theory of auditory perception (why we can hear and distinguish sounds at frequencies well beyond the capacities of single neurons). He also developed the concept of the *unconscious inference* stating that at some level the mind learns what the world is like and imposes order on our experiences based on its previous interpretations of similar experiences. This is the basis for many perceptual illusions.

Helmholtz was able to measure the speed of neural impulse and determined conduction in humans varied in the range of 165-330 feet per second. This was far slower than the speed of light and electromagnetic energy meaning some biochemical process based on the transfer of ions must be responsible. This further suggests that not only the speed of motor reflexes, but also that of cognitive processes could be measured empirically. He also invented the ophthalmoloscope, allowing him to observe the structure of the intact retina.

Wundt (1879)

Set up psychology lab in Leipzig, Germany studying the nature of conscious experience and sensation via techniques of introspection. Determined that it takes visual information approximately 125 milliseconds longer to be processed than auditory information.

Ebbinghaus (1880's)

Developed savings technique for the assessment of memory by studying retention of material from lists of nonsense syllables (VOT, DAK, NOF).

Schools of Psychology: By the 1890s interest in the field of psychology was growing considerably. As more people began working in psychology different perspectives and approaches to its study developed. These different interpretations of what a science of psychology should entail were the basis of what were known as schools of psychology. These schools of psychology were often in opposition and each had its own proponents and adherents. There was considerable debate when it came to what direction the field should take. Over the course of time each school would have considerable influence at some point then wane in importance as the field continued to develop.

Structuralism and Functionalism - Wundt, Titchner, Boring, and James. Relied on introspection to discover the fundamental components of conscious experience and their functional significance.

Psychodynamic / Psychoanalytical - Freud and Jung. Focus on unconscious drives and conflicts. Freud believed these to be almost exclusively sexual in nature. Jung added in other sources including the collective unconscious.

Behaviorism - Pavlov, Watson, Hull, and Skinner. Newtonian physics is the model, reduce phenomenon to components and attempt to manipulate them. Behavior is the only factor psychologists can actually observe and objectively measure. Mental states may exist, but are subjectively experienced and ultimately add nothing to the understanding in so far as our goal is solely the prediction and control of behavior. Present things such that new associations are formed between different stimuli and so change the individual's responses. Rewards and punishments provided by the social environment become associated with certain behaviors that either increase or decrease accordingly.

Gestalt - Lewin, Festinger, and Wertheimer. Reductionism does not always provide meaningful information or understanding. The flammable gases hydrogen and oxygen combine to form water, the product is far different from the constituent components. Same is true for individual's characteristics and the social situation. Must examine the experience of the social situation and the individual's reaction to it as a unified whole. Fundamental attribution error, for instance, wherein we tend to underestimate situational factors and overestimate the role of individual characteristics. Need to understand that both factors interact and contribute to what is observed, each tempers the other.

Humanistic - Adler, Maslow, Rogers, Erikson. Influenced by Gestalt, looks at the whole person. Emphasizes individual growth, self-worth, and the realization of one's potential. Therapy focuses on self-discovery on the part of the patient rather than interpretations made by the therapist.

Cognitive - Tolman, Piaget, Bandura, and Miller. Combined the elements of both behaviorism and gestalt along with insights gained from other areas, particularly artificial intelligence. Current model is the computer network. Various interconnections between beliefs and ideas all play a role in how the individual reacts to situational factors, group presence and influence, other individuals, and the consequences of behavior.

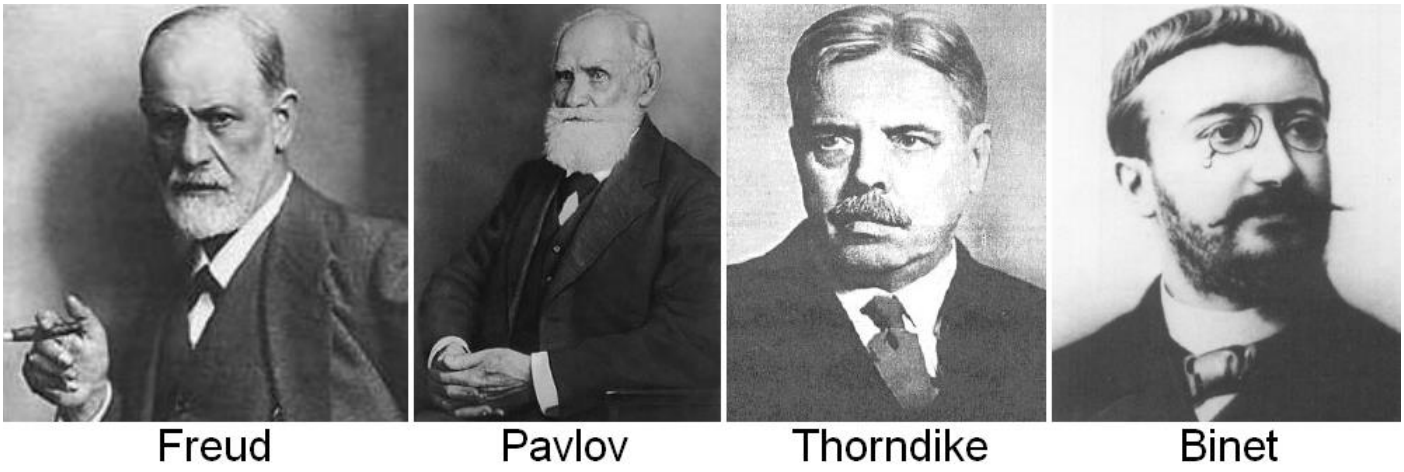
Cognitive dissonance, self-fulfilling prophecy. Much of this research done within the realm of social psychology.

Table 1.3 MAJOR SCHOOLS OF PSYCHOLOGY

School	Prominent Figures	Major Emphases	Techniques of Studying
Structuralism	Wilhelm Wundt Edward Titchener	The importance of thought processes and the structure of the mind The identification of the elements of thought	Trained introspection
Functionalism	William James John Dewey	The importance of applying psychological findings to practical situations The function of mental processes in adapting to the environment	Introspection Experimental method Comparative method (comparing psychological functioning of people and animals)
Psychoanalytic Theory	Sigmund Freud Carl Jung	The influence of the unconscious on behavior The importance of early life experiences on personality development	Individual case studies of patients
Gestalt Psychology	Max Wertheimer Wolfgang Köhler Kurt Koffka	The importance of organization and context in the perception of meaningful wholes	Perception experiments
Behaviorism	Edward Thorndike John Watson B. F. Skinner	The importance of objective, observable behavior in the study of psychology The importance of careful research methods The conviction that behaviors are mere responses to external stimuli.	Experiments, primarily on learning and often done with animals
Humanistic Psychology	Carl Rogers Abraham Maslow	The importance of people's feelings The view of human nature as naturally positive and growth-seeking Faith in people's abilities to solve their own problems	Interview techniques
Cognitive Psychology	Jean Piaget Albert Ellis Albert Bandura Robert Sternberg Howard Gardener	Focus on thinking and reasoning processes Focus on the mental processing of information	Memory experiments Information processing approach
Psychobiology	Johannes Müller Karl Lashley David Hubel Torsten Wiesel	Behavior as a result of complex chemical and biological processes within the brain	Brain scans Electrical brain stimulation and recording Chemical analysis of brain tissue
Evolutionary Psychology	Charles Darwin Konrad Lorenz E.O. Wilson	Behavior, including intelligence and personality, is influenced by innate factors.	Naturalistic observation
Cultural Psychology	John Berry	Behavior is influenced by its cultural context.	Experimental method comparing the responses of different people from different cultures

Edward Titchner (1890's)
Building on Wundt's research, establishes *structuralism*. Attempts to use introspection to determine the fundamental components of thought and consciousness.

William James (1890's)
Establishes *functionalism*. Attempts to use introspection to determine the function of mental processes in adapting to the environment and to ascertain fundamental mental processes. Also writes the first major textbook in psychology.



Sigmund Freud (1856-1939)
Utilized extensive case studies in the treatment of mental illness employing hypnosis, free association, and dream analysis. Wrote *The Interpretation of Dreams* (1900). Freud was one of the first to fully recognize and call attention to the importance of childhood experiences in the development of the adult personality. He formulated an elaborate theory of psychological development and the doctrine of *psychodynamics*. The basic tenet of his theories was that we are driven by largely unconscious sexual drives and conflicts present from early childhood through adulthood. How we deal with those conflicts determines whether we are happy and well-adjusted or troubled.

Alfred Adler (1870-1937)
Originally a close colleague of Freud, they came to differ on key concepts. Adler believed that the primary motivation of our behavior was a desire to excel, to improve ourselves, to take control of our lives, and reach our full potential. Those that achieved this state of self-actualization strive to do things that benefit society as well. Those that do not achieve this have feelings of low self-worth, low self-esteem, and inferiority. To compensate they may try to control others to provide a sense of superiority or socially isolate themselves. However, Adler emphasized that each individual case is unique and therapy must be a joint effort between patient and therapist. These latter ideas were the basis of the *humanistic* school of psychology.

Carl Jung (1875 –1961)
Also was originally a close colleague of Freud, they also came to differ on key concepts. Jung expanded upon Freud's theories developing the *psychoanalytic* approach. He proposed that we all have both masculine and feminine qualities (animus and anima). He also developed the concepts of the collective unconscious and archetypes proposing that we are unconsciously influenced not only by our own life experiences but also those from the shared history of humanity. So ultimately the individual is driven by a variety of unconscious factors, not merely sexual urges as Freud believed.

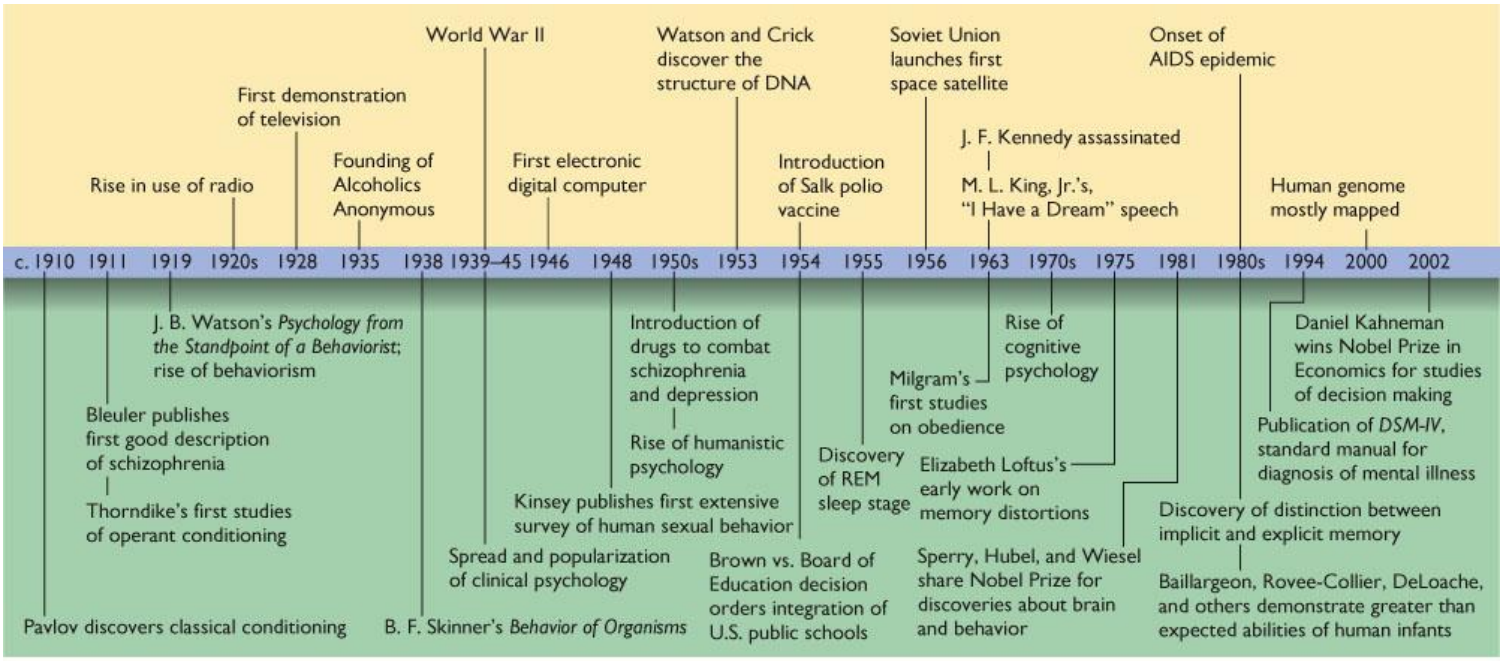
E.L. Thorndike (1898)
Pioneering work in instrumental conditioning (first empirical investigation of the law of effect) using cats in a puzzle box. The stamping in of behaviors shows a learning curve.

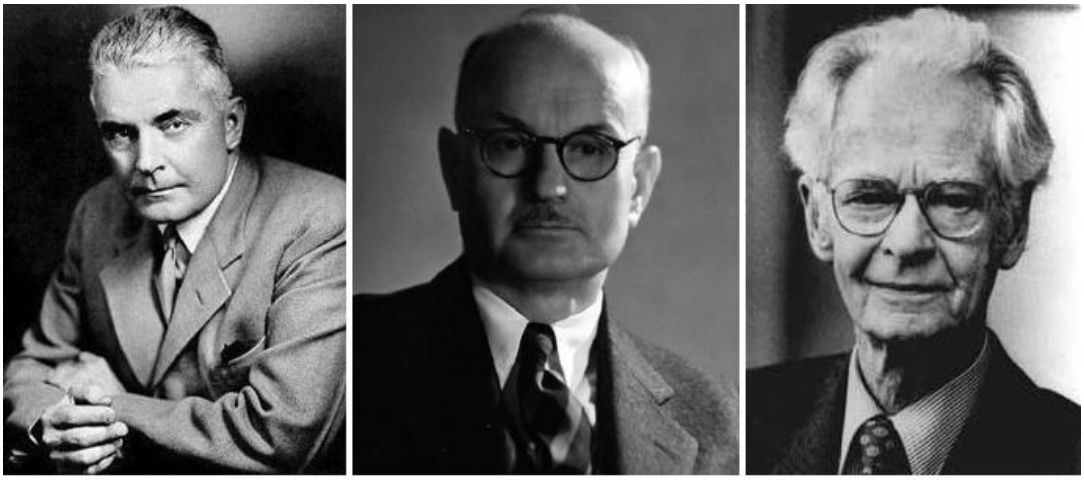
Ivan Pavlov (1849-1936)
Nobel prize (1904) winning Russian physiologist begins work studying salivary response. Discovers principles of classical conditioning.

Alfred Binet and **Theodore Simon** (1905)
Devise the first standardized intelligence test. Propose the concept of mental age. This work leads to the development of I.Q. testing.

Ramon y Cajal (ca 1890s)
Discovers the synapse, the narrow gap separating one neuron from another.

Charles Sherrington (1857-1952)
In 1906 demonstrated the difference between a neural impulse traveling down a single axon and communication between neurons occurring at the synapse.





John B. Watson (1878-1958)
In 1913 proposes that psychology should focus on observable behavior if it is to be a true science like Newtonian physics, thus establishing *behaviorism*.

Clark Hull (1884-1952)
During the 1930's and 40's develops elaborate quantitative theory of behavior based on the concept of habit strength.

B.F. Skinner (1904-1990)
Designs operant chamber (Skinner box) for controlling the environment of experimental subjects. Studies simple animal behavior over time using cumulative records. Finds relationships between schedules of reinforcement delivery and patterns of behavior. Refines behaviorism into radical behaviorism based on operant principles.

Wolfgang Kohler and **Max Wertheimer** (1930's)
Establish *Gestalt* psychology, based on the assumption that psychological phenomenon cannot be reduced into component parts.

Edward Tolman (1886-1959)
Research on latent learning and cognitive maps serve as the basis of *cognitive* psychology.

George Miller (1956)
Determines storage capacity of short-term memory to be 7 ± 2 items.

Roger Sperry (1913-1994)
Performed research on split-brain patients revealing much about the lateralization of function between the two brain hemispheres.

David Hubel and **Torsten Wiesel** (1959)
Used microelectrode recording to isolate feature detector cells in the visual cortices of cats and monkeys. Further examination of the receptive fields of various cell types in the visual cortex has provided extensive information on visual processing and the organization of the visual cortices of both animals and humans.

S.S. Stevens (1960's)
Continued work on psychophysical relationships. Formulated Steven's power law which states that across sensory modalities changes in experience are scaled as power functions of the corresponding changes in the actual physical intensity of the stimuli (inverse square law, decibel scale, etc.).

Albert Bandura (1960s - 1970s)
Studied imitation and learning by observation. We mimic the behavior of others expecting the same outcome. This may also extend to what we view in the media.

Jean Piaget (1960s - 1970s)
Develops a theory of cognitive development focusing on the conceptual capabilities and the forms of logic used by children of various ages.

Candace Pert (1972)
Discovered opiate receptors within the brain leading to the isolation of endorphins. This was the pioneering work in understanding the neurochemistry of the brain. In the years since much has been learned concerning the neurotransmitters and neuropeptides the brain uses and their sites of action.

Modern Psychology: It should be noted that the modern approach to psychology has largely abandoned the idea of separate schools of psychology. The field still has many specialty areas of research and clinical applications. And distinctions are still made between types of psychologists, based on areas of specialization. But most psychologists no longer align themselves with one particular viewpoint. The general approach has become more eclectic and psychologists commonly integrate a number of different perspectives in their work. The biggest distinction still remaining is that between psychologists and psychiatrists. Psychologists are PhD's

with a great deal of training in either research or assessment. Psychiatrists are medical doctors, often with a more limited background in psychology, but only they can prescribe medications. In many clinical settings psychologists do most of the assessments and conduct most of the therapy sessions, while psychiatrists serve more administrative roles along with prescribing medications.

TABLE 1.2 Some Major Specializations in Psychology

Specialization	General Interest	Example of Interest or Research Topic
Biopsychologist	Relationship between brain and behavior	What body signals indicate hunger and satiety?
Clinical psychologist	Emotional difficulties	How can people be helped to overcome severe anxiety?
Cognitive psychologist	Memory, thinking	Do people have several kinds of memory?
Community psychologist	Organizations and social structures	Would improved job opportunities decrease psychological distress?
Counseling psychologist	Helping people make important decisions	Should this person consider changing careers?
Developmental psychologist	Changes in behavior over age	At what age can a child first distinguish between appearance and reality?
Educational psychologist	Improvement of learning in school	What is the best way to test a student's knowledge?
Environmental psychologist	How noise, heat, crowding, etc. affect behavior	What building design can maximize the productivity of the people who use it?
Ergonomist	Communication between person and machine	How can an airplane cockpit be redesigned to increase safety?
Evolutionary psychologist	Evolutionary history of behavior	Why do men generally show more sexual jealousy than women?
Industrial/organizational psychologist	People at work	Should jobs be made simple and foolproof or interesting and challenging?
Learning and motivation specialist	Learning in humans and other species	What are the effects of reinforcement and punishment?
Personality psychologist	Personality differences	Why are certain people shy and others gregarious?
Psychometrician	Measuring intelligence, personality, interests	How fair are current IQ tests? Can we devise better tests?
School psychologist	Problems that affect schoolchildren	How should the school handle a child who regularly disrupts the classroom?
Social psychologist	Group behavior, social influences	What methods of persuasion are most effective for changing attitudes?

Modern psychology also utilizes recent technical advances in biological imaging such as PET and MRI scans whenever possible in both research and assessment. What can be defined as observable aspects of behavior has changed radically. It is now possible to observe a living brain as it performs different tasks. Changes in glucose metabolism and blood flow can be used to determine functional areas of the brain responsible for different abilities, and detect cites of damage. Great advancements have also been made recently in understanding the biochemistry of the brain, leading to improved medications for various psychological conditions.

Psychological Research, Methodology, and Ethics

How do you study psychology as a science? There are unique aspects of doing research in psychology that do not play a large role in the physical sciences. In some cases it is difficult or impossible to randomly assign subjects to different experimental groups or conditions. People simply are of one gender or another and cannot be reassigned, and it is not ethical to assign particular subjects to high-risk behaviors (drug use or criminal behavior). So it is often the case that only observational data can be collected. Alternatively, quasi (or psuedo) experiments are performed instead of completely controlled experimentation. And biases can affect subjects and researchers in a number of ways, thus affecting data. Finally, there are important ethical considerations to be considered. These apply when observing or monitoring particular behaviors, to the use of deception, to long-term effects on mental health, and to concerns about the invasion of privacy and data security.

However, the ultimate goals are the same as for any other form of scientific research. These comprise five levels, with each encompassing and expanding upon the preceding level. So it is that research is aimed at describing, predicting, controlling, and explaining phenomena in order to reach an overall *understanding*.

The principle of *parsimony* applies to psychological research just as it does in any other field. As scientists we prefer theories that explain various phenomena and findings adequately, while requiring a minimum of underlying assumptions. Thus, the simplest explanation that adequately explains the observations is preferred. So why assume a horse has a grasp of mathematics when there's a simpler explanation, that the animal is responding to cues from those questioning him (Clever Hans). A great number of anecdotal cases are cited as evidence that ESP exists. Now most of the time if we try to guess what someone else is thinking, or predict a future event, these guesses will be wrong. However, it's likely that occasionally these guesses will be correct just by chance. The problem is that we don't take much note of all the instances when we were wrong, but remember the few cases when we were correct. That's selective memory, and that concept just as adequately explains what is happening. So it is the more parsimonious explanation, in that it does not require the existence of unseen forces or mysterious abilities in order to account for the phenomenon.

Types of Descriptive Research Performed:

Naturalistic Observations - Unobtrusively observe individuals and simply note the behaviors exhibited. There is no intervention, with the aim being the simple description of various behaviors or other phenomena. The mere presence of an observer may affect the phenomena being studied, so there is a need to blend into the surroundings.

Participant Observations - Infiltrate a group in order to experience the effects of group membership first hand and so better understand how the group is perceived and what motivates members to act in certain ways. Can't really appreciate or understand the power of being in a cult, or the effect on the individual members, from the outside. Need to experience it from the inside to gain full understanding.

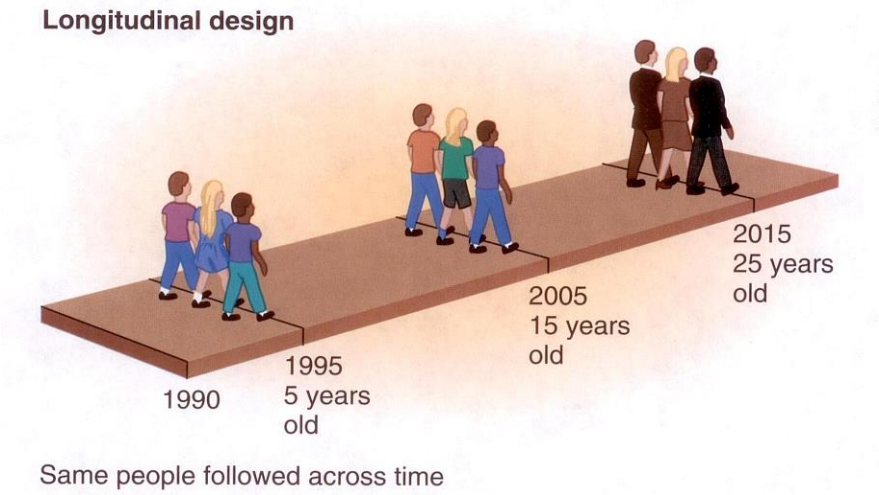
Case studies - Particular individuals or members of certain unique groups may be studied at length. These are generally rare and extreme cases, but learning about what is peculiar to these cases may reveal much about typical functioning. Examples are those with very specific brain lesions, or those demonstrating extreme psychopathologies such as serial killers.

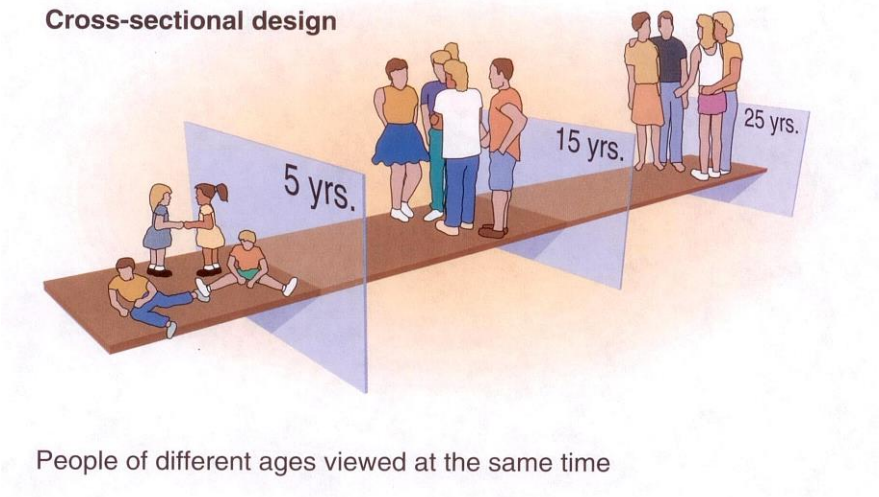
Surveys, Polls, and Interviews - Get large amounts of information about individual perceptions with relatively little expense. Biggest drawbacks are how representative is the sample and self-selection of the subjects. What's the difference between those that participate and those that do not? Are those that do not participate paranoid, lazy, too busy, or apathetic? Problems also arise concerning subject bias and demand characteristics. The subjects may shape their responses based upon their perceptions of what the researcher is looking to find. On the other hand, there can be problems arising from experimenter biases. The way in which questions are stated may lead to certain responses or particular responses may accidentally receive reinforcement.

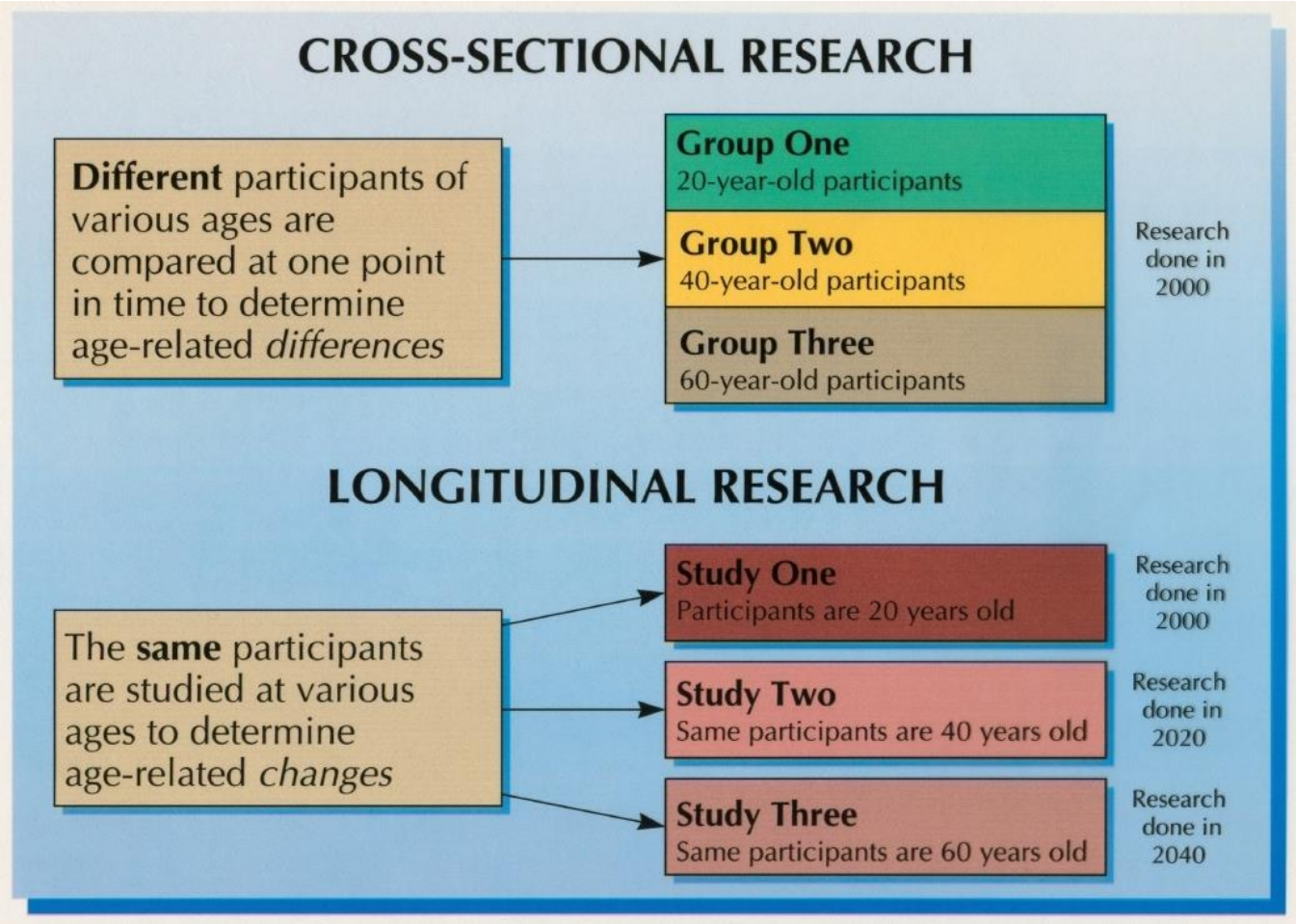
Note that the surveys, polls, and interviews used in psychological research are far different from the self-administered quizzes and such provided by many magazines and other sources. The latter often entail no actual collection of data, and so no real collaboration of the results with any baseline measures. Without any of this kind of analysis these quizzes are virtually meaningless, and must be considered only as entertainment. The purpose is not to attain information or to educate, but merely to increase sales of these publications.

Cross-Sectional studies - Compare attitudes and perceptions of individuals from different areas of society (age, ethnic background, SES, geographic region, etc.). An example would be comparing perceptions of technology by young versus older executives and managers. Do the younger people who grew up with the technology see it as merely a tool, while the older people see it as a threat? (Note: It is currently very common for older executives to have assistants print out their email, as they have no desire to interact with computers even at the simple level of reading their email off the screen). In some cases a great deal of effort is devoted to creating demographically balanced samples in order to mirror the overall population, such as in television ratings samples.

Longitudinal studies - Follow individuals over time and take multiple measurements. Do individuals change views, behavior patterns, and so forth over the lifespan? Are differences found over time due to aging itself (perceptual capacities), greater amounts of personal experiences (relationships), or changes in society (new technologies)? Questions arise concerning both the subjects who remain in the study over time, and those who drop out. What makes the difference? What about those that die?







The nature of correlational data: For the most part, the research methods described so far yield correlational data at best. We learn what factors co-vary, or change, in conjunction with each other. And we can determine the nature or direction of those changes, and the strength of those relationships. Thus, correlational data provides a basis of discovering, evaluating, and describing relationships. Such relationships are numerically represented as *measures of correlation ranging from -1.0 to 0 to +1.0.* Given two factors A and B, finding a correlation of *zero means the two factors are not related,* meaning that knowledge of the value of A tells nothing about the value of B. When a correlation is found, there is some degree of relationship between the factors A and B, meaning that knowledge of the value of A can provide information about the value of B. For measures of correlation *positive and negative signs only reflect the direction of the relationship*, not its strength. *A positive correlation means that as the value of A increases, the value of B increases. A negative correlation means that as the value of A increases, the value of B decreases.* In either case knowing the value of A aids in predicting the value of B. The farther a measure of correlation is from zero, whether positive or negative, the stronger that correlation. Stronger correlations imply stronger relationships and greater predictive power.

Correlation in and of itself, however, does not imply causation. All finding a correlation tells you is two factors are somehow related, and so they co-vary. However, you don't know which is affecting which, or if another factor is affecting both of them. Correlational data provides clues as to where to begin looking for a causal relationship, if one exists. This information can be used to generate hypotheses. Those hypotheses, in turn, can be tested via quasi-experiments or true experiments. Only from that type of research can we begin to form causal statements.

Hypothesis versus Theory: A *hypothesis* is a testable statement derived from observations, usually making some form of prediction or causal statement. The data can come from any type of research. Experiments are used to test hypotheses. If the predictions are upheld the hypothesis is verified. If predictions not upheld you formulate new hypotheses and test those. Once a number of related hypotheses have been verified theories are developed to encompass the body of findings.

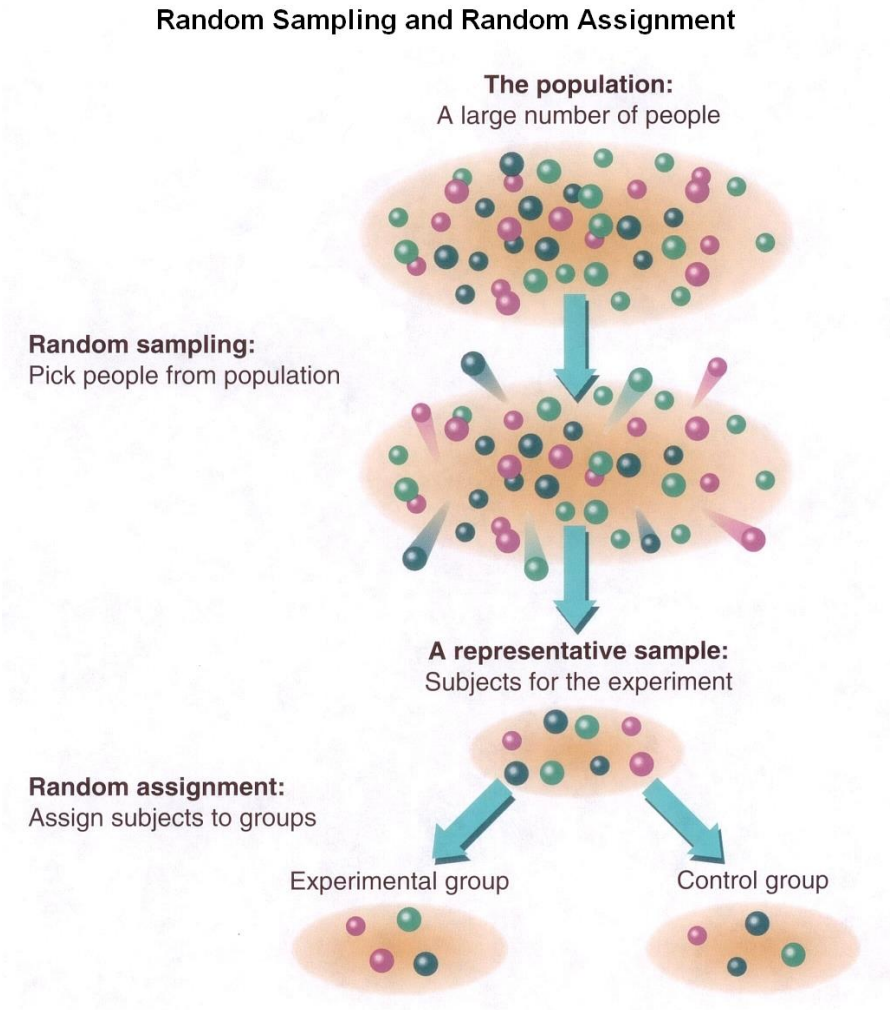
A *theory* is an attempt to explain some phenomena, based on a body of evidence. Given that, a good theory should also generate further testable hypotheses. And if those hypotheses are verified, that serves as further evidence supporting the theory. If those hypotheses are not verified, then the theory has not been supported. It may be incorrect to some degree. As a result it may be necessary to expand, revise, or replace that theory. Also, to be truly scientific, one should be able to envision ways of proving the theory wrong. If not, it really isn't testable. And that is dogma, not theory. Finally, the principle of *parsimony* applies to theories. The simplest explanation that adequately explains the findings with a minimum of underlying assumptions is preferred.

Overall, science relies on a continuous process: Observations --> Descriptions & Correlations --> Hypotheses --> Theories --> Hypotheses --> Expand, Revise, or Replace Theories --> Hypotheses **...**

Hypothesis Testing by Experimentation: The best way to test a hypothesis is to do an experiment. Experiments provide the degree of control over the relevant factors that is necessary for causal statements to be made. For the most part psychologist have been pretty ingenious at designing experiments that bring rather complex sets of factors under laboratory control.

Random selection - This means that any member of the population has an equally likely chance of being a subject in the experiment. That should result in a sample that adequately represents the population as a whole. And generally speaking, the larger the sample size, the greater the likelihood of the sample representing the population. An alternative sometimes used is a demographically selected sample designed to ensure certain population characteristics are adequately represented.

Random assignment - The subjects are randomly assigned to different experimental groups that will receive different treatment levels of some controlled (independent) variable. Random assignment should ensure that the experimental groups start out the same, so if differences are found later they can be assumed to be due to the different levels of treatment.



Independent Variable - This is what the experimenters mess around with, what they manipulate. There are different levels or arrangements of the independent variable. And this is what the experimental groups are based upon.

Dependent Variable - The resultant changes due to difference in the independent variable. This is what gets measured. It is suspected that performance levels will differ based on the assigned levels of the independent variable. In other words, performance is dependent upon the level of the independent variable received.

Subject Bias - If some of the subjects know they're being treated differently than other subjects it can affect the results of the experiment. A subject that is aware that he or she is in an experimental condition may act in ways he or she thinks the experimenter wants them to, or perhaps in ways they think the experimenter doesn't want. In a drug study, if one group gets a pill and the other does not, clearly there's a problem. Those getting the pill may act differently just because they got a pill. To avoid these problems all groups in an experiment, including the control group, are treated as much the same as possible. Hence, placebos are used in drug studies. This is called a blind study, because the subjects are not aware of which group they are in.

Experimenter Bias - In addition, experimenters have expectations, based on the very hypotheses they are testing. So it is possible that the experimenter may subtly influence the performance of the subjects. To avoid this problem the experimenter may employ assistants to carry out the experiment who do not actually know which group the individual subjects are in. This is usually done along with the subjects being unaware as well, a double-blind study. The collection and interpretation of the data is also subject to experimenter bias. Safeguards such as the following are used to minimize experimenter bias: Inter-observer agreement is used to verify assessments. Instruments are used to collect data whenever possible. And computers are used to perform most data analysis operations.

Deception - To avoid biasing factors subjects sometimes are deceived. The use of placebos is just one example. In some cases the true and complete nature of the experiment is not revealed to the subjects. That's because if the subjects were aware of this they probably wouldn't behave naturally. In other cases the experimental situation itself is based upon some sort of deception, such as the use of confederates who are working with the experimenters, but playing a role while posing as fellow subjects. In all these cases the true nature of the deception must be revealed after the completion of the experiment. Strict ethical guidelines have been set up to insure that no lasting harm will come to those participating in psychological research.

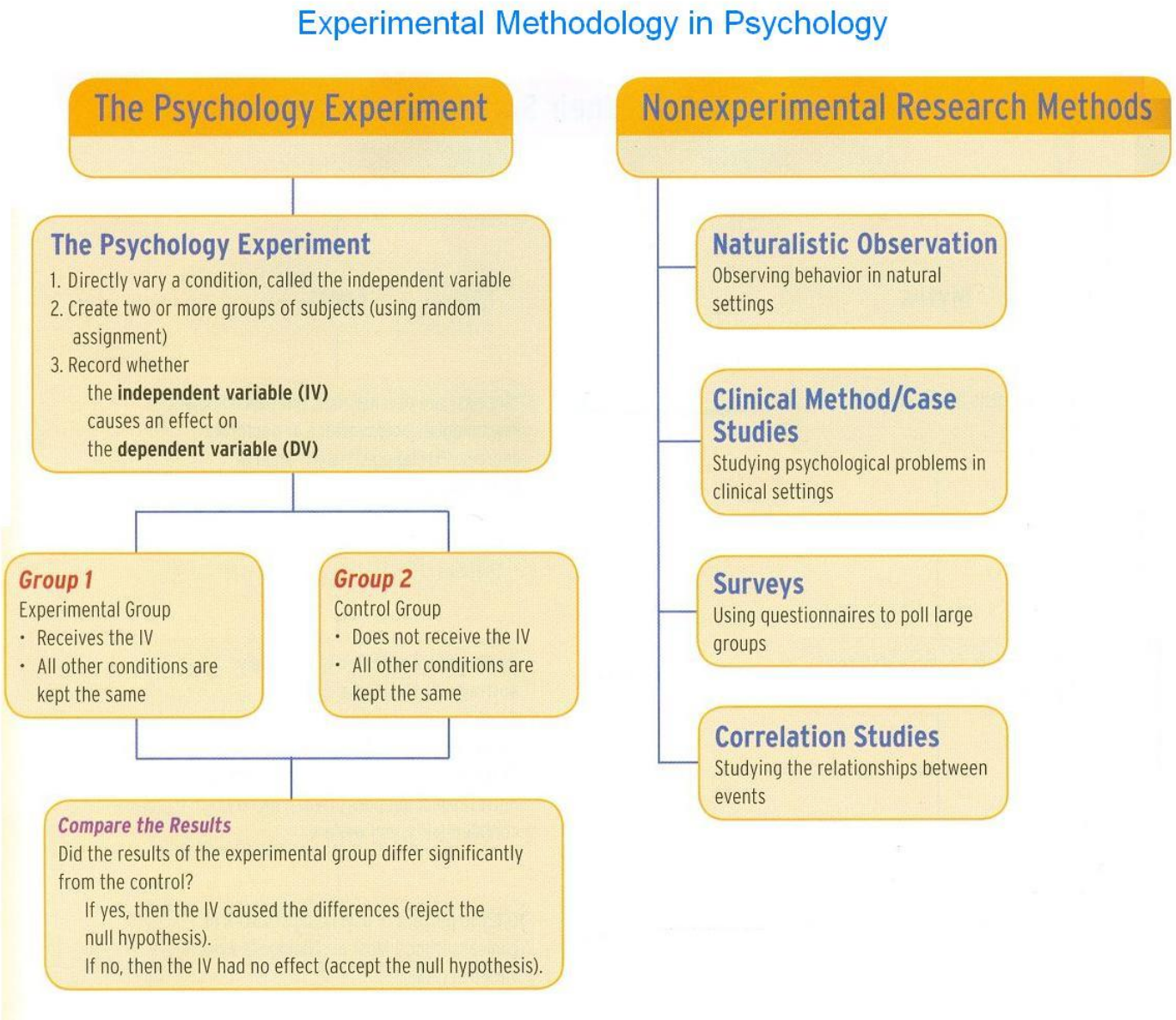
Types of Experimental Research Performed:

Human studies - Human psychology is, of course, the primary focus of much of the research done. And as noted, psychologists are quite ingenious at designing experiments that bring rather complex sets of factors under laboratory control. Unique to human psychological research is the occasional need for deception or reliance on the use of confederates. However, experimental subjects have rights, and are entitled to fair and ethical treatment. Various safeguards are in place to ensure this. In order to have proper accreditation institutions must have review boards that evaluate the potential harm of an experiment before it is performed. Most scientific journals will not accept research that has not been so approved. Subjects must be provided with what is called '*informed consent*,' meaning that the procedures and possible risks are explained to them before participation. In cases where deception is required, as much information as possible must still be provided to the subjects. And although the true nature of the study is not revealed to the subjects at the time it is conducted, it must be revealed once the research is complete. Finally, the subjects must be able to end their participation at any time if they choose to do so. They cannot be required or forced to complete the research. These extensive ethical considerations are used to ensure that no long-term harm will come to the subjects.

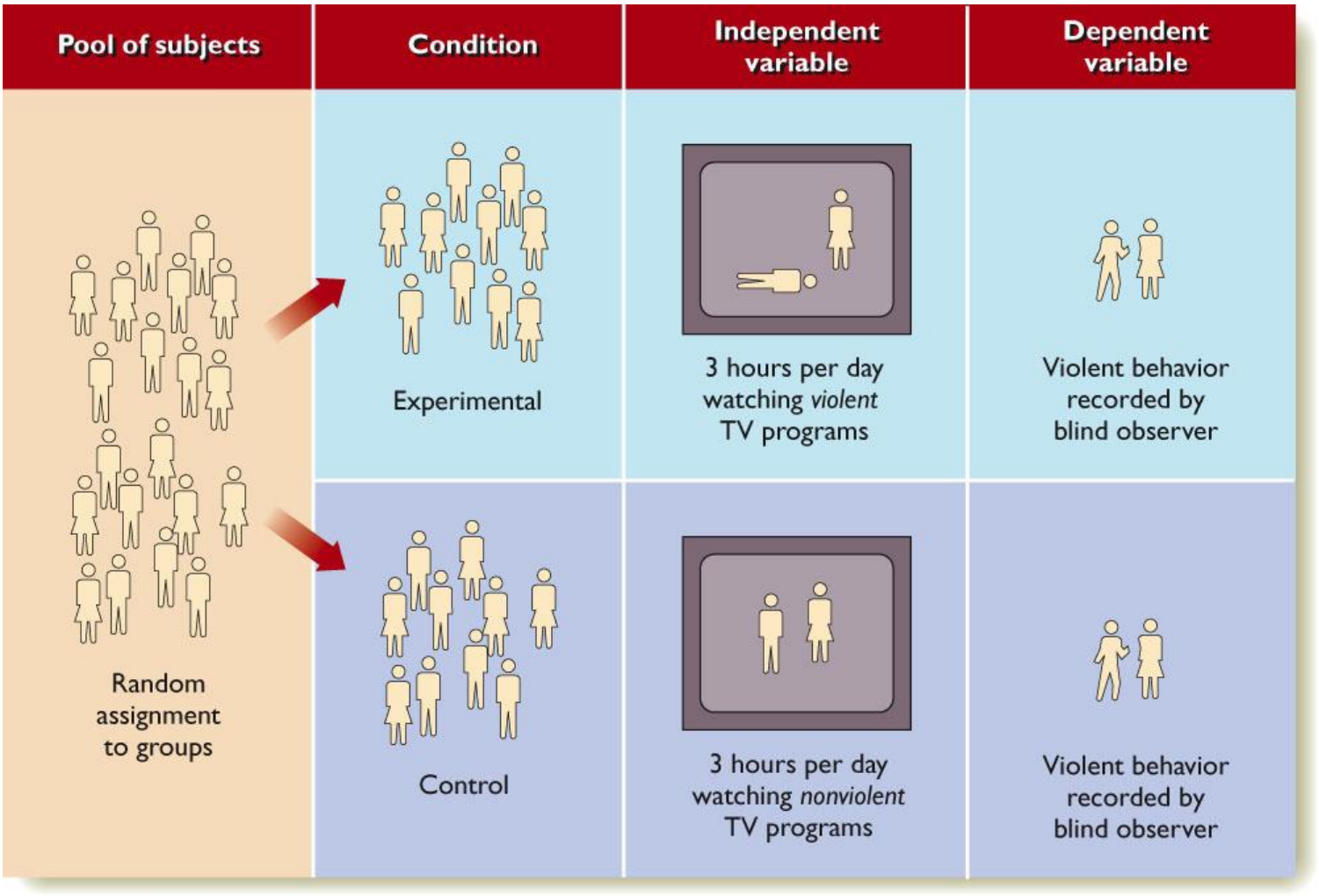
Animal studies - Animal behavior, in and of itself, is of interest. People want to know how to train pets and so forth. And many animal responses are very similar to human responses. For example, sex is sex. When one is concerned with the role of hormones, pheromones, or overcrowding on sexual activity then animal studies may provide a good deal of information. Learning, and the processes governing it, has similar properties across species. Many drugs affect animals in much the same way they affect humans. These kinds of animal studies can then be followed up with research on human subjects. The advantage is that all aspects of the subjects' lives come under experimenter control. The disadvantage is that there is never a certain guarantee that all animals will react in a similar fashion. Rats, pigeons, monkeys, and humans may all react differently to a particular experimental manipulation. However, when similar findings are found across species that provides strong support for the hypothesis under investigation. Note that animal subjects are rarely exposed to adverse

circumstances. Not only are there are rigorous guidelines in place, but since animals in distress behave in ways that are atypical data so obtained is of little use to psychological research. Although laboratory animals may be subjected to food restrictions to motivate them to perform (food as reward), they are not starved. In fact, when allowed to free-feed they usually overeat, so restrictions merely bring weights down to what would be found in their wild counterparts.

Quasi (or psuedo) Experiments - Not everything can be imitated in a laboratory setting nor lends itself to tight laboratory control. Sometimes we can only approximate a true experiment in psychology. It may be that one needs to examine some phenomena out in the world where it occurs, which limits control. It may be that all the relevant factors cannot be controlled, perhaps for ethical reasons. These cases are referred to as quasi-experiments or psuedo-experiments. The experimental method is employed to as great a degree as possible, but the level of control found in true experiments is not obtained. Most often this is because random assignment to experimental groups is not possible for one of the following reasons. First, it may be impossible to randomly assign subjects. Such is the case with current age or gender. Second, although possible it is unethical to randomly assign subjects. Such is the case with age of first drug use, or first sexual experience. Third, random assignment of subjects could have been done, but wasn't for some reason. This could be simply that the experimenters were unconcerned about obtaining complete control in light of other considerations. These could be concerns about delaying or withholding treatment to one particular group, budgetary restraints, and so on. Strictly speaking the data from this type of research is only correlational. However, causal relationships are often implied. Therefore it is important it to recognize studies of this kind and to distinguish them from true experiments.



An Example Experiment: Now consider the experimental design presented below. It's based on a number of experiments done since the 1960s stemming from Albert Bandura's work on observational learning. A number of studies have sought to determine if there is a relationship between television violence and aggressive behavior.



The P-Value (p < or = 0.05) Are the differences in the dependent variable obtained due to mere chance (possibly due to differences between the groups before the experiment ever began)? Or are they great enough to be considered a legitimate result of what you messed with (the levels of the independent variable)? Statistical tests are employed to determine this. P-Value reflects how sure we want to be about this question, what statistical differences must be found before we can conclude a legitimate result. It is set at 0.05 in most social science research, meaning that there's only a 5% probability (5 times in 100) that the results are due to chance differences between the groups that existed before you ever did the experiment. That also means that there's a 95% probability (95 times in 100) that the results are due to differences between the groups that were generated by what you messed with. The number could be set higher or lower. In evaluating a drug with harmful side effects, a lower number may be used to increase the certainty that any improvements are due to use of the drug. In the case of comparing different study methods, a higher level may be used, since any form of study may be beneficial. The 0.05 level used in the social sciences strikes a nice balance between not missing an effect (not demanding overly rigorous standard to say effect is real), versus accepting as real what is merely due to chance (false alarms). Other p-values go further toward one extreme or the other.

Proving the hypothesis versus rejecting the null hypothesis? You state your hypothesis. You come up with reliable and valid dependent measures for an effect. You perform an experiment. You perform various statistical analyses and the results meet the criterion for significance based on the p-value. Was your prediction correct? Yes! Have you proven the hypothesis? No!

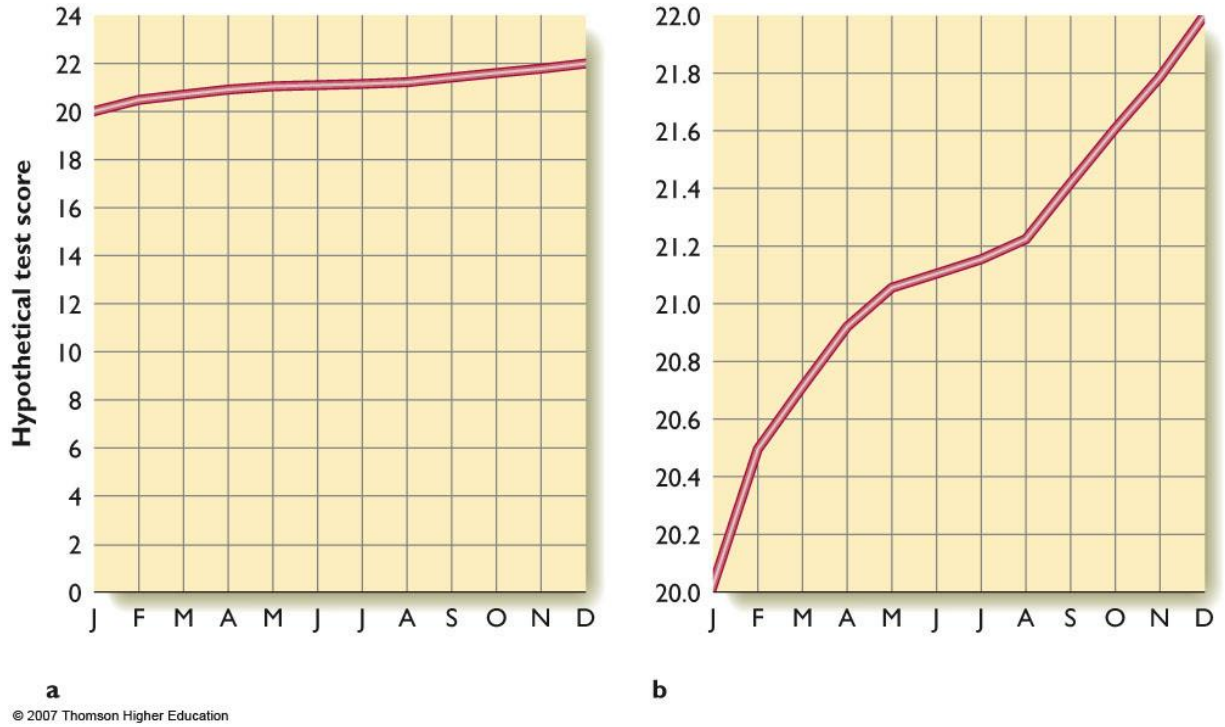
What you have done is *successfully rejected the null hypothesis*. The null hypothesis states that the relationship stated in your hypothesis does not exist, that the different levels of the independent variable have no effect on the dependent variable(s). You can rule out the null hypothesis this time, but you haven't proven your hypothesis to be true or correct.

What you have proven is that your hypothesis is not false or incorrect this time, as the null hypothesis presumes it to be. But you have not categorically proven your hypothesis to be correct or true. What you have done is found an instance that lends *support to your hypothesis*, and perhaps your overriding theory as well. However, there could be other factors ultimately governing the situation, and those factors could be the true causal factors. Continued experimentation and successful replications will contribute more and more support and credibility to your theories. This is the type and degree of skepticism required by science. Even though gravity has thus far well proven itself to me as theory, I can conceive of it not working the very next time I let go of some object, as I may not be aware of all the relevant factors involved. So although the aim of experimental research is to find causal relationships, and to some degree one can do so, absolute proof can never be attained.

ETHICAL PRINCIPLES OF PSYCHOLOGISTS IN THE CONDUCT OF RESEARCH

1. Psychologists must take steps to avoid harming their research participants.
2. When planning research, psychologists must evaluate its ethical acceptability. Because individual researchers might not be objective judges of the ethical acceptability of their studies, they should seek ethical advice from others, including Institutional Review Boards. (Institutional Review Boards are a group of scientists and nonscientists who judge whether the risks to participants outweigh the potential gains of the research.)
3. As much as possible, the researcher should describe the procedures to participants before they take part in a study, and obtain informed consent from participants that documents their agreement to take part in the study as it was described to them.
4. Deception may be used only if there are no other viable means of testing a hypothesis and only if an Institutional Review Board rules that it does not put participants at undue risk. After the study, participants must be provided with a full description and explanation of all procedures, in a post-experimental interview called the debriefing.
5. All participants must be informed that they are free to withdraw from a study at any point.
6. All information obtained from individual participants must be held in strict confidence, unless the consent of the participant is obtained to make it public.

Statistics



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Summary of Descriptive Statistics

Descriptive Statistic	Explanation of Statistic
Correlation Coefficient	A number between -1.0 and +1.0 whose sign indicates the type ('+' = positive and '-' = negative) and whose absolute value (0 to 1.0) indicates the strength of the relationship between two variables.
Mean	Numerical average for a distribution of scores.
Median	Middle score in a distribution of scores when all scores are arranged in order from lowest to highest.
Mode	Most frequently occurring score or scores in a distribution of scores.
Range	Difference between the highest and lowest scores in a distribution of scores.
Standard Deviation	Average extent to which the scores vary from the mean for a distribution of scores.

The nature of correlational data:

-- Many types of research only yield correlational data. We learn what factors co-vary, or change, in conjunction with each other. And we can determine the nature or direction of those changes, and the strength of those relationships. Thus, correlational data provides a basis of discovering, evaluating, and describing relationships. Such relationships are numerically represented as *measures of correlation ranging from -1.0 to 0 to +1.0.*

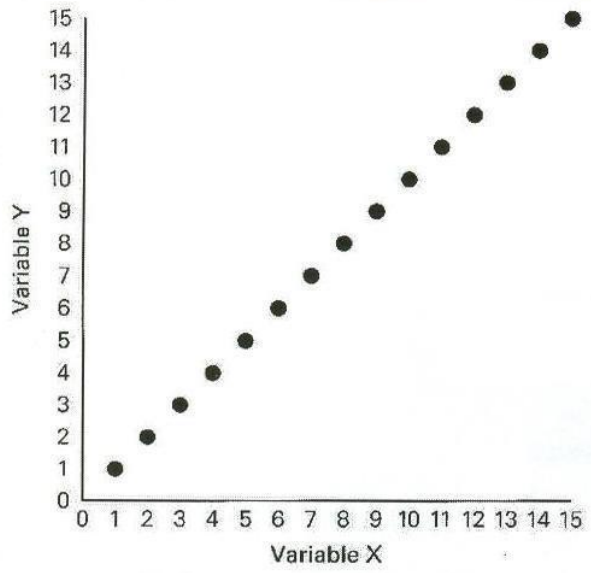
-- Given two factors A and B, finding a correlation of *zero means the two factors are not related,* meaning that knowledge of the value of A tells nothing about the value of B. A scatter-plot of the data would be quite random (or possibly represented by a vertical or horizontal line).

-- When a correlation is found, there is some degree of relationship between the factors A and B, meaning that knowledge of the value of A can provide information about the value of B. For measures of correlation *positive and negative signs only reflect the direction of the relationship*, not its strength. The key factor in determining the strength of a correlation is the distance from zero, the absolute value of the number (in algebra this means ignore the sign). The farther a measure of correlation is from zero, whether positive or negative, the stronger that correlation. Stronger correlations imply stronger relationships and greater predictive power.

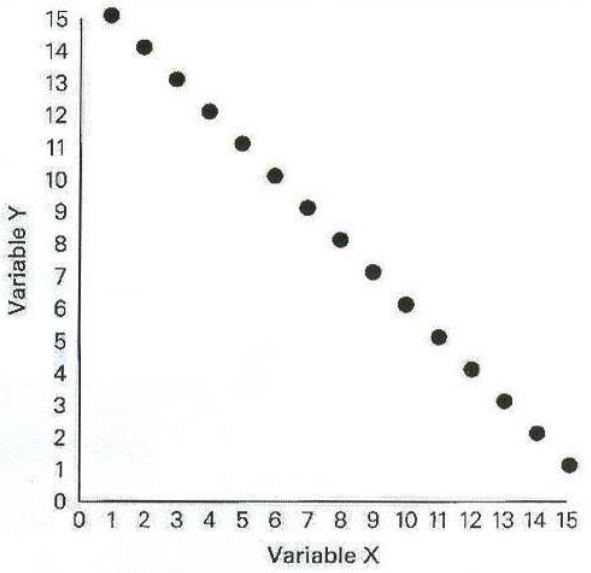
-- *A positive correlation indicates that A and B co-vary in the same direction. This means that as the value of A increases, the value of B increases* to some degree. Knowing the value of A aids in predicting the value of B (restricts the range of possible values for B). The greater the (absolute) value of the correlation the more precisely A can be used to predict B. So a correlation of +0.2 would be considered weak, while one of +0.8 would be considered strong. Height and IQ are weakly correlated (maturation and nutrition do affect both), while height and weight are strongly correlated. Perfect correlations occur when A and B show a one to one correspondence, such as height in inches and height in centimeters. A can be used to exactly predict B. Perfect positive correlations can be graphically represented by a line, which ultimately represents an equation.

-- *A negative correlation indicates that A and B co-vary in opposite directions. This means that as the value of A increases, the value of B decreases* to some degree. The same rules apply to negative correlations. Knowing the value of A still aids in predicting the value of B. The greater the (absolute) value of the correlation the more precisely A can be used to predict B. So a correlation of -0.2 would be considered weak, while one of -0.8 would be considered strong. Generally, while the number of questions on an exam and the percentage correct are weakly correlated, the number of hours studying for an exam and the number of incorrect responses on the exam are strongly correlated. Perfect negative correlations also exist as the number of correct responses on an exam has a perfect negative correlation to the number of incorrect responses. Again, A can be used to exactly predict B. Perfect negative correlations can be graphically represented by a line, which ultimately represents an equation.

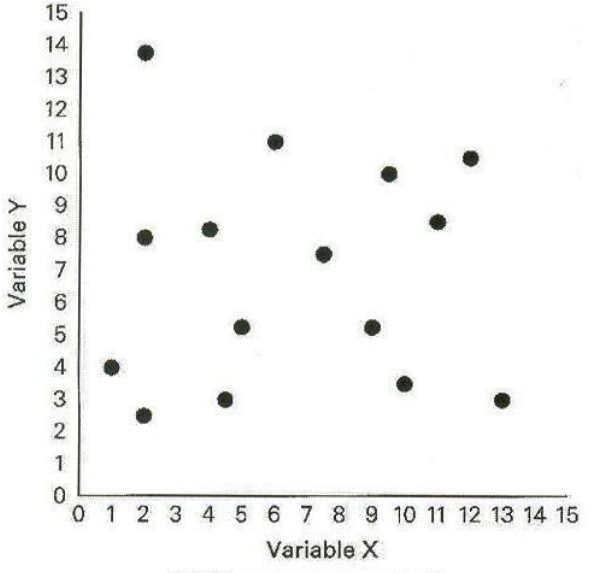
-- *Correlation in and of itself, however, does not imply causation.* All finding a correlation indicates is that two factors co-vary, that they are somehow related. However, there's no way to tell, based on correlational data alone, which factor is causally responsible for the co-varying data. It may even be that another, perhaps unknown factor is ultimately the cause (nutrition in the case of height and I.Q. is such a confounding variable). This is true even of perfect correlations. One's height in inches can't be said to cause one's height in centimeters, the real cause is just the individual's general size based on assorted genetic and environmental factors. So finding a correlation doesn't provide the kind of information necessary to isolating causal factors. Correlational data only provides clues as to where to begin looking for a causal relationship, if one exists. This information can be used to generate hypotheses. Those hypotheses, in turn, can be tested via quasi-experiments or true experiments. That type of research allows us to begin forming statements about causality once all the relevant factors are known. And only true experiments can produce the level of control and certainty necessary to making valid statements of causality (by holding constant or systematically manipulating the relevant factors across groups). Of course, true experiments do produce correlational data as well, but they go beyond this in unique ways because of the extreme levels of control used that serve to isolate the causal factors. Thus, experiments produce a unique form of data. Although all successful experiments produce correlational data, they also produce evidence of causal relationships. Always keep in mind that not all correlational data are derived from successful experiments. So the bottom line is that finding a correlation is not by itself adequate for the purpose of making statements regarding causality.



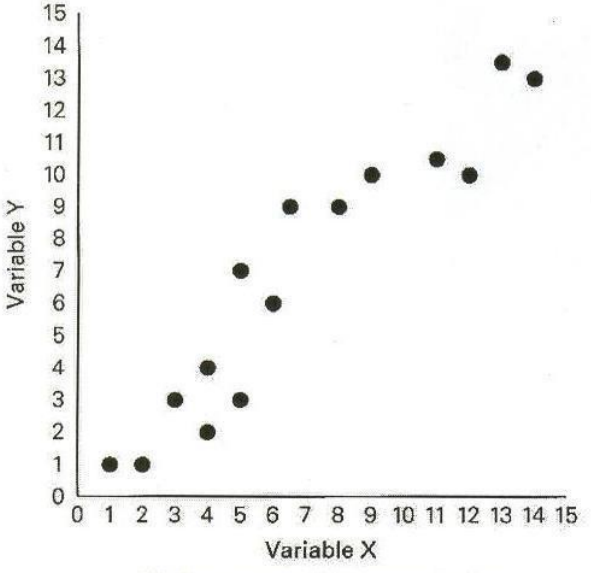
(a) Perfect positive correlation



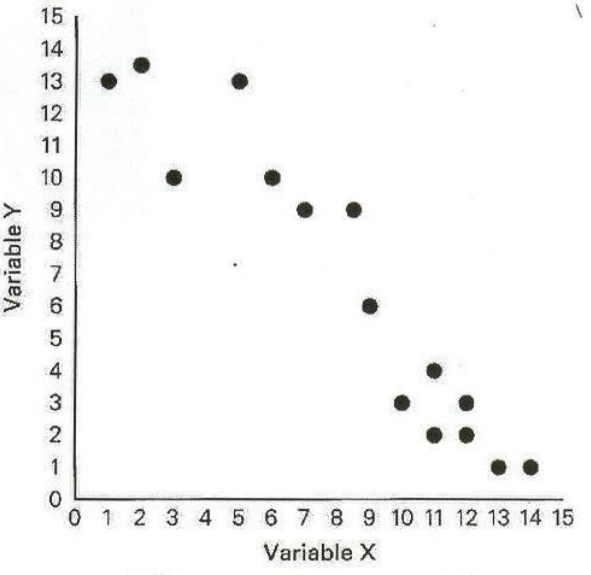
(b) Perfect negative correlation



(c) Near-zero correlation



(d) Strong positive correlation

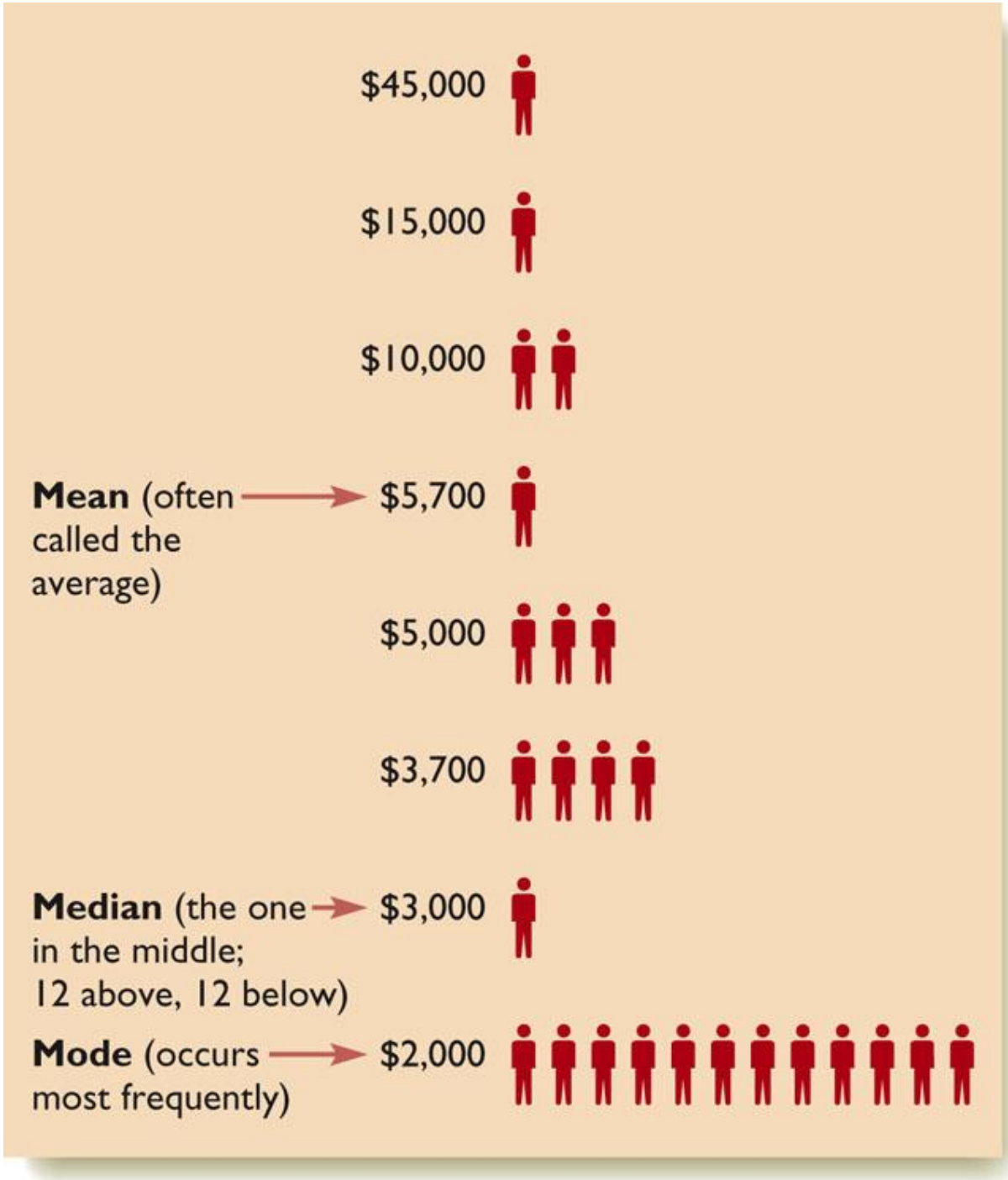


(e) Strong negative correlation

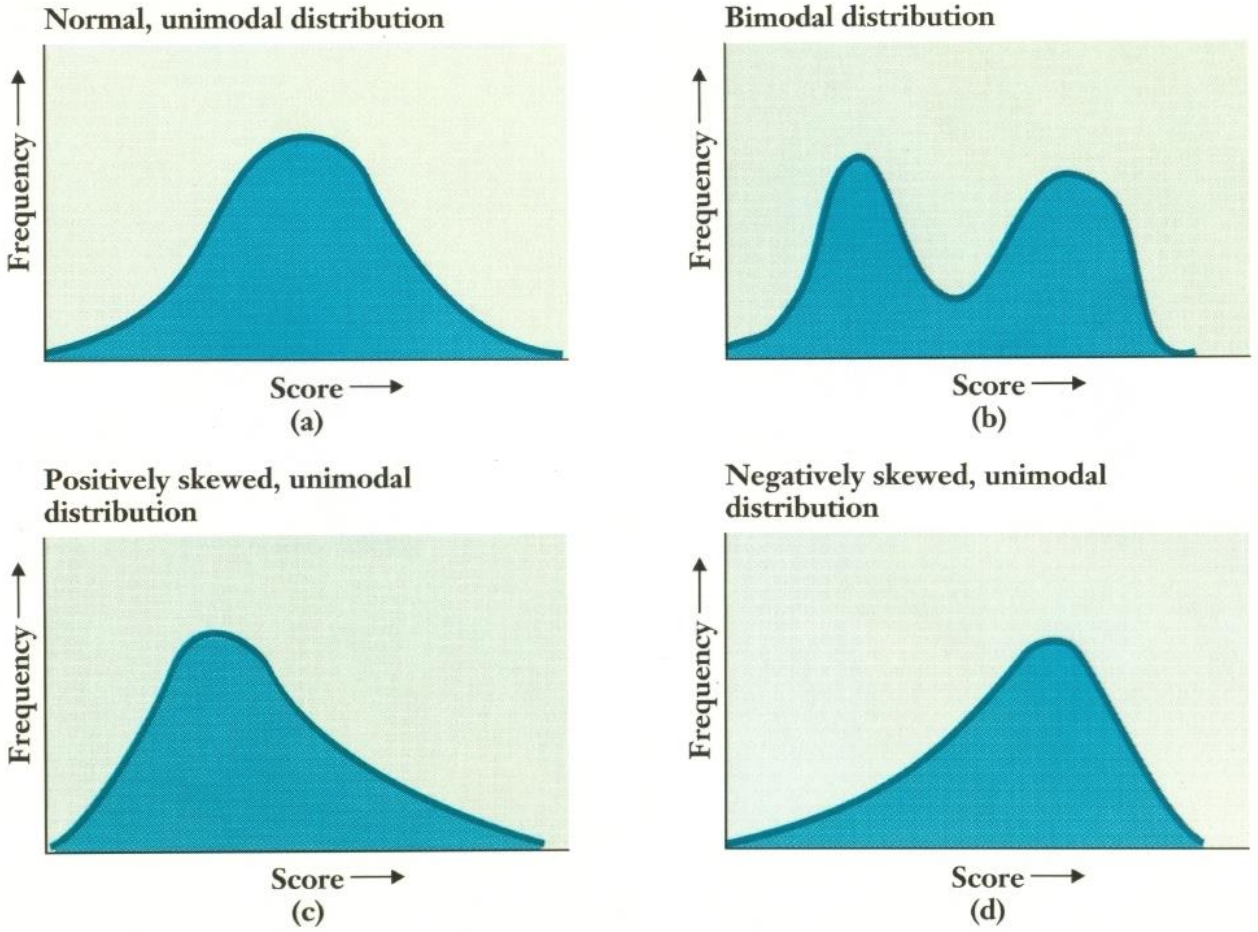
▲ Figure 1.1 | Some Sample Scatterplots | (a) and (b) are examples of perfect correlations because there is no scatter—all of the data points in each plot fall on the same line. The correlation in (a) is positive because the data points show an increasing trend (go from bottom left to top right) and is negative in (b) because the data points show a decreasing trend (go from top left to bottom right). (c) is an example of a near-zero correlation because the data points are scattered all over and do not show a directional trend. (d) is an example of a strong positive correlation because there is not much scatter and the data points have an increasing trend. (e) is an example of a strong negative correlation because there is not much scatter and the data points show a decreasing trend.

Measures of Central Tendency

Mean	**Numerical average for a distribution of scores.**
Median	**Middle score in a distribution of scores when all scores are arranged in order from lowest to highest.**
Mode	**Most frequently occurring score or scores in a distribution of scores.**

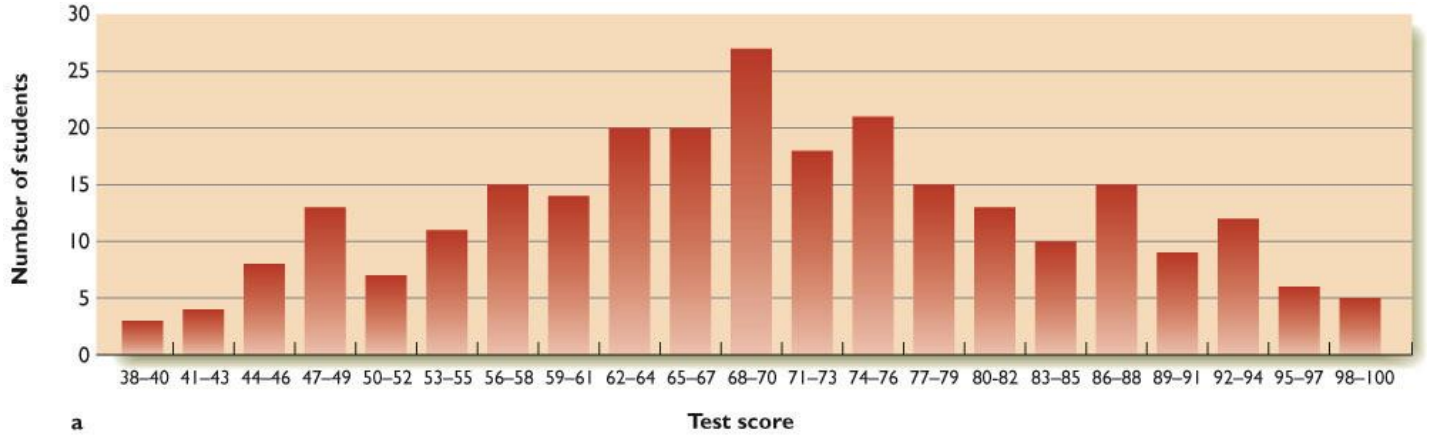


Four Differently Shaped Frequency Distributions

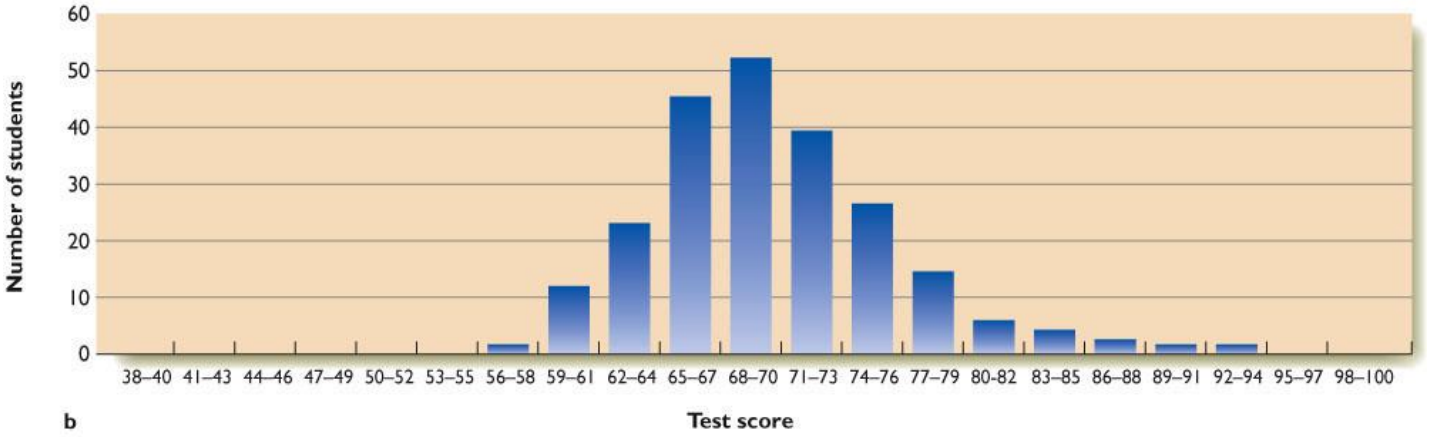


Measures of Variability

Range	**Difference between the highest and lowest scores in a distribution of scores.**
Standard Deviation	**Average extent to which the scores vary from the mean for a distribution of scores.**



a



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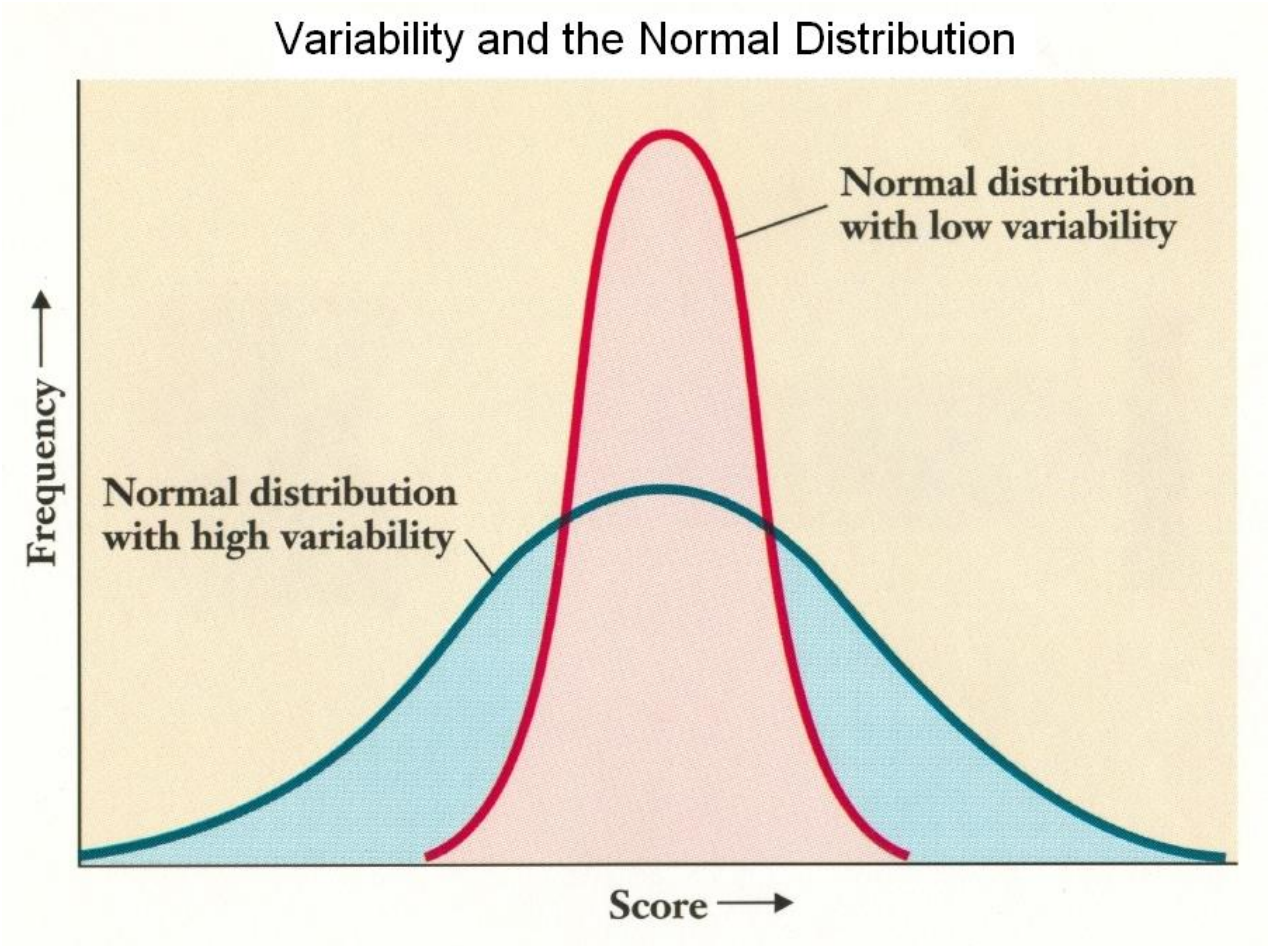
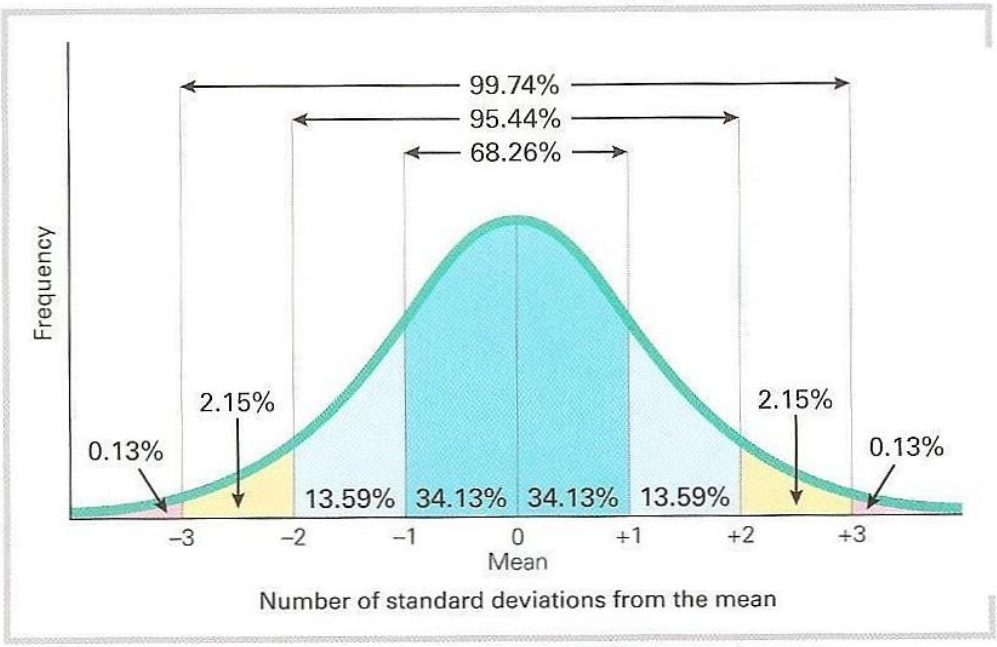
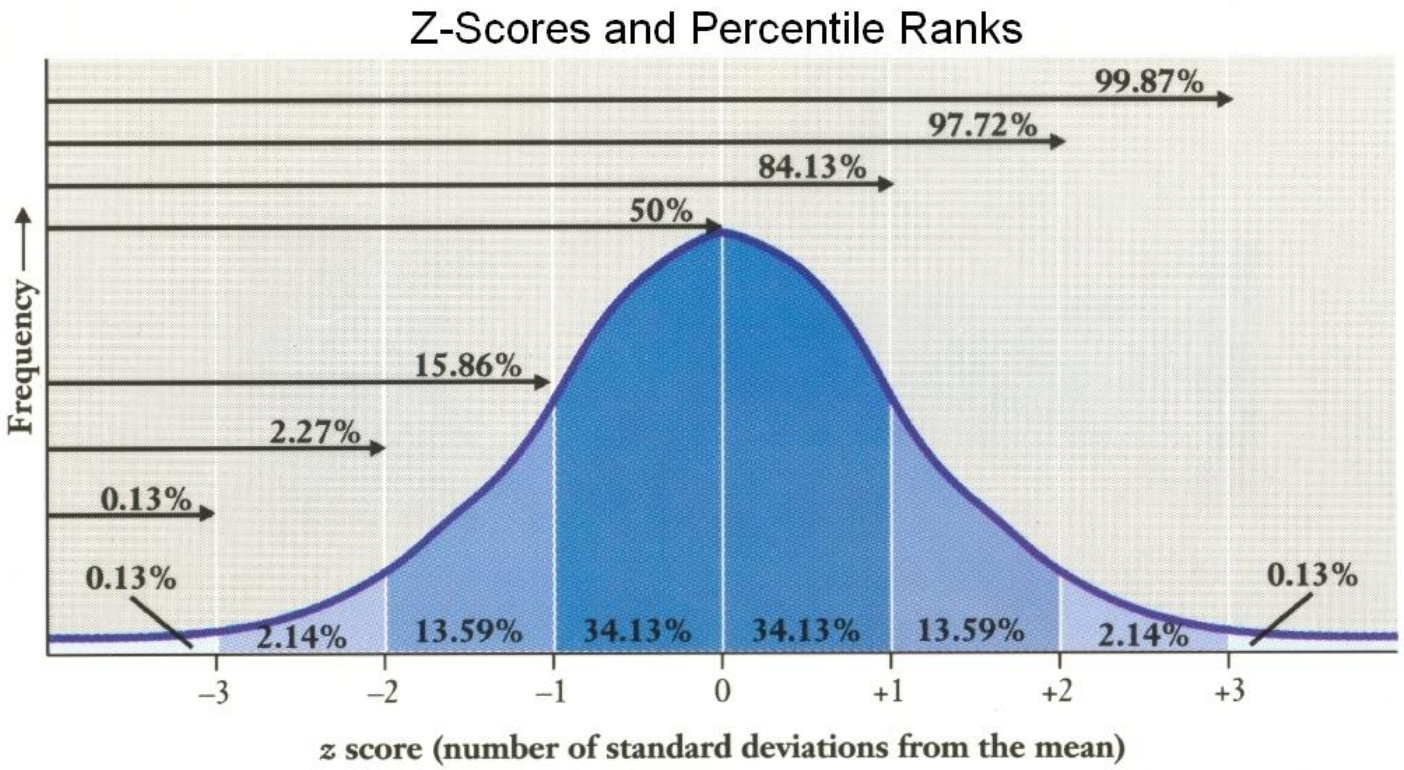


The Normal Distribution

In a normal distribution, the mean, the median, and the mode are all equal because the distribution is perfectly symmetrical about its center. In addition, about 68 percent of the scores fall within 1 standard deviation of the mean, about 95 percent within 2 standard deviations of the mean, and over 99 percent within 3 standard deviations of the mean.

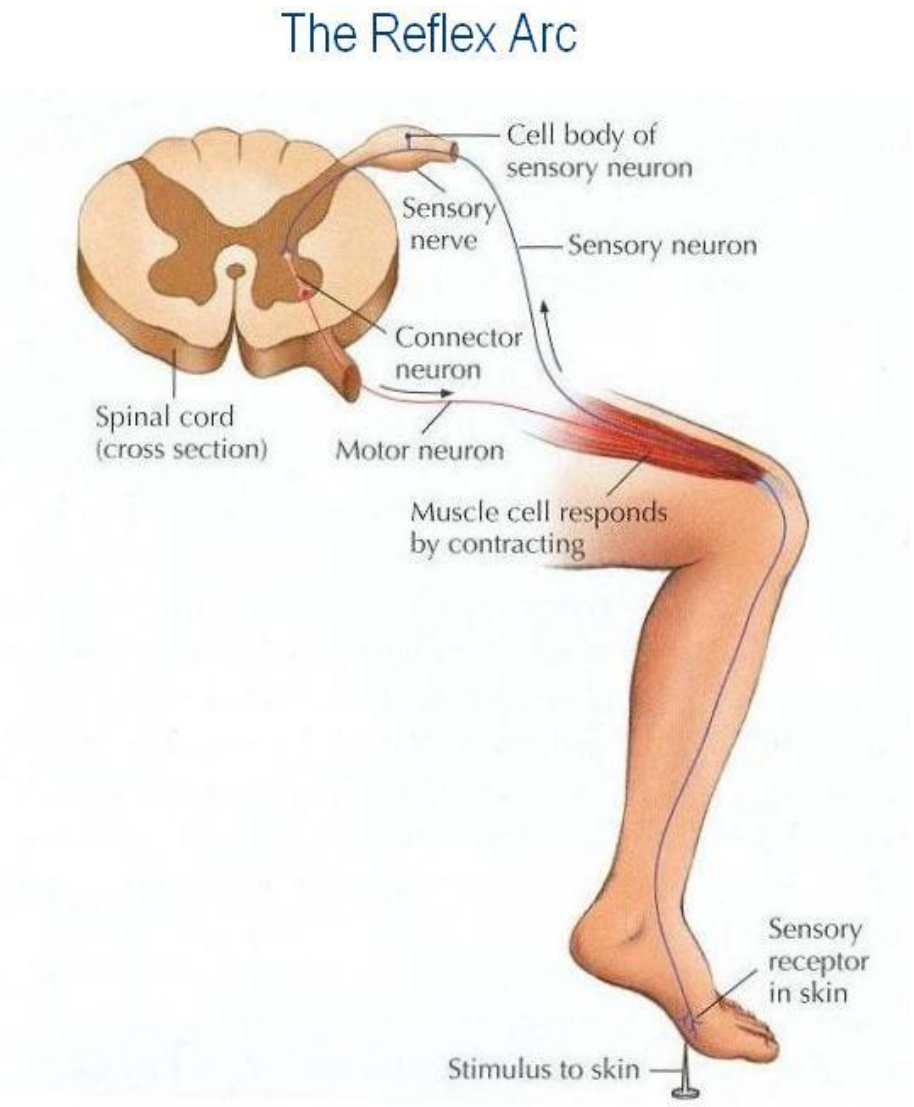




Comparing Means: Data Analysis generally consists of comparing means from different experimental groups. A number of tests are available, but the most commonly used are the t-test and the Analysis of Variance (ANOVA). If there is a significant difference between groups then the data lend support to the hypothesis under consideration. As already noted P-Value is used to determine how great this difference must be in order to be considered significant.

Reflexive Actions and Classical Conditioning

Reflex: A simple unlearned response to a triggering stimulus, often occurring in a fairly automatic way. Descartes first mapped out the *reflex arc*, a common pattern shared by many subcortical reflexes. First some stimulus triggers an action potential in a sensory neuron, the axon of which enters the dorsal horn of the spinal column. In the spinal column the information is passed along to an interneuron. The information is then, in turn, passed on to a motor neuron. The axon of the motor neuron leaves by way of the ventral horn of the spinal column and travels to the spindle fibers of the appropriate muscle(s) and initiates muscle contraction. The interneuron is the means by which the brain monitors these activities, and provides the route by which the brain can override the reflexive action in emergencies.



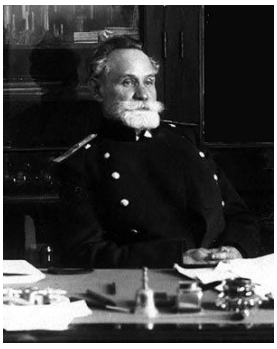
A sensory-motor arc, or reflex, is set in motion by a stimulus to the skin (or other part of the body). The nerve impulse travels to the spinal cord and then back out to a muscle, which contracts. Such reflexes provide an "automatic" protective device for the body.

Fixed Action Patterns (FAPs): Sometimes referred to as *Modal Action Patterns*, these are an ordered series of actions triggered by some stimulus or event (often involved in reproductive behaviors and triggered by seasonal hormonal changes). The chain of actions appears to have a purpose, and the organism appears to be acting in order to achieve some goal. However, the entire series of actions is automatic and will occur in sequence from beginning to end once triggered, regardless of whether or not the sequence is somehow interrupted. The organism does not start over if the sequence is interrupted, but merely carries on from that point (even if the subsequent actions are then futile or pointless). This is because the FAP is part of the organism's instinctual behavior and as such the organism has no true conception of a goal or purpose.

Imprinting: This phenomenon is related to fixed action patterns and is common among waterfowl such as ducks and geese. Hatchlings have a tendency to follow their mothers, thereby keeping the family together. This aids the mother in feeding and protecting the young. However, the actual mechanism is not an instinct to follow the mother. During a critical period lasting a couple of hours after hatching these animals form an attachment to the first moving object they encounter and subsequently follow it. Since this is normally the mother or a sibling it works to keep the family together. But the hatchlings will imprint on any moving object during the critical period, including a mechanical device, a dog, or a person.

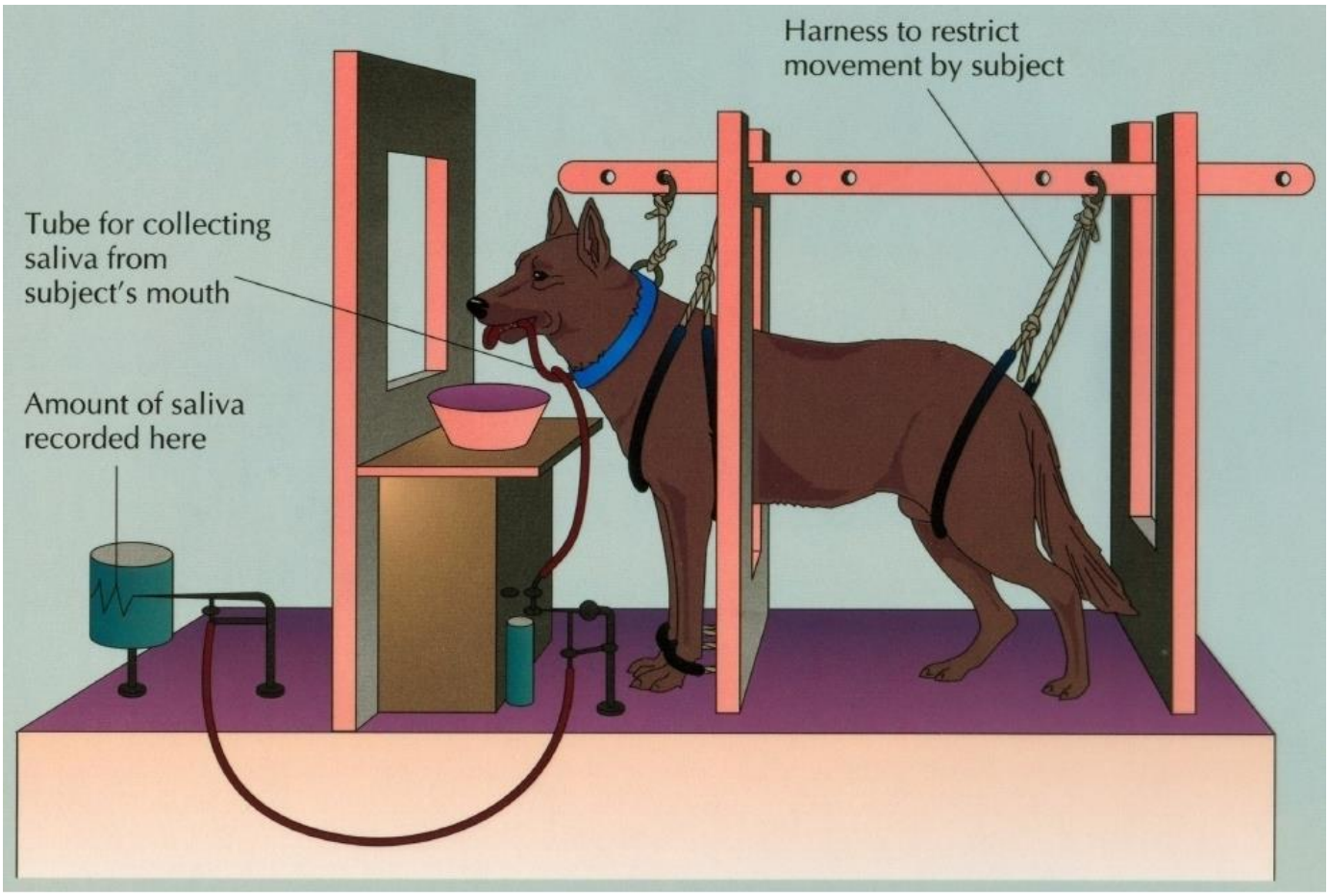
Habituation: Learning not to respond. A stimulus or event that an organism initially reacts to will cease to trigger a response if it occurs repeatedly and is followed by no immediate consequence to the organism. This is beneficial for two reasons. It saves energy that need not be spent reacting to something that has no bearing on the organism's immediate survival. It also frees the attentional resources to be used for monitoring and detecting other potentially more important events. If the stimulus or event ceases to occur for some time there will again be an initial reaction to it (in case the situation changes and the event has greater bearing important to survival). For example, thunder is of little consequence if one has already obtained shelter and so one can safely habituate to it. On a subsequent occasion one may need to pay close attention to thunder in order to gage the strength and proximity of an approaching storm if one has not yet obtained shelter.

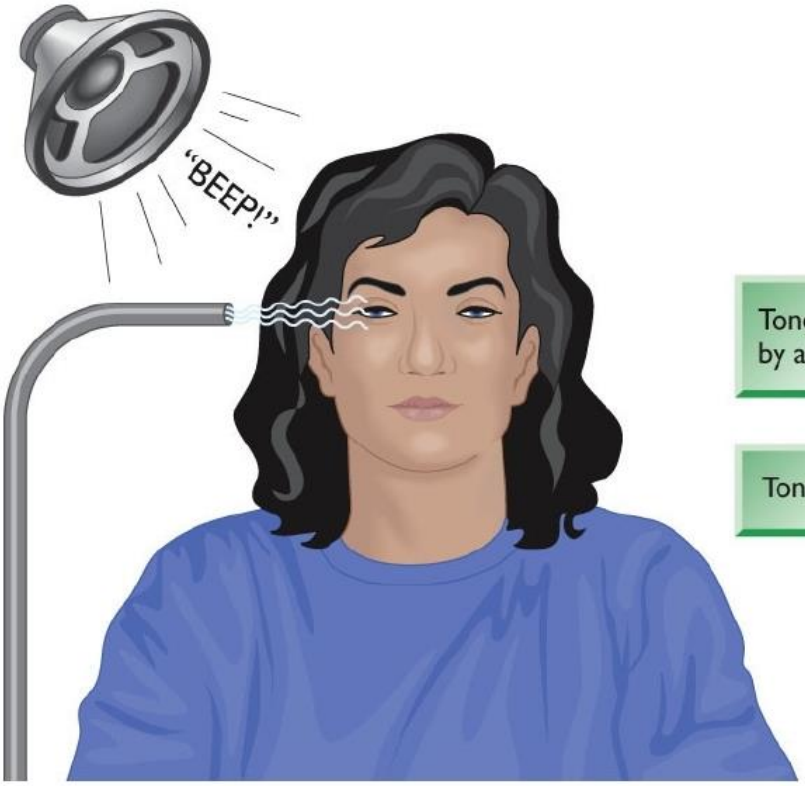
Sensitization: A unique situation in which the normal process of habituation to a repeated stimulus or event does not engage. Usually this is due to an initial instance being followed by important consequences and the lag between subsequent repetitions being too short for the organism to calm down since the prior instance. The result is a hypersensitive condition of extreme reactivity. The classic example is *shell shock*.



Classical Conditioning: Also referred to as *Pavlovian* or *Respondent Conditioning.*
Learning a reflex-like response to a previously neutral stimulus, due to that stimulus being paired with a stimulus that naturally brings about a reflexive response. The basis of classical conditioning is the *law of contiguity*, events that occur closely in time and/or space come to be associated. Consider a natural reflex. A stimulus triggers a response, and this does not need to be learned or conditioned, so these are referred to as the *unconditioned stimulus* (US) and the *unconditioned response* (UR). Now consider the presentation of some other stimulus prior to the US. This stimulus is attended to, but is neutral in that it would not ordinarily trigger any response related to the natural reflex. However, with repeated pairings of this neutral stimulus being presented prior to the US the neutral stimulus becomes conditioned as a signal for the subsequent occurrence of the US. An association has been formed and the previously neutral stimulus becomes a *conditioned stimulus* (CS) that generates a *conditioned response* (CR).

The test of this learned association involves the occasional presentation of the CS without the subsequent US. Without the US, there is no UR. Any response (CR) to the CS must then be due to conditioning, because of the prior pairing of the CS and US. If the CS is repeatedly presented without the subsequent US the CR will weaken and eventually disappear, a process known as *extinction*. However, the CR is not forgotten, it is unlearned. Much like the case of habituation, the CS has come to have little relevance so it no longer generates a CR. After a prolonged period without CS presentations a CR will initially occur to the CS when it is again presented (spontaneous recovery). If the CS is once again paired with the US, the CR will become re-established and this learning will take place more readily than the initial learning of the CR.

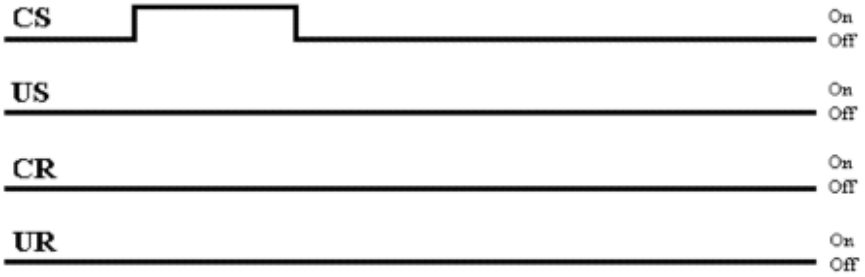




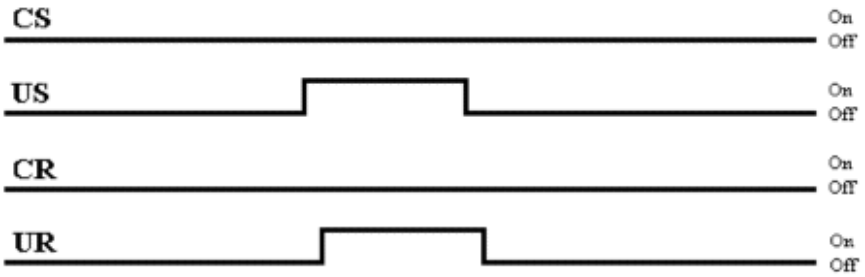
Tone (CS) followed by air puff (UCS) → Eye blink (UCR)

Tone (CS) → Eye blink (CR)

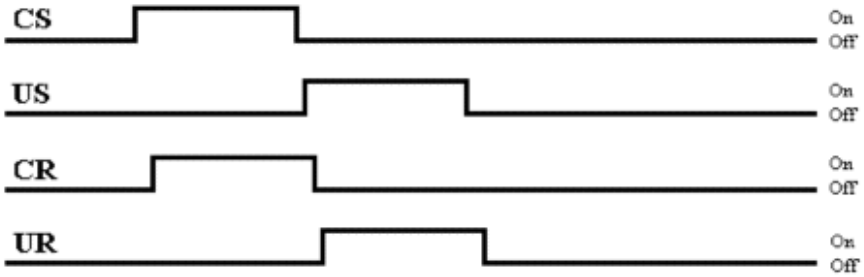
CS Presentation -- Prior to Conditioning



US Presentation -- Prior to Conditioning

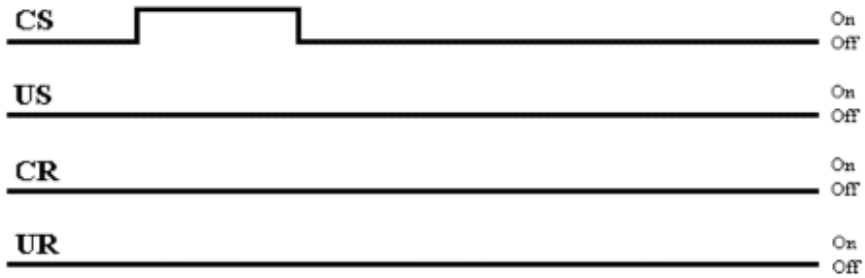


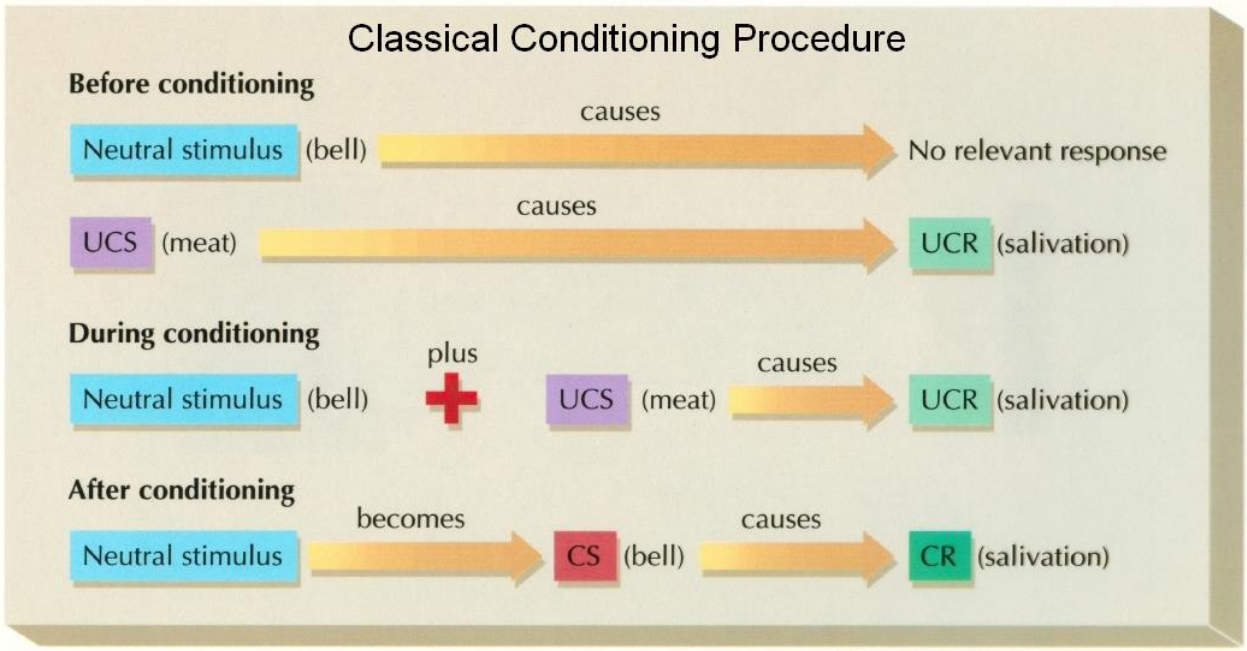
Standard / Forward Conditioning



Testing / Extinction

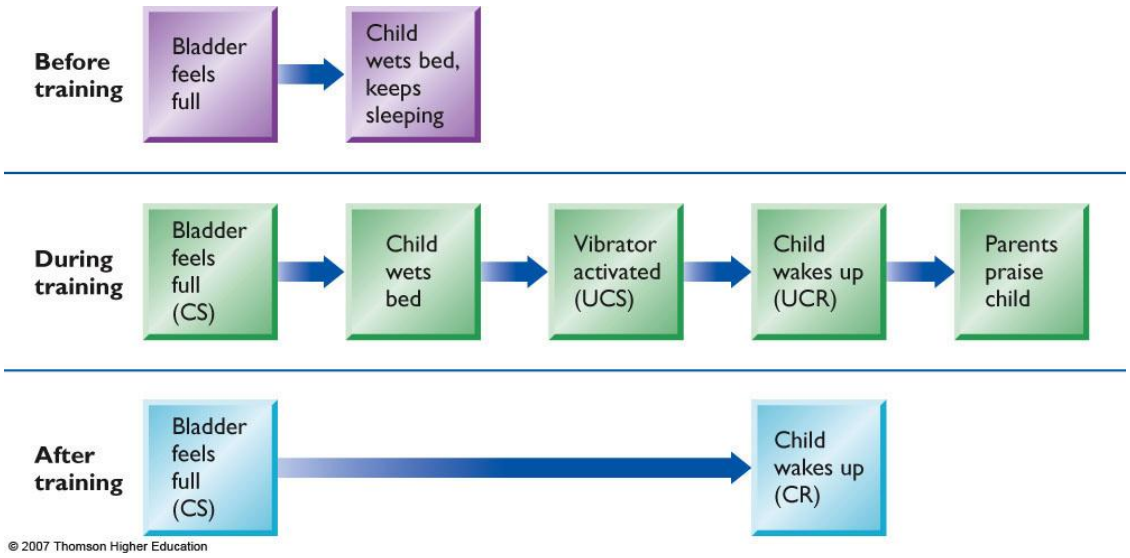
CS Presentation -- After Extinction





One application of classical conditioning is advertising. After studying the work of Pavlov the American psychologist John Watson performed a number of experiments in which he showed emotional responses could be conditioned. In the early 1920s Watson left academics and began work in advertising. Rather than detailing technical specifications or exposing the benefits of a product his approach was to craft advertising campaigns in such a way as to generate associations between products and various forms of stimuli so that the products would trigger positive conditioned emotional responses. That is how cartoon mascots, the use of humor, and most effectively, the use of sex entered into advertising.

Another application of classical conditioning is the treatment of nocturnal enuresis. Mowrer and Mowrer (1938) first developed and outlined the procedure. The problem, of course, is that the sensation of a full bladder that causes most of us to wake up and go pee aren't sufficient to wake the child. So the idea is to pair that sensation with something that will wake up the child such as a mild electric shock or an alarm. A device that closes a circuit when moisture is present is triggered when only a few drops of liquid are released, and that triggers the shock or alarm. The child then awakens and goes to pee. So here the CS is actually a biological condition, the full bladder sensations. The US is the external stimuli, the shock or alarm. That US results in a UR, waking up. Through pairing the CS with the US a CR develops, waking up to the sensations of a full bladder. This is one case where after sufficient training the CS seldom extinguishes, perhaps because there are operant principles of reinforcement at work here as well.



Elicited Response: In both reflexive and classically conditioned responses, the response occurs as more or less a reaction to the stimulus or event. The stimulus draws the response from the organism. It is more or less automatic, or involuntary. In a sense the organism cannot 'not respond.' At best there may be some degree of response suppression, an overriding of the response by the brain. This is the case regardless of whether the response is a natural US-UR reaction or a learned CS-CR reaction. And once well established a CS-CR reaction may become fairly resistant to extinction procedures.

The Role of the CS and the Nature of the CR: The CS serves as a signal that the US is going to occur, it is not a substitute or surrogate form of the US. As a result an established CR prepares the organism for the upcoming US-UR combination. As the CR is *preparatory* it is sometimes very similar to the UR, but at other times compensatory and quite different from the UR. The latter is especially the case if the UR involves changes in the homeostatic functions of the body. An example of each type of preparatory CR will further clarify the concept. When the US is presentation of food, the resultant UR is activation of various digestive processes such as salivation. A CS that serves as a signal for the presentation of food triggers a CS that simply starts these digestive processes a little sooner, so the body is all the more ready to consume and digest the food. On the other hand, in cases of drug tolerance the situation can be quite different. Opiate drugs (heroine, morphine) tend to produce various effects, some of which involve reducing metabolic functions (decreases in respiration, heart rate, and blood pressure). In order to maintain bodily *homeostasis*, CS events (such as repeated patterns or rituals occurring prior to drug administration) generate conditioned responses that compensate for these unconditioned effects by elevating metabolic functions (increases in respiration, heart rate, and blood pressure). When the CS events do not occur, as when the drug user takes the drug in unfamiliar situations, then the compensatory CRs are not generated. The unconditioned responses that reduce metabolic functions go unchecked and the individual may overdose, even with a dosage that had been taken repeatedly under the accustomed situations. So it is that a large part of drug tolerance effects are due to learned behavioral processes.

Counter-Conditioning: What happens when an undesirable association is formed? Can a well-established conditioned response be unlearned, or even replaced? This is what counter-conditioning techniques attempt to do.

One application involves the phenomenon of *conditioned taste aversion*, created when illness becomes associated with the flavor of a particular substance. Garcia and Koelling (1966) first demonstrated taste aversions using rats. Rats were put in cages with access to flavored water. After drinking some they were injected with a chemical to make them ill. All of the rats then showed a subsequent aversion to the flavored water, and would not drink it. The flavor had become associated with illness and became aversive to them. Likewise, people often avoid foods or beverages that caused them great discomfort, such as a bad reaction or hangover. These associations are readily acquired, often after only a single trial. In addition, they can occur even after relatively long delays between tasting the substance and subsequent illness. This is beneficial in that the organism learns to avoid these things in the future. However, the same thing can happen even if the substance wasn't the cause of the illness (as was the case for Garcia and Koelling's rats). Eating something on a cruise ship, then getting seasick, can create an aversion. Moreover, many chemotherapy patients develop taste aversions to the last thing they ate before receiving treatment. Over the course of chemotherapy treatment, some patients develop taste aversions to a number of foods they had always enjoyed previously. And this occurs despite knowing that it was the chemotherapy, not the food, that made them ill. Of course, this can lead to excessive weight loss, which is not particularly good when trying to fight disease. About the only way to undo this is to force oneself to eat the stuff, hopefully without undesirable effects, an extinction procedure. Another method is to prevent these taste aversions and the accompanying weight loss from developing using a *blocking* procedure. And so chemotherapy patients are now given an odd tasting piece of candy immediately before treatment, so an aversion develops to that taste, not whatever food they may have eaten earlier.

These same principles are sometimes used to help people improve their lives. Certain smoking cessation programs will induce nausea after a person has smoked several cigarettes to breakdown the positive associations the client has with smoking and replace them with negative associations, thereby making smoking less attractive. The drug Anabuse is used in a similar way to curb alcohol consumption.

Another application has to do with the rehabilitative treatment of sex offenders such as rapists and child molesters. The technique is known as *aversive counter conditioning*. In a nutshell, the idea is to replace

inappropriate feelings of arousal generated by certain images, with an incompatible CR to these stimuli such as fear or disgust. So the stimuli are presented, and when any degree of sexual arousal is detected an electric shock or a spray of ammonia into the nose is delivered. Ultimately, the undesirable effects of these measures become associated with the stimuli and CRs are developed that result in aversion. These reactions would then transfer to encounters with similar sights in the real world.

Motivation

Motivation: This is what stimulates an organism to act. Instinct plays a part. The role of instinct depends on the species and the behavior in question. Physiological need plays an important role in motivating all organisms as living creatures are motivated to obtain things that will satisfy these needs. Primary needs are those crucial to individual survival such as food, water, and shelter. The avoidance of pain and pursuit of pleasure are also of a primary nature. Secondary needs such as those for affiliation and mating are important for the survival of the species. Not all species display tertiary needs such as those for competence, achievement, and approval. Higher level needs generally are not pursued unless primary needs are first satisfied.

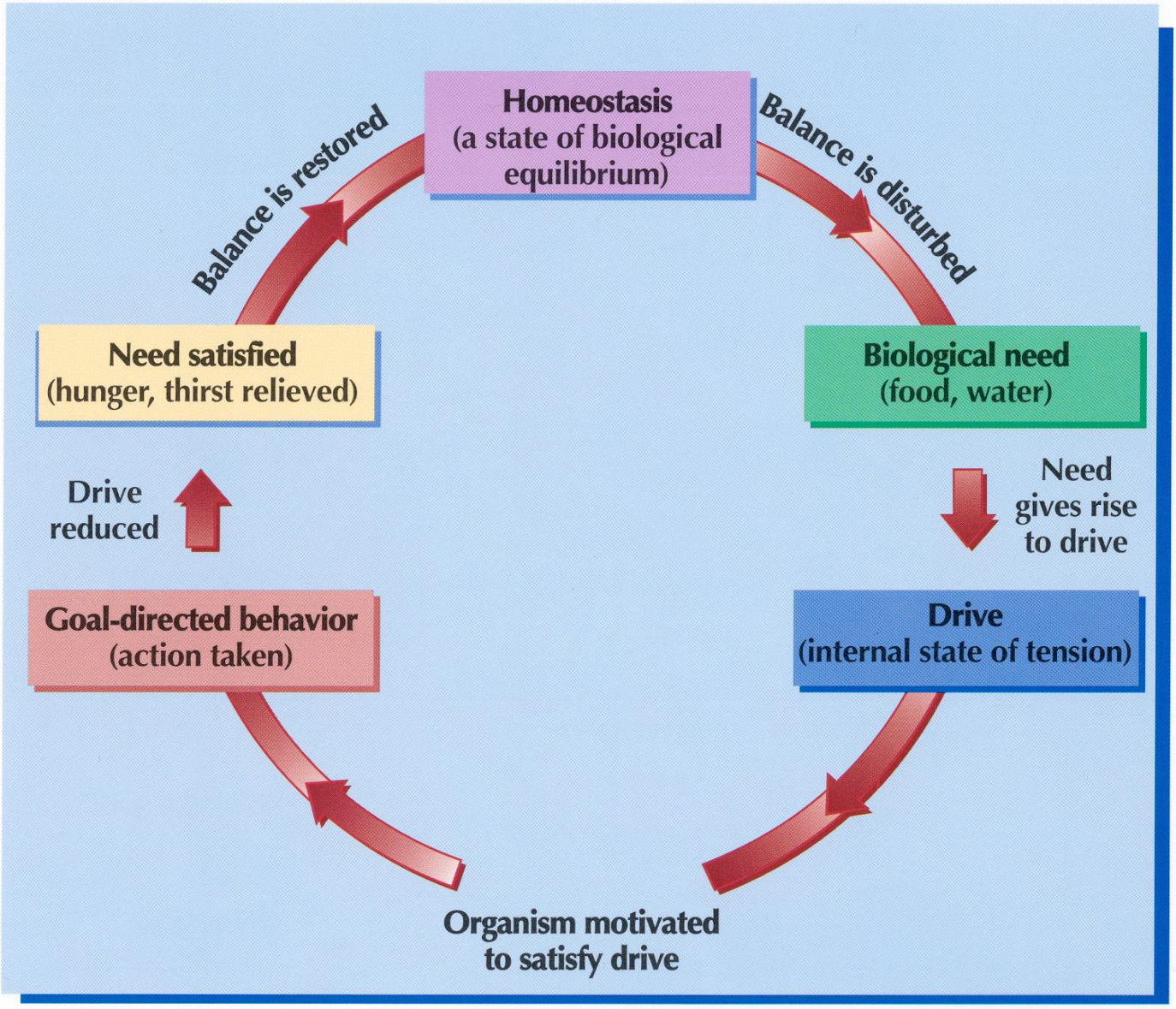
Extrinsic versus Intrinsic Motivation: Most of the time we are motivated to seek out that which will provide something that either satisfies a need or serves some purpose. The reinforcement value is largely external to the behaviors performed or the object itself. Thus obtaining food is only reinforced after the food is consumed. This is extrinsic reinforcement. However, there are other activities that are in and of themselves reinforcing, such as reading a novel. These pursuits are sources of intrinsic reinforcement. Making extrinsic reinforcement contingent upon behaviors that are a source of intrinsic reinforcement often results in negating those intrinsically reinforcing properties.

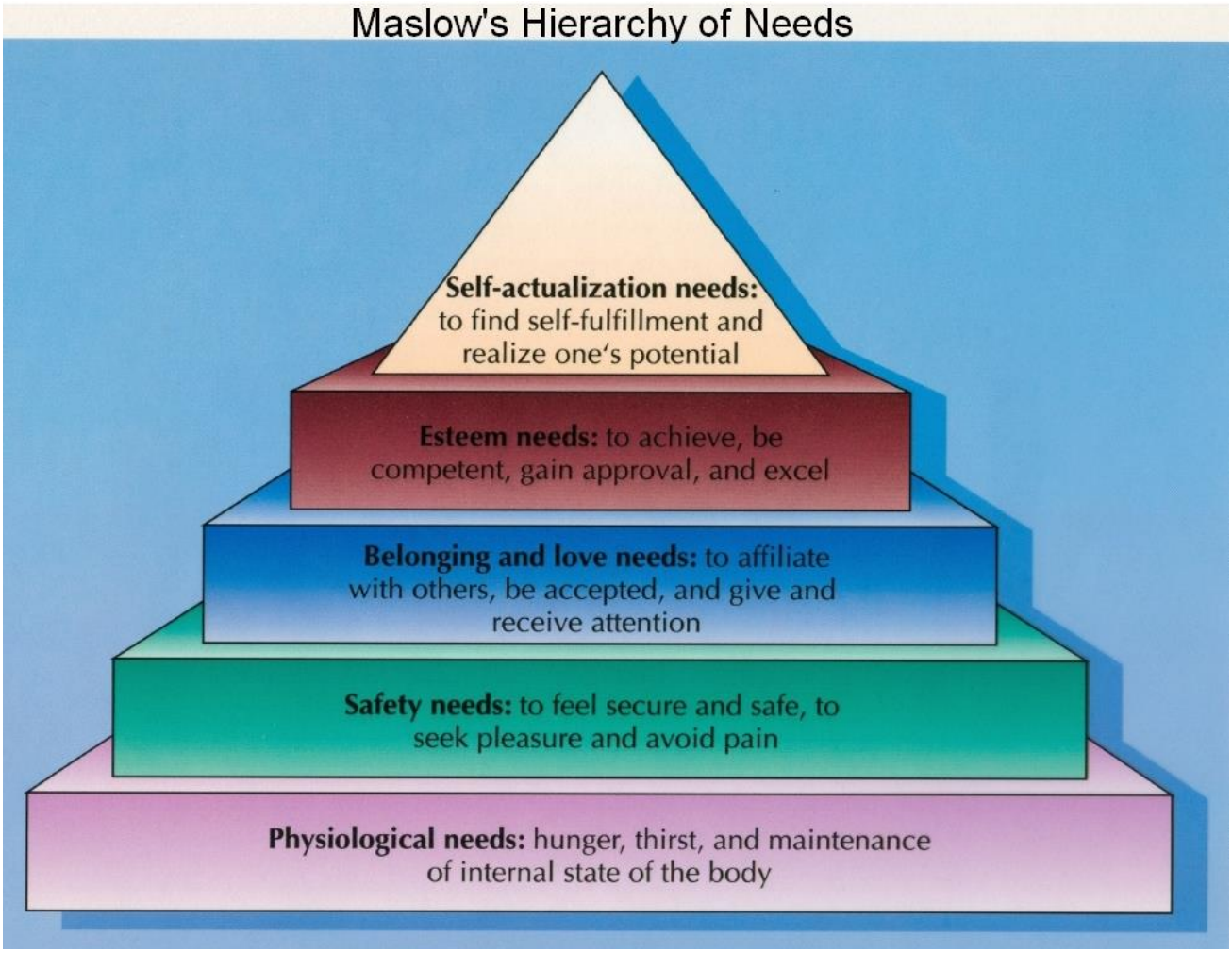
Effect of Arousal: The level of physiological arousal, stemming from physiological need and/or situational factors can affect motivational levels and behavioral performance. A certain level of arousal can facilitate performance, too little or too much can interfere.

Expectancies: Some species do seem to have expectations, and as a result goal-directed behavior.

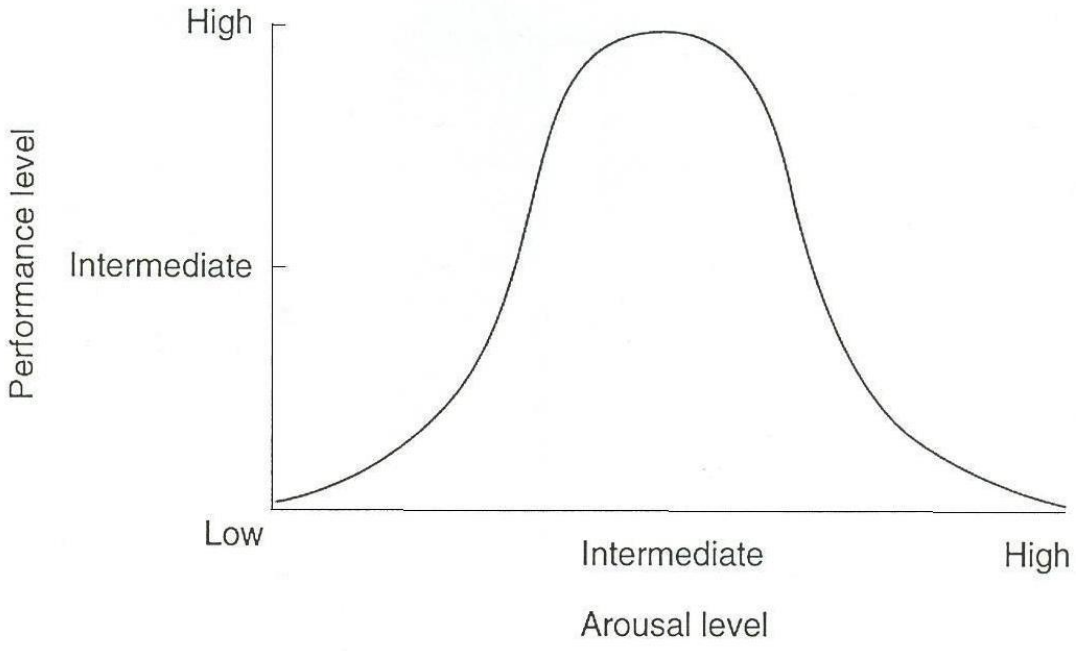
Table 11.2 THEORIES OF MOTIVATION

Theory	View
Biological Theories	
Instinct	Motivation results from behaviors that are unlearned, uniform in expression, and universal in a species.
Drive-Reduction	Motivation begins with a physiological need (a lack or deficiency) that elicits a psychological energy (drive) directed toward behavior that will satisfy the original need.
Psychosocial Theories	
Incentive	Motivation results from environmental stimuli that "pull" the organisms in certain directions.
Cognitive	Motivation reflects thought processes (such as attributions and expectancies) in goal-directed behaviors.
Interactionism	
Maslow's Hierarchy Of Needs	Lower motives (such as physiological and saftey needs) must be satisfied before advancing to higher needs (such as belonging and self esteem).


Homeostasis
(a state of biological equilibrium)
Balance is disturbed
Biological need
(food, water)
Need gives rise to drive
Drive
(internal state of tension)
Organism motivated to satisfy drive
Goal-directed behavior
(action taken)
Drive reduced
Need satisfied
(hunger, thirst relieved)
Balance is restored



The Yerkes–Dodson Law



Instrumental / Operant / Emitted Behavior

Unlike classically conditioned behaviors, instrumental responses are produced by the organism in order to achieve some goal or end (responding to get something, more of a voluntary nature, an act of will). However, according to the behaviorists it is not necessary to bring in mentalistic concepts such as expectation. Instead one can say that the effects of history and experience are responsible. In the past a particular behavior lead to some outcome. Much of the research in this area has used animal subjects. The idea is that by studying uncomplicated creatures performing simple behaviors in a strictly controlled environment basic laws of behavior can be derived. These laws of behavior can then be applied to all behavior, including the complicated actions taken by humans.

Thorndike (1898): Empirical proof of the Law of Effect.

Puzzle box & cats, graphing number of responses (or time to escape) over trials he found learning curve (both measures decreasing with successive trials). Law of Effect: Those behaviors that lead to a desirable state of affairs were Stamped In, while ineffectual responses faded.

He also found animals learned how to deal with box situation more effectively over successive problems, as they became more systematic in their actions. Hence, learned not only how to solve the puzzle effectively in any given situation, but also became more efficient at puzzle solving in general.

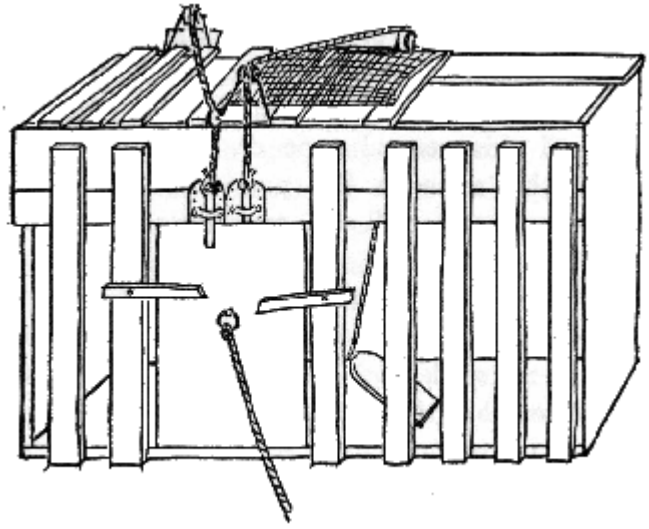
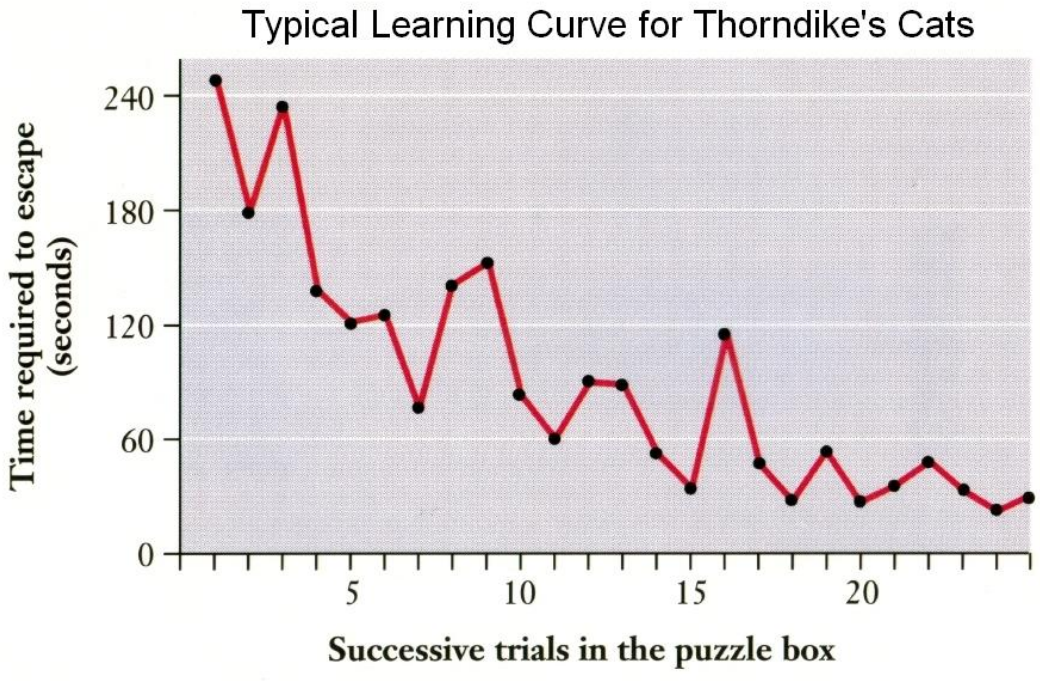
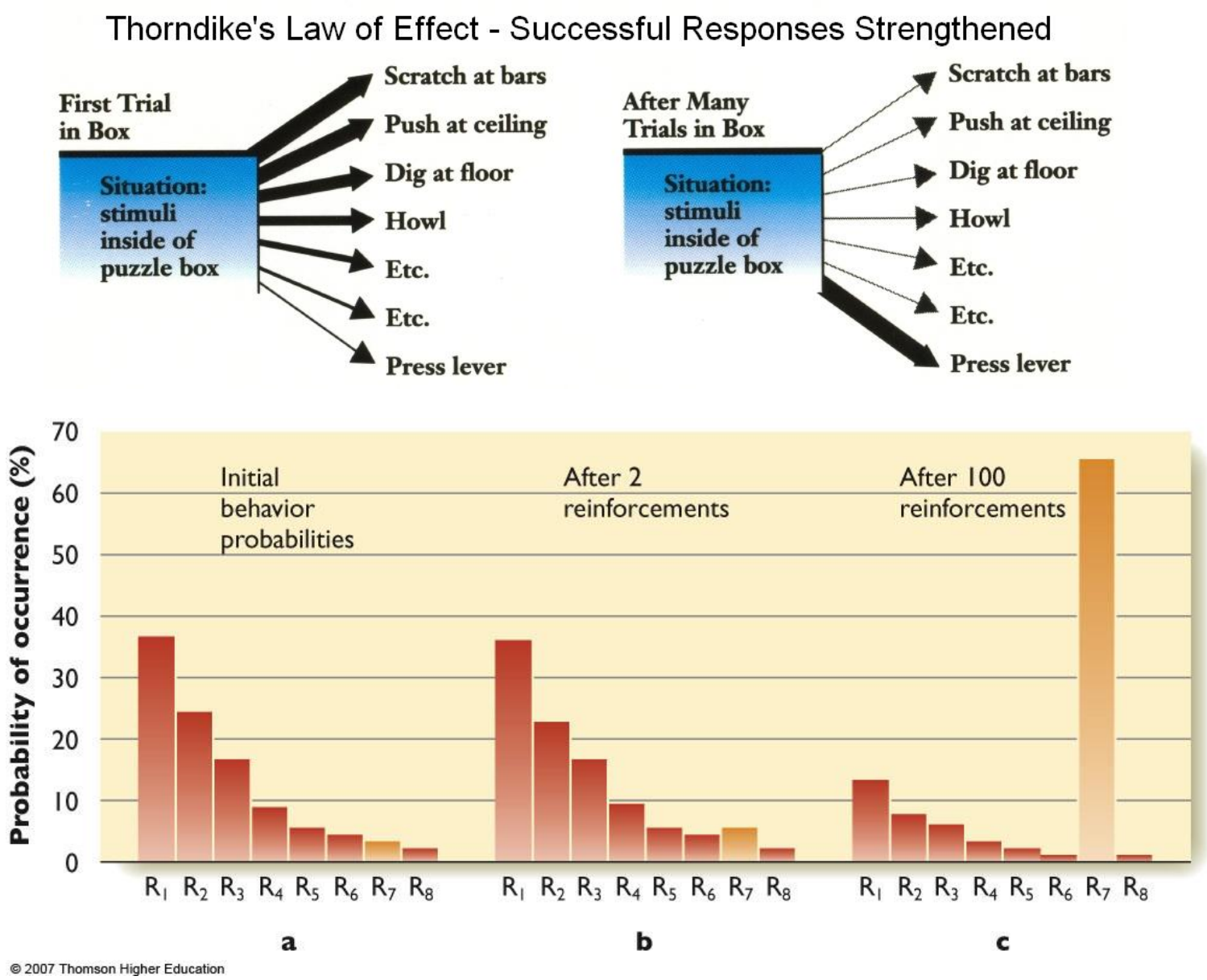


FIG. 1.





Habit Strength:

Clark Hull's conception of the Law of Effect. The more an organism receives reinforcement for a behavior, the stronger is the habit of making that response. An entire system of equations and theories to predict, control, and explain behavior was developed based on this conception. This he referred to as the Global Theory of Behavior:

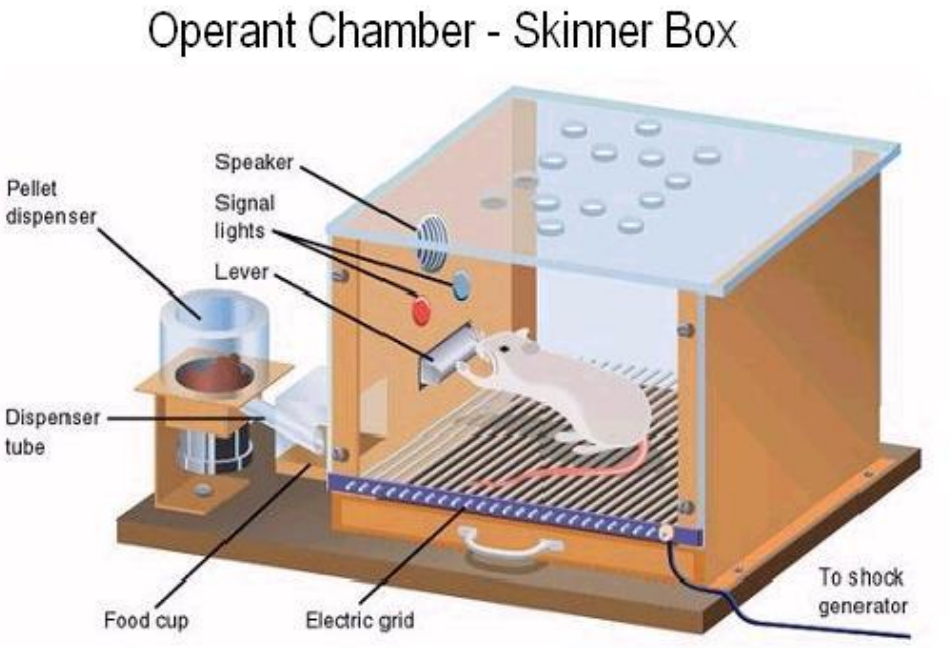
sEr = (sHr x D x K x J x V) - (sIr + Ir) +/- sOr

Habit strength, **sHr**, is determined by the number of reinforced training trials. Drive strength or biological deprivation, **D**, is measured by the hours of deprivation. The variable **K** is the incentive value of a stimulus, its size or magnitude. **J** represented the delay before the animal was allowed to pursue the goal. **V** was a measure of the intensity of the stimulus that set off the behavior, a measure of what he called connectiveness. Inhibitory strength, **sIr**, is the number of non-reinforced training trials. Reactive inhibition, **Ir**, captures when the organism has to work hard for a reward and becomes fatigued. The last variable in his formula is **sOr**, which accounts for random error. Hull believed that this formula could account for all behavior, that it would generate more accurate empirical data, and eliminate all ineffective introspective methods.

Thus, a response that has been followed by reinforcement 100 times becomes a stronger habit (is more likely to recur) than a response that has only been followed by reinforcement 50 times. By this same argument, a response that has been followed by reinforcement on every other trial should not be as strong of a habit as a response that has been followed by reinforcement on every trial. And by his argument a response should lose

habit strength if not followed by reinforcement. Thus, the greatest habit strength should be a for a response that was followed by reinforcement on each of 100 trails. The habit strength of a response followed by reinforcement on each of 50 trails would be less. The habit strength of a response followed by reinforcement on every other of 100 trails (50 total) should be even less. And finally, a response never followed by reinforcement on 50 or 100 trails should have little or no habit strength. This is all generally supported by most measures of response strength derived from classical conditioning such as magnitude, frequency, delay, and latency. However, there is a problem concerning resistance to extinction (response no longer followed by reinforcement). Intermittent reinforcement produces more resistance to extinction than does continuous reinforcement. This is counter to Hull's entire theory of habit strength, and as the theory had no way to account for this finding it faded into history.

Schedules of Reinforcement: Skinner recorded the accumulated responses made by his subjects inside an operant chamber. He systematically varied how contingent reinforcement was delivered, either as a function of the number of responses that had been made, or the timing of responding. By examining the cumulative records of the responses made he found that different methods of reinforcement delivery resulted in different characteristic patterns of responding.



Continuous Reinforcement: Every response receives reinforcement. Produces and maintains steady rate of behavior, but satiation becomes likely and there is a low resistance to extinction.

Intermittent Schedules of Reinforcement: Some number of responses, or some pattern of responding, is required to receive reinforcement. Overall maintains a high and steady rate of responding (with notable exceptions) with increased resistance to extinction. There are a variety of schedules that can be used varying in complexity. There are four basic schedules of reinforcement, for each there is only one controlling factor. These are the simple schedules of reinforcement:

Fixed Ratio: After a fixed number of responses are made reinforcement is received. FR-1, reinforcement follows every response, FR-5 = reinforcement follows every 5th response. This type of schedule produces a bi-modal response pattern with alternating pre-ratio pausing and high rates of responding (e.g. factory piecework).

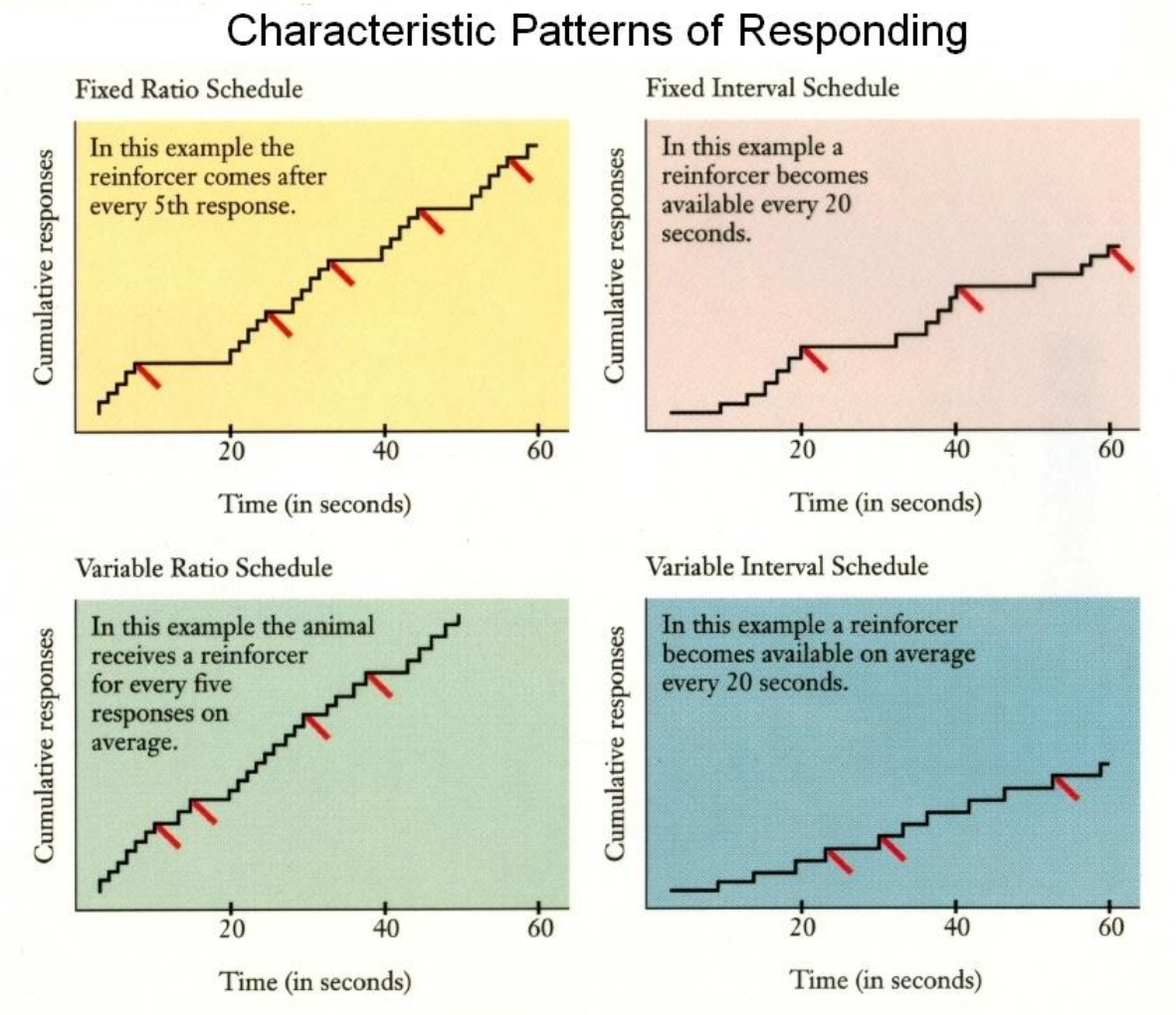
Variable Ratio: After some number of responses are made reinforcement is received, with the number of responses varying around some average over the course of trials. VR-5 = on average reinforcement follows every 5th response, but on a given trial it may follow 2nd, 5th, or 8th response. Usually there is some set of established components which are used, the mean of which equals the schedule value. This type of schedule produces high, steady rates of responding (e.g. slot machines and many other forms of gambling/gaming).

Fixed Interval: After a fixed period of time has elapsed, the next response made receives reinforcement. The time must elapse, and then a response must be made, in order to receive reinforcement. FI-30" = after 30

seconds the next response made will be followed by reinforcement. This type of schedule produces a positively accelerating rate of responding until reinforcement is received. That is to say there is little responding immediately after reinforcement, but as time elapses, and opportunity for reinforcement nears, then the rate of responding steadily increases (e.g. regular television programming, happy hour specials, regular bedtime).

Variable Interval: After a period of time has elapsed, which averages around some particular value, the next response made receives reinforcement. The time must elapse, and then a response must be made, in order to receive reinforcement. In addition the amount of time varies, but overall it averages around some mean value. VI - 30" = on average after 30 seconds the next response will be followed by reinforcement. On some trials it will be 15 seconds, on others 30 seconds, and on others 45 seconds that must elapse. And then the next response will be followed by reinforcement. Usually there some set of established components are used, the mean of which equals the schedule value. This type of schedule produces moderate, steady rates of responding (e.g. fishing, checking incoming emails).

Note the different role of responses vs. time in determining when reinforcement is received. On ratio schedules time is not a factor, so the faster the subject makes the required number of responses the sooner reinforcement is received. So when they do respond on ratio schedules, they do so rapidly (in bursts after pre-ratio pausing on FR, steadily on VR). On interval schedules time is a controlling factor, and a certain degree of temporal spacing between responses is optimal. It's unlikely that the interval requirement will time out from one response to the next when responding at a very high rate, as only a fraction of a second may elapse. Optimal pattern is to be responding at a moderate rate when the interval is about to time out so as to minimize any delays to receiving reinforcement. Thus, subjects respond in such a way that only a short period of time will pass between when reinforcement becomes available and when they receive it. Subjects build up the rate on fixed interval schedules as the end of interval becomes more eminent. On variable interval schedules subjects maintain a steady rate (because when the interval will elapse cannot be predicted). With longer interval requirements expect greater spacing of responses and so a slower overall rate of responding.



Shaping: Differential reinforcement of successive approximations to target behavior. First thing you need to do is establish the response. When it already exists there's no problem, apply a schedule of reinforcement. Shaping works with natural variability in behavior to establish a new response (to a particular stimulus or setting) and add it to the response repertoire.

Superstitious Behavior: If reinforcement is delivered randomly without being contingent upon any particular response it can still affect behavior. Whatever response was occurring just prior to the delivery of reinforcement will become more probable. From the subject's point of view it would seem that response produced the reinforcement and so the response is repeated. If the response subsequently precedes delivery of yet another reinforcement the response becomes even more probable. However, since the response actually has no bearing on the delivery of reinforcement it's possible for the relationship to breakdown just as easily. If some other response happens to occur immediately before the delivery of reinforcement that new response will increase in probability and may come to supplant the original superstitious response. So over time the form of superstitious behaviors will drift and tend to vary a great deal. These kinds of associations can sometimes disrupt the process of shaping if the person doing the shaping isn't careful. Superstitious behaviors are commonly demonstrated by athletes, as behaviors that previously preceded scoring are repeated regularly (forms of stretching, gestures, items of clothing worn, etc.).

Three Term Contingency: The ABCs of Learning. Antecedent conditions are said to set the occasion for responding. Given the *antecedent* conditions are present, now is the time to emit the *behavior* because responding will be followed by a particular *consequence* (e.g. positively reinforcing stimulus). If antecedent is not present, don't bother to respond because no reinforcement will be received. If you're in Uncle J.R.'s class, then commenting on psychological phenomena will result in praise and attention. If your not in Uncle J.R.'s class, then commenting on psychological phenomena will be ignored. Note there may be more than one set of antecedent conditions that can serve to signal when a particular class of responding will receive reinforcement. You could have two psychology classes with two different instructors. Being in either class could then result in praise and attention for commenting on psychological phenomena. The same response, in your algebra class, will still be ignored.

Generalization and Discrimination: Hull and Spence (1940's to early 50's) - Focus is on S-R theory, given this stimulus organism responds (because in the past doing so has lead to particular outcome).

S^D : Training stimulus - respond and receive reinforcement. Generalization gradient builds up around this stimulus, similar responding more likely the more a particular stimulus is like the S^D. If S^D is a 3000 Hz tone, get maximal responding to 3000 Hz, get nearly as strong responding to 2500 Hz or 3500 Hz tones, get far lesser responding to 500 Hz or 5500 Hz tones.

S^{Delta} : Discrimination training stimulus - respond and never receive reinforcement. The opposite of a generalization gradient builds up around this stimulus, responding less likely the more a particular stimulus is like the S^{Delta}. If S^{Delta} is a 10,000 Hz tone, get minimal responding to 10,000 Hz, and weak responding to 9000 Hz or 11,000 Hz tones, less effect responding to 5000 Hz or 15,000 Hz tones.

Behavioral or Response Outcomes: Five possible outcomes following a response, one of which is that nothing happens, no consequence. This, of course, has little effect on behavior. There are then four possible outcomes that affect behavior, by increasing (reinforcement) or decreasing (punishment) the probability of repeating the behavior in the future. These are often diagramed as a 2 X 2 matrix of possible events. When we speak of positive and negative we mean, in the purely mathematical sense of adding (presenting) or subtracting (removing) stimuli. A positive number is not a good number, nor is a negative number a bad number. These conceptions come from business and economic theory, with a positive cash flow considered good (making money), and a negative cash flow as being bad (losing money). Anyway, stimuli can either be added (presented) or subtracted (removed) from an organism's environment. Additive and subtractive may have been better terms to use (fewer connotations) than positive and negative. In addition, these stimuli can be either desirable (satisfying) or undesirable (aversive). This results in four possibilities: Positive Reinforcement, Positive Punishment, Negative Reinforcement, Negative Punishment. There can be differences and overlap in how different outcomes are interpreted.

From the same perspective: Are Thorndike's cats being negatively reinforced in that they escape puzzle box (remove aversive stimuli) or positively reinforced in that they gain freedom (present desirable stimuli). Is turning up the temperature in a cold room positive reinforcement (adding heat) or negative reinforcement (removing cold)? Usually go with physical definitions: Thorndike's cats negative reinforcement, turning up temperature positive reinforcement, getting a ticket positive punishment, subsequent fine when taken negative punishment.

From different perspectives: Dad picks up crying baby Elwood and he stops crying. For baby: Cry and get picked up - positive reinforcement. For Dad: Pick up baby and crying stops - negative reinforcement.

Consequences of Behavior

	Positive (+) Add Present	Negative (-) Subtract Remove
Desirable Stimulus	Positive Reinforcement Increases Probability of Behavior	Negative Punishment Decreases Probability of Behavior
Undesirable Stimulus	Positive Punishment Decreases Probability of Behavior	Negative Reinforcement Increases Probability of Behavior

Related Terms

Positive Reinforcement: Reward, Payoff, Payment, Gain, Credit, Winnings, Bonus, Prize, Gift, Present, Promotion, Perc ...

Negative Reinforcement: Relief, Escape, Avoidance, Pardon, Reprieve ...

Positive Punishment: Penalty, Injury, Demerit, Citation ...

Negative Punishment: Response Cost, Time Out, Loss, Debit, Fine, Fortiture, Revocation, Suspension, Tax, Restriction, Restraint, Cut Off, Disown, Disinherit ...

Psychology in Action: Behavioral Self-Management—A Rewarding Project

By applying learning principles to one's life, many behaviors can be improved.

Applying Operant Conditioning

By applying operant conditioning principles, it is possible to change or manage your own behavior.

1. Choose a Target Behavior

Identify the activity you want to change.

2. Record a Baseline

Record how much time you currently spend performing the target activity or count the number of desired or undesired responses you make each day.

3. Establish Goals

Remember the principle of shaping, and set realistic goals for gradual improvement on each successive week. Also, set daily goals that add up to the weekly goal.

4. Choose Reinforcers

Establish daily and weekly rewards for your accomplishments.

5. Record Your Progress

Keep accurate records of the amount of time spend each day on the desired activity or the number of times you make the desired response.

6. Reward Successes

If you meet your daily goal, collect your reward. If you fall short, be honest with yourself and skip the reward. Do the same for weekly goals.

7. Adjust Your Plan as You Learn More About Your Behavior

Overall progress will reinforce your attempts at self-management.

Breaking Bad Habits

Here are additional strategies that can help break bad habits.

Reinforce Alternative Responses

Try to get the same reinforcement with a new response.

Promote Extinction

Try to discover what is reinforcing an unwanted response and remove, avoid, or delay the reinforcement.

Break Response Chains

Break up response chains that precede an undesired behavior. Scramble the chain of events that leads to an undesired response.

Avoid Antecedent Cues

Try to avoid, narrow down, or remove stimuli that elicit the bad habit.

Try Behavioral Contracting

If all else fails, try behavioral contracting.

- First, state the specific problem behavior you want to control, or a goal you want to achieve.
- Second, state the rewards you will receive, privileges you will forfeit, or punishments you must accept.
- Third, sign the contract and have a person you trust also sign.
- Follow through.

Octopi Individuality

Peter Dews (1959) discovered that individual differences in learners affect the course of learning, even when the learners are octopi.

Dews wanted to see if lever pulling could be shaped in three octopi, Albert, Bertram, and Charles. Each octopus lived in a tank filled with salt water, with a lever mechanism attached to the tank during training sessions. The basic procedure consisted of shaping lever pulling by providing the octopus with food when it approached the lever, then when it touched it, and finally only when it pulled it.

Learning proceeded by the book with both Albert and Bertram. Charles also learned to pull the lever, but things did not go as smoothly with him. Instead of pulling the lever while floating, Charles anchored several tentacles to the sides of his tank, wrapped the others around the lever, and pulled with great force. He bent the lever a number of times and finally broke it, which led to the unplanned termination of the experiment.

Charles also displayed unusual interest in a light suspended over the water. He repeatedly grasped the light with his tentacles and pulled it toward the water. This, as Dews observed, was incompatible with lever pulling.

Perhaps Charles's most interesting behavior was a tendency to squirt water out of the tank, generally in the direction of the experimenter. Dews reports that Charles "spent much time with eyes above the surface of the water, directing a jet of water at any individual who approached the tank. This behavior interfered materially with the smooth conduct of the experiments, and is, again, clearly incompatible with lever-pulling" (p. 62).

Charles's behavior demonstrates that individual differences exist, even among octopi. The differences may be due to previous learning, heredity, or other factors. Whatever their source, such individual differences play an important role in the course of operant learning.

Table 5.1 A REVIEW OF CONDITIONING

	Classical Conditioning	Operant Conditioning
Other Names	Respondent conditioning Pavlovian conditioning	Instrumental conditioning Law of Effect (Thorndike) Skinnerian conditioning
Pioneers	Ivan Pavlov John B. Watson	Edward Thorndike B.F. Skinner
Example	Sound of bell (CS) begins to produce salivation	Baby cries and parents pick up baby
Major Terms	Unconditioned stimulus (UCS) Conditioned stimulus (CS) Unconditioned response (UCR) Conditioned response (CR) Conditioned emotional response (CER)	Reinforces (primary and secondary) Reinforcement (positive and negative) Punishment (positive and negative) Shaping Reinforcement schedules (continuous and partial)
Shared Terms	Extinction Spontaneous recovery Generalization Discrimination	Extinction Spontaneous recovery Generalization Discrimination
Major Differences	Involuntary (subject is passive)	Voluntary (subject is active)
Behavior Order	CS must come *before* the UCS	Reinforcement comes *after* the behavior

Aversive Control, Punishment and Two-Factor Theory

Aversive Counter Conditioning: This is a form of therapy based on the principles of classical conditioning. It is commonly applied to sex offenders. The idea is to replace the arousal responses that are elicited by particular stimuli with unpleasant responses. Images depicting inappropriate sexual acts are shown to the subject. When the subject begins to show signs of arousal a noxious stimulus is administered, such as a spray of ammonia up the nose. The goal is to have the disgust and revulsion associated with the noxious stimuli transferred to the sexual imagery. After therapy these images, and perhaps related thoughts, of inappropriate sexual acts will no longer elicit arousal, but disgust and revulsion instead. This treatment is about 50% effective in the long run. The biggest problem is that out in the world the noxious stimuli are no longer administered when thoughts or images related to inappropriate sexual acts are encountered, so after a while arousal may again be elicited. Follow up counter conditioning sessions can prevent this kind of relapse, but the subjects don't readily submit to them voluntarily. Similar treatments have been employed to help people quit smoking or drinking. Noxious stimuli are used to negate the pleasant associations usually attending these drugs. Again, the treatment is unpleasant and people are not inclined to go in for follow up treatments to maintain the conditioning.

Punishment: This is the form of aversive control most commonly encountered. The principles of operant conditioning apply, although parents and governments have been using these methods long before the underlying principles were investigated. The primary focus here will be on the use of positive punishment. Most of this information also holds true for negative punishment. However, the use of positive punishment is far more controversial, and some of the relevant issues are considered here. It must first be noted that undesirable behavior is engaged in for some reason, presumably some form of reinforcement is maintaining it. So from the beginning the forces of reinforcement are working against the use of punishment. When using punishment to decrease an undesirable behavior the situation is much more complicated that when one uses reinforcement to increase a desirable behavior (where there is no such opposing force already in place). Because of these opposing forces the application of punishment requires much more precision than does the use of reinforcement. Nevertheless, there are instances when the use of punishment is the best behavioral technique available. It must be noted that, like reinforcement, punishment must be delivered consistently, reliably, and immediately in order to be effective. However, unlike reinforcement, an intermittent schedule of punishment generally is not effective. And unlike reinforcement, there are also unwanted side effects to the use of punishment. For these reasons punishment should only be used when other options are unavailable or ineffective. The best technique is to use punishment as part of an overall plan that also includes the use of reinforcement for desirable behavior.

When to Use Punishment: The use of punishment is the most effective and preferred method of control in the following cases.

The Lesser of Two Evils: A swift, strong, and unforgettable punishment is warranted for high risk behaviors. When a child touches a hot stove, the child experiences pain and removes his/her hand quickly. This avoids the tissue damage that could occur from a severe burn if the child kept his/her hand there, or continued to experiment with the stove. It's also the case that the child will be very unlikely to repeat the behavior. Here pain serves as an automatic punishment. The effect is less than the potential greater evil (the pain of a minor burn as opposed to severe burns and the accompanying severe pain and risk of infection). Similarly, a child running out into the street is engaging in a high risk activity, but may be able to do so a number of times without mishap. If one doesn't want the child to get struck by a vehicle and severely injured or killed some form of intervention is required. Now, if the child is too young to understand the risk and potential harm, then an unforgettable delivery of punishment may serve to make the behavior very unlikely in the future. So here it is necessary for the caregiver of the child to deliver punishment in order to prevent the future occurrence of such high risk behavior.

Breaking Up a Pattern of Continuously Engaging in an Undesirable Behavior: If a particular undesirable behavior is engaged in to the exclusion of all other behaviors how does one stop it? In such a case there may be no alternate behavior available that could receive reinforcement and come to replace the undesirable behavior. So punishment of the undesirable behavior may be necessary in order to break up the pattern of continuous undesirable behavior. This provides a window of opportunity in which some other behavior (any other behavior or simply not doing anything) can emerge and receive reinforcement. Thus, punishment is initially needed to

provide the variability in behavior necessary for the application of differential reinforcement in order to shape new desirable behavior. The self-injurious behavior of some autistic children is an example. Lovaas found that the only way to break up the behavior was to use electric shock as punishment. Then for a brief period the children were a bit stunned and did not engage in self-injury. During this time reinforcement could be delivered for any other behaviors they exhibited (or for simply sitting still and not injuring themselves). Eventually less time was spent engaged in self-injurious behavior and more time spent in desirable and productive behaviors.

How to most effectively use punishment: It is important to administer punishment consistently and immediately. Each and every occurrence of the undesirable response must immediately be followed by punishment. Intermittent use of punishment, and delay of punishment, both greatly reduce its effectiveness. Punishment should be delivered at full strength from the beginning of its use. Gradually incrementing the degree, or strength, of the punishment decreases its capacity as a means to control behavior. Subjects tend to adapt (become desensitized) to the punishment if it is gradually increased over trials. Decisions as to the maximum amount of punishment to be used should be made in advance, and that amount used from the beginning of training.

Problems in the use of punishment: Punishment is not as simple as just the opposite of reinforcement. There can be unwanted side effects to the use of punishment as well as important limitations to its use.

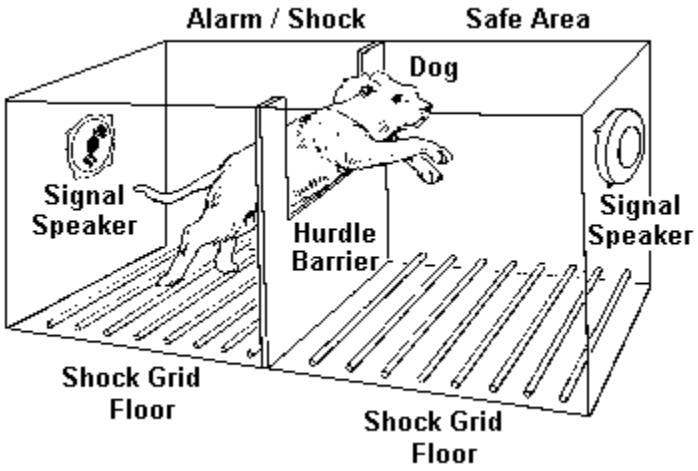
Side Effects: Avoidance of the agent of punishment. Increases in other undesirable behaviors such as lying in order to avoid punishment may occur. Increased aggression is common, particularly when positive punishment is used. A tendency toward over reliance on the use of punishment may occur because it is often easier, simpler, and more expedient than other ways of controlling behavior. If punishment is the only means of behavioral control used in a family, those children grow up knowing no other means of controlling behavior and continue the cycle on to the next generation.

Limitations: Punishment itself tells the subject nothing about appropriate behavior, only what is not appropriate or undesirable. It is best to couple the use of punishment for undesirable behavior with the use of reinforcement for desirable behavior. This will provide information as to what behaviors are desirable and serve to establish long term behavioral change as the desired behaviors come to replace the undesirable. Remember that the agent delivering punishment must be continuously present and ready to reliably and immediately deliver contingent punishment, which is not particularly convenient nor always practical. In contrast, the use of reinforcement for desirable behavior, especially that which is incompatible with the undesirable behavior, can eventually evolve into an intermittent schedule. And so the agent of control no longer has to continuously monitor behavior in order to maintain the behavioral change. Overall, though punishment may have its place, the use of reinforcement is ultimately more effective.

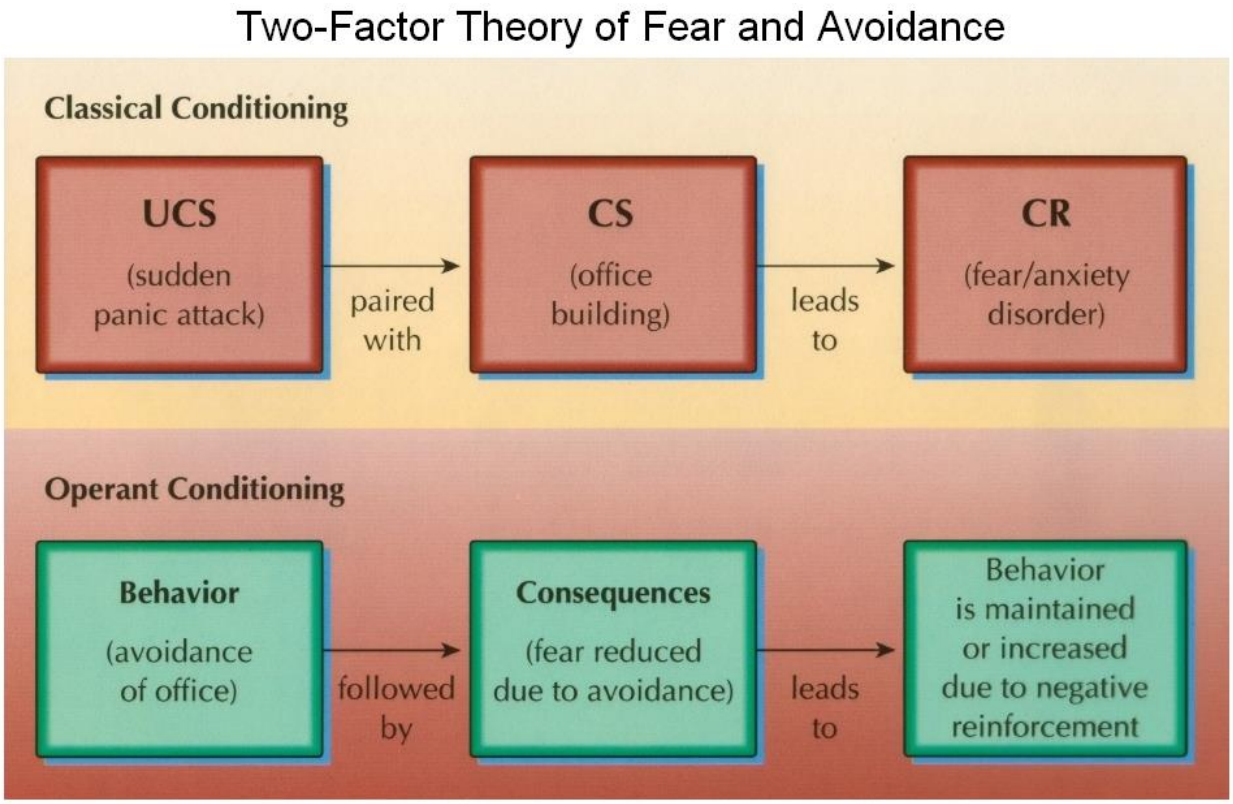
Escape and Avoidance:

Escape Training: The subject learns to respond in order to terminate an aversive stimulus. A frequently used procedure involves the use of a shuttle box with a grid floor that can be electrified, delivering a mild shock. Typically the box is divided in two by a small wall in the middle, the subject is placed on one side and then shock is delivered to that side only. To escape the shock the subject need only jump or climb the wall to get to the safe side. The escape response is quickly established and readily maintained. Termination of the shock provides negative reinforcement for the response of going over the wall.

Avoidance Training: A signal is introduced that precedes delivery of the shock. If the subject makes the appropriate response in a timely fashion once the signal comes on it can avoid the shock altogether. For instance, when a red light comes on ten seconds prior to delivery of shock, the subject need only go over the wall before the ten seconds elapses in order to avoid the shock completely. The avoidance response is quickly established and readily maintained. The question is: What is the source and the nature of reinforcement? The subject never receives the shock, so termination of shock cannot be acting as a negative reinforcement. Avoidance of an aversive stimulus altogether is not the same as termination or removal of an aversive stimulus that has been presented. Hence we must look elsewhere for the source of reinforcement.



Two-Factor Theory: In cases of avoidance responding there is both a classically conditioned response and an operant response. The signal precedes the aversive event. Hence the two stimuli become associated by contiguity, and the signal becomes a CS for the occurrence of the US. So in the given example, the red light becomes a CS for the delivery of shock (US), while the UR to shock is discomfort or pain. After a few such pairings this CS comes to elicit a Conditioned Emotive (Emotional) Response [CER] analogous to the UR of pain, and that CER is fear. Thus, the contingent factor in avoidance is that the operant response receives negative reinforcement in the form of removing the CS which has become aversive in its own right because it elicits fear (an unpleasant emotional state). So in the final analysis there really is no such thing as avoidance, only escape. In this example, the subject in the shuttle box goes over the wall when the red light comes on in order to escape the red light and the fear that stimulus has come to elicit. This explanation avoids any mentalistic conceptions of the subject responding because of some sort of abstract expectancy that a shock will occur once the signal comes on. Note that a subject constantly making the avoidance response would never realize if the shock were turned off. The subject never hangs around long enough to find out that the red light is no longer a signal for impending shock, if shocks were no longer scheduled.

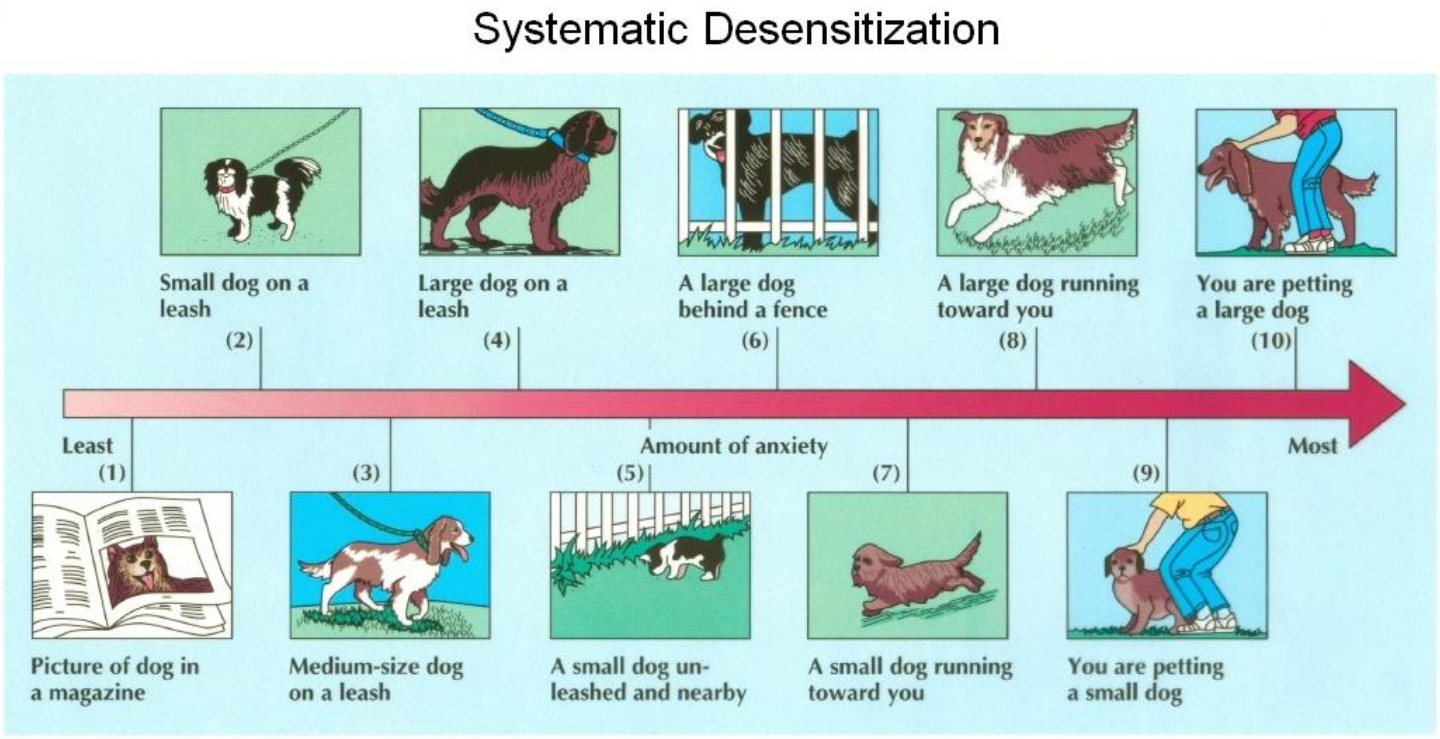


Phobias and Obsessive-Compulsive Behaviors: These disorders are maintained by irrational fears and anxiety. Those with phobias avoid situations that may bring them in contact with the fear evoking object. And they quickly retreat from any actual exposure. Phobias are learned and persist because the patient avoids the object of the phobia and so never realizes that it is not excessively dangerous. Likewise, those who perform obsessive-compulsive behaviors always do so, never risking the feared consequences by not performing the behaviors. So once a phobia or OC behavior is established (and it really doesn't matter how they are established), it perpetuates because exposure to the current consequences never occurs due to the avoidance-like nature of the responses.

Implosive Therapy (Flooding) and Systematic Desensitization: Both of these are used to treat phobias and OC behaviors by exposing patients to the actual consequences associated with their fears. Based on two-factor theory, the idea is that exposing the patient to the object of the phobia, or preventing the performance of the OC behavior actually is beneficial. Because if this is done until anxiety decreases, then the patient learns there is no real danger.

Implosive Therapy for Phobias: The patient is either asked to imagine the worst case scenario of exposure to the object of the phobia, or actually exposed to it in reality. This excessive exposure situation is maintained until the patient eventually gets used to it to some degree and anxiety decreases. Along with this, the patient comes to learn that the phobic object (or situation) is not that dangerous. For example, the patient with a fear of water is thrown into the deep end of a swimming pool.

Systematic Desensitization Treatment for Phobias: There are two aspects to this treatment. The patient is first trained in relaxation techniques. Then the patient is asked to generate a hierarchy based on the level of anxiety evoked by different degrees of exposure to the object of the phobia. The patient is then directed to imagine each level of exposure, from least threatening to the worst case scenario. At any level, if the patient experiences anxiety, the relaxation techniques are to be employed until the anxiety subsides. The key here is that anxiety is incompatible with relaxation, and since relaxation is preferable it wins out. Gradually the patient becomes able to successfully deal with all the levels of exposure, as imagined. Then the patient repeats the process, but in real life, with actual exposure to each level. For example, this is commonly used for people with a fear of flying. Each phase of taking a plane trip, from ordering tickets, packing the night before, going to the airport, going through the gate, boarding the plane, and taking off are all part of the hierarchy. They are practiced in imagination, then in real life. The relaxation techniques are employed whenever anxiety is experienced, until it subsides. Airlines often provide this type of therapy.



Systematic Desensitization