CHAPTER 1

The need for psychological science

•Humans cannot rely solely on intuition and common sense.
•Three phenomena illustrate this:
•Hindsight bias
•Judgmental overconfidence
•Tendency to perceive patterns in random events

Hindsight Bias

•Tendency to believe, after learning an outcome, that we could have predicted it.
•Also known as the
I-knew-it-all-along phenomenon.

The Limits of Intuition and Common Sense

Knowing the answer makes us overconfident

Perceiving order in random events

• People perceive patterns to make sense of their world.
• Even in random, unrelated data people often find order, because random sequences often do not look random.
• In actual random sequences, patterns and streaks (such as repeating numbers) occur more often than people expect.
• People trust their intuition more than they should because intuitive thinking is flawed.

The need for psychological science

•Why is intuition overused and errors made?
•Hindsight bias, overconfidence, and our tendency to perceive patterns in random events often lead us to overestimate our intuition.
•But scientific inquiry can help us sift reality from illusion.

The Scientific Attitude (curiosity skepticism, humility)

Curiosity

•Includes a passion to explore and understand the world without misleading or being misled
•Questions to consider
•What do you mean?
•How do you know?

Critical Thinking

•Critical thinking refers to a more careful style of forming and evaluating knowledge than simply using intuition.

•In addition to the scientific method, critical thinking helps develop a more effective and accurate ways to figure out what makes people do, think, and feel the things they do.

Skepticism

•Supports questions about behavior and mental processes: What do you mean? How do you know?

•Don't just believe everything that you hear!

Humility

•Involves awareness that mistakes are possible and willingness to be surprised

•One of psychology's early mottos: "The rat is always right."

The scientific Method

Scientific method is the process of testing ideas about the world by

•Setting up situations that test our ideas

•If the data do not fit our ideas, then ideas are modified and tested again.

•Making careful, organized observations

•Analyzing whether the data fit with our ideas

•Descriptive methods describe behaviors, often by using case studies, surveys, or naturalistic observations.

•Correlational methods associate different factors. (You'll see the word factor often in descriptions of research. It refers to anything that contributes to a result.)

•Experimental methods manipulate, or vary, factors to discover their effects.

Theory

•Explanation using an integrated set of principles that organizes observations and predicts behaviors or events

Hypothesis

•Testable prediction, often implied by a theory

Operational definition

•Carefully worded statement of the exact procedures (operations) used in a research study

Replication

•Repeating the essence of a research study, usually with different participants in different situations, to see whether the basic finding extends to other participants and circumstances

What Makes a Good Theory

•Effectively organizes a range of self-reports and observations

•Leads to clear predictions that anyone can use to check the theory

•Often stimulates research that leads to a revised theory which better organizes and predicts what we know

•May be replicated and supported by similar findings

Research strategies

Descriptive Research

•Descriptive research is a *systematic, objective observation of people*

•The goal is to provide a clear, accurate picture of people's behaviors, thoughts, and attributes

Case study

•Descriptive technique in which one person is studied in depth in the hope of revealing universal principles (cannot be used to generalize)

Naturalistic observation

•Descriptive technique of observing and recording behavior in naturally occurring situations without trying to change or control the situation

Survey

•Descriptive technique for obtaining the self- reported attitudes or behaviors of a group, usually by questioning a representative, random sample of that group

Correlation

Scientific definition: a measure of how closely two factors vary together, or how well you can predict a change in one from observing a change in the other

Positive correlation (between 0 and +1.00)

•Indicates a direct relationship, meaning that two things increase together or decrease together

Negative correlation (between 0 and −1.00)

•Indicates an inverse relationship: As one increases, the other decreases.

Correlation coefficient

•Provides a statistical measure of how closely two things vary together and how well one predicts the other

Regression Toward the Mean

Illusory correlation

•Refers to the perception of a relationship between two variables when only a minor or no relationship actually exists

•May be fed by regression toward the mean

Regression toward the mean

•Refers to the tendency for extreme or unusual scores or events to fall back (regress) toward the average

Correlation and Causation

•No matter how strong the relationship, correlation does not prove causation.

•Correlation indicates the possibility of a cause-effect relationship, but does not prove it.

Experimentation

•With experiments, researchers can focus on the possible effects of one or more factors in several ways.

•Manipulating the factors of interest to determine their effects

•Holding constant ("controlling") other factors

•Experimental group and control group

Double-blind procedure: Eliminating bias

•Neither those in the study nor those collecting the data know which group is receiving the treatment.

•Treatment's actual effects can be separated from potential placebo effect.

Placebo effect

• Effect involves results caused by expectations alone.

Independent variable- factor that is manipulated; the variable whose effect is being studied

Confounding variable- factor other than the independent variable that might produce an effect

Dependent variable- factor that is measured; the variable that may change when the independent variable is manipulated

Predicting Real Behaviour

Experiment purpose

•Test theoretical principles, not recreation of exact everyday life behaviors

Resulting principles

•Help explain everyday behavior, not specific findings

Psychological science

•Focuses on seeking general principles that help explain many behaviors and less on particular behavior

Can laboratory experiments illuminate everyday life?

•Controlled, artificial environments are created in laboratory experiments to test general theoretical principles.

•These general principles help explain everyday behaviors.

Psychology's Research Ethics

•Values in research

•Affect what is studied, how it is studied, and how the results are interpreted

•Can color "facts"

•Can be influenced by popular application of psychology

Protecting Research Participants: Studying and Protecting Animals

Is it right to place the well-being of humans above that of other animals?

•Response varies by culture

•Canada and U.S.: About 60% deemed medical testing on animals as "morally acceptable"

•Britain: only 37% agreed

What safeguards should protect animals in research?

•Response varies by culture

•98% support government regulation protecting primates, dogs, and cats

•74% support protection for rats and mice.

Professional associations and funding agency guidelines

•Universities: IRB ethics committees; laboratory regulation and inspection

•British Psychological Society (BPS): Guidelines for reasonably natural living conditions and companions for social animals

•American Psychological Association (APA): Guidelines for humane treatment and minimization of infection, illness, and pain

•European Parliament: Standards for animal care and housing

Ethics codes of APA, Britain's BPS, and university ethics committee

•Obtain potential participants' informed consent before the experiment

•Protect them from harm and discomfort

•Keep information about individual participants confidential

•Fully debrief people (explain the research afterward)

Statistical Reasoning in Everyday Life

Describing Data

Accurate statistical understanding is important.

- Casual estimates often misread reality and misinform
- Big, round, undocumented numbers warrant caution
- Teaching statistical reasoning is needed
- Presentation of statistical information needs more transparency

Measures of central tendency include a single score that represents a set of scores.

- Mode: Most frequently occurring score(s) in a distribution
- Mean: Arithmetic average of a distribution, obtained by adding the scores and then dividing by the number of scores; can be distorted by few atypical scores
- Median: Middle score in a distribution; half the scores are above it and half are below it.

Measures of variation reveal similarity or diversity in scores.

- Range: Difference between the highest and lowest scores in a distribution
- Standard deviation: Computed measure of how much scores vary around the mean score.
- Normal curve (normal distribution): Symmetrical, bell-shaped curve that describes the distribution of many types of data; most scores fall near the mean (68 percent fall within one standard deviation of it) and fewer and fewer near the extremes

Significant Differences

When is an observed difference reliable?

•Representative samples are better than biased samples.

•Less-variable observations are more reliable than those that are more variable.

•More cases are better than fewer.

•*Generalizations based on a few unrepresentative cases are unreliable*.

When is an observed difference significant?

•When sample averages are reliable and the difference between them is relatively large, the difference has statistical significance.

•Observed difference is probably not due to chance variation between the samples.

•In psychological research, proof beyond a reasonable doubt means that the odds of its occurrence by chance are less than 5 percent.

Questions

•The average of a distribution of scores is the MEAN.

•The score that shows up most often is the MODE.

•The score right in the middle of a distribution (half the scores above it; half below) is the MEDIAN.

•We determine how much scores vary around the average in a way that includes information about the RANGE of scores (difference between highest and lowest) by using the STANDARD DEVIATION formula.

When we have the tendency to believe , after learning an outcome, that one would have foreseen it, it is called:

A. intuition.

B. hindsight bias.

C. overconfidence.

D. perceiving order in random events.

Which of the following is NOT one of the three main components related to critical thinking?Which of the following is NOT one of the three main components related to critical thinking?

A. Humility

B. Intuition

C. Skepticism

D. Curiosity

A testable prediction is called (a/an):

A. operational definition.

B. theory.

C. replication.

D. hypothesis.

Which of the following does NOT explain the utility of a theory?

A. It organizes a range of self-reports and observations.

B. It explains causation.

C. It implies predictions to derive practical applications.

D. It stimulates further research that may lead to a revised theory.

Which method involves manipulating factors to discover their effects?

A. Replication

B. Descriptive

C. Experimental

D. Correlational

Random Sampling:

A. represents a given population.

B. allows each person an equal chance of participating.

C. allows greater generalizability.

D. all of the above.

In a double-blind procedure, who is unaware of the experimental group assignment?

A. The experimenter

B. The participants

C. Neither the experimenter nor the participants are aware

D. Both the experimenter and participants are aware

Which of the following is the most frequently occurring score/s in a distribution?

A. Mode

B. Mean

C. Skew

D. Median

Which of the following is a computed measure of how much scores vary around the mean?

A. Range

B. Skew

C. Normal curve

D. Standard deviation

Which of the following is NOT a consideration in generalizing from a sample?

A. Random sampling is unnecessary if the sample is large.

B. Representative samples are better than biased samples.

C. Less-variable observations are more reliable that more variable.

D. More cases are better than fewer.

Mary watches several different species of birds to discover how they feed their young in their habitat, without being intrusive. This would be an example of what type of study?

A. Case study

B. Naturalistic observation

C. Survey

D. Experiment

Which of the following would be considered a strong, negative correlation?

A. -0.23

B. 0.90

C. 0.01

D. -0.85

In an experiment that looks at the effects of sugar consumption on hyperactivity in children, the independent variable would be:

A. hyperactivity.

B. cookies.

C. the age of the experimenter.

D. sugar.

In an experiment that looks at the effects of caffeine on alertness in class, one group of students gets caffeinated coffee, another group of students gets water, and a final group of students gets decaffeinated coffee (but thinks it's caffeinated). This last (decaf) group would be the:

A. control group.

B. placebo group.

C. experimental group.

D. confound.

Shandra is designing her research study. As part of her methodology, she is being sure to include informed consent, keeping all records confidential, and plans to debrief participants at the conclusion of the study. What piece of ethics is Shandra missing?

A. Controlling all confounds.

B. Informing participants of her hypothesis.

C. Protecting participants from harm.

D. Informing participants if they are in the control or experimental group.

CHAPTER 2

Neural and Hormonal Systems: Biology, Behavior, and Mind

•Everything psychological—every idea, every mood, every urge—is biological.

•Psychologists working from a biological perspective study the links between biology and behavior.

•Humans are biopsychosocial systems in which biological, psychological, and social-cultural factors interact to influence behavior.

During the past century, researchers discovered

•Nerve cells conduct electricity and communicate through chemical messages across tiny separating gaps

•Specific brain systems serve specific functions and information is integrated to construct a wide range of experiences

•The adaptive brain is wired by experience

Neuron's Structure

•Neuron- Nerve cell; the basic building block of the nervous system

•Dendrites- Neuron extensions that receive messages and conduct them toward the cell body

•Axon- or nerve fiber is a long, slender projection of a nerve cell, or neuron, in vertebrates, that typically conduct electrical impulses known as action potentials away from the nerve cell body.

•Glial cells (glia)- Cells in the nervous system that support, nourish, and protect neurons; they may also play a role in learning, thinking, and memory. Create Myelin.

•Synapse- Junction between the axon tip of the sending neuron and the dendrite or cell body of the receiving neuron

•Refractory period- Period of inactivity after a neuron has fired

•Threshold- Level of stimulation required to trigger a neural impulse

•All-or-none response- Neuron's reaction of either firing (with a full-strength response) or not firing

•Neurotransmitters- Neuron-produced chemicals that cross synapses to carry messages to other neurons or cells. When released by the sending neuron, neurotransmitters travel across the synapse and bind to receptor sites on the receiving neuron, thereby influencing whether that neuron will generate a neural impulse

•Reuptake- Neurotransmitter's reabsorption by the sending neuron

•A neuron consists of a cell body and branching fibers: The dendrite fibers receive information from sensory receptors or other neurons, and the axon fibers pass that information along to other neurons. The axons of some neurons are encased by a myelin sheath, which helps speed their impulses.

Neurons and Neural Communication

Most of the neurons are in the brain but there are motor and sensory neurons throughout the body.
The message does not travel down the axon in the same way an electrical signal does down a wire; in fact electricity in a wire travels 3 million times faster.
In the body, neural signals travel about 2 to 180 miles per hour. However, the chemical signal has an advantage; it does not decrease in intensity as it travels down the axon. No signal is lost.
Note the myelin sheath. Multiple sclerosis involves the degeneration of this layer, thus interfering with neural communication with muscles and other areas.

Action Potential

1. Neuron stimulation causes a brief change in electrical charge. If strong enough, this produces depolarization and an action potential.
2. This depolarization produces another action potential a little farther along the axon.
3. As the action potential continues speedily down the axon, the first section has now completely recharged.

How Do Neurons Communicate With Each Other?

•A neural impulse, or action potential, fires when the neuron is stimulated by signals from the senses or when triggered by chemical signals from neighboring neurons.

•The action potential is a brief electrical charge that travels down the axon. Received signals trigger an impulse only if the excitatory signals minus inhibitory signals exceeds a minimum intensity called the threshold. The neuron's reaction is an all-or-none response.

•During the resting potential, the fluid interior of the axon carries mostly negatively charged atoms (ions), while the fluid outside has mostly positively charged atoms. Then, the first bit of the axon is depolarized (its selectively permeable surface

allows positive ions in), and the electrical impulse travels down the axon as channels open, admitting ions with a positive charge.

•During a resting pause (the refractory period), the neuron pumps the positively charged sodium ions back outside. Then it can fire again.

How Nerve Cells Communicate With Other Nerve Cells

•When electrical impulses reach the axon terminal, they stimulate the release of chemical messengers called neurotransmitters that cross the junction between neurons called the synapse.

•After these molecules traverse the tiny synaptic gap (cleft) between neurons, they bind to receptor sites on neighboring neurons, thus passing on their excitatory or inhibitory messages.

•Excess neurotransmitters are reabsorbed, in a process called reuptake, drift away, or are broken down by enzymes

How Neurotransmitters Influence Behaviour

•Neurotransmitters travel designated pathways in the brain and may influence specific behaviors and emotions.

•the neurotransmitter acetylcholine (ACh) plays a crucial role in learning and memory. Found at every junction between a motor neuron and skeletal muscle, ACh causes the muscle to contract.

•The brain's endorphins, natural opiates released in response to pain and vigorous exercise, explain the "runner's high" and the indifference to pain in some injured people.

•When the brain is flooded with opiate drugs such as heroin and morphine, it may stop producing its own natural opiates, and withdrawal of these drugs may result in intense discomfort

Neurotransmitters and Their Functions

Acetylcholine- Enables muscle action, learning and memory

Dopamine- Influences movement, learning, attention, and emotion

Serotonin- Affects mood, hunger, sleep, and arousal

Norepinephrine- Helps control alertness and arousal

GABA- A major inhibitory neurotransmitter

Glutamate- A major excitatory neurotransmitter; involved in memory

Neural and Hormonal Systems: The Nervous System

Nervous system

•Body’s speedy, electrochemical communication network, consisting of all the nerve cells of the central and peripheral nervous systems

•Central nervous system (CNS)

• Brain and spinal cord are body’s decision maker

•Peripheral nervous system (PNS)

Links the central nervous system with the body’s sense receptors, muscles, and glands. The axons carrying this PNS

Autonomic Nervous System Subdivisions

•Sympathetic subdivision arouses and expends energy and enables voluntary control of skeletal muscles.
•Parasympathetic subdivision calms and conserves energy, allowing routine maintenance activity and controls involuntary muscles and glands.

Types of Neurons

Sensory neurons

•Carry messages from the body's tissues and sensory receptors inward to your spinal cord and brain for processing.

Motor neurons

•Carry instructions from your central nervous system out to body’s muscles

Interneurons within brain and spinal cord

•Communicate with one another and process information between the sensory input and motor output

The Peripheral Nervous System

•The peripheral nervous system (PNS) links the central nervous system (CNS) with the body’s sense receptors, muscles, and glands.
•The axons carrying this PNS information are bundled into the electrical cables we know as nerves.
•Sensory neurons send information from the body’s tissues and sensory organs inward to the brain and spinal cord, which process the information.
•Motor neurons carry outgoing information from the central nervous system to the body’s tissues.
•Interneurons in the central nervous system (CNS) communicate internally and intervene between the sensory inputs and motor outputs.
•Somatic nervous system peripheral nervous system division controlling the body’s skeletal muscles. Also called the skeletal nervous system.
•Autonomic nervous system peripheral nervous system division controlling the glands and the muscles of the internal organs (such as the heart).
•Its sympathetic subdivision arouses; its parasympathetic subdivision calms.
•Sympathetic nervous system autonomic nervous system subdivision that arouses the body, mobilizing its energy in stressful situations.

•Parasympathetic nervous system autonomic nervous system subdivision that calms the body, conserving its energy.

The Endocrine System

•The endocrine system's glands secrete hormones, chemical messengers produced in one tissue that travel through the bloodstream and affect other tissues, including the brain.

•Compared with the speed at which messages move through the nervous system, endocrine messages move more slowly, but their effects usually last longer.

•The endocrine system's hormones influence many aspects of our lives, including growth, reproduction, metabolism, and mood, keeping everything in balance while responding to stress, exertion, and internal thoughts.

•In a moment of danger, the adrenal glands release the hormones epinephrine and norepinephrine, which increase heart rate, blood pressure, and blood sugar, providing us with increased energy.

•The pituitary gland is the endocrine system's most influential gland. Under the influence of the brain's hypothalamus, the pituitary's secretions influence growth and the release of hormones by other endocrine glands.

•These may in turn influence both the brain and behavior and thus reveal the intimate connection of the nervous and endocrine systems.

The Brain

Reticular formation

•Involves nerve network running through the brainstem and thalamus; plays an important role in controlling arousal.

Thalamus

•Is area at the top of the brainstem; directs sensory messages to cortex and transmits replies to the cerebellum and medulla

The Cerebellum

•Aids in judgment of time, sound and texture discrimination, and emotional control

•Coordinates voluntary movement and life-sustaining functions

•Helps process and store information outside of awareness

The Limbic System

•This neural system sits between brain's older parts and its cerebral hemispheres

•Its neural centers include:

• the hippocampus (which processes conscious memories)

•the amygdala (involved in responses of aggression and fear)

•the hypothalamus (involved in various bodily maintenance functions, pleasurable rewards, and the control of the endocrine system).

• The hypothalamus controls the pituitary (the "master gland") by stimulating it to trigger the release of hormones.

Amygdala

Consists of two lima-bean-sized neural clusters in the limbic system; linked to emotion.

Hypothalamus

•Is neural structure lying below the thalamus

•Directs several maintenance activities

Helps govern the endocrine system via the pituitary gland, and is linked to emotion and reward

The Cerebral Cortex

Cerebral cortex: Thin layer of interconnected neurons covering the cerebral hemispheres; the body's ultimate control and information-processing center

Frontal lobes: Portion of the cerebral cortex lying just behind the forehead; involved in speaking and muscle movements and in making plans and judgments.

Parietal Lobes: portion of the cerebral cortex lying at the top of the head and toward the rear; receives sensory input for touch and body position.

Occipital Lobes: portion of the cerebral cortex lying at the back of the head; includes areas that receive information from the visual fields.

Temporal lobes: Portion of the cerebral cortex lying roughly above the ears; includes areas that receive information from the ears.

Functions of the Cortex

Sensory functions

•The *visual cortex* of the occipital lobes at the rear of your brain receives input from your eyes.

•The *auditory cortex*, in your temporal lobes—above your ears—receives information from your ears.

Association areas of the cortex

•Are found in all four lobes

•Found in the frontal lobes enable judgment, planning, and processing of new memories

Damage to association areas

•Results in different losses

Brain

Our Divided Brain

Split brain hemisphere

•Isolated by cutting the fibers (mainly those of the corpus callosum) connecting them

Intact brain

•Data received by either hemisphere are quickly transmitted to the other side across the corpus callosum.

Severed corpus callosum brain

•This information sharing does not take place.

Right-Left Differences in Intact Brains

•Each hemisphere performs distinct functions. Humans have unified brains with specialized parts.

•Left hemisphere is good at making quick, exact interpretations of language.

•Right hemisphere excels in making inferences, modulating speech, and facilitating self-awareness

Questions

1. Which structure in neural communication passes messages through its branches to other neurons, muscles, or glands?

A. Neuron
B. Dendrite
C. Axon
D. Myelin

2. The period of inactivity after a neuron has fired is called the:

A. Refractory period
B. Threshold
C. Action Potential
D. All or none response

3. Which type of cell communicates within the central nervous system and processes information between incoming and outgoing messages?

A. Glial Cells
B. Motor Neurons
C. Interneurons
D. Sensory Neurons

4. Which neurotransmitter affects mood, hunger, sleep and arousal?

A. Acetylcholine
B. Serotonin
C. GABA
D. Dopamine

5. Which of the following enables voluntary control of our skeletal muscles?

A. Autonomic Nervous System

B. Somatic Nervous System
C. Sympathetic Nervous System
D. Parasympathetic Nervous System

6. Which structure of the endocrine system affects metabolism?

A. Adrenal Gland
B. Hypothalamus
C. Pancreas
D. Thyroid Gland

7. Which technique involves the usage of magnetic fields and radio waves to produce computerized images of soft brain tissue?

A. Lesion
B. EEG
C. MRI
D. PET

8. Which brain structure enables nonverbal learning and skill memory?

A. Thalamus
B. Reticular Formation
C. Pons
D. Cerebellum

9. Which portion of the cerebral cortex receives sensory input for touch and body position?

A. Parietal Lobes
B. Occipital Lobes
C. Frontal Lobes
D. Temporal Lobes

10. Which part of the cortex is involved in higher mental functions?

A. Motor Cortex
B. Corpus Callosum
C. Somatosensory Cortex
D. Association Areas

11. Following neuron stimulation, which causes a brief change in electrical charge, what happens next?

A. Gates open and sodium atoms rush in
B. Depolarization produces an action potential
C. The action potential speed down the axon
D. The sodium/potassium pump transports sodium ions back out of the cell

12. Gerald’s grandmother suffers from Alzheimer’s disease and exhibits symptoms of memory loss. Which neurotransmitter is likely impaired?

A. GABA
B. Serotonin
C. Dopamine
D. Acetylcholine

13. Stephanie suffers from migraines and often and occasional seizures, but has tested negative for epilepsy. WHich of the following might be prescribed to help her condition?

A. Antagonist for glutamate
B. Agonist for serotonin
C. Antagonist for GABA
D. Agonist for norepinephrine

14. Hasan is nervous for an oral presentation. His heart beats rapidly, his palms are sweaty, and his breathing has increased. Which part of the nervous system would be activated?

A. Central
B. Somatic
C. Sympathetic
D. parasympathetic

15. Penelope claims to be bothered by the fact that her left hand unties her shoe while her right hand ties it. She appears to be unable to integrate messages between her left and right hemisphere. This may be a result of:

A. An intact corpus callosum
B. Neurogenesis
C. Plasticity
D. A split brain surgery