Mid-Term Exam Study Guide

Conceptual Questions and Answers

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Contents

Part I

Decision Making and Reasoning

1. The ”Economic Man vs. Bounded Rationality” Question

Question

Analyze why the ”Model of Economic Man and Woman” is considered an unrealistic description of human decision-making. Compare this model to the concept of **Bounded Rationality**. How does the ”satisficing” strategy (vs. maximizing) demonstrate a more psychologically realistic approach to choice? Give a real-world example.

Answer

The **”Model of Economic Man and Woman”** is unrealistic because it assumes humans are perfectly rational computers. It demands that we are **fully informed** (know all options), **infinitely sensitive** (detect tiny differences), and **fully rational** (always act to maximize value).

This fails to describe real humans, who operate under limitations. This is where **Bounded Rationality** comes in. It's the more realistic theory that we are rational *within limits*. Our decision-making is ”bounded” or constrained by our limited cognitive resources, time, and information.

Satisficing is the *strategy* we use *because* of Bounded Rationality.

- An ”Economic Man” would be a **Maximizer**, needing to examine every single option to find the *absolute best* one.
- A ”Satisficer” simply considers options one by one until they find one that is **”good enough”**—one that meets their minimum level of acceptability.

Example: When choosing a university, a *Maximizer* (Economic Man) would need to research every single university in the country and calculate the single highest ”utility” score. This is impossible. A *Satisficer* (Bounded Rationality) will search until they find one that meets their criteria (e.g., ”It's in Karachi, it has a good Psychology program, and my friends are going there”). They then apply and stop searching, even if a ”perfect” school might still exist.

2. The ”Strategies of Choice” Question

Question

Imagine a student is choosing which university to attend from a list of 20 options. Apply the **Satisficing** heuristic to this decision (what would they do?). Then, apply the **Elimination by Aspects** heuristic to the *same* decision. Explain which strategy is more cognitively demanding.

Answer

- **Applying Satisficing:** The student would look at the universities one by one (e.g., in alphabetical order). They have a ”good enough” mental threshold. They might look at MAJU first. If it meets their minimum criteria (e.g., ”has my major,” ”is affordable,” ”has a good reputation”),

they would stop the search and choose it, *even though they haven't even looked at the other 19 options.*

- **Applying Elimination by Aspects (EBA):** The student would *not* look at them one by one. Instead, they would:
    1. Choose the most important **aspect** (e.g., "Must have a Psychology B.S. program"). They eliminate all 8 universities that don't.
    2. Choose the next aspect (e.g., "Tuition must be under Rs. 200,000 per semester"). From the remaining 12, they eliminate 5 more.
    3. Choose the next aspect (e.g., "Must be in Karachi"). From the remaining 7, they eliminate 4 more.
    4. They continue this process until only one or two options remain.

Comparison: Elimination by Aspects is more cognitively demanding. Satisficing only requires you to evaluate one single option at a time against a simple threshold. EBA requires you to define multiple aspects, rank them by importance, and systematically apply them to the *entire set* of options, which is a much more complex analytical process.

3. The "Heuristic Comparison" Question (Classic)

Question

Compare and contrast the **Representativeness Heuristic** and the **Availability Heuristic**. For each: (1) Define it, (2) Explain the specific error it causes, and (3) Provide a real-world example.

Answer

While both are mental shortcuts, they work in different ways: Representativeness is a bias of **similarity**, while Availability is a bias of **memory**.

Representativeness Heuristic

1. **Definition:** We judge the probability of an event by how well it *matches* (or *represents*) our existing **prototype** or stereotype.
2. **Error:** This causes us to **ignore base rates**—the actual statistical frequency of an event in the population.
3. **Example:** If I describe a man as "shy and likes to read," and ask if he is more likely a *farmer* or a *librarian*, most people say librarian. Why? His description *represents* our *stereotype* of a librarian. We ignore the **base rate**: there are thousands of times more farmers than male librarians.

Availability Heuristic

1. **Definition:** We judge the probability of an event by how *easily* examples of it come to **mind** (how "available" they are in our memory).
2. **Error:** This causes us to **overestimate** the frequency of events that are recent, vivid, or heavily publicized.

3. **Example:** People overestimate the risk of plane crashes. Why? Because every crash is a vivid, highly publicized news story. It's *highly available* in memory. We underestimate the risk of car crashes, *even though they are statistically far more deadly.*

4. The "Framing & Anchoring Application" Question

Question

You are trying to sell a used car. Explain how you could use the **Anchoring** bias to get a higher price. Then, explain how you could use the **Framing Effect** (specifically "risk aversion for gains") to make a buyer feel good about the deal.

Answer

- **Using Anchoring:** I would set a very high initial asking price. Let's say I want to sell the car for $8,000. I would advertise it for $10,000. This $10,000 becomes the **"anchor"** (the initial reference point). All negotiation will now be biased by this high number. When a buyer negotiates me down to $8,500, they *feel* like they got a great deal, and I get *more* than my target price.
- **Using Framing:** I would frame the car's quality in terms of a **certain gain**, not a probability.
  - *Bad Frame (Risky):* "This car has a 90% chance of not needing any repairs for a year." This introduces a 10% risk, and people are **risk-averse** for gains.
  - *Good Frame (Certain Gain):* "This car is **guaranteed** to be reliable. I'll even include a 3-month warranty." We choose options with "small but certain gains." The word **"guaranteed"** is a positive, certain frame that avoids any sense of risk.

5. The "Bias in Real Life" Question

Question

A student does very poorly on an exam. Analyze this situation using the concepts of **Overconfidence** (before the exam) and **Hindsight Bias** (after getting the grade). What would the student likely say in each case?

Answer

- **Before the Exam (Overconfidence):** The student experiences **Overconfidence**, an over-valuation of their own knowledge. As the slide notes, "people do not realize how little they know."
  - **What they say:** "I've got this, this topic is easy. I glanced at the slides. I'm sure I'll get an A."
- **After Getting the Grade (Hindsight Bias):** The student, having received a 'D', now experiences **Hindsight Bias**, the "I-knew-it-all-along" effect. They retrospectively believe the bad outcome was obvious.
  - **What they say:** "I knew it! I knew I was going to fail. The professor's questions were so unfair, I *knew* she would ask about that one topic. I totally saw this coming."

This combination is toxic for learning: Overconfidence stops them from preparing, and Hindsight Bias "hinders learning" by impairing their ability to compare their (wrong) expectation with the outcome.

6. The "Gambling and Investing" Question

Question

A man has invested $50,000 into a business that is clearly failing.

1. Analyze his decision to *keep* investing more money using the **Sunk-Cost Fallacy**.
2. Now, imagine he says: "I know the last 4 investments have failed, so this next one is *bound* to be a success!" Identify this error.
3. Explain why his friend (who is "a bank teller and active in social causes") is *less* likely to be "a bank teller *and* active in social causes" than *just* "a bank teller." What fallacy is this?

Answer

1. **Sunk-Cost Fallacy:** The $50,000 is the **"sunk cost"**—it is gone. A rational decision would be to evaluate the business *today*. However, the fallacy is that his decision to *continue* investing is driven by his *past* investment, "hoping to recover what has already been lost."
2. **Gambler's Fallacy:** This is the **Gambler's Fallacy**. He mistakenly believes that a series of past random events (the 4 failures) will influence the probability of the next event. He thinks a "win" is "due" to balance things out.
3. **Conjunction Fallacy:** This is the **Conjunction Fallacy**. It is a basic rule of probability that a subset (A+B) can *never* be more probable than the larger set (A). The group of "bank tellers" includes *all* bank tellers. The group of "bank tellers *and* active in social causes" is a *smaller subset* of that first group. Therefore, it is *always* more probable that she is just a bank teller.

7. The "Groupthink" Question (A Bestseller)

Question

Imagine you are on a student council that is making a very fast, premature decision to ban an event, even though some members privately disagree. Identify this as **Groupthink**. From your slides, describe three *symptoms* you would look for.

Answer

This phenomenon is **Groupthink**, defined as "premature decision making resulting from the group attempting to avoid conflict." This is common in "cohesive, homogenous groups" under "high stress".

Based on Slide 28, three symptoms I would look for are:

1. **Squelching of Dissent:** If one member *does* raise a concern, other members will quickly shut them down, saying, "Come on, we're all on the same page."
2. **Formation of a "Mindguard":** One person, often close to the leader, will take on the role of the **"mindguard."** They will actively "keep the group norm" by filtering information or by personally telling dissenters to "get with the program."

3. **Feeling Invulnerable and Feeling Unanimous:** The group leader might say, "So, we're all in agreement then? Great," without *actually* polling everyone. This **illusion of unanimity** (where silence is mistaken for agreement) and a **feeling of invulnerability** ("This is the right choice") are classic symptoms.

8. The "Deductive vs. Inductive" Question

Question

Contrast **Deductive Reasoning** and **Inductive Reasoning**. Your answer *must* explain the key difference in the **certainty** of their conclusions. Provide your own example of a **syllogism** (Deductive) and a **causal inference** (Inductive).

Answer

The primary difference is **certainty**.

- **Deductive Reasoning** is reasoning from general premises to a specific conclusion. If the premises are true, the conclusion is **logically certain** and cannot be false.
- **Inductive Reasoning** is reasoning from specific facts or observations to a general, probable conclusion. The conclusion is **never logically certain**; it is only *likely* or *probable*.

Deductive Example (Syllogism):

- *Major Premise:* All courses taught by Miss Somal Kayani are Psychology courses.
- *Minor Premise:* "Decision Making" is taught by Miss Somal Kayani.
- *Conclusion:* Therefore, "Decision Making" is a Psychology course.
- (If the premises are true, this conclusion is 100% *certain*.)

Inductive Example (Causal Inference):

- *Observation:* Every time I study for an exam *after midnight* (Event A), I seem to get a bad grade (Event B).
- *Inference (Conclusion):* Therefore, studying after midnight *causes* me to get bad grades.
- (This is only *probable*. It is not *certain*. Other factors like stress or "illusory correlation" could be the real cause.)

9. The "Wason Task & Confirmation Bias" Question (Advanced)

Question

Explain what the **Wason Selection Task** (the card task) demonstrates about human reasoning. Connect this to **Confirmation Bias** by explaining *how* this bias causes people to fail the task. Finally, explain why people are *better* at this task when it's presented as a **Pragmatic Reasoning Schema**.

Answer

The **Wason Selection Task** demonstrates that humans are *not* naturally good at abstract, formal deductive logic. Given a rule like "If a card has a 'D' (p), it must have a '3' (q)," people fail to test it

logically.

The failure is caused by **Confirmation Bias**. This is our tendency to "seek... information in a way that confirms" our beliefs.

- People correctly turn over the 'D' card (to *confirm* there is a '3').
- But then they *incorrectly* turn over the '3' card (also to *confirm*).
- They *fail* to turn over the '7' card (not-q). This is the only card that could *falsify* the rule. We are biased to *confirm* a rule, not to try and *break* it.

We are *better* at this task when it uses a **Pragmatic Reasoning Schema** because our brains have evolved to understand real-world rules.

- If the rule is a **Permission Schema** like, "If you are drinking alcohol (p), you must be over 18 (q)," we know *exactly* what to do.
- We check the person "drinking alcohol" (p) and we check the person "under 18" (not-q). This "cheater detection" is a practical, social reasoning skill that makes the underlying logic intuitive.

10. The "Big Picture: Two Brains" Question

Question

Analyze a single, complex decision (e.g., "choosing a career") using the **Dual Process Theory**. Describe how the 'Associative System' (System 1) would approach it, and name two specific heuristics it might use. Then, describe how the 'Rule-based System' (System 2) would override it.

Answer

Let's analyze "choosing a career":

1. **Associative System (System 1):** This is the *fast, automatic, intuitive, and bias-prone* system. It would rely on "gut feelings."
    - **Heuristic 1: Availability Heuristic:** This system would recall vivid examples. "My cousin is a graphic designer and she seems so happy. That must be a great career." The career is "available" in memory.
    - **Heuristic 2: Representativeness Heuristic:** This system would use stereotypes. "I am a caring person who is good at science. The *prototype* of a 'caring science person' is a *doctor*. Therefore, I should be a doctor."
2. **Rule-Based System (System 2):** This is the *slow, analytical, logical, and effortful* system. It would override the "gut feeling."
    - It would *consciously* research the **base rates** of salary for graphic designers, not just rely on the "available" example.
    - It would *logically* analyze the pros and cons of *multiple* "caring science" jobs (e.g., researcher, pharmacist), not just the one that *represents* the stereotype.
    - It would engage in *analytical thinking* like, "To be a doctor, I need to go to medical school, take on debt, and do a residency..." This is the slow, effortful system at work.

Part II

Visual Perception

1. The ”Tree in the Forest” Question

Question

Your slides pose the classic riddle: ”If a tree falls in the forest and no one is around to hear it, does it make a sound?” Answer this riddle twice: first from the perspective of **Sensation**, and second from the perspective of **Perception**.

Answer

This is the classic question that separates sensation from perception.

1. **From the perspective of Sensation (YES):** A ”sound” is a *physical event*. The falling tree (stimulus) displaces air, creating physical **sound waves** that radiate outward. This is the ”raw information from the environment.” This physical phenomenon (the sensation) occurs whether an ear is present to detect it or not.
2. **From the perspective of Perception (NO):** A ”sound” is a *psychological experience*. For the sound waves to become ”sound,” they must be detected by a sense organ (an ear) and, crucially, be ”given meaning and interpretation” by a brain (perception). As your slide states, perception is a *psychological process*. Without a brain to interpret the raw sensory signals, the *experience* of sound does not exist.

2. The ”Attention & the Gorilla” Question

Question

In the ”Invisible Gorilla Experiment”, the participants’ **sensation** clearly registered the gorilla (light waves hit their retinas). **Analyze** *why* they failed to **perceive** the gorilla. What does this experiment demonstrate about the relationship between **attention**, **sensation**, and **perception**?

Answer

This experiment is the perfect demonstration that **sensation can occur *without* perception.**

- **Sensation Occurred:** The light waves from the gorilla’s image *did* enter the participants’ eyes, hit their retinas, and were successfully transduced into electrochemical impulses. The *raw data* was successfully detected.
- **Perception Failed:** Perception, unlike sensation, is not automatic. It is an active process that requires **attention**. The participants were engaged in a demanding task (counting basketball passes) that consumed their attentional resources. Because their attention was directed elsewhere, the sensory information from the gorilla—though present—was never selected for higher-level processing.

- **Relationship:** This experiment proves that **attention acts as a filter or gatekeeper** that determines which sensations get to become conscious perceptions. We are ”blind” to things we don’t pay attention to, even if they are right in front of our eyes.

3. The ”Two Theories” Question (Classic)

Question

Compare and contrast Bottom-Up processing and Top-Down processing. Your answer must: (1) Define each, (2) Provide one specific theory as an example for each, and (3) Explain why ”degraded stimuli” force the brain to rely *more* on Top-Down processing.

Answer

1. **Definitions:**
    - **Bottom-Up Processing** is ”data-driven.” Perception begins with the raw sensory input. The brain builds up a perception by starting with the smallest features and assembling them into a meaningful whole.
    - **Top-Down Processing** is ”knowledge-driven.” Our existing knowledge, expectations, and context *guide* how we interpret sensory input. We start with a high-level concept (the ”top”) and use it to make sense of the data (the ”bottom”).
2. **Examples from your Slides:**
    - *Bottom-Up Example:* **Recognition-by-Components (RBC) Theory**. It states that we first detect basic edges, which we then use to identify ”geons” (3D building blocks). We then combine these geons to recognize the object.
    - *Top-Down Example:* **Context Effects**. We recognize a ”loaf of bread” *faster* in a kitchen scene than in a random scene. Our high-level *knowledge* of ”kitchens” (the top-down context) *primes* our brain to expect kitchen-related objects.
3. **Degraded Stimuli:** When a stimulus is ”unclear, weak, or incomplete” (like the ”ST_P” sign), the **bottom-up data is insufficient**. The raw features are ”degraded” and ambiguous. The brain *cannot* build a reliable perception from the bottom-up alone. Therefore, it *must* rely on **Top-Down processing** to fill in the gaps. Our brain makes an educated guess based on context (”this is an intersection”) to construct a complete perception.

4. The ”Evolution of Theories” Question

Question

Analyze the *weakness* of **Template Theory** that led to its rejection. **Explain** how **Feature-Matching Theory** was an improvement. Finally, **explain** the main advantage **Recognition-by-Components (RBC) Theory** has over *both*.

Answer

- **Weakness of Template Theory:** Its weakness is its extreme **inflexibility**. It requires a 1-to-1 match between the sensory input and a stored ”template.” This fails in the real world. We would

need an impossibly large library of templates for every object in every possible orientation, size, and font.

- **Improvement of Feature-Matching Theory:** This was a major improvement because it *is* flexible. Instead of matching the *whole* object, it just breaks the object down into its core **features** (e.g., lines, curves). The **Pandemonium Model** is a great example. This is better because all letter 'A's (A, *A*, **A**) share the same features.
- **Advantage of RBC Theory:** RBC's main advantage is **viewpoint invariance**. Feature-matching still struggles when an object is rotated in 3D, as its 2D features change. RBC solves this by proposing **geons**, which are 3D building blocks. The geons of an object (like the cylinder and handle of a *mug*) are recognizable from almost *any* angle.

5. The "What vs. Where" Question (A Bestseller)

Question

Contrast the **"What" (Ventral) Pathway** and the **"Where/How" (Dorsal) Pathway**. Now, use this to analyze two patients:

- Patient A has **Visual-Object Agnosia**. Which pathway is likely damaged? **Justify**.
- Patient B has **Optic Ataxia**. Which pathway is likely damaged? **Justify**.

Answer

These are the two crucial streams of visual processing:

- The **"What" (Ventral) Pathway** flows to the **temporal lobe** and is responsible for **object identification** (its shape, color, and identity).
- The **"Where/How" (Dorsal) Pathway** flows to the **parietal lobe** and is responsible for processing the object's **location** in space and **how to interact** with it.

Patient Analysis:

- **Patient A (Visual-Object Agnosia):** This patient has damage to the **"What" (Ventral) Pathway**.
  - *Justification:* They can *see* the object's parts (their "Where" stream is fine) but cannot *identify* what it is. Their identity-processing stream is broken, so they can't link the features to a stored concept like "eyeglasses."
- **Patient B (Optic Ataxia):** This patient has damage to the **"Where/How" (Dorsal) Pathway**.
  - *Justification:* Their "What" stream is intact, so they can *identify* the object perfectly ("That is a broom"). However, their "How" stream is broken, leading to an "impairment in using visual information to guide physical movement." They cannot guide their hand to accurately grasp the object they clearly see.

6. The ”Face & Expert” Question (Advanced)

Question

A patient with damage to the **Fusiform Gyrus** develops **Prosopagnosia** (face blindness). **Explain** how the **Expert-Individuation Hypothesis** *refines* this diagnosis. According to this hypothesis, what *other* (non-face) recognition skill would this patient likely lose, *assuming they were an expert* in it?

Answer

- **Analysis:** Initially, damage to the **Fusiform Gyrus** was linked only to **Prosopagnosia**, leading scientists to believe this was a ”face-only” brain module.
- **Refinement:** The **Expert-Individuation Hypothesis** *refines* this idea. It proposes that the Fusiform Gyrus is *not* just for faces, but for *any* visual category in which we are **experts** and must make ”fine-tuned individual distinctions.” Faces are simply the *one* category we are *all* experts at.
- **Application:** According to this hypothesis, if this patient with Prosopagnosia was *also* a car expert or a bird-watching expert, they would *also* lose this specific expert skill. They would still be able to recognize ”a car,” but they would lose their expert ability to *individuate* it, for example, ”That is a 1968 Ford Mustang, not a 1969.”

7. The ”Gestalt” Question (Application)

Question

You are looking at a poster for a concert. **Explain** how the **Gestalt Principles** help you organize the visual information. **Apply** the principles of: (1) Figure-Ground, (2) Proximity, and (3) Closure.

Answer

The Gestalt principles are how our brain automatically organizes sensory parts into a meaningful whole.

1. **Figure-Ground:** The first thing my brain does is a ”figure–ground relationship.” The poster itself, with its text and images, becomes the **figure**—the clear, unified object of my attention. The wall it is hanging on becomes the diffuse, unattended **ground**.
2. **Proximity:** The poster has words on it. I don’t see a jumble of 200 individual letters. My brain uses the **principle of proximity** to automatically group letters that are *close together* into words, and words that are *close together* into sentences.
3. **Closure:** The band’s logo might be stylized, using an ”incomplete” font where the letters have gaps in them. My brain uses the **principle of closure** to automatically *fill in the gaps* and perceive *complete* letters, allowing me to read the logo effortlessly.

8. The ”Constancy” Question (Application)

Question

A door is opening toward you. The image on your retina is changing from a rectangle to a trapezoid. **Analyze** this situation using **Shape Constancy**. Then, as a person walks away, **analyze** why you perceive them as ”getting farther away” rather than ”shrinking,” using **Size Constancy**.

Answer

- **Shape Constancy:** As the door opens, the raw sensory image on my **retina** changes. This is the **sensation**. However, my *perception* does not change. My brain, using top-down knowledge about doors, applies **shape constancy**. It ”knows” the door’s *actual* shape is a rectangle. Therefore, I *perceive* an unchanging, rectangular door *moving*—not a shape that is *morphing* from a rectangle to a trapezoid.
- **Size Constancy:** As the person walks away, the image they project on my **retina** gets objectively *smaller*. Again, I do not perceive the person as physically *shrinking*. My brain uses other depth cues to understand they are moving *away*. It then applies **size constancy**, automatically scaling the retinal image up so that my *perception* is of a person of stable, constant size who is simply *increasing their distance*.

Part III

Cognitive Neuroscience Methods

1. The ”Central Trade-off” Question

Question

Your slides emphasize a central ”trade-off.” **Explain** the difference between **Temporal Resolution** and **Spatial Resolution**. **Compare EEG** and **fMRI** using this trade-off. Why can’t a researcher get ”the best of both worlds” (high temporal and high spatial) from a single method like fMRI?

Answer

This is the core concept of neuroscience methods.

- **Temporal Resolution** is about *time*. It’s how *quickly* the method can detect changes in brain activity (e.g., in milliseconds).
- **Spatial Resolution** is about *location*. It’s how *accurately* the method can pinpoint the source of the activity (e.g., in millimeters).

Comparison:

- **EEG** has **excellent temporal resolution** (˜1 ms). It measures electrical ”brain waves” directly from the scalp in real-time. But it has **poor spatial resolution** (˜1-2 cm) because the electrical signal gets smeared by the skull, so we can’t tell exactly *where* it came from.
- **fMRI** has **good spatial resolution** (˜1-3 mm). It can pinpoint activity in deep brain structures. But it has **poor temporal resolution** (˜1-2 seconds).

Why not both? An fMRI *cannot* be fast because it does not measure neural firing directly. It measures the **blood flow** (the BOLD signal) that *follows* neural firing. This blood flow response is extremely **slow and sluggish**, taking several seconds to rise and fall. The machine is tracking a slow biological process, not the instantaneous firing of a neuron.

2. The ”Causality” Question (Classic)

Question

Most human brain imaging (like fMRI and EEG) is **correlational**. **Analyze** what this means. Now, **contrast** this with **TMS** (Transcranial Magnetic Stimulation). Why is TMS considered a unique and powerful tool that *can* establish **causal** relationships?

Answer

- **Correlational:** When a person does Task A (e.g., look at a face) and Brain Area B (e.g., the fusiform gyrus) ”lights up” in an fMRI, we have only found a **correlation**. We know the two events happen together. We do *not* know if Area B *caused* the face recognition, if the recognition *caused* Area B to light up, or if a third variable (like ”attention”) caused both. We see a *relationship*, not a *cause*.

- **Causal (TMS): TMS** is unique because it allows for **intervention**. It sends a magnetic pulse to a specific, superficial brain region to *temporarily disrupt or "deactivate" it*.
  - If we use TMS to disrupt Area B, and the person suddenly *cannot* perform Task A (e.g., they can't recognize the face), we have established a **causal link**.
  - We have shown that the normal functioning of Area B is *causally necessary* for performing Task A. This is a much more powerful finding than a simple correlation.

3. The "Gold Standard" Question

Question

According to your slides, **Single-Cell Recording** has *both* excellent temporal and excellent spatial resolution. If it's the "best" in precision, **analyze** why it is *not* the primary method used in human cognitive neuroscience. What are its major limitations?

Answer

Single-Cell Recording is the "gold standard" for precision (˜1 ms temporal, ˜0.1 mm spatial), but it is **highly invasive**.

- **Limitation:** It requires surgically implanting a micro-electrode deep into the brain tissue to record the electrical firing of a *single neuron*.
- **Application:** This is not ethically or safely possible in healthy human subjects. Therefore, its use is "typically limited to **animal studies**" (like rats or monkeys) or, in very rare human cases, on patients who are already undergoing brain surgery for a medical reason (like epilepsy).
- We use non-invasive methods like fMRI and EEG in healthy humans, sacrificing the "best" precision for **human suitability and safety**.

4. The "Middle Ground" Question

Question

A researcher wants to study language processing, which is very fast (milliseconds) but also located in specific cortical areas. **Analyze** why **fMRI** (too slow) and **EEG** (too imprecise) are both non-ideal for this. **Explain** how **MEG** acts as a "bridge" to help solve this problem.

Answer

- **fMRI is non-ideal:** Language processing (e.g., understanding a word) happens in hundreds of milliseconds. An fMRI's temporal resolution is in *seconds* (˜1-2 s). It is far too slow and would miss the entire event, averaging it all together.
- **EEG is non-ideal:** EEG is fast enough (˜1 ms temporal resolution). However, its spatial resolution is *poor* (˜1-2 cm). It could tell *when* a language event happened, but it couldn't reliably tell *which* specific language area (e.g., Broca's area vs. Wernicke's area) was responsible.
- **MEG as a "Bridge": MEG** (Magnetoencephalography) is the "bridge" because it has the **excellent temporal resolution** of EEG (˜1 ms) but **moderate spatial resolution** (˜5-10 mm), which is much better than EEG. It detects the magnetic fields produced by neural activity.

Because magnetic fields are not distorted by the skull (unlike the electrical fields in EEG), MEG can provide a much more accurate location for the fast-acting language processes.

5. The "Multimodal Solution" Question

Question

Your final slide mentions "multimodal imaging." **Explain** this concept. **Propose** a multimodal study (e.g., combining two methods) to study anxiety. **Justify** your choice by explaining how the *strengths* of one method would compensate for the *limitations* of the other.

Answer

Multimodal Imaging means using two or more neurophysiological methods at the same time (or in the same study) to get a more complete picture of brain function. The goal is to combine their strengths to overcome their individual limitations.

Proposed Study: Combining EEG and fMRI to study anxiety.

- **Procedure:** Place an EEG cap (which is fMRI-safe) on a participant's head and have them lie inside an fMRI scanner. Show them a series of images, some neutral (a chair) and some anxiety-provoking (a snake).
- **Justification (How they compensate):**
    1. The **EEG** (strength: excellent temporal resolution) will capture the *exact millisecond* the brain's "fear circuit" (like the amygdala) fires after seeing the snake. This compensates for the fMRI's *limitation* (poor temporal resolution).
    2. The **fMRI** (strength: good spatial resolution) will pinpoint *which* deep brain structures (like the amygdala, the prefrontal cortex, the insula) are lighting up. This compensates for the EEG's *limitation* (poor spatial resolution).
- **Result:** By combining them, we can see *both* the precise **timing** (from EEG) *and* the precise **location** (from fMRI) of the anxiety response, something neither method could provide alone.

Part IV

Introduction to Cognitive Psychology

1. Activity 1 (from slide): The ”Cocktail Party Effect”

Question

”Step outside, observe any cognitive activity, and analyze what mental processes are involved and how they work.” (Using the ”Cocktail Party Effect” as an example).

Answer

- **Observation:** I am at a loud, crowded cafeteria at MAJU. I am focused on a conversation with my friend, but my attention snaps to another table when someone says my name, ”Alina.”
- **Analysis of Mental Processes:**
  - **Sensation:** My ears are taking in *all* the sound waves from the room at once—a single, messy, overwhelming wave of sound.
  - **Selective Attention:** My brain is actively *selecting* the sound pattern of my friend’s voice and *suppressing* (or ”turning down the volume on”) all the other irrelevant sounds.
  - **Unconscious Monitoring:** Here is the key part. A part of my brain is *unconsciously monitoring* all the ”suppressed” sounds in the background. It is filtering this background noise for one specific, highly important pattern: my own name.
  - **Attentional Shift:** The moment someone at another table speaks my name, my unconscious monitor sends an ”alert.” My **selective attention** *automatically* breaks away from my friend’s conversation and shifts to the source of my name.
  - **Memory (Recognition):** This entire process is only possible because the sound ”Alina” is stored in my **long-term memory** as a high-priority signal.

2. Activity 2 (from slide): Connecting to Historical Approaches

Question

”Using the data you collected [the Cocktail Party Effect], reflect on which historical approach better explains your chosen cognitive activity and why?”

Answer

- **Behaviorism (The ”Black Box”):** This school fails *completely*. A behaviorist could only observe the **stimulus** (my name being spoken) and the **response** (my head turning). They would have *no way* to explain the internal, unobservable mental processes of *selective attention* or *unconscious monitoring*. The entire phenomenon happens inside the ”black box.”
- **Functionalism (William James):** This is a *much better* fit. A functionalist would ask, ”What is the *purpose* or *function* of this effect?” The clear answer is *survival and social relevance*. It

is highly adaptive (functional) to be able to monitor our environment for important social cues (like our name) even when we are busy. This approach explains *why* the effect exists.

- **Modern Cognitive Psychology:** This is the *best* approach. It's the only one that provides the tools to create a testable *model* of how this works. A cognitive psychologist would use *empirical* experiments (like dichotic listening tasks) to build a *rationalist* theory (an information-processing model) of attention, complete with filters and a "dictionary" for important words like our name.

3. The "Rationalism vs. Empiricism" Question

Question

Contrast Rationalism (Descartes) and **Empiricism** (Locke). **Analyze** why a modern cognitive psychologist cannot *only* be one or the other, and explain how the two philosophies are *synthesized* in modern research.

Answer

- **Rationalism (Descartes):** This is the belief that knowledge comes from **logical analysis and internal reflection**. It is a "top-down" approach that *emphasizes theory construction*.
- **Empiricism (Locke):** This is the belief that knowledge comes from **observation and experience**. The mind starts as a "tabula rasa" (blank slate). It is a "bottom-up" approach that *emphasizes data gathering*.

Synthesis: A modern cognitive psychologist *must* be both.

1. Research starts with **Empiricism** (data gathering): A psychologist *observes* a phenomenon (e.g., George Miller *observes* that people can only remember about 7 items).
2. This data is then used to build a *theory* (**Rationalism**): Miller *theorizes* that this is due to a "limit in information processing."
3. This *theory* then guides new research (**Empiricism**): "If this theory is true, *then* we should *observe* that 'chunking' information will help people remember more."

As your slide says, **data informs theory, and theory guides data interpretation.** They work in a continuous cycle.

4. The "Chomsky vs. Behaviorism" Question (A Bestseller)

Question

Analyze why the **Behaviorist** view of the mind as a "black box" (focusing only on S-R) was a major problem for psychology. Using **Noam Chomsky's** critique of language, explain how language acquisition *cannot* be explained by simple reinforcement.

Answer

The Behaviorist "black box" view was a problem because it *intentionally ignored* all the most interesting parts of being human: thought, memory, and perception.

Noam Chomsky's critique of language was a key part of the Cognitive Revolution because it showed that behaviorism *could not* explain a complex, universal human skill:

- Behaviorism (like B.F. Skinner's) argued that children learn language through simple **stimulus-response (S-R) and reinforcement**. (e.g., Child says "milk," Mother gives milk (reinforcement)).
- **Chomsky's Critique:**
  1. **Creative Language:** Children say things they have *never heard before* and have *never been reinforced for* (e.g., "I *goed* to the store"). This creative generation of language is impossible in a simple S-R model.
  2. **Poverty of the Stimulus:** The language children hear (the stimulus) is often messy and ungrammatical. Yet, they *all* manage to extract the complex *rules* of grammar (the syntax) from it.
- **Conclusion:** Chomsky argued that language must be based on **innate, biological structures** in the brain—a "language acquisition device." This idea—that we must look at internal mental structures—was a direct attack on the "black box."

5. The "Miller & Hebb" Question (Key Figures)

Question

Your slides mention two key figures: **George Miller** and **Donald Hebb**. **Explain** the "magic number seven" and what it revealed about information processing. Then, **explain** Hebbian Learning and its importance.

Answer

- **George Miller (1956):** His "magic number seven, plus or minus two" was a landmark in cognitive psychology.
  - **What it is:** Miller observed that for many different tasks (like remembering lists of numbers), people's **short-term memory capacity** consistently "broke" at around 7 items.
  - **What it revealed:** This was the first strong evidence that our internal mental processes have a **fixed, measurable limit** or "bottleneck." This supported the new idea of the brain as a type of information processor, which is a core concept of cognitive psychology.
- **Donald Hebb (1949):** Hebb provided the *biological link* for the cognitive revolution.
  - **What it is:** Hebbian Learning, or "Hebb's Rule," is the simple idea that **"neurons that fire together, wire together."**
  - **What it revealed:** When one neuron helps to fire another, the connection (synapse) between them gets stronger. This was the first plausible theory to connect the *psychological* act of *learning* (Associationism) to the *neurological* act of *neurons connecting*, bridging the gap between psychology and neuroscience.

6. The ”Interdisciplinary” Question

Question

Cognitive psychology is a ”unified field” that draws on many other disciplines. **Analyze** how studying **AI** (like the Turing Test) or **Anthropology** (culture and brain wiring) helps a psychologist understand human cognition.

Answer

Cognitive psychology cannot exist in a vacuum. It needs these other fields to get a complete picture:

- **How AI Helps (Computer Science):**
  1. **AI helps Psychology:** To understand the human mind, we can try to *build a model* of it. If we can design a computer program (an AI) that *simulates* a human cognitive process (like language), it proves we have a good *theory* of how that process works. The **Turing Test** is a test of this: if an AI can simulate human conversation, what does that tell us about our own ”thinking”?
  2. **Psychology helps AI:** To build a *better* AI, computer scientists study the *human brain*—the best ”computer” that exists—to get new ideas.
- **How Anthropology Helps:** If we *only* study psychology students at MAJU, we might mistakenly think a cognitive process is ”universal.” **Anthropology** teaches us that **culture can literally ”rewire” the brain.**
  - For example, some cultures’ languages may not have words for ”left” and ”right,” using only ”north” and ”south” (cardinal directions). This cultural difference forces their brains to develop a *completely different* and superior system for spatial awareness. This shows us that our cognitive processes are not just fixed biology but are also *flexible* and shaped by our cultural environment. itemize