# IST605: Human Information Processing — Perception Practice Questions

**Distribution:** 25% Easy (5) | 40% Normal (8) | 35% Hard (7) — 20 questions total
**Types:** MCQ, structural (short answer), and complete (paragraph). All with answers and explanations.

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## EASY (25% — 5 questions)

### E1. MCQ

**Sensation involves the conversion of sensory energy into nerve impulses that are carried to the brain. This conversion process is called:**
A) Coding
B) Transduction
C) Sensory reduction
D) Perception

▶ **Answer**

**B)** Transduction

**Explanation:** Transduction is the conversion of sensory stimuli into neural impulses. Sensory receptors transduce physical energy (light, sound, etc.) into nerve impulses. Coding refers to mapping input to specific sensations; sensory reduction refers to filtering and analyzing before sending to the brain.

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### E2. Structural

**What is the smallest amount of a stimulus that a person can detect called?**

▶ **Answer**

**Absolute threshold**

**Explanation:** The absolute threshold is the minimum intensity of a stimulus needed for it to be detected 50% of the time. It is a key concept in psychophysics.

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### E3. MCQ

**In Signal Detection Theory, when the signal is absent and the person responds "yes," this outcome is called:**
A) Hit
B) Miss
C) False alarm
D) Correct rejection

▶ **Answer**

**C)** False alarm

**Explanation:** A false alarm occurs when there is no signal but the person reports that a signal was present. A hit is signal present + "yes"; a miss is signal present + "no"; correct rejection is signal absent + "no."

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### E4. Structural

**Name two Gestalt principles of perceptual organization.**

▶ **Answer**

Any two of: Similarity, Proximity, Closure, Continuity, Figure-ground, Prägnanz (Simplicity), Connectedness.

**Explanation:** Gestalt laws describe how people group visual elements into wholes. For example, similarity groups like items; proximity groups nearby items; closure fills in gaps; figure-ground separates foreground from background.

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### E5. MCQ

**Retinal disparity is a depth cue that:**
A) Uses only one eye
B) Results from slightly different images on the left and right retina
C) Is most effective for distant objects
D) Involves texture gradients

▶ **Answer**

**B)** Results from slightly different images on the left and right retina

**Explanation:** Retinal disparity is a binocular cue. Each eye receives a slightly different image because they are in different positions. The brain uses the difference (disparity) between these images to infer depth. It is most effective when objects are close, and disparity decreases with distance.

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## NORMAL (40% — 8 questions)

### N1. MCQ

**Which statement best describes the relationship between low-level and high-level vision?**
A) High-level vision occurs before low-level vision
B) Low-level vision extracts preliminary information (e.g., edges); high-level vision focuses on meaning and identity of objects and scenes
C) Low-level vision requires both eyes; high-level vision uses only one
D) They operate independently with no interaction

▶ **Answer**

**B)** Low-level vision extracts preliminary information (e.g., edges); high-level vision focuses on meaning and identity of objects and scenes

**Explanation:** Visual perception is an active process with multiple levels. Low-level vision processes the pattern of light on the retina (edges, features, motion). High-level vision interprets this to recognize objects, understand scenes, and integrate with memory and meaning.

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## N2. Complete

**Distinguish between sensitivity and criterion in Signal Detection Theory. How can they affect a person's responses?**

▶ **Answer**

**Sensitivity (d')** is the ability to discriminate between signal and noise; it reflects how well the sensory system separates signal from noise. **Criterion (β)** is the decision threshold—the point at which a person says "yes, signal present" versus "no, signal absent." It can be biased: a cautious person may say "no" more often (fewer hits but fewer false alarms); a liberal person may say "yes" more often (more hits but more false alarms). Sensitivity is independent of criterion; two people can have the same sensitivity but different criteria, leading to different hit and false-alarm rates.

**Explanation:** SDT separates sensory ability (sensitivity) from decision strategy (criterion). This matters in applications like medical screening, where the criterion can be adjusted based on the cost of misses vs false alarms.

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## N3. MCQ

**Low spatial frequency in edge detection typically corresponds to:**
A) Sharp edges and fine textures
B) Gradual changes and the overall shape of an object
C) Only high-contrast regions
D) Information from a single eye

▶ **Answer**

**B)** Gradual changes and the overall shape of an object

**Explanation:** Low spatial frequency captures coarse, global information—gradual changes and overall structure. High spatial frequency captures fine details: sharp edges, textures, abrupt changes. Evidence suggests processing may begin with global (low frequency) information before incorporating local (high frequency) details.

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## N4. Structural

**Name three monocular depth cues (cues that work with one eye).**

▶ **Answer**

Any three of: Interposition (occlusion), Linear perspective, Relative size, Shadows, Size constancy, Shape constancy, Texture gradients, Relative clarity, Motion parallax.

**Explanation:** Monocular cues use information from a single eye. For example, interposition (one object blocking another implies it is closer); linear perspective (converging lines imply distance); relative size (smaller retinal image implies farther away).

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## N5. MCQ

**Feature detection theories of object recognition are limited because they:**

A) Require too many features
B) Ignore spatial relationships among features
C) Only work for simple shapes
D) Depend on binocular vision

▶ **Answer**

**B)** Ignore spatial relationships among features

**Explanation:** Feature theories decompose objects into separable features but do not specify how features are arranged. For example, a horizontal and vertical line describe both "T" and "+"; without spatial relations (e.g., t-junction vs cross), the two cannot be distinguished. Structural theories add spatial relations to address this.

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## N6. Complete

**What is motion parallax, and how does it provide information about depth when a person moves?**

▶ **Answer**

**Motion parallax** (also called relative motion) is a monocular depth cue that arises when the observer moves. As the head moves (e.g., left to right), images on the retina move (e.g., right to left). **Nearby objects** appear to move faster and in the opposite direction of head movement; **distant objects** appear to move more slowly and in the same direction. For example, when driving, nearby trees pass by quickly while distant mountains move slowly; the moon barely moves at all. This differential motion provides effective depth information.

**Explanation:** Motion parallax is powerful in real-world environments where observers move. It does not require two eyes and works well for depth ordering.

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## N7. MCQ

**In Biederman's Recognition-by-Components (RBC) theory, geons are:**

A) Neural circuits in the retina
B) Simple 3-D geometric shapes that serve as building blocks for object recognition
C) High spatial frequency features
D) Templates stored in long-term memory

▶ **Answer**

**B)** Simple 3-D geometric shapes that serve as building blocks for object recognition

**Explanation:** Geons (geometric icons) are primitives such as cylinders, blocks, cones, and wedges—roughly 36 in number. Objects are recognized by identifying component geons and their spatial relations. Geon

properties are viewpoint-invariant, allowing recognition from many angles.

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### N8. Structural

**What is the Word Superiority Effect? Provide one reason it might occur.**

▶ **Answer**

**Word Superiority Effect:** Letters are recognized more easily when they appear within a word than when they appear in isolation or in a non-word string. For example, letters in "TREE" are identified more readily than letters in "TVXC."

**Reason:** Top-down processing—the meaningfulness of the word helps identify its component letters. Alternatively, pronounceability: real words are easier to pronounce than non-words, which may aid recognition.

**Explanation:** This effect illustrates that perception is not purely bottom-up; context, meaning, and expectations (top-down) influence how we process individual elements.

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## HARD (35% — 7 questions)

### H1. MCQ

**Why is perception described as "very hard for computers" despite humans doing it effortlessly?**
A) Computers lack memory
B) The same 2-D retinal image can be produced by an unlimited number of different 3-D arrangements of objects; the brain resolves this ambiguity unconsciously
C) Computers cannot use binocular vision
D) Humans use templates that computers lack

▶ **Answer**

**B)** The same 2-D retinal image can be produced by an unlimited number of different 3-D arrangements of objects; the brain resolves this ambiguity unconsciously

**Explanation:** The inverse optics problem: light from 3-D scenes projects onto a 2-D retina, so many 3-D configurations could produce the same 2-D image. Humans resolve this ambiguity (often unconsciously) using cues like depth, context, and prior knowledge. Computers struggle with this inverse problem and the sheer variability of viewing conditions.

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### H2. Complete

**Compare feature detection theory, structural description theory, and template matching as approaches to object recognition. What does each assume, and what are their main strengths and weaknesses?**

▶ **Answer**

**Feature detection theory:** Assumes objects are composed of separable features; recognition involves matching features against stored representations. **Strength:** A small set of features can describe many

objects. **Weakness:** Ignores spatial relations—e.g., "T" and "+" share the same features but differ in arrangement.

**Structural description theory:** Assumes objects are described by features *and* spatial relations (how parts connect). **Strength:** Can distinguish objects with the same features but different arrangements; viewpoint-invariant (e.g., geons in RBC). **Weakness:** May fail for objects with similar parts (e.g., wolf vs cat) or objects hard to decompose (e.g., loaf of bread).

**Template matching:** Assumes representations are 2-D pixel arrays; matching involves aligning and comparing with stored templates. **Strength:** Direct and implementable. **Weakness:** Sensitive to size, rotation, and viewpoint; humans do not suffer as much. Proponents add an alignment stage (transformations) before matching to improve robustness.

**Explanation:** Each approach captures different aspects of recognition. Modern theories and systems often combine elements (e.g., features + structure; deep learning with learned representations).

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## H3. MCQ

**A radiologist tends to report "possible tumour" more often than colleagues, leading to more biopsies. In Signal Detection Theory terms, this radiologist likely has:**

A) Lower sensitivity (d')
B) A more liberal criterion (lower threshold for saying "yes")
C) A more conservative criterion (higher threshold for saying "yes")
D) Higher sensitivity (d')

▶ **Answer**

**B)** A more liberal criterion (lower threshold for saying "yes")

**Explanation:** A liberal criterion means the person is more willing to say "signal present" (e.g., "tumour present"). This increases hits when a tumour is present but also increases false alarms (reporting tumour when none exists). Sensitivity (d') reflects ability to distinguish signal from noise and is independent of the criterion. The radiologist's tendency is a decision bias, not necessarily a change in sensitivity.

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## H4. Structural

**Describe how bottom-up and top-down processing interact in perceptual context effects. Give one concrete example.**

▶ **Answer**

**Bottom-up processing** starts from sensory input (raw data) and works upward; **top-down processing** uses prior knowledge, expectations, and context to interpret that input. They interact continuously: context (top-down) influences how ambiguous or degraded input (bottom-up) is interpreted.

**Example:** An ambiguous character that looks like "H" or "A" is perceived as "H" when embedded in "T_E" (THE) and as "A" when embedded in "C_T" (CAT). The same physical stimulus is interpreted differently based on word context—top-down processing disambiguates bottom-up input. Another example: a partly blotted letter "E" is still perceived when the word context supports it.

**Explanation:** Perceptual context effects show that perception is not a one-way pipeline from sensation to meaning; higher-level knowledge constrains lower-level interpretation.

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## H5. MCQ

**Size constancy refers to the tendency to:**
A) Prefer larger objects over smaller ones
B) Perceive an object's actual size as constant despite changes in retinal image size with distance
C) Use relative size as the only depth cue
D) See objects as larger when they are closer

▶ **Answer**

**B)** Perceive an object's actual size as constant despite changes in retinal image size with distance

**Explanation:** As an object moves farther away, its retinal image shrinks, but we perceive its real size as unchanged. Conversely, as the retinal image grows (object approaches), we infer it is getting closer, not bigger. Size constancy helps maintain a stable perception of the world despite changing viewing conditions.

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## H6. Complete

**Explain how Gestalt principles are applied in user interface design. Use at least two principles and describe how each affects how users perceive and use interfaces.**

▶ **Answer**

**Law of Similarity:** Similar shapes, sizes, or colours are perceived as a group. In UI design, similar elements (e.g., buttons, icons) are grouped by appearance so users infer shared functionality. Designers use consistent styling to indicate related actions or content.

**Law of Proximity:** Objects that are close together are perceived as related. Placing related controls or information near each other helps users understand grouping. Conversely, spacing elements apart creates negative space and separates distinct sections or functions.

**Law of Figure-Ground:** Users divide the visual field into foreground (figure) and background (ground). Clear figure-ground separation—e.g., a prominent logo or call-to-action against a neutral background—helps users focus on key elements. This is used in logos and branding.

**Law of Continuity:** The eye follows smooth, continuous lines. Designers use flow (e.g., lines, cards, layouts) to guide navigation and reading order. For example, a path on a map or a timeline follows continuity to make navigation intuitive.

**Explanation:** Gestalt principles are widely used in UX, UI, and interaction design to create interfaces that match human perceptual tendencies and improve usability.

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## H7. MCQ

**A person reads the sentence "I would like to go out and drink a microwave" and pauses at "microwave." This slowdown is best explained by:**

A) Low-level vision deficits
B) Top-down processing: the word violates expectations based on sentence context, forcing re-analysis
C) Template matching failure
D) Retinal disparity

▶ **Answer**

**B)** Top-down processing: the word violates expectations based on sentence context, forcing re-analysis

**Explanation:** Readers use background knowledge and context to predict likely upcoming words. "Microwave" is unexpected in the phrase "drink a [X]" (one expects "coffee," "tea," etc.). When prediction fails, processing slows as the reader rechecks and re-interprets. This extends the Word Superiority Effect to the sentence level: predictable text is read faster; random or unexpected words disrupt the flow.

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# Answer Key (Quick Reference)

| ID | Answer |
|---|---|
| E1 | B |
| E2 | Absolute threshold |
| E3 | C |
| E4 | Any two Gestalt principles |
| E5 | B |
| N1 | B |
| N2 | (See explanation: sensitivity vs criterion) |
| N3 | B |
| N4 | Any three monocular depth cues |
| N5 | B |
| N6 | (See explanation: motion parallax) |
| N7 | B |
| N8 | (See explanation: Word Superiority Effect) |
| H1 | B |
| H2 | (See explanation: feature, structural, template) |
| H3 | B |
| H4 | (See explanation: bottom-up/top-down + context) |
| H5 | B |
| H6 | (See explanation: Gestalt in UI design) |
| H7 | B |