

## CHAPTER 3

# Responding to the World



## Read This Chapter to Learn About

- > Emotion
- > Stress

## EMOTION

Emotions are more than a simple, one-dimensional experience. They comprise cognitive, behavioral, and physiological components, although there is significant scientific debate about which component is the primary (first or strongest) component. The **cognitive component** involves the cognitive appraisal of the situation. This appraisal is partially automatic and partially under individual control. The **behavioral component** refers to the activities that relate to the cognitive component of emotion. This aspect of emotion is under individual control, and the behaviors may exacerbate or diminish the experience of the emotion (e.g., honking your horn loudly to someone who cuts you off in traffic or taking slow, deep breaths). The **physiological component** of emotion reacts via the autonomic nervous system (ANS). The **sympathetic component** of the ANS activates the body during emotional extremes, particularly during instances of the fight-or-flight response: releasing stress hormones, increasing heart rate, and increasing breath capacity. The parasympathetic nervous system reverses the changes of the sympathetic nervous system and returns the body to normal. It can be activated by the individual via diaphragmatic breathing, meditation, or other relaxation exercises. The sympathetic and parasympathetic nervous systems are generally in homeostatic equilibrium.

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## Universal Emotions

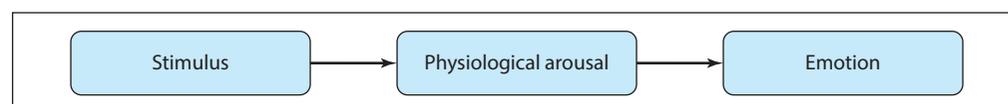
Anthropology research has identified a number of **universal emotions**. Originally developed from research by Paul Ekman, the list typically includes from four to seven “basic” emotions. The generally accepted emotions are fear, anger, happiness, surprise, joy, disgust, and sadness.

Similar facial expressions that match these emotions have been shown to exist across different cultures. While expression of emotions does have cultural components, it is possible that there is a genetic component to understanding those expressions. Some research indicates that these seven emotions also occur in animals, particularly primates. Humans from different cultures, and primates as well, can separate and categorize facial expressions for each of the seven basic emotions. Emotional expression across cultures is certainly adaptive. Being able to recognize friendly or threatening behavior would be critical when encountering people from other cultures. It is also adaptive within a community as a way to communicate emotions. Some evolutionary psychologists believe that emotional expression developed before language as a proto-language to share knowledge of dangerous and safe items in the environment.

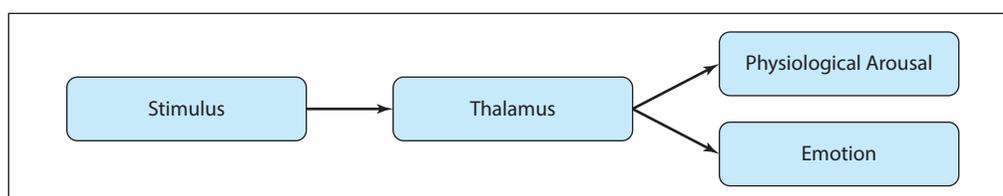
Other researchers examining how emotional memories are stored and retrieved prefer the **biaxial theory of emotions**. This theory identifies emotions based on valence (positive or negative) and the level of arousal it causes (elevated or neutral). These factors then determine how memories are stored in the brain and the emotional status that makes it easier to retrieve these memories. These researchers place all human emotions on these two axes rather than the distinct “basic” emotions of Ekman’s theory.

There are three major theories of how humans consciously experience emotions and label which emotion they are experiencing. These theories attempt to answer the question “Which comes first, the experience or the label?”

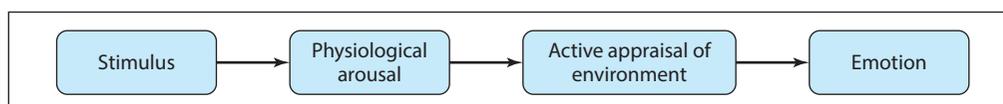
- According to the **James–Lange theory**, the experience of emotion stems from a person’s perception of autonomic arousal. A stimulus creates autonomic arousal, which the individual labels as “fear.” Emotion misattribution to physiological arousal may occur, but generally it assumes that humans can (subconsciously) differentiate among physiological arousal caused by fear, anger, or excitement.



- The **Cannon–Bard theory** of emotion differs from the James-Lange theory in claiming that the experience of physiological arousal can occur without the emotion (e.g., while exercising). According to this theory, a stimulus triggers the thalamus (and other subcortical brain structures) to simultaneously create autonomic arousal and cause the individual to label the emotion.



- The **Schachter–Singer theory** of emotion is a combination of the two previous theories. It posits that a stimulus (e.g., a threatening dog) triggers an autonomic arousal in the body (e.g., via the sympathetic nervous system). That causes the person to appraise the environmental context, and based on that appraisal to interpret the emotion (e.g., fear). This is the only theory that involves active appraisal of the environmental context, which is critical because the same autonomic experience in a different context may trigger a different emotion to be identified (e.g., a roller-coaster ride would be interpreted as “thrilling”). This emotional theory has gained precedence in recent research.



## Biology and Emotional Perception

The development, identification, and experience of emotions involve a number of different brain areas. The **limbic system** comprises the amygdala, hypothalamus, and adjacent structures. The amygdala is particularly associated with negative emotions such as fear and anger. Sensory inputs potentially related to emotion arrive in the thalamus. Those inputs that could relate to a threat are “fast tracked” directly to the amygdala, while those that are determined to not be a threat are “slow tracked” to the appropriate area of the cortex for analysis (e.g., visual-occipital lobe). In addition to the limbic system, the **prefrontal cortex** is critical to voluntary control of emotions relating to cognitive, behavioral, and physiological factors. In addition, the prefrontal cortex is critical for processing emotional experiences, planning responses to

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emotional experiences, and relating emotional experiences to temperament and decision making. The **anterior cingulate cortex** functions to identify the level of threat from pain and the emotional distress related to that pain level (e.g., short-term injury versus long-term injury). The **mesolimbic dopamine pathway** is also critical in regulating emotion; this pathway is activated by pleasant or rewarding events. During the use of drugs of abuse, this pathway is “hijacked.” There is also a **hemispheric difference** in how emotion is processed. The right hemisphere of the brain is more active in interpreting other people’s emotions as well as in the expression of positive emotions. The left hemisphere is more active in the expression of negative emotions.

Strong emotions are closely tied to elevations in the **sympathetic nervous system**. Strong emotions (both positive and negative) are associated with autonomic arousal. Excitement and fear both cause increased heart rate, increased respiration rate, release of cortisol and other stress hormones, and increased galvanized skin response. In contrast, feeling calm or mildly happy activates the **parasympathetic nervous system** with reduced heart rate, reduced muscle tension, and slowed breathing. However, there are some unique physiological markers of emotion as well. For example, asking an individual to shift facial muscles to a smiling or frowning position can actually create positive or negative mood shifts, respectively.

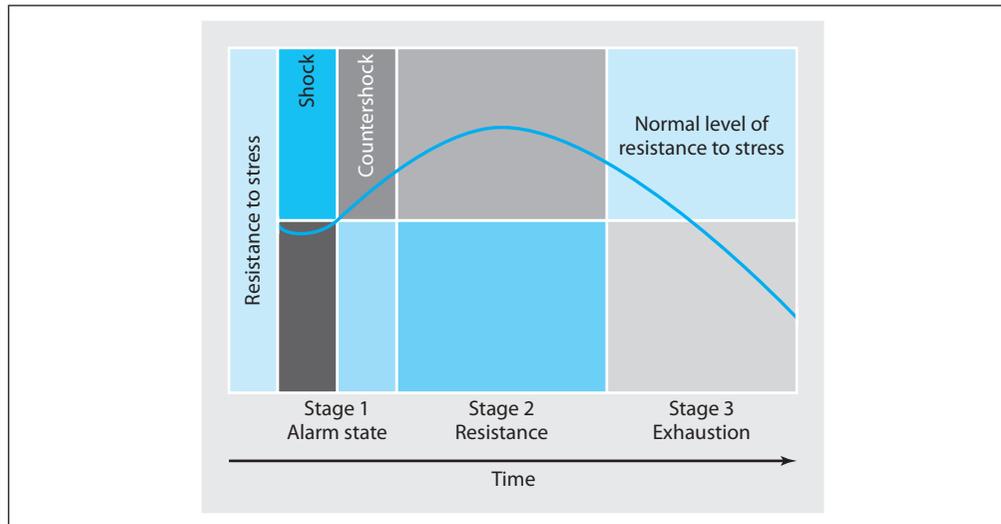
The links between emotions and autonomic nervous arousal are also likely related to episodic memories. Strong emotional experiences can be integrated into episodic memories. Those episodic memories can then be triggered by strong emotions that are similar to those in the memory of the original event. Post-traumatic stress disorder flashbacks are an example of how emotions can repeatedly trigger episodic memories.

## STRESS

Stress has behavioral, cognitive, and physiological components. Austrian-Canadian endocrinologist Hans Selye was the father of stress research. He found that stress can be caused by both positive and negative events, and that the stress caused by both kinds of events can have similar physiological, behavioral, and cognitive effects. Selye identified the body’s primary stress system as the hypothalamus-pituitary-adrenal axis (HPA axis). (See Figure 3-1.) He found that the HPA axis goes through three states:

1. The **alarm state** is the initial activation after an acute stressor.
2. The **resistance state** is prolonged activation during a chronic stressor.
3. In the **exhaustion state**, the HPA axis and the body’s ability to respond to stress begin to break down.

The new and growing field of positive psychology examines positive stress, as well as positive emotions in general and the positive psychological processes that keep humans mentally healthy and resilient to stress.



**FIGURE 3-1** Selye's general adaptation syndrome. *Source:* Adapted from *J. W. Santrock. Adolescence*, 15th ed., McGraw-Hill Education, 2014.

Stress occurs when people experience events that they judge as being beyond their ability to handle. It is this critical appraisal that can activate the fight-or-flight response. Stress can occur in acute situations (e.g., a car running a stoplight and heading for your car), or it can be chronic (e.g., long-term financial difficulties). Stressful events can be cataclysmic and shared with many other people (e.g., the 9/11 attacks), or they can be very personal (e.g., divorce).

## Responses to Stressors

Response to stressors depends on the chronicity of the stressor. Acute stress heightens the individual's ability to respond to the stressful situation. By contrast, chronic stress takes a toll on the individual. Physiologically, stress causes acute activation of the sympathetic nervous system. Over time in the context of chronic stress, other issues begin to develop. Chronic stress causes the body to experience decreased sleep quantity and quality, reduced immune response to infections, weight gain, increased insulin resistance (and resulting increased susceptibility to type II diabetes), fatigue, and slowed wound healing. Emotionally, chronic stress can create a burnout experience in which the individual feels chronically fatigued, has difficulty with positive emotional responses, and experiences a decreased optimistic outlook. Cognitively, acute stress can enhance cognitive abilities. By contrast, chronic stress impairs memory encoding and can interfere with recall. It also can produce increased stereotyping and pigeonholing because making judgments based on superficial attributes rather than on individualized assessments requires less cognitive load. The individual with chronic stress also begins to experience slowed cognitive speed and decreased problem-solving

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ability. Behaviorally, chronic stress is likely to create impulsive behaviors, increased reliance on habits, and behaviors based on stereotyped cognitions.

## Coping

Researchers have identified many different coping strategies that individuals use to manage stress. The strategies are typically grouped in dichotomous models, as follow:

- ▶ **Instrumental versus emotion-focused.** **Instrumental stress management** consists of taking concrete problem-solving actions to reduce the source of the stress (e.g., studying for a test that is causing you stress). **Emotion-focused stress reduction** involves improving the mood state (e.g., going for a run when you have had a bad day). This form may involve reducing sympathetic nervous system arousal. Multiple strategies may be involved in this process, including exercise, meditation, diaphragmatic breathing, and spiritual resources. Both instrumental and emotional forms of stress management are active stress-control techniques. For most stressors, it is ideal to combine the two strategies.
- ▶ **Approach versus avoidance.** Another dichotomous coping model is approach versus avoidance. In this model, an individual copes with a stressor by using a problem-solving (approach) method to address the stressor and resolve it. In avoidance coping, the individual may attempt to escape the situation through alcohol, drugs, distraction, or other means to attempt to avoid facing the stressor. Both approach and avoidance coping strategies can be considered active or passive depending on the situation.
- ▶ **Active versus passive.** Active coping involves actively engaging the stressor in some way. This may be in an approach or avoidance manner, but it requires the individual to acknowledge the stressor and attempt to reduce the impact of the stressor on his or her life (by engagement or disengagement). Passive coping strategies are often associated with avoidance strategies; the individual takes no active steps to reduce the impact of the stressor on his or her life but just waits for it to go away.
- ▶ **Adaptive versus maladaptive.** Adaptive and maladaptive forms of coping are generally defined by their outcomes, and these may be environmentally or situationally determined. Coping strategies that may be adaptive and enhance outcomes in one situation (e.g., going for a run to reduce stress and improve long-term health outcomes) may actually impair outcomes under different environmental pressures (e.g., going for a run outside in Beijing or Los Angeles during “hazardous” air pollution alert days). Therefore, research into adaptive and maladaptive coping strategies clearly outlines the individual, environment, and situation that is being studied to identify how these strategies may help or hurt individuals who are in these situations.

# Unit I Minitest

## 22 Questions

## 30 Minutes

This minitest is designed to assess your mastery of the content in Chapters 1 through 3 of this volume. The questions have been designed to simulate actual MCAT questions in terms of format and degree of difficulty. They are based on the content categories associated with the foundational concept that is the theme of this unit. They are also designed to test the scientific inquiry and reasoning skills that the test makers have identified as essential for success in medical school.

In this test, most of the questions are based on short passages that typically describe a research study or some similar process. There are also some questions that are not based on passages.

Use this test to measure your readiness for the actual MCAT. Try to answer all of the questions within the specified time limit. If you run out of time, you will know that you need to work on improving your pacing.

Complete answer explanations are provided at the end of the minitest. Pay particular attention to the answers for questions you got wrong or skipped. If necessary, go back and review the corresponding chapters or text sections in this unit.

Now turn the page and begin the Unit I Minitest.

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**Directions:** Choose the best answer to each of the following questions. Question 1 is not based on a passage.

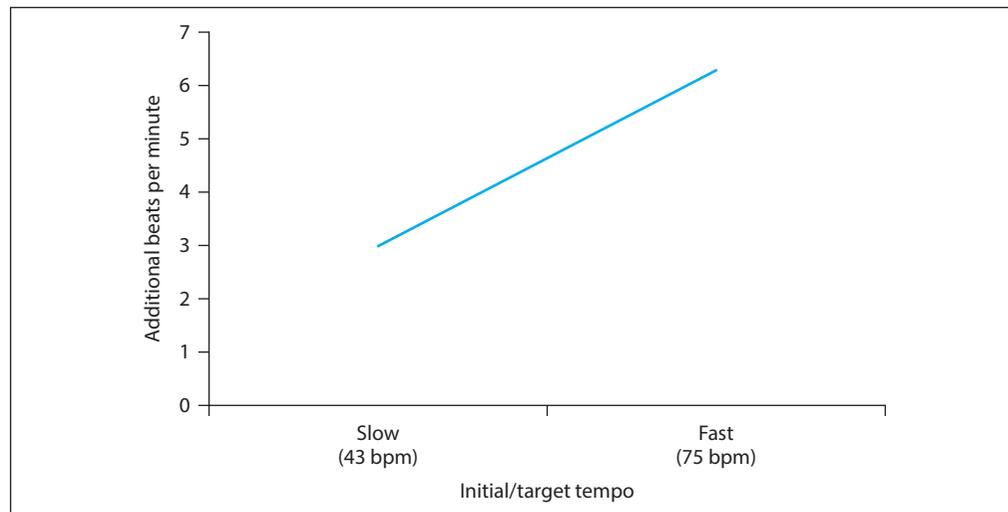
1. The theory of hearing that best explains perception of low pitched sounds is called \_\_\_\_\_. The theory of hearing that best explains perception of very high pitched sounds is called \_\_\_\_\_.
- A. place theory, frequency theory
  - B. frequency theory, place theory
  - C. auditory gate theory, place theory
  - D. place theory, auditory gate theory

Questions 2–5 are based on the following passage.

**Passage I**

Researchers studying signal detection have documented various magnitude differences necessary to detect the presence of stimuli (absolute threshold) and to detect changes in the perceptual experience of the stimuli (just noticeable difference). These differences are dependent on the type of sensory experience being measured and can be characterized by proportional differences in magnitude rather than absolute amounts.

A recent study examined the just noticeable difference necessary to perceive tempo changes. In this experiment, signal detection methods were used to examine the amount of change necessary to detect a difference between an initial/target tempo and a comparison stimulus. Two test conditions were evaluated. The initial/target tempo



Detecting tempo change (beats per minute). *Source:* Adapted with permission from Thomas, K. (2007). "Just noticeable difference and tempo change." *Journal of Scientific Psychology*, 2, 14–20.

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speed was either *slow* (43 beats per minute [bpm]) or *fast* (75 bpm). Comparison tempos were presented that were either sped up or slowed down relative to the initial/target tempo. Participants were asked to identify whether the comparison tempos were the same tempo or a different tempo from the initial/target tempo. The accompanying graph depicts the tempo changes necessary for detection for both the *slow* and *fast* initial/target tempos.

2. If a third initial/target tempo of 60 beats per minute was tested, which of the following would you expect to be TRUE based on the results of this study?
  - A. It would take a change in magnitude greater than the *fast* tempo for participants to detect a change.
  - B. It would take a change in magnitude smaller than the *slow* tempo for participants to detect a change.
  - C. It would take a change in magnitude greater than the *slow* tempo but less than the *fast* tempo for participants to detect a change.
  - D. The magnitude of the change necessary for participants to detect a change more than 50 percent of the time would be exactly the same regardless of the target tempo.
3. Suppose this study used a forced-choice signal detection method. Which type of signal detection response would be MOST likely as the speed of the comparison tempo increased, regardless of the initial/target tempo?
  - A. a miss
  - B. a false alarm
  - C. a correct rejection
  - D. a hit
4. Which of the following statements BEST describes Weber's law?
  - A. The just noticeable difference (JND) necessary to detect a change in the magnitude of a comparison stimulus (i.e., the tempo) is a constant proportion of the initial/target stimulus.
  - B. The JND necessary to detect a change in the magnitude of a comparison stimulus (i.e., the tempo) is a fixed amount, independent of the initial/target stimulus.
  - C. The JND necessary to detect a change in the magnitude of a comparison stimulus (i.e., the tempo) is always the same as the absolute threshold to detect the stimulus.
  - D. The JND necessary to detect a change in the magnitude of a comparison stimulus (i.e., the tempo) is exactly half of the magnitude necessary to perceive that the stimulus is present.

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5. Which of the following conclusions is supported by this study?
- A. The faster the tempo of the initial/target stimulus, the greater the difference required between the initial and comparison tempos for participants to perceive a difference.
  - B. The faster the tempo of the initial/target stimulus, the greater the proportion of change needed for participants to perceive a difference.
  - C. The slower the tempo of the initial/target stimulus, the greater the difference required between the initial and comparison tempos for participants to perceive a difference.
  - D. The slower the tempo of the initial/target stimulus, the greater the proportion of change needed for participants to perceive a difference.

*Question 6 is not based on a passage.*

6. A researcher inserts electrodes into the brain of a monkey. When the monkey is shown lines aligned at different orientations, the cells respond preferentially to lines of certain particular orientations. It is MOST likely that the researcher has inserted the electrodes into which region of the brain?
- A. occipital lobe
  - B. temporal lobe
  - C. frontal lobe
  - D. parietal lobe

*Questions 7–10 are based on the following passage.*

**Passage II**

Jean Piaget, a prominent figure in developmental psychology, believed that the development of all cognitive abilities occurred during the first two years of life. Piaget devised various procedures for examining development in young children. These activities focused on how children (and people) think and how they interact with the world around them. Piaget asserted that biological changes interacted with childhood experiences, resulting in unique developmental stages characterized by schemas, or mental structures.

The following table lists the four stages of development identified by Piaget and their function.

Piaget's Stages of Development.

Stage	Age	Purpose
<b>Sensory Motor</b>	Birth–2 years	Coordination of sensations with voluntary motor movement
<b>Preoperational</b>	2–7 years	Increased use of mental images and symbols
<b>Concrete Operational</b>	7–11 years	Increased problem-solving abilities; mastery of conservation; cognition and mental operations are mostly limited to tangible objects and actual events
<b>Formal Operational</b>	11–Adult	Begins to understand and mentally manipulate abstract constructs (e.g., ethics, free will, love)

7. Two children, Tommy and Janet, watch a researcher pour water from a short, wide glass into a tall, narrow glass. When asked, Tommy confidently states that there is now more water in the tall, narrow glass than there was in the short, wide glass. Janet asserts that the amount of water has not changed. Based on Piaget's stages of development, which answer BEST represents this example?
- A. Tommy and Janet are exhibiting egocentrism because they are unable to share each other's viewpoints.
  - B. Tommy is not aware of the continued existence of the water once it is poured from one glass to the other, while Janet has developed object permanence.
  - C. Janet has developed reversibility and understands that the water can be poured back into the original container, while Tommy has not yet developed reversibility.
  - D. Janet has developed conservation and is aware that the amount of water inside a container is the same even if the dimensions change, while Tommy has not yet developed conservation.
8. Amanda's mother hides Amanda's toy rattle beneath a blanket. Amanda does not search for the rattle and appears to be unaware of its existence. Based on Piaget's model, what stage is Amanda in and what concept has she NOT yet mastered?
- A. sensory motor, object permanence
  - B. sensory motor, conservation
  - C. preoperational, object permanence
  - D. preoperational, conservation

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9. Based on Piaget's model, what concept is characterized by the ability to absorb new ideas and what concept is characterized by the process of modifying previously developed mental processes?
- A. Accommodation is characterized by the ability to absorb new ideas; assimilation is characterized by the process of modifying previously developed mental processes.
  - B. Assimilation is characterized by the ability to absorb new ideas; accommodation is characterized by the process of modifying previously developed mental processes.
  - C. Coordination is characterized by the ability to absorb new ideas; consolidation is characterized by the process of modifying previously developed mental processes.
  - D. Consolidation is characterized by the ability to absorb new ideas; coordination is characterized by the process of modifying previously developed mental processes.
10. On a rainy day, Juan is asked why it is raining. He replies that it is raining so that he can "play with his toy boat." What developmental stage is Juan likely in, and what concept has he yet to master?
- A. formal operational, decentering
  - B. sensory motor, transitivity
  - C. preoperational, egocentrism
  - D. concrete operational, classification

*Question 11 is not based on a passage.*

11. Which field of psychology examines positive stresses as well as positive emotions in general?
- A. psychodynamic approach
  - B. human-focused psychology
  - C. positive psychology
  - D. motivation and emotion approach

*Questions 12–15 are based on the following passage.*

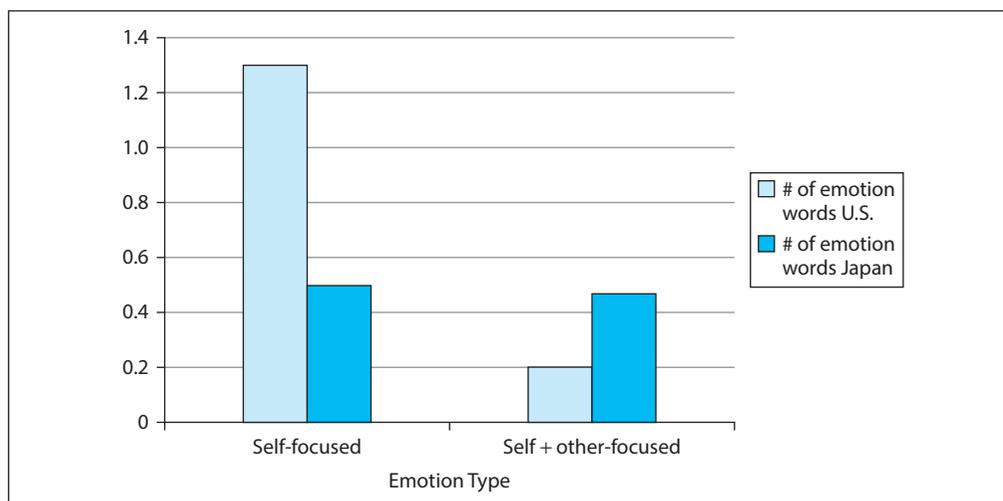
**Passage III**

The study of emotional experience is often characterized by the attempt to answer the question, "Which comes first, the experience or the label?" Some researchers suggest that the physiological arousal occurs, then the individual contextualizes the experience

based on his or her environment, resulting in emotion such as “fear” or “happiness.” Other researchers suggest that humans can subconsciously identify the difference in arousal caused by various emotional states or that the arousal and classification occur in parallel.

Recent research has examined the relationship between culture and emotion. One such study examined the differences between how American and Japanese participants contextualize emotion. The researchers examined athletes’ use of emotion-related words in interviews. Compared to American athletes, Japanese athletes were found to be more likely to identify emotions with others than with themselves. Based on these findings, the researchers conducted a second experiment in which they asked Japanese and American participants to describe typical emotions experienced by Olympic medalists. The researchers counted the number of emotion-related words and assigned them to either self-focused or self+other-focused groups for comparison.

The results of the second study are shown in the following graph.



Number of emotion words used by American and Japanese participants. Responses assigned to self-focused and self + other-focused groups. *Source:* Adapted with permission from Uchida, Yukiko, et al. “Emotions as within or between people? Cultural variation in lay theories of emotion expression and inference.” *Personality and Social Psychology Bulletin* 35(11), (2009): 1427–1439.

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12. Which statement BEST describes how the Schachter–Singer theory of emotion could be used to interpret the results of this study?
- A. The experiences triggered physiological arousal, which caused specific emotions. Because the physiological arousal conditions were similar, the responses between the cultural groups were similar as well.
  - B. The experiences triggered autonomic arousal, which the participants then appraised. Each group interpreted their emotional experiences based on cultural differences as a result of the appraisal process.
  - C. The experiences activated the thalamus, which simultaneously created both physiological arousal and the emotion. Any differences observed were due to different types of arousal in participants from different cultures.
  - D. Experiences between cultures occur in different ways and use different brain regions. The observed cultural differences represent different theories of emotion.
13. Which of the following BEST describes the results of the second study described in the passage?
- A. Japanese athletes described more self+other–focused emotions than self-focused emotions.
  - B. Japanese athletes described fewer self-focused emotions than American athletes.
  - C. American athletes described more self+other–focused emotions than Japanese athletes.
  - D. American athletes described more self+other–focused emotions than self-focused emotions.
14. Which theory of emotion posits that a stimulus creates autonomic arousal, which causes an individual to subconsciously identify an emotional state?
- A. James–Lange theory
  - B. Cannon–Bard theory
  - C. Schachter–Singer theory
  - D. James–Singer theory
15. What additional experiment could be included in future research to further investigate emotion and cultural differences between populations?
- A. asking participants to complete a memory recall task prior to indicating the emotions that they believed the athletes exhibited
  - B. conducting the experiment on additional groups from different cultures and comparing the results between them
  - C. conducting the experiment on the same group of participants over time but changing the narrative scripts
  - D. asking participants to wear heart rate monitors and measuring their arousal while reading narrative scripts

Questions 16 and 17 are not based on a passage.

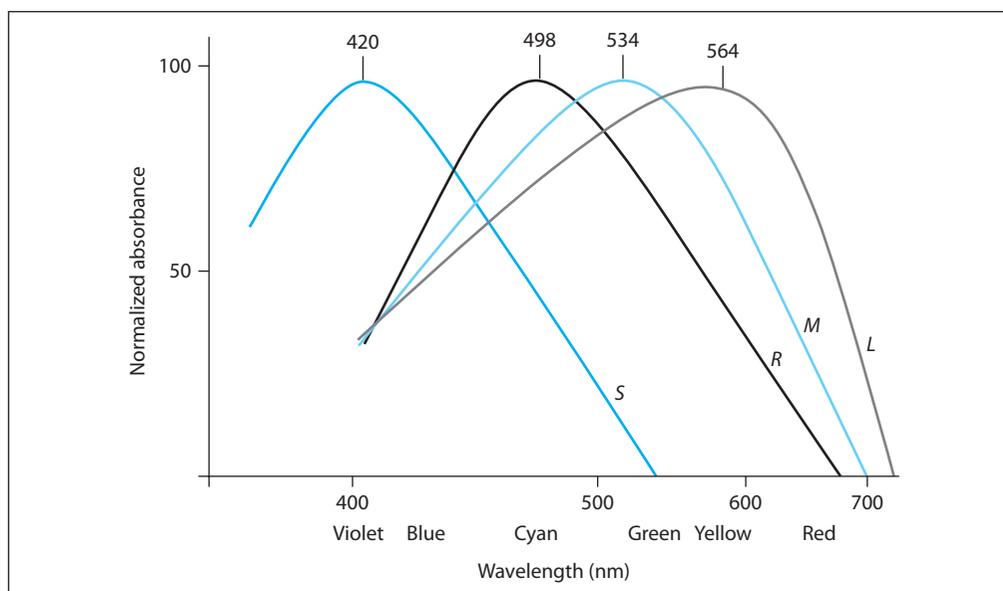
16. Jane is able to remember and consciously reexperience her 15th birthday party when her parents gave her a Beatles album. She also remembers the Beatles' classic look because her parents described it to her in detail. Which type of memory BEST characterizes the first example, and which type of memory BEST explains the second?
- A. episodic memory, procedural memory
  - B. episodic memory, semantic memory
  - C. semantic memory, procedural memory
  - D. procedural memory, explicit memory
17. At what stage of learning does retroactive interference affect memory?
- A. Review
  - B. Short-term memory
  - C. Forgetting
  - D. Encoding

Questions 18–22 are based on the following passage.

#### Passage IV

Researchers studying vision use various methods to investigate human perceptual experience. In certain instances the perceptual experience mirrors physiology. Research on spectral sensitivity of the rod and cone visual receptors highlights this relationship.

The following figure depicts the normalized absorbance of various wavelengths of light by each photoreceptor type. There are three types of cones that each respond



Four photoreceptor absorbance curves for each wavelength of light.

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preferentially to specific wavelengths in the electromagnetic spectrum. Rods also preferentially respond to specific wavelengths, overlapping the cone receptors' response frequencies.

18. The three cone pigment curves shown in the figure are generally used to highlight which historical explanation for color vision?
- A. Hering theory of color vision
  - B. opponent-process theory
  - C. Young-Helmholtz theory of color vision
  - D. Gestalt activation theory
19. A 600-nm wavelength of light would excite which types of receptors?
- A. only S cones
  - B. M and L cones
  - C. M and L cones as well as R rods
  - D. none of the above
20. Based on the graph and the trichromatic theory of color vision, which of the following statements is true?
- A. Light observed at 475 nm would most likely be perceived as cyan, and each type of receptor would be stimulated, with rods and red-sensitive (L) cones most stimulated.
  - B. Light observed at 430 nm would most likely be perceived as blue, and each type of receptor would be stimulated, with rods and blue-sensitive (S) cones most stimulated.
  - C. Light observed at 475 nm would most likely be perceived as cyan, and only cones would be stimulated, with blue-sensitive (S) and green-sensitive (M) cones most stimulated.
  - D. Light observed at 430 nm would most likely be perceived as blue, and only cones would be stimulated, with blue-sensitive (S) and red-sensitive (L) cones most stimulated.
21. Which of the following statements is true?
- A. A person lacking rod pigment receptors sensitive to red would most likely have red-green color blindness.
  - B. A person with red-green color blindness would most likely have a disorder resulting in a lack of color perception at the interneuron level.
  - C. A person lacking cone pigment receptors sensitive to blue would most likely have red-green color blindness.
  - D. A person lacking cone pigment receptors sensitive to red or green would most likely have red-green color blindness.

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22. The wavelength of light and the amplitude of light are associated with what features in perception?
- A. Wavelength primarily characterizes color and amplitude primarily characterizes brightness.
  - B. Wavelength primarily characterizes brightness and amplitude primarily characterizes color.
  - C. Both wavelength and amplitude characterize color equally.
  - D. Wavelength characterizes color, but amplitude has no impact on perception.

**This is the end of the Unit I Minitest.**

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## Unit I Minitest Answers and Explanations

1. **The correct answer is B.** According to frequency theory, pitch perception corresponds to the frequency of vibration of the entire basilar membrane in the inner ear. According to place theory, pitch perception corresponds to the vibration of specific locations along the basilar membrane. Frequency theory cannot account for neurons firing over 1000 times per second, so it is associated only with lower-pitched sounds. The volley theory reconciles the two theories by showing that the neurons work together using the functions described in both place and frequency theories to signal pitch.
2. **The correct answer is C.** If a third tempo of 60 bpm was introduced, it would be in between the *slow* tempo condition (43 bpm) and the *fast* tempo condition (75 bpm). According to Weber's law, a proportional difference in the initial/target and comparison tempos would be necessary for a person to detect a difference. Therefore, the magnitude (number of beats per minute) of the change would need to be greater than the *slow* tempo but less than the *fast* tempo.
3. **The correct answer is D.** If this study used a forced-choice signal detection method, responses could be classified into four categories: miss (failing to identify a changed stimulus), false alarm (identifying an unchanged stimulus as changed), correct rejection (identifying an unchanged comparison as the same as the initial/target stimulus), or hit (correctly identifying a comparison stimulus that differs from the initial/target stimulus). As the magnitude of the comparison tempo increased, the greater would be the likelihood that a participant would perceive a change and the greater the chance that he or she would identify the comparison tempo as different from the initial/target tempo.
4. **The correct answer is A.** According to Weber's law, the JND of a stimulus is in a constant proportion to the intensity/size of the initial/target stimulus. Therefore, the JND must be a constant proportion of the initial/target stimulus. While the absolute threshold is a similar concept, that term refers to the minimum intensity/size necessary to perceive the existence of a stimulus and does not indicate the amount of change in an existing stimulus necessary to perceive a difference.
5. **The correct answer is A.** The faster the initial/target tempo, the greater the difference needed for detection between the initial and the comparison stimuli. The slower the initial/target tempo, the smaller the difference needed for detection between the initial and the comparison stimuli. The magnitude of the change necessary to perceive differences increased in proportion to the magnitude of the initial/target stimuli. The proportion of difference necessary is constant because the results were consistent with Weber's law.
6. **The correct answer is A.** The occipital lobe is responsible for processing visual images. Further, research examining line orientation has found that specific neurons selectively fire in response to lines of different orientations. This is also consistent with feature integration theory (bottom-up processing).

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7. **The correct answer is D.** Janet is displaying an understanding of conservation, while Tommy has yet to develop an understanding of conservation. Conservation is characterized by the ability to understand that the amount of a substance within a container remains the same even if the dimensions of the container change. Egocentrism is characterized by difficulty in sharing another person's viewpoint, a problem that is not necessarily represented in the question. Reversibility is not necessary for an understanding of conservation and is associated with a more complex understanding about state changes in objects and numbers. Object permanence is developed earlier, during the sensory motor stage.
  8. **The correct answer is A.** The sensory motor stage is associated with the development of motor coordination and a memory of past events. During this stage, children master the concept of object permanence. Object permanence is characterized by the knowledge that an object continues to exist even when out of view of the child.
  9. **The correct answer is B.** Assimilation is characterized by the ability to absorb new ideas and experiences and to incorporate them into existing mental structures. Accommodation is the process of modifying previously developed mental structures and behaviors and adapting them to new experiences.
  10. **The correct answer is C.** The preoperational stage is characterized by the increased use of mental images and symbols. A key characteristic of the preoperational stage is egocentrism, in which the child is unable to see the world externally. To the child, the world does not exist by itself and only exists to satisfy the child's interests and needs.
  11. **The correct answer is C.** Positive psychology is a growing field that examines positive stress and emotions and how positive psychological processes keep humans mentally healthy and resilient.
  12. **The correct answer is B.** The Schachter–Singer theory of emotion posits that a stimulus triggers an autonomic arousal in the body (sympathetic nervous system), which causes a person to appraise the environmental context, and based on that appraisal, to interpret the emotion. This is the only theory that requires active appraisal of the environmental context, which is critical because the same autonomic experience in a different context may trigger a different emotion to be identified.
  13. **The correct answer is B.** Japanese athletes described fewer self-focused emotions than American athletes. Additionally, Japanese athletes described more self+other-focused emotions than American athletes. However, Japanese athletes described slightly more self-focused emotions than self + other-focused emotions.
  14. **The correct answer is A.** The James–Lange theory posits that a stimulus creates autonomic arousal, causing the individual to identify an emotional state. The Cannon–Bard theory of emotion posits that a physiological arousal can occur without the emotion and that the stimulus simultaneously triggers autonomic arousal by the thalamus and the labeling of the emotion. The Schachter–Singer

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theory posits that stimuli trigger an autonomic arousal in the body, which causes the individual to appraise the environmental context in order to determine the emotional response.

15. **The correct answer is B.** Conducting the experiment on additional groups from different cultures could yield more information about culture-specific differences in populations. A memory recall task and repeated measures of the same group would most likely not reveal any new information. Likewise, measuring arousal would not be very likely to result in new information.
16. **The correct answer is B.** Episodic memory is characterized as the ability to remember and consciously re-experience past events. Semantic memory is characterized by memory of facts.
17. **The correct answer is D.** Interference primarily occurs at the encoding stage of learning information. This is true regardless of whether it is retroactive or proactive interference. In rare circumstances it can also interfere with retrieval.
18. **The correct answer is C.** The Young-Helmholtz theory of color vision posits that color vision depends on three pigment receptors. Each of these receptors has different spectral sensitivities. Light of a particular wavelength activates the pigment receptors to different degrees, and the pattern of activity represents the perceived color. Ewald Hering proposed the opponent-process theory of color vision. This theory posits that color vision is caused by opposing responses generated by blue and yellow wavelengths and by red or green wavelengths (black and white are also sometimes added).
19. **The correct answer is C.** The photo receptors will all respond to the wavelength of light. However, certain wavelengths will result in increased relative activation compared to others. This relative activation results in the perception of color.
20. **The correct answer is B.** The trichromatic (Young-Helmholtz) theory posits that receptors are stimulated within a range of wavelengths. So while they are preferentially stimulated by certain wavelengths, they respond to many. This is true for both rods and cones. Further, the combination of the three cone pigment receptors creates the perceived color.
21. **The correct answer is D.** A person lacking red- or green-sensitive cone pigment receptors would have red-green color blindness. The photoreceptors' stimulation curves overlap substantially, and the lack of either can be classified as red-green color blindness.
22. **The correct answer is A.** Wavelength stimulates the cone receptors. The combination of stimulation from the wave creates the perception of color. The perception of brightness results from the amplitude of the wave. The intensity of the stimulation increases, but the relative activation of the cone receptors stays relatively the same.