SOLUTIONS

COMPARATIVE COGNITION

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1. Which of the following is false about visual adaptations?

   a) Animals that inhabit environments with different patterns of light absorption have evolved different visual sensitivities.
   b) Some guppies are more sensitive to red light while others are more sensitive to blue light.
   c) Nocturnal animals have a much higher proportion of cones than rods.
   d) Animals that have very good binocular vision have a much smaller field of view.

2. Which of the following is true about sensory adaptations?

   a) All snake species respond at higher rates to chemical cues than to visual or thermal cues.
   b) Noctuid moths have ears that provide feedback on wing position and detect sound.
   c) Fruit flies show an increase in eye size that is related to their time in an environment with minimal light.
   d) The stripes on zebras act as insect repellant.

3. According to the sensory drive hypothesis,

   a) sophisticated sensory abilities emerge when there are harsh ecological conditions.
   b) natural selection favors sensory adaptations that maximize the effectiveness of communication in a new environment.
   c) selective pressures reduce sensory traits that are too costly to maintain.
   d) sensory preferences drive particular traits to become selected for.

4. In one experiment, Greylag geese retrieved and attempted to incubate giant artificial eggs, while neglecting their own normal sized eggs. This is an example of

   a) sensory bias.
   b) Sensory exploitation.
   c) maladaptation.
   d) a and b.
5. The period in which experience dependent changes can have profound and enduring effects on development is called the

   a) critical period.
   b) **sensitive period.**
   c) sensory period.
   d) experience-dependent period.

6. Which of the following statements does not fit the compensatory plasticity hypothesis?

   a) A loss or a deficit in one sense leads to a heightened capacity in another.
   b) Once one sense becomes dominant during development, it cannot be reversed.
   c) **Compensatory plasticity provides a mechanism for adaptation across generations.**
   d) None of the above statements fit the hypothesis.

7. How do sensory receptors code for stimulus duration?

   a) **Pattern of firing.**
   b) Rate of firing.
   c) Number of neurons firing.
   d) Duration of firing.

8. What is the simplest way to study discrimination abilities in animals?

   a) Breed and raise animals under different stimulus conditions.
   b) Experimentally manipulate the physical attributes of a sensory stimulus.
   c) **Train animals to make one response when a stimulus is present and another when it is absent.**
   d) Vigilance tasks.

9. What happens between sensation and perception?

   a) **Sensory information is taken apart and then recombined and integrated at relay nuclei.**
   b) Sensory information is filtered by specialized neurons.
   c) Sensory information divided into elements and then reprocessed to produce a perceptual whole.
   d) Sensation and perception happen at the same time.
10. Schneider showed that lesions of the visual cortex rendered golden hamsters unable to discriminate between visual stimuli, but did not impair the ability to turn towards a food reward. How can this be?

a) The hamsters could smell the food.

b) The visual system that identifies the ‘where’ of stimuli was intact in these hamsters.

c) The hamsters’ lateral geniculate nucleus showed compensatory plasticity.

d) Lesions of the visual cortex do not impair a hamsters’ ability to attend to relevant stimuli.

11. Blue jays were better at detecting one type of moth over another if it appeared in successive trials. What does this finding suggest?

a) Blue jays were using selective attention.

b) Blue jays were using sustained attention.

c) Blue jays were forming search images.

d) a and c.

12. The Sensory Drive Hypothesis states: “When populations occupy new habitats with different sensory environments, natural selection favors adaptations that maximize the effectiveness of ______.”

a) foraging.

b) mating.

c) prey detection.

d) communication.

13. What is the biggest indicator of how much of the environment an animal can see at once?

a) Where it’s eyes are located.

b) How big it’s eyes are.

c) How big its pupils are.

d) How big it’s head is.

14. Vision is an example of a

a) feature.

b) dimension.

c) sensory modality.

d) stimulus.
15. Which of the following is the best definition for psychophysics?

a) A branch of psychology concerned with how sensations are translated into mental processes.
b) A branch of psychology concerned with the interaction between the physics of movement (e.g., inertia, momentum) and perception.
c) A branch of psychology concerned with examining psychopaths.
d) A branch of psychology that examines how learning and memory shape perception.

16. What is the primary factor which shapes the types of sensory information that an animal uses to find food or mates and to hide from predators?

a) The size of the animal.
b) How plentiful food, mates, young and predators are.
c) The environment in which they are active.
d) How quickly the animal moves.

17. Many animals have evolved in such a way that it is difficult for them to hide from predators. What is a primary explanation for this paradox?

a) Being visible to predators makes the animals liable to be inadvertently harmed.
b) Being more visible to predators also makes them more visible to potential mates.
c) Animals have to sacrifice mobility to remain hidden.
d) Animals have multiple predators with different sensory abilities.

18. Children who are born with cataracts never fully recover their sight if they are removed after the age of 3. Cataracts that develop and are removed in adulthood have no impact on this vision. This reflects the fact that the visual system has a specific:

a) type of energy that it responds to.
b) peak developmental period.
c) sensitive period.
d) functional period.

19. The loss or deficit in one sense that leads to a heightened capacity in another sense is related to the

a) sensory preference hypothesis.
b) plastic development principle.
c) compensatory plasticity hypothesis.
d) compensatory development principle.
20. _______ are produced when physical stimuli activate receptors which send neural signals to the rest of the CNS. _________ is the interpretation of these signals when the sensory information is processed, organized and filtered.

   a) **Sensations; Perception.**
   b) Sensory Illusions; Sensation.
   c) Sensations; Attention.
   d) Sensations; Sensory Coding

21. The _______ threshold for detecting light that occurs under reduced illumination is called ________________.

   a) raised; dark adaptation.
   b) **lowered; dark adaptation.**
   c) lowered; light adaptation.
   d) raised; light adaptation.

22. The processing of separating and extracting meaningful information from the abundance of sensory cues in the environment is known as

   a) stimulus separation.
   b) sensory processing.
   c) extraction process.
   d) **stimulus filtering.**

23. Which region of the thalamus relays information received from the eyes?

   a) Lateral dorsal nucleus.
   b) medial geniculate nucleus.
   c) Dorsal geniculate nucleus.
   d) **Lateral geniculate nucleus.**

24. Which cortical region might be responsible for assigning motivational values to sensory systems?

   a) **Orbitofrontal Cortex.**
   b) Dorsolateral Prefrontal Cortex.
   c) Anterior Cingulate Cortex.
   d) Ventromedial Prefrontal Cortex.
25. Which theory states that characteristics of a sensory stimulus are coded before they get combined to a whole?

   a) Top-down theory.
   b) Elemental parts theory.
   c) **Feature integration theory.**
   d) Building block theory.

26. Which is the best definition of the term, “sign stimulus”?

   a) **An essential feature of a stimulus that releases a fixed activity pattern (FAP).**
   b) A stimulus that orients the individual in space.
   c) A stimulus that elicits a quick cessation of behavior (like a stop sign).
   d) Any stimulus that delivers information about the intentions of others.

27. The process through which sensory receptors translate physical events into electrical signals is called

   a) **transduction.**
   b) stimulus filtering.
   c) optic flow.
   d) an action potential.

28. The process of separating and extracting meaning information from the myriad of stimuli in our environment is called

   a) **stimulus filtering.**
   b) sensory exploitation.
   c) selective attention.
   d) transduction.

29. The Tinbergen study in which birds tended to artificial oversized eggs while ignoring their own normal sized eggs is an example of

   a) **supernormal stimuli.**
   b) compensatory plasticity hypothesis.
   c) greedy birds.
   d) sensory bias.
30. According to the principal of frequency coding, as the intensity of the physical stimulus increases

   a) the frequency of action potentials increase.
   b) the number of neurons firing increases.
   c) more attention is paid to the stimulus.
   d) information travels along the axon at a faster rate.
1. Define supernormal stimuli and provide an example.

2. In the experiments described in the textbook, how did researchers determine that hamsters could discriminate the scent marks of other hamsters?

3. Explain how eye placement differs in predator and prey animals. What is the adaptive value of these differences?

4. Describe the sensory drive hypothesis and give an example of a trait that demonstrates this principle.

5. Describe sensory bias and explain why it is a paradoxical.

6. Describe, in a step-wise process, how sensory receptors in the eye transmit a signal to the visual cortex.

7. A researcher conducts the following experiment: Participants must look for a red coloured square amongst many red circles. At the same time, participants must respond to a break in a consistent auditory signal. Explain, in terms of attention, what results the experimenter may find regarding the search task and why. How would these results change if the participant were to repeat the same task ten days in a row?

8. According to ethologists, what is a releaser?

9. List and describe the two mechanisms by which the nervous system codes stimulus intensity.

10. Describe the mechanism by which the nervous system codes stimulus duration.

11. Explain what is meant by the statement “perception is not a direct reflection of sensation”. Provide an example of a situation in which perception does not directly reflect sensation.

12. Describe the Weber fraction and explain what function it serves.

13. What is blindsight? What structure of the brain is responsible for blindsight?

14. Describe the compensatory plasticity hypothesis using a specific example.

15. What is optic flow? Why is it important from an evolutionary perspective?
16. Define each of the following: selective attention, divided attention, sustained attention.
1. Recent brain imaging studies have described visual cortex activity in blind individuals during nonvisual activities, such as Braille reading or auditory discrimination (Burton et al. 2000, *Neurophysiology*; Sadato et al. 2002, *Neuroimage*). These findings suggest that a loss of vision does not lead to complete inactivation of the visual cortex, but rather to cross-modal plasticity. Define and describe cross-modal plasticity, then discuss how this phenomenon relates to compensatory plasticity.

2. What most laymen refer to as "multitasking" can better be described as "divided attention". In today's world of cell phones, social networking, and nearly instant access to information, what would be the advantages of an improved ability to divide attention effectively? How might this impact future generations of humans? Is a premium being placed on "multitasking" abilities at the expense of the ability to concentrate for sustained periods? How might this impact educational policies and pedagogical techniques?

3. Create your own animal! Describe the cognitive, sensory, and motor abilities of an animal that will survive into the next few centuries. Base your description on evolutionary principles and on how you expect the environment to change over this time period.

4. The textbook describes two different hypotheses for the evolution of zebra stripes. Is one hypothesis more probable than the other? Why or why not? Select another highly conspicuous trait in a different animal (not discussed in the text) and postulate how this trait provides an evolutionary advantage to that species.

5. Paul Bach-y-Rita was a neuroscientist who created “sensorial substitution” devices whereby he would “convert” one sense to another. For example, he created a tactile-vision device: a chair with a vibrating back used for blind people. The blind person would “scan” a scene using a joystick that moved a camera; electrical signals of the visual image were sent to a computer which converted these to vibrating stimulators on the subject’s back. These “vibrating pixels” allowed the blind individual to experience the space in front of them as 3-dimensional. Use the same principle to design a different sensorial substitution device.

6. The textbook describes a number of examples in which perception is altered by attention. Is it possible to have the reverse? That is, could attention be altered by perception? If so, is this a phenomenon that would be restricted to humans? If not, what other animals may show altered perception based on differences in attentional processes? How might this occur?