

CH. 7. PERCEIVING ENVIRONMENT-ENVIRONMENT RELATIONS - STUDY QUESTIONS

1. To what does the phrase *environment-environment relation* refer?

Introduction

2. From your own experience, give an example of a consistent relation between two environment events, i.e., an *environment-environment relation*.

3. Two types of environment-environment relations are distinguished—*perceptual i* _____ and *perceptual r* _____. How are they similar and how are they different? Can you think of an example of each in addition to those mentioned in the readings?

4. Why is it said that "*perceptual regularities* cannot be the products of reinforcement alone?" Does this mean that reinforcement plays no role in the selection of environment-environment relations?

Perceiving as the Product of Selection Processes

5. How does the example of imprinting illustrate the imprecision with which natural selection may specify environment-environment relations? What does this reveal about the limitations of selection processes in general?

Direct Perceiving

5. What is direct perception, and how does it differ from the constructionist view of perceiving? To illustrate your answer, describe the same perceptual phenomenon from the standpoint of *direct perception* and, then, of *constructionism*. What is the problem that the constructionist view attempts to address?

6. Comment on the following: If the environment contains enough information to tell the "mind" when to construct a complete "percept" from incomplete information, then the environment contains enough information to specify the complete "percept".

Perceiving and Its Relation to Other Biobehavioral Processes

7. Environment-environment relations are sensitive to the correlations between environmental events. What are some of the events that are correlated with the sight of nearby as contrasted with distant objects? In order to accurately specify distance, must the "mind" construct a 3-dimensional "percept" from 2-dimensional information on the retina? Explain your answer.

8. In general, do you think that the selection of environment-behavior and environment-environment relations should occur independently of one another or should their selection be coordinated? Explain your answer.

Perceiving Invariants

9. Why does understanding environment-environment relations have a greater need for analyses at the neural level than the analysis of environment-behavior relations?

10. The neural processes in perceiving t _____ discriminations are considered in this section.

11. The major topics in this section are: the structure of the v_____ system, the s_____ c_____ involved in texture discriminations, and the integration of activity in different s_____ - c_____ needed for the selection of p_____ invariants.

Structure of the Visual System

Reception of visual energy

12. Light energy acts upon p_____ contained in the visual receptors. These compounds are sensitive to wavelengths in the range of _____ - _____ nanometers (nm).

13. From an evolutionary perspective, why might organisms be sensitive to wavelengths in this range?

Major visual pathways

14. Look over **Figure 7.2**. Be able to describe the major structures and pathways in the visual system extending from the receptors to the visual cortex. Sketch your own diagram of these structures and pathways.

15. What is an a_____ - d_____ mechanism, and what role do such mechanisms play in the development of the nervous system? (You will be better able to answer this after reading later sections.)

16. Is there only one sensory channel in the visual system? Indicate some of these channels.

17. Behaviorally, what is *blindsight*? What are some of the possible neural mechanisms responsible for blindsight?

Relation of the retina to the visual cortex

18. Using the correct anatomical terms, indicate the visual pathways activated by stimuli to the left and the right of the point in space upon which the gaze is fixated (see Figure 7.2b).

19. If neural activity initiated by light to the left and right of the fixation point produces activity in different visual cortices, then how is information from a fixated integrated?

20. Rabbits and pigeons have eyes on either side rather than the front of their heads. Would you expect to find extensive connections between the two sides of the visual system in these species? Explain.

Selection of a Sensory Invariant

21. Why might motion play such an important role in the selection of sensory invariants? Use the example described in the readings to illustrate your answer. Describe a comparable example.

Textural Invariants in the Structure of the Light

Observing the structure of light

22. Do two people "looking" at the same object see the same thing? Explain your answer making reference to the study in which eye movements were monitored. (See **Figure 7.3.**) Relate these findings to the earlier work on observing responses.

23. Are humans born with the innate capacity to fixate moving objects? Explain making use of the term s_____ eye movements.

Texture: Spatial frequency analysis

24. Describe one object in your environment that is characterized by relatively frequent variations in light and dark, i.e., relatively high spatial frequencies. Describe one that is characterized by relatively low spatial frequencies. What happens to the spatial frequency if an object moves toward you? Explain.

Interconnections among cells in primary visual cortex

25. Describe the connections between neurons in the lateral geniculate nucleus, cortical neurons on the primary visual cortex, and what the reading refers to as intermediate neurons. (See **Figure 7.4.**) Which neurons are excitatory and which are inhibitory?

Receptive fields of cortical cells

26. Indicate the method whereby visual stimuli are identified that individual cortical cells are most responsive to. Use the terms *receptive field*, *grating*, *electrode*, and *spatial frequency* in your answer.

27. Cortical cells are grouped in clusters. What do cells within a cluster have in common with regard to the visual stimuli to which they respond? How do cells within a cluster differ with respect to the stimuli to which they maximally respond? (See **Figures 7.5** and **7.7.**) How do neurons in other clusters differ with respect to the visual stimuli to which they respond? (See **Figure 7.6.**)

Selection of spatial-frequency clusters

28. Making reference to *lateral inhibitory* interactions, describe generally the processes by which spatial-frequency clusters form.

29. Describe the process whereby an individual cortical cell is able to respond maximally to one spatial frequency rather than another. (See **Figure 7.9.**)

30. How do the results of computer simulations of the formation of spatial-frequency clusters bear on this account? (See **Figure 7.8.**)

31. What does this statement mean: "What we perceive are the objects specified by the spatial frequencies, not the individual frequencies themselves?" Include some reference to the *verbal bias* in your answer.

Illusions

33. Describe the illusion shown in **Figure 7.10** and indicate how it is produced by inhibitory interactions among neurons in the visual system. Use the term *lateral inhibition* in your answer.

34. Why do visual (and other) illusions occur? How do you reconcile the existence of illusions with the idea that selection processes produce adaptation to the demands of the environment?

Contributions of the ancestral and individual environments

35. Indicate a contribution of selection by the ancestral environment to the development of spatial-frequency sensitivity. Indicate a contribution of selection by the individual environment to the development of spatial-frequency sensitivity.

36. What is a possible reason that more cortical cells are sensitive to vertical and horizontal orientations than to oblique orientations of spatial frequencies?

37. Indicate possible reasons why different animals are sensitive to different spatial frequencies, and why human infants are sensitive to different spatial frequencies than adults.

Experimental analysis

38. Describe experimental evidence which indicates that experience affects the spatial frequencies to which organisms are sensitive.

39. Why is it unlikely that the mechanisms by which we distinguish between letters while reading are different from the mechanisms by which other animals distinguish differences between other kinds of visual stimuli?

Selection of a Polysensory Invariant

40. What is the difference between a *sensory invariant* and a *polysensory invariant*? Give an example illustrating a polysensory invariant. Use the term *sensory channel* in your answer.

41. Using the example of the polysensory invariant involving localization of objects in space using light and sound in the owl, describe evidence which demonstrates that both natural selection and selection by the individual environment are required to produce this polysensory invariant.

42. Can the individual environment modify this polysensory invariant throughout the owl's life? Explain using the term *sensitive* or *critical period* in your answer.

Perceiving Regularities

43. What is a polysensory regularity? Illustrate your answer with an example of a polysensory regularity.

Polysensory Regularities

44. In what way is localizing an object in space and localizing one's self in space the same, and in what way are they different?

Place learning

45. What is p_____ l_____? Indicate why localizing oneself in space requires the selection of polysensory regularities.

46. Describe the experimental procedure used for studying place learning in rats. Would this procedure be effective if the tank were located in the middle of a featureless room? Explain.

Configural conditioning, or patterning

47. What is c_____ c_____? Indicate why configural conditioning requires the selection of polysensory regularities.

48. A brain structure called the h_____ plays a crucial role in the selection of polysensory regularities. What evidence from *place learning* and *configural conditioning* supports this statement?

Interpretations of Polysensory Regularities

49. After reading this section up to the heading, *Stimulus-selection network*, describe the process whereby connections to cells in sensory association cortex are thought to strengthen to produce sensitivity to polysensory regularities. (See **Figure 7.13**.) Comment on the relation of this process to the process whereby connections in motor association cortex are selectively strengthened by projections from the *ventral tegmental area*.

50. Indicate how this process might work in the case of localizing oneself in space or in configural conditioning.

Stimulus-selection network

51. Describe the simulation of polysensory regularities by means of a stimulus-selection network. Indicate the relation between the outcome of this simulation and the phenomenon of configural conditioning. (Refer to **Figure 7.14**.)

Relation of the stimulus- and response-selection networks

52. Describe the similarity in the neural mechanism by which connections are strengthened in the stimulus- and response-selection networks. (Use the term neuromodulator in your answer.)

53. What physiological evidence indicates that the selection of connections in the motor association cortex and the sensory association cortex are coordinated? What is the effect of this coordination on the functioning of the learner?

Implications of stimulus selection

Latent learning

54. What is latent learning, and how might the selection of environment-environment relations contribute to this phenomenon?

Equivalence classes

55. How might environment-environment relations contribute to the formation of equivalence classes? Does this possible contribution indicate that equivalence classes are dependent on verbal behavior? Explain.

Perceptual learning

56. Comment on possible contributions of polysensory regularities and environment-behavior relations to the findings on perceptual learning in kittens.

Effects of Environment-Environment Relations

57. Summarize the general relation between the ancestral and individual environments in the selection of perceptual invariants and regularities.

Perceptual Invariants and Regularities Guide Behavior

58. Interpret the behavior of the man who mistook his wife for a hat in terms of the neural mechanisms for the selection of perceptual regularities.

59. Comment on the implications of this case for nature of the neural information that is sent from the primary and association sensory cortices to the motor areas of the brain.

Selectionism and constructionism

60. Constructionists hold that "mental processes" must supplement environmental stimuli for accurate perception to occur. For example, accurate perceptions occur even when stimuli are impoverished--e.g., when the stimuli provided by an object are incomplete or imperfect. Comment on the implications for this view of computer simulations of the functioning of adaptive networks. (See **Figure 7.15.**)

61. Do the results of computer simulation indicate that neural networks always construct accurate "perceptions" when the stimuli are imperfect? What behavioral and neural evidence bears on this point?