DEPTH PERCEPTION

1) Cue theory

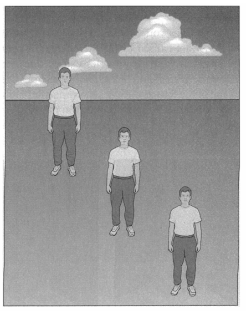

Figure 7.4
Relative height. Other things being equal, objects below the horizon that appear higher in the field of view are seen as being farther away. Objects above the horizon that appear lower in the field of view are seen as being farther away.

a) Oculomotor cues

i) Convergence

ii) Accommodation

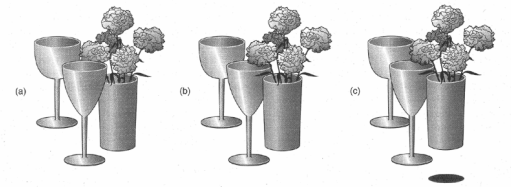

Figure 7.3
(a) Occlusion indicates that the tapered glass is in front of the round glass and vase. (b) Occlusion now indicates that the vase is in front of the tapered glass. However, relative height indicates the opposite. (c) The cast shadow under the vase provides additional information about its position in space, which helps clear up the confusion.

b) Monocular cues

i) Occlusion

ii) Relative vertical position

iii) Shadows

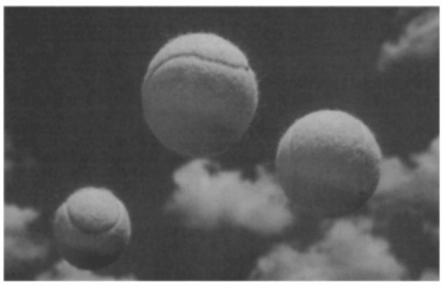

Figure 7.5
We perceive the relative distances of these three tennis balls based on their relative size in the field of view.

iv) Relative size

v) Familiar (template) size

Figure 7.6
Line drawings of the stimuli used in Epstein's (1965) familiar-size experiment. The actual stimuli were photographs that were all the same size as a real quarter.

vi) Atmospheric perception

vii) Texture gradient

viii) Highlight cues

ix) Parallax

x) Deletion/accretion (occlusion)

c) Binocular cues

i) Convergence of eyes

ii) Binocular disparity

(1) Disparity leads to stereopsis

(2) Separation can be done by
(a) Physically separate images presented

(b) Different colored images

(c) Polarization

(3) Computation of depth from disparity

(4) Horopter

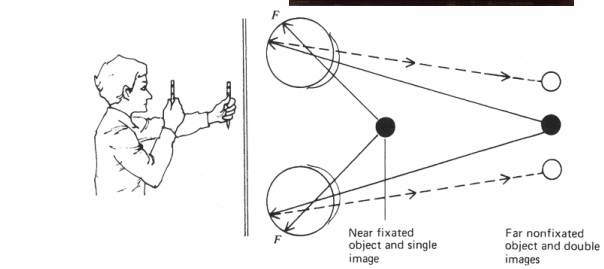

figure 9.22 Double images and binocular disparity. See demonstration below.

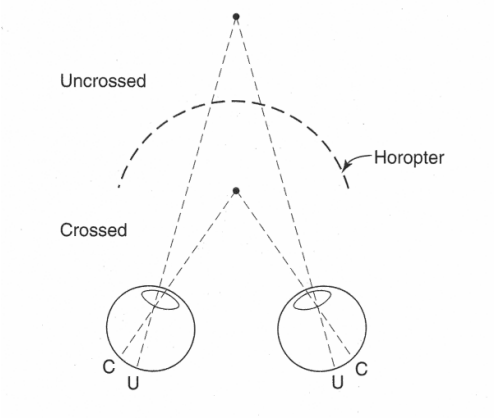

Figure 7.23
Crossed disparity occurs for objects in front of the horopter; uncrossed disparity occurs for objects behind the horopter. Notice how the retinal images move inward, toward the nose, as the object moves farther away.

(5) Random dot stereogram

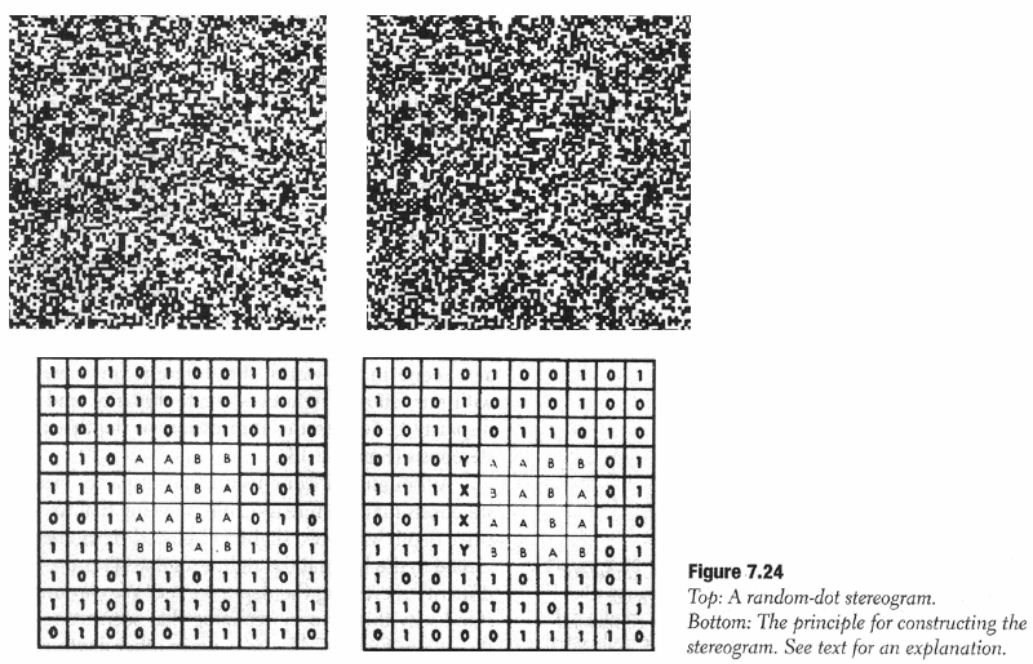

Figure 7.24
Top: A random-dot stereogram.
Bottom: The principle for constructing the stereogram. See text for an explanation.

2) Neural basis of depth perception

a) Disparity detectors in striate cortex (V1)

i) Fixation plane

ii) "nearer" detectors

iii) "farther" detectors

iv) also: present in:
(1) dorsal (where/how) pathway (V2, MT)

(2) ventral (what) pathway

b) Stereoblindness

c) Development of stereopsis

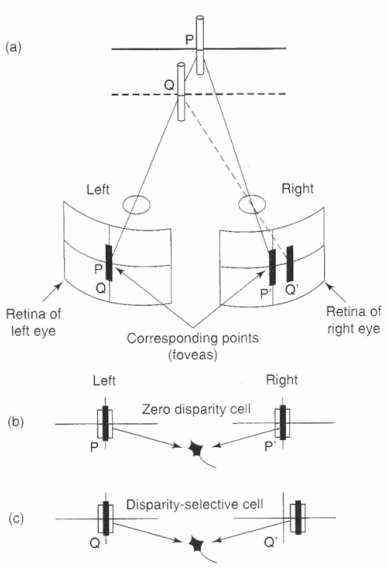

Figure 7.25
(a) The image of P falls on corresponding points since the person is looking at it. The image of Q falls on noncorresponding points. (b) A zero-disparity neuron fires to the images of P, which fall on corresponding points. (c) A disparity-selective neuron responds to the images of Q, on noncorresponding points. This particular neuron is tuned to respond to Q's specific amount of disparity. (From Ohzawa et al., 1996.)

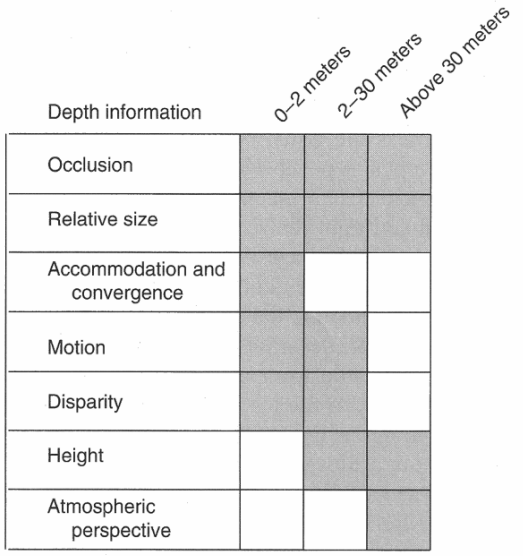

Figure 7.28
Range of effectiveness of different depth cues. Occlusion and relative size work over the entire range of vision, from close up to very far away. Accommodation is effective only at distances less than 2 meters, and atmospheric perspective provides useful depth information only at distances above 30 meters. (Based on Cutting and Vishton, 1995.)

3) Interaction of cues

a) Constructivist approach

b) Gibson's Direct Perception approach

c) One cue vs. another?

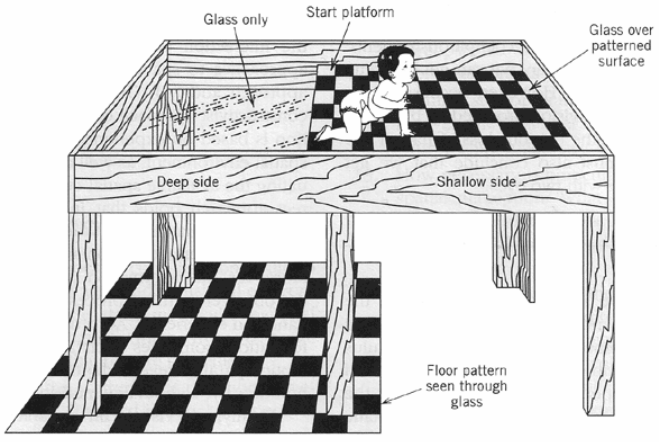

figure 9.28 A drawing of a model of the visual cliff. (*Source:* Based on R. D. Walk, The study of visual depth and distance perception in animals, in D. S. Lehrman, R. A. Hinde, and E. Shaw (Eds.). *Advances in the study of behavior,* New York: Academic Press, 1965, p. 103. Reprinted by permission of the author and the publisher.)