

Vision Science III – Ocular Motility and Binocular Vision

Test 2

(April 19, 2002)

Total points = 47; 1 point each, unless noted otherwise

1. Among the following choices, which shows two factors that both determine the relationship between retinal disparity (η) and linear depth difference (ΔD)?
 - a. Vertex distance and PD
 - b. Viewing distance and PD
 - c. Viewing distance and VA
 - d. None of the above

2. Which of the following depth cues is probably least important to a commercial aircraft pilot who is scanning the sky for other aircraft?
 - a. superposition
 - b. motion parallax
 - c. image size
 - d. stereopsis

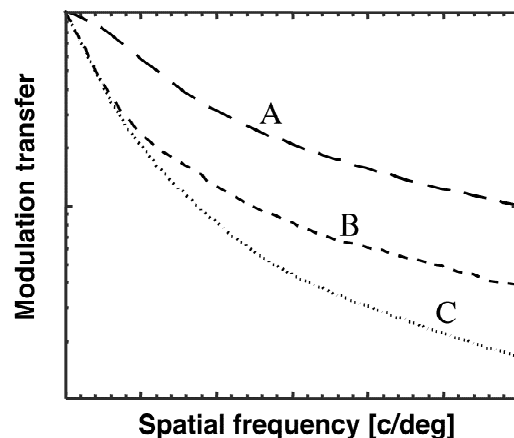
3. When viewing equidistant red and blue objects binocularly, the red ones often appear nearer than the blue ones. This phenomenon can best be explained by
 - a. trichromacy
 - b. monochromatic higher order aberrations
 - c. different retinal disparities for red and blue images
 - d. kinetic depth effect

4. If a person with optic neuritis in the right eye (which causes that eye's image to appear dimmer) views a pendulum that is swinging in the fronto-parallel plane, it will appear to
 - a. come nearer when swinging from left to right and farther on the return swing.
 - b. come nearer when swinging from right to left and farther on the return swing.
 - c. come nearer when swinging in both directions
 - d. slow down when swinging from left to right, but speed up on the return swing.

5. Which of the following is most closely associated with crossed disparity?
 - a. left handedness but right eye dominant
 - b. right handedness and right eye dominant
 - c. an object whose retinal images are located temporal to the foveas
 - d. an object located beyond the fixation point

6. Which of the following slide pairs would stimulate Worth Grade 1 fusion only?
 - a. Slide 1: cat's body with ears but no tail; Slide 2: same cat's body with a tail, but no ears.
 - b. Two nearly identical photos of a traffic jam, taken from a bridge at two slightly different positions
 - c. Slide 1: just a fish; Slide 2: just an empty fish bowl
 - d. None of the above.

7. Which of the following slide pairs would stimulate only Worth Grades 1 and 2 fusion?
- Slide 1: cat's body with ears but no tail; Slide 2: same cat's body with a tail, but no ears.
 - Two nearly identical photos of a traffic jam, taken from a bridge at two slightly different positions
 - Slide 1: just a fish; Slide 2: just an empty fish bowl
 - None of the above.
8. Which of the following slide pairs would stimulate Worth Grades 3 fusion?
- Slide 1: cat's body with ears but no tail; Slide 2: same cat's body with a tail, but no ears.
 - Two nearly identical photos of a traffic jam, taken from a bridge at two slightly different positions
 - Slide 1: just a fish; Slide 2: just an empty fish bowl
 - None of the above.
9. Which of the following would best explain a case in which the binocular threshold is half that of the monocular threshold?
- probability summation but not physiological summation
 - both probability and physiological summation working together
 - neither probability nor physiological summation could be involved
 - Fechner's paradox



10. The three MTF curves above represent optical performance for a patient corrected with contact lenses in three different ways. Curve B most likely represents
- Monocular MTF when the eye is well corrected for distance vision
 - Binocular MTF when both eyes are well corrected for distance vision
 - Binocular MTF for monovision with a + 2.25 D add for the near eye.
11. Assuming Fechner's paradox is present, how should the binocularly perceived brightness of a light change when a medium neutral density filter is placed over the right eye only?
- It will become slightly brighter.
 - It will show no change in perceived brightness.
 - It will decrease to appear equal to that seen by the right eye alone.
 - It will decrease but will be brighter than that seen by the right eye alone.

12. After testing a monovision patient's sensory dominance at far and near, you decide to put the near correction on OD. Which of the following is consistent with this plan?

- a. With the distance Rx in place, the distance binocular visual acuity gets worse when a +1.50 add is placed over OD, rather than OS.
- b. With the distance Rx in place, the distance binocular visual acuity is better when a +1.50 lens is placed over OD rather than OS.
- c. With the near Rx in place, the near binocular visual acuity is better when a -1.50 lens is placed over OD rather than OS.
- d. With the distance Rx in place, a directional dominance indicates that OD is dominant at far.

13. Which of the following is true about utrocular discrimination?

- a. It explains why sensory and directional dominances are opposite in some patients.
- b. It is the basis for interocular transfer of motion after effects.
- c. It enables us to discriminate between crossed and uncrossed disparities.
- d. Carefully designed experiments have shown that it does not exist.

14. Describe a simple way to measure the refraction of each eye under binocular viewing conditions, using only the equipment in a typical exam room at the Pheiffer Optometry Clinic at Hastings hospital. (1)

Slightly blur the eye not being refracted (about +0.75 D sphere above estimated best Rx).

15. Which of the following clinical tests provides the most information about the binocular development of a young pediatric patient?

- a. binocular visual acuity
- b. alternate cover test
- c. stereoacuity test
- d. Park's three step

16. In the Stereo fly test, the wings of the fly appear to be raised 43.0 mm off the page. What is the disparity in arc seconds? Assume PD = 60 mm, viewing distance = 16 inches. (Note: The short disparity equation will have about 10% error for disparities this large. The long disparity equation will have about 20% error since radian measure does approximate the tangent for such large angles. (5)

3581 arc seconds

17. Calculate the linear offset between the two images (wing tips seen by OD and OS) corresponding to your answer above. (2)

7.1 mm

18. Under ideal laboratory conditions, what is the minimum stereoacuity threshold?

- a. 2-10 arc seconds
- b. 2-10 arc minutes
- c. 6-10 arc minutes
- d. 20-40 arc seconds

19. A person with a PD of 64 mm can first tell that an object is closer than the horizon when it is exactly 264 meters away by stereopsis. What is the person's stereoacuity threshold? (1)

50 arc seconds

20. Which of the following lenses would provide the greatest axial magnification and sense of stereoscopic depth when doing fundus biomicroscopy? Choose the best answer.

- a. 90 diopter lens
- b. 78 diopter lens
- c. 60 diopter lens
- d. Axial magnification is the same with all three.



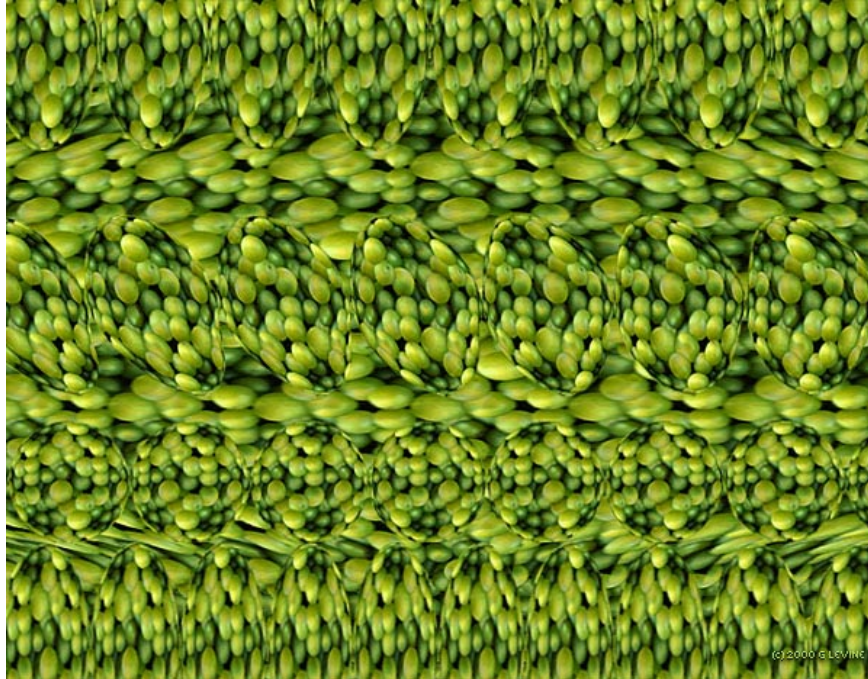
(Free-fusion stereogram from: http://www.colorstereo.com/artists/venus_hd.htm)

21. Explain how the artist, G. Levine, created this free-fusion stereogram of the famous Botticelli painting, *Birth of Venus*. (3)

- Start with the original image.
- Make an exact copy
- Select certain features and shift them in one or the other images to create disparities.

22. List the steps used to create a random dot stereogram that stimulates crossed disparity. (4)

- Generate a pattern of random dots.
- Duplicate the pattern so you have one for each eye.
- On one pattern, cut out a center section and shift it slightly to the right if it's the OS slide or the left if its the OD slide.
- Fill in the remaining uncovered region with random dots.



(Example autostereogram from: http://www.colorstereo.com/2nd-sird/pseudo_sis/graptime.html)

23. List the basic principles involved in creating and seeing stereoscopic depth in an autostereogram. (4)

- a repetitive pattern
- eye converge or diverge one repetitive width
- similar images, but with disparities fall on the right and left retinas
- disparities stimulate stereoscopic depth

24. When looking at an anaglyph stereogram of a natural scene, reversing the red/green glasses does not cause a noticeable depth reversal, as is seen with simple line figures. Why?

- a. Disparities are present only when the red and green lenses are worn over the proper eyes.
- b. The abundance of stereoscopic cues prevents any disparity reversals.
- c. Disparity reversals occur only in random dot stereograms, where no image is visible monocularly.
- d. **The stereopsis will contradict abundant monocular cues so it will be ignored by the brain.**

25. Based on the research of Hofstetter, which we discussed in class, which of the following would be most suitable as a pass/fail criterion for assessing normal stereoacuity?

- a. 20 arc seconds
- b. **40 arc seconds**
- c. 20 arc minutes
- d. 40 arc minutes

26. Using Bagolini lenses to test the relative depth of suppression, you find that OD is suppressed using a 1.5 ND filter, but OS is suppressed using a 1.0 ND filter. What does this tell us about this patient's visual system?

- a. OS is more likely to perceive Fechner's paradox than OD.
- b. OS is more susceptible to suppression.
- c. OS is probably the sensory dominant eye.
- d. They are not capable of Worth grade 3 fusion.

27. If a patient views a wall, parallel to his face, through meridional size lenses that magnify in the 45 degree meridian for OS and the 135 degree meridian for OD, how will the magnification change the appearance of the wall? (2)

The wall will appear larger at the top and seem to tilt away.

28. Explain why we perceive the SILO affect? (6)

- BO prism OU causes the eyes to converge, as if the object were moving closer.
- Image size remains the same, but normally as object move in, their images enlarge.
- Since they don't enlarge, the brain perceives that the object must be shrinking.
- BI prism OU causes the eyes to diverge, as if the object were moving farther away.
- Image size remains the same, but normally, as objects move away, their images shrink.
- Since the image doesn't shrink, the brain perceives that the object must be growing.