

Vision Science III – Binocular Vision Final Examination

Wednesday, May 8, 2002

1. Using a helmet mounted binocular system, a person with a stereo acuity threshold of 40 arc seconds is capable of judging stereoscopic depth out to a distance of 1,030 meters. What is their effective PD in this hyperstereopsis system?
 - a. 0.10 mm
 - b. 50 mm
 - c. 100 mm
 - d. **200 mm**

2. If you measure a person's horopter by the AFPP method (using a Howard-Dolman apparatus) at the abathic distance, the subject will arrange the rods in a ...
 - a. straight line that points directly towards his egocenter
 - b. **straight line parallel to his frontal plane**
 - c. straight line that tilts closer to the dominant eye
 - d. shallow arc that coincides with the Vieth-Müller circle

3. A circle through the two nodal points and the fixation point is known as the ...
 - a. Hering-Hillebrand deviation
 - b. **Vieth-Müller circle**
 - c. Panum's limiting case
 - d. Nonius horopter

4. According to the formula relating geometric disparity (η) with PD, linear offset (ΔD) and viewing distance (D), for a fixed disparity (η) and fixed PD, the interval ΔD is...
 - a. directly proportional to viewing distance, D
 - b. directly proportional to PD
 - c. **directly proportional to the square of the viewing distance, D**
 - d. inversely proportional to the square of the viewing distance, D

5. Which of the following depth cues is probably least important to a commercial pilot scanning the airspace for other approaching aircraft?
 - a. **horizontal disparity**
 - b. motion parallax
 - c. geometric perspective
 - d. aerial perspective

6. Due to chromostereopsis, equidistant red and blue objects may appear to be located at different distances. This illusion would be seen most easily if the person ...
- wears red/green glasses.
 - alternately occludes the eyes at about 1 Hz.
 - views monocularly with the sensory dominant eye.
 - views binocularly.**
7. After watching a faint, small point source in an otherwise unlit room, it may appear to move about. This is known as
- autokinesis**
 - self-motion
 - induced movement
 - kinetic depth effect
8. Which of the following best explains this effect?
- top-down processing
 - shifts in the retinal image caused by involuntary eye movement**
 - Fechner's paradox
 - utricular discrimination
9. If a stationary dot is located in the center of a clearly visible frame and the frame is moved slowly to the right, the dot will appear to ...
- move slowly to the right.
 - shrink and move in.
 - move slowly to the left.**
 - enlarge and move out.
10. If an ND filter is placed before the left eye, a swinging pendulum that is confined to the subject's fronto-parallel plane will appear to swing ...
- slower than its physical motion
 - appear to swing in a counterclockwise elliptical pattern (closer to the subject when swinging left to right)
 - appear to swing in a figure eight pattern centered on the fixation point
 - appear to swing appear to swing in a clockwise elliptical pattern (closer to the subject when swinging right to left)**
11. Stereopsis is ...
- absent in neonates, but appears at about 3 months.**
 - present in neonates, but is inferior to that of adults.
 - present at adult levels in neonates.
 - absent in infants up to about 2 years of age.

12. Visual acuity and contrast sensitivity

- a. are at adult levels at birth
- b. develop slowly during the first 6 months of age and then increase rapidly to adult levels
- c. **develop rapidly during the first 6 months of age and then show a gradual improvement during the next several years**
- d. approach adult levels during early adulthood

13. Pioneering studies by Hubel and Wiesel showed that monocular deprivation ...

- a. produces large changes in retinal ganglion cell densities in the deprived eye.
- b. in young cats produces large changes in LGN ocular dominance.
- c. **in young cats produces large changes in cortical ocular dominance.**
- d. in young cats produced a large reduction in the number of cortical cells

14. Animal studies of monocular deprivation showed that the most severe changes were seen following ...

- a. loss of high spatial frequency input
- b. **deprivation of form information**
- c. reduction in retinal illumination
- d. artificially induced strabismus

15. Surgically induced strabismus in young animals leads to which of the following effects in the primary visual cortex?

- a. an overall shift in ocular dominance to the ipsilateral eye
- b. sensory blindness in the contralateral eye
- c. a preponderance of group 4 cells in Hubel and Wiesel's ocular dominance scheme
- d. **a scarcity of group 4 cells and preponderance of cells in groups 1 and 7**

16. After suffering brain damage, some people find it difficult to recognize and/or orient simple objects that they can easily "see." This phenomenon is best described by the term ...

- a. **agnosia**
- b. past pointing
- c. anisometropia
- d. amblyopia

17. The condition in which the two ocular images are different in size and/or shape is referred to as ...

- a. anisometropia
- b. anisocoria
- c. **aniseikonia**
- d. anisophoria

18. If a patient experiences asthenopia due to dissimilar images sizes, and A-scan ultrasonography indicates that the more myopic eye is significantly longer, Knapp's Law says you should ...

- a. refer the patient to an ophthalmologist.
- b. correct the refractive error with spectacles rather than contact lenses.
- c. correct the refractive error with contact lenses rather than spectacles.
- d. prescribe slab-off prism

19. When tested in the clinic, strabismic amblyopes tend to exhibit which of the following?

- a. reduced threshold for high spatial frequencies.
- b. vernier thresholds in the 2-10 arc second range
- c. anomalous color perception
- d. normal visual acuity and contrast sensitivity in the peripheral ($15^\circ+$ eccentricity) visual field

20. The space eikonometer cannot be used to measure aniseikonia in patients with which of the following conditions?

- a. fixation disparity
- b. suppression
- c. heterophoria
- d. anisometropia

21. A patient exhibits 4 degrees nasal eccentric fixation of the left eye. When a Haidinger's brush test is performed at a distance of 40 cm on the left eye, the patient would be expected to report seeing the bushes located ...

- a. 2.8 cm to the right of the fixation spot
- b. 2.8 cm to the left of the fixation spot
- c. centered on the fixation spot
- d. slightly temporal to the fixation spot

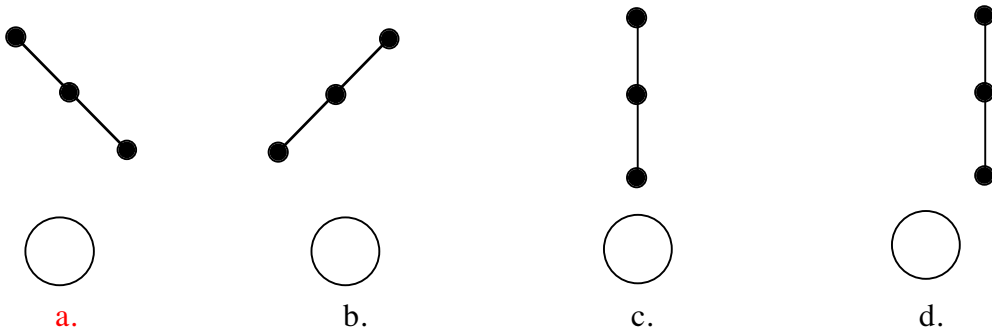
22. When performing the alternate cover test, the patient notices that the chart appears to move down when you shift the patch from the right to the left eye and up when the patch shifts from the left to the right. Which of the following conditions best matches this response?

- a. right hyperphoria
- b. left hyperphoria
- c. right esophoria
- d. right hyper fixation disparity

23. Which of the following is most closely associated with oculocentric visual direction in a person with normal binocular vision?

- a. subjective visual direction
- b. ego center
- c. extraocular muscle proprioception
- d. **local sign**

24. A person with normal binocular vision (and no heterophoria) stares at the middle bead of a Brock String, then closes his right eye. Which of the following best illustrates what he will see? The circle represents the cyclopean eye.



25. If a person with normal binocular vision sees an object that gives rise to crossed disparity, its retinal images will be located ...

- a. on both foveas.
- b. nasal to both foveas.
- c. **temporal to both foveas.**
- d. nasal to the fovea on OD and temporal to the fovea on OS.

26. Which of the following statements about fixation disparity is false?

- a. A higher gain causes a smaller fixation disparity.
- b. **In normal binocular vision, disparity vergence should reduce fixation disparity to zero.**
- c. Disparity vergence is the only vergence stimulated by retinal disparity.
- d. Crossed disparity stimulates positive disparity vergence (disparity convergence).

27. After letting an exophoric patient wear BI prism for fifteen minutes, you remeasure their subjective heterophoria and find that it has not changed. This indicates that ...

- a. the patient has adapted to the prism and might benefit from wearing a BI prescription.
- b. **the patient did not adapt to the prism and might benefit from a BI prescription.**
- c. the patient has adapted to the prism and would not benefit from a BI prescription.
- d. the patient did not adapt to the prism and would not benefit from a BI prescription.

28. If a laboratory technician suffers from eye strain and headaches when using a binocular microscope, and it is caused by excessive proximal convergence and proximal accommodation, you could help them by prescribing ...

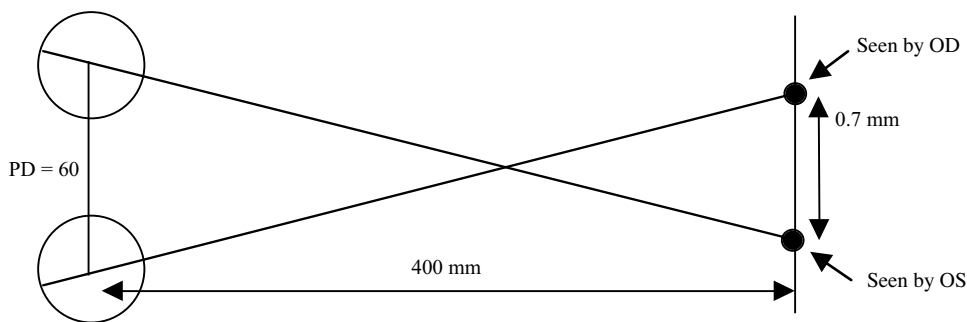
- a. BI prism and plus lenses
- b. BI prism and minus lenses
- c. BO prism and plus lenses
- d. **BO prism and minus lenses**

29. What is the approximate angular width of Panum's area near the fixation point (center of the horopter)?

- a. ~10 arc seconds on either side of the horopter
- b. **~10 arc minutes on either side of the horopter**
- c. ~10 degrees on either side of the horopter
- d. ~10 radians on either side of the horopter

30. The Nonius technique provides the truest estimate of the horopter because it measures the ...

- a. the objective fronto-parallel plane
- b. vernier acuity
- c. proximal and distal limits of stereopsis
- d. **the location of points in space that stimulate zero disparity**



31. In a Sheedy Disparometer-type fixation disparity tester, the line seen by OD is displaced to the left and the line seen by OS is displaced to the right as shown in the figure above. If the distance between the two lines is 0.7 mm, what is the amount and type of fixation disparity?

Assume that the PD = 60 mm and the target is viewed at a distance of 40 cm.

- a. 3 arc minute exo
- b. 3 arc minute eso
- c. 6 arc minute exo
- d. **6 arc minute eso**

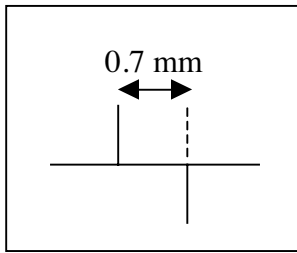
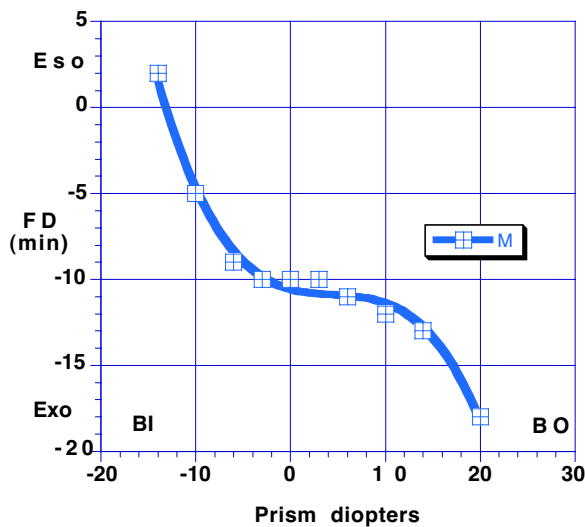


Figure for Question 32

32. Assuming the same PD, viewing distance and offset as in Question 31, but with a Wesson-type fixation disparity tester, what is the amount and direction of the fixation disparity? As shown in the figure above, the patient will see the top line (seen by OD) displaced to the left and the bottom line displace to the right.

- a. 3 arc minute exo
- b. 3 arc minute eso
- c. 6 arc minute exo
- d. 6 arc minute eso



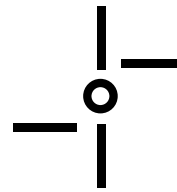
33. Which of the following best describes the fixation disparity plot shown above?

- a. Type I, 12 BI associated phoria, 10 arc min fixation disparity
- b. Type I, 10 BI associated phoria, 12 arc min fixation disparity
- c. Type II, 12 BI associated phoria, 10 arc min fixation disparity
- d. Type III, 10 BI associated phoria, 12 arc min fixation disparity

34. Which of the following symptoms would least likely be caused by a vertical phoria?

- a. Eye strain and headaches when reading
- b. Occasional diplopia
- c. Blurred vision at near
- d. Skipping lines or losing place when reading

von Graefe	BU OS duction	BD OS duction	Assoc. phoria
1 BD OS	2/0	4/2	1/2 BD OS



35. You test a patient with symptoms of a vertical phoria and get the findings listed in the table above. In addition, you decided to show them a vectograph fixation disparity test and the patient sees the right line (seen by OD) displaced upward and the left line (seen by OS) displaced downward, as shown in the figure above. Which of the following is correct?

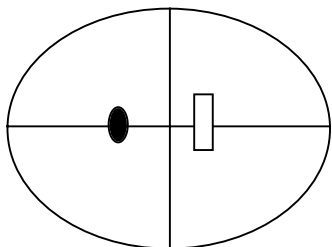
- All the measurements agree, and indicate a left hyperphoria.
- The fixation disparity is in the opposite direction to the other findings.
- All the measurements agree, and indicate a right hyperphoria.
- The associated phoria is in the opposite direction to the fixation disparity.

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

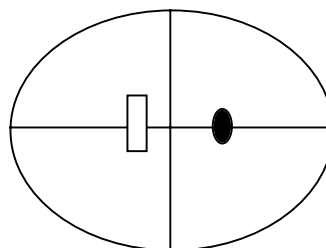
- 2-10 arc seconds
- 20-40 arc seconds
- 2-10 arc minutes
- 20-40 arc minutes

37. According to a study by Hoffstetter, approximately 98% of the population should have a stereoacuity threshold of at least ...

- 10 arc seconds
- 40 arc seconds
- 10 arc minutes
- 40 arc minutes



ft eye receptive field



right eye receptive field

38. A laboratory monkey was trained to fixate on a point 50 cm directly in front of their nose, while scientist recorded from neurons in the visual cortex. The scientist discovered that the monkey had receptive fields for each eye similar to those illustrated in the figure above. The white rectangle shows the location of the receptive field in each visual field; the center of the

cross indicates foveal fixation and the black ovals are the blind spots. Which of the following best describes the cortical neuron?

- a. It must be monocular since it may be stimulated by either the right or left eye, but the two receptive fields are not in corresponding locations (local signs don't match).
- b. It is binocular, but has anomalous correspondence since the local signs of the receptive fields don't match.
- c. **It is binocular and tuned to respond to an object located nearer than 50 cm.**
- d. It is binocular and tuned to respond to an object located farther than 50 cm.

39. Which of the following is not a basic design feature of an autostereogram?

- a. a repetitive pattern
- b. **two identical images, except the center is shifted slightly**
- c. The eyes must over or underconverge slightly.
- d. Slightly dissimilar images are seen by the two eyes.

40. What was the most important principle about binocular vision that Julesz discovered using random dot stereograms?

- a. Objects nearer than fixation stimulate crossed disparity; objects beyond stimulate uncrossed disparity.
- b. First-order neurons in the adult area V1 are monocular; second-order neurons are binocular.
- c. Reversing disparity may not reverse depth perception if strong monocular cues are present.
- d. **Stereopsis is possible even in the absence of a monocularly visible image.**

41. When testing a patient with an eikonometer, the vertical lines appear tilted farther away on the right side, but the cross appears parallel to the fronto-parallel plane. The person has ...

- a. greater horizontal magnification in right eye.
- b. greater vertical magnification in the left eye.
- c. **overall magnification in the right eye.**
- d. overall magnification in the left eye.

42. When testing a patient with an eikonometer, the vertical lines appear tilted farther away on the right side, and the cross also appears tilted farther away on the right side. The person has ...

- a. **greater horizontal magnification in right eye.**
- b. greater vertical magnification in the left eye.
- c. overall magnification in the right eye.
- d. overall magnification in the left eye.

43. When testing a patient with an eikonometer, the vertical lines appear parallel to the fronto-parallel plane, and the cross appears tilted farther away on the right sight side. The person has ...

- a. greater horizontal magnification in right eye.
- b. **greater vertical magnification in the left eye.**
- c. overall magnification in the right eye.
- d. overall magnification in the left eye.

44. How will a wall in front of a patient appear if he has aniseikonia due to the following spectacle Rx?

OD -1.00 -2.00 x 180
OS -3.00 sphere

- a. trapezoid base left and the right side will appear farther away.
- b. trapezoid base right and the left side will appear farther away.
- c. **trapezoid base right and the right side will appear farther away.**
- d. trapezoid base left and the left side will appear farther away.

45. How will a wall in front of a patient appear if he has aniseikonia due to the following spectacle Rx?

OD -2.00 sphere
OS plano -2.00 x 090

- a. trapezoid base left and the right side will appear farther away.
- b. trapezoid base right and the left side will appear farther away.
- c. **trapezoid base right and the right side will appear farther away.**
- d. trapezoid base left and the left side will appear farther away.

46. How will a wall in front of a patient appear if he has aniseikonia due to the following spectacle Rx?

OD -2.00 -3.00 x 045
OS -2.00 -3.00 x 135

- a. trapezoid base up, top side closer
- b. trapezoid base up, bottom side closer
- c. trapezoid base down, bottom side closer
- d. **trapezoid base down, top side closer**

47. A person with a 10 prism diopter right esotropia by the cover test is able to fuse, and subjectively seems to have no strabismus. Which of the following conditions does this patient most likely have?

- a. suppression of one eye
- b. alternating suppression
- c. unharmonious anomalous correspondence
- d. **harmonious anomalous correspondence**

48. A person with a 20 prism diopter right esotropia by the cover test is able to fuse, and subjectively seems to have a 10 prism diopter strabismus. Which of the following conditions does this patient most likely have?

- a. suppression of one eye
- b. alternating suppression
- c. **unharmonious anomalous correspondence**
- d. harmonious anomalous correspondence

49. Which of the following best describes the normal course of stereopsis development in humans?

- a. **rapid development to adult levels between 3 and 6 months of age**
- b. rapid development from birth to about 6 months of age, and slower development afterwards.
- c. gradual development to about 8 months of age, then rapid development to adult levels shortly after age 1
- d. rapid development to age 3 months, then gradual development to about age 3.

50. Which of the following kinds of strabismus is most frequently seen among children about 6 months of age?

- a. **infantile esotropia**
- b. accommodative (refractive) esotropia
- c. intermittent exotropia
- d. constant infantile exotropia

51. Which of the following kinds of strabismus is most frequently seen among children between 3 and 4 years of age?

- a. infantile esotropia
- b. **accommodative (refractive) esotropia**
- c. intermittent exotropia
- d. constant infantile exotropia

52. If a baby is born with a dense cataract, he will have a low probability of developing better than 20/50 visual acuity in that eye unless he has surgery before ...

- a. 3 weeks of age.
- b. 3 months of age.
- c. 1 year of age.
- d. 3 years of age.