PIN _____

Vision Science III - Ocular Motility & Binocular Vision

Examination 3

April 27, 2001

1. Why is sensory dominance, rather than directional dominance, more relevant to monovision contact lens fitting? (1)
a. Sensory dominance supports crossed dominance, which is more relevant for crossed disparity at near.
b. Sensory dominance is more accurate for near vision, but directional dominance is better for distance vision.
c. They both test the same thing, but sensory dominance is easier to test in a clinical setting.
d. Monovision causes monocular blur then retinal rivalry and suppression, both of which are sensory adaptations.

2. Which of the following procedures would help you determine the sensory dominant eye? (1)
a. Have the patient binocularly look through a hole held at arm's length, and center the hole on the doctor's right eye. The doctor will be looking at the dominant eye with his right eye. (1)
b. Hold a +1.50 lens over either eye. The monocular VA is worse when the dominant eye is covered.
c. Hold a +1.50 lens over either eye. The binocular VA is worse when the dominant eye is covered.
d. Hold a +1.50 lens over either eye. The binocular VA is worse when the non-dominant eye is covered.

3. Crossed dominance is when ... (1)
a. the near and far dominant eyes are on opposite sides.
b. the dominant eye and hand are on opposite sides.
c. the sensory and directional dominant eyes are opposite.
d. the right image is seen by the left eye and left image seen by the right eye in physiological diplopia.

4. Which of the following is true about utrocular discrimination? (1)
a. It is the reason that sensory and directional dominances are opposite in some patients.
b. Carefully designed experiments have shown that it does not exists.
c. It enables us to discriminate between crossed and uncrossed disparities.
d. It is the basis for interocular transfer of motion after effects.

5. Among the following, which is the most significant benefit of binocular vision? (1)
a. Absolute depth perception
b. Binocular summation
c. Utrocular discrimination
d. Relative depth perception

6. When testing a patient's stereoacuity with the circles on the Stereo Fly test, the circles appear to come toward you. If you flip the polarized glasses over, they reverse direction. Explain why they appear to come toward you at first, but away from you after flipping the lenses. (3)

> The polarized glasses make the right eye see the left circle and the left eye see the right circle, which leads to crossed disparity. In crossed disparity, objects appears closer. When you flip the glasses the disparities are reversed. The right sees the right one and the left sees the left one. This causes uncrossed disparity and the apparent location beyond the page.

7. The most widely accepted explanation of the moon illusion is based on the assumption that the perceived distance to the moon, when it is near the horizon, is farther than when it is overhead. Explain how monocular depth cues create the illusion that the moon is larger when it's on the horizon. (3)

> This is based on the principle of size constancy, which is also the basis for the SILO effect. When a fixed size object moves further away, its retinal image normally shrinks. The only way the angular size of an object can remain the same when it is further away is if it grows in size. Since the retinal image size of the moon remains the same, but its apparent distance increases, your brain is fooled into perceiving that is has become larger.

8. What stimulates the sense of stereopsis? (1)
a. Motion parallax
b. Retinal disparity
c. Binocular correlation
d. Size constancy

9. While riding down the highway, you gaze out the side window at the forest passing by. If the moon is visible just above the trees, and you are focused on the trees, how will the moon appear to move? (1)
a. It will appear stationary.
b. In the same direction you are traveling
c. In the opposite direction.
d. There is insufficient information to predict how it will appear to move.

10. Under ideal conditions, what is the best stereoacuity threshold? (1)
a. 2-10 arc seconds
b. 10-40 arc seconds
c. 6-10 arc minutes
d. 20-40 arc minutes

11. If an AH-64 Apache helicopter pilot with a PD of 60 mm has a stereoacuity threshold of 80 arc seconds, at what distance can he first judge the relative position of a distant, approaching helicopter using only stereopsis? (2)

about 155 meters

12. Suppose an enemy helicopter launches a missile at the Apache from this distance. At what distance away from the Apache can its pilot first tell that the missile is closer to him than the enemy helicopter, using stereopsis alone? (4)

about 77 meters

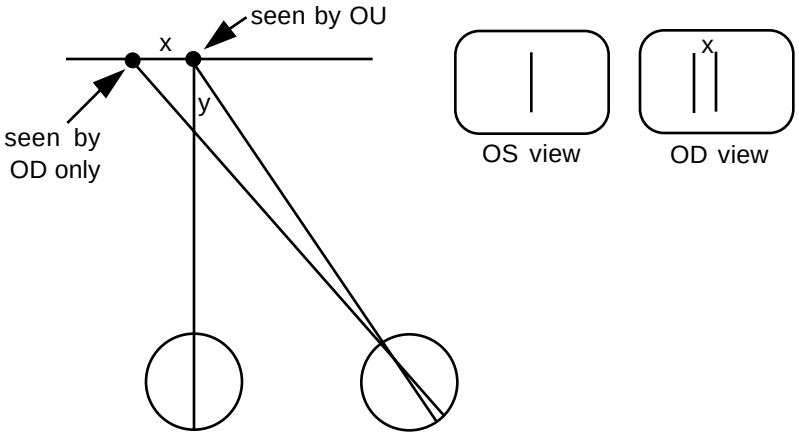
13. (BONUS QUESTION) If the incoming missile is traveling at 1,000 miles per hour, how much reaction time (to the nearest second) does the Apache pilot have, from the time stereopsis tells him the missile is approaching, until impact? (2)

about zero (0.2) seconds

14. Based on the correct results to the above hypothetical scenario, how important is stereoscopic depth perception to a military pilot for evaluating the position of other aircraft? (1)
a. Essentially useless.
b. Important but only within 1,000 meters
c. Indispensable
d. Important, but only for pilots with a PD of 60 mm or less.

15. If the antlers in the Stereo Reindeer test appear to lifted approximately 2.0 cm off the page, how much retinal disparity does this create for a person with a PD of 64 mm? This test is designed for a working distance of 14 inches (35.56 cm). Choose the closest answer. (2)
a. 20 arc seconds
b. 200 arc seconds
c. 2000 arc seconds
d. 20,000 arc seconds

16. Refer to the figure below. Polarizers are used with a flat target that consists of two vectograph lines. OS sees only one line straight ahead, and OD fixates on the right line, but sees another one to the left. This creates a perception of two lines seen in stereoscopic depth—a fixated line and another located at a distance of y closer to the observer. How much must the second line, seen by OD, be offset to the left (distance x to the nearest 0.01 mm), to create a crossed disparity of 20 arc seconds? Assume a PD of 64 mm and a working distance of 40 cm. (3)



y=.25 mm; angle b; x = 0.04 mm

17. The stimulus used in the previous problem is an example of ... (1)
a. hyperstereopsis
b. geometric disparity
c. binocular parallax
d. Panum's limiting case

18. If a person with glaucomatous damage to OD only experiences the Pulfrich effect, how would a pendulum swinging from left to right in his fronto-parallel plane appear to move? (1)
a. Away from the person, or in a clockwise elliptical path if seen from above.
b. Toward the person, or in a counter-clockwise elliptical path if seen from above.
c. In a circle that contains the fixation point and nodal points of both eyes.
d. In the opposite direction, that is, right to left in the fronto-parallel plane.

19. Explain how you could create a pair of free-fusion crossed disparity stereograms on a computer. Assume parallel viewing. (4)

- Draw an object with a background or outline.
- Put another object inside the frame
- Create an exact duplicate of this image
- Shift the inner detail slightly to one side; to the left for the OD image and/or to the right for the OS image.

20. Explain how to create an random dot stereogram that stimulates uncrossed disparity. (4)

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

21. Sometimes a very compelling sense of three-dimensional depth can be elicited from a two-dimensional image because of the motion in the image. This is referred to as ... (1)
a. course motion stereopsis
b. fine static stereopsis
c. motion capture
d. the kinetic depth effect

22. From the pairs of words in each row, circle the retinal image characteristics that would dominate, or tend to suppress the other in a case of binocularly rivalry. (7)

dark	bright
low contrast	high contrast
blurred image	clear image
foveal image	peripheral image
stationary image	moving image
nasal image	temporal image
pattern	homogeneous field

23. In theory, an overall magnification before one eye causes less aniseikonia than a horizontal only magnification before the same eye. Why? (1)

The induced and geometric effects cancel each other out.

24. Describe what features must be included in a pair of dichoptic slides designed to stimulate only Worth Grade 1 fusion. (1)

Two different image with no common features.

25. Describe what features must be included in a pair of dichoptic slides designed to stimulate only Worth Grade 2. (3)

Some common fusible features, but no disparity, and some parts seen by OD and OS only .

26. Describe what features must be included in a pair of dichoptic slides designed to stimulate only Worth Grade 3. (2)

Common fusible features with some disparities that can stimulate stereopsis.

27. What important principle was demonstrated by the random dot stereograms of Julez? (1)
a. Objects located off the horopter stimulate disparate retinal points.
b. Monocular form perception always precedes stereopsis.
c. Monocular form perception is not required for stereopsis.
d. Two identical random dot patterns can stimulate stereopsis.

28. Which of the following may be used to test for suppression? (1)
a. biological motion
b. Bonferroni prisms
c. a Da Vinci stereoscope
d. Bagolini lenses

29. If you suspect that a person is suppressing their right eye, you can test them by quickly moving a 4 base out prism over that eye, while they fixate a near target. If that eye makes a quick convergence movement, you will know that ... (1)
a. they were suppressing the opposite eye.
b. they were suppressing that eye.
c. they were not suppressing that eye.
d. they have a vertical phoria.

30. If an aniseikonia patient has a right axis-90 magnification, what would you expect them to see when looking into a Space Eikonometer? (2)

- The vertical lines and
- cross would be rotated away from the right eye.

31. If an aniseikonia patient has a right axis-180 magnification, what would you expect them to see when looking into a Space Eikonometer? (2)

- The vertical lines would still be straight,
- the cross would be rotated toward the right eye.

32. If an aniseikonia patient has an overall right magnification, what would you expect them to see when looking into a Space Eikonometer? (2)

- The vertical lines would be rotated away from the right eye but
- The cross would not be tilted.

33. Assuming that a patient experiences aniseikonia from using the spectacle Rx below, describe his perception of a rectangular wall in from of them. (2)

OD -2.00 sph
OS plano -2.00 x 090

- Wall tilted toward OS
- Left side smaller (trapezoid base right).

34. Assuming that a patient experiences aniseikonia from using the spectacle Rx below, describe his perception of a rectangular wall in from of them. (2)

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

- Wall tilted closer at top
- Wider at bottom (trapezoid base down).

35. Summarize Knapp's law. (2)

- For an axial anisometropia it should be better to correct in the spectacle plane.
- For a refractive anisometropia, it should be better to correct in the corneal plane.

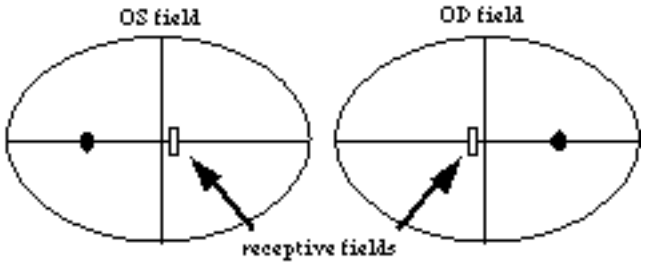
36. List, in sequence, the location of the important synapses along the parvocellular pathway from the ganglion cells to the extra-striate centers. (7)

Foveal ganglion cell, layers 3-6 of LGN, Layer IVC beta of V1, layers II or III of V1 (blob and interblob), V2, V4 and IT.

37. List, in sequence, the location of the important synapses along the magnocellular pathway from the ganglion cells to the extra-striate centers. (7)

Peripheral ganglion cells, layers 1,2 of LGN, Layer IVC alpha of V1, Layer IVB of V1, V2, V3, V5 (MT)

38. A laboratory monkey maintains straight ahead fixation on a point 60 cm away, while you record from a neuron in the visual cortex. The location of the receptive fields for the right and left eye are shown above (both tested at 60 cm). Which answer best describes the neuron? (1)



a. The neuron is a monocular neuron since it is sensitive to a stimulus in either the right or left eye, but they are in non-corresponding locations.
b. The neuron is binocular, but when stimulated by identical objects in each receptive field, the animal should perceive diplopia since the receptive fields are located in non-corresponding retinal locations.
c.The neuron is binocular and specifically tuned to detect an object in space with a certain amount of crossed disparity.
d.The neuron is binocular and specifically tuned to detect an object in space with a certain amount of uncrossed disparity.
e. The response shown in the figure cannot be correct since it is impossible for a single neuron to have receptive fields in non-corresponding locations.

39. According to Held's two stage model of binocular development, which of the following statements does NOT correctly describe normal binocular development in the visual cortex? (1)
a. Neurons in layer II and III of V1 that are destined to become the first truly binocular neurons receive mixed inputs at birth, but they must eventually receive two inputs with distinct right and left eye data.
b. At birth there is considerable overlap of afferents from the LGN in the primary visual cortex, but over the next several months, the first-order neurons change to become dominated by either the right or left eye input.
c. At birth, neurons in V1 layer IVC may be considered binocular in a primitive way, but with maturity these neurons become monocular.
d. At birth layer IVC of the primary visual cortex is clearly delineated into right and left ocular dominance columns, but as the system matures, afferents from the LGN increasingly overlap, thereby allowing development of binocular neurons at this level.