Exercises for Three-Dimensional Vision

Find and download the following paper and try to answer the questions that follow. Note that you are not expected to be able to read the whole paper in the time available!

DeAngelis, D. C. (2000). Seeing in three dimensions: The neurophysiology of stereopsis. *Trends in Cognitive Sciences*, Vol. 4, No. 3, pp. 80-90.

1. Define what is meant by stereopsis and binocular disparity.

2. What is the *horopter* and how does it relate to the Vieth-Müller circle?

3. Briefly describe the 4 classes of disparity-selective neurons identified by Poggio and his colleagues.

4. Why are near cells also called "crossed disparity" cells?

5. What is MST? Briefly describe what it does. (Consult Wikipedia!)

6. Suppose an observer is looking straight ahead and fixating on a point 5m away. Estimate the occular disparity of another point whose depth is 1 m in front of the fixation point. Assume the interocular separation is 6.5 cm.

7. What gives rise to vertical disparity?

8. Describe the locus of points with zero vertical disparity.

9. If you know the x and y angles of a point, the interocular separation, I, and the vertical disparity, v, write down a formula that gives you the viewing distance, D, of the point.

10. Briefly describe the *position difference* and *phase difference* models of disparity encoding. Which of the two models is best supported by experimental evidence on the size-disparity correlation?

11. What is the earliest brain area in the visual pathway at which disparity encoding could occur?

12. What is the earliest brain area in the visual pathway for which there is evidence for encoding of relative disparity?

13. Explain what is meant by the terms "topographic map" and "columnar architecture".

14. Explain why horizontal disparity alone is not enough to be able to compute the viewing distance of an object. What additional information is required to calculate egocentric distance?