9.35 Spring 2024 – practice questions for Midterm 4

As with the previous set of practice questions, I have included some questions that are more in the style of the midterms we are using this year. Expect a similar format as Midterm 3.

There are also some shorter questions that are shorter than what we will feature on the midterm, but which cover the topics that will be on the midterm.

Explain the aperture problem that results from local motion signals from edges, and its relation to constraint lines in velocity space. Explain how motion signals from multiple edges of an object can be combined to help overcome the aperture problem. What rule specifies how they should be combined? Explain in terms of velocity space. Describe two pieces of evidence that the integration of motion signals is influenced by whether the signals are likely to be due to the same object.

In "biological motion", patterns of dot motion are sometimes interpreted as coherently moving organisms (e.g. a person walking). Consider two candidate perceptual interpretations: that of a person walking, and that of individual dots wiggling around. People typically will see the first interpretation when the display is right side up, and the second when the display is upside down. Please compare the two interpretations in each of the two display conditions (right side up and upside down) in terms of the prior and likelihood.

Explain the intersection of constraints algorithm with a velocity-space diagram.

What is a plaid stimulus, and how was it used to illuminate the analysis of image motion in the visual system?

Explain the aperture problem.

Describe one piece of evidence that amodal completion influences motion integration.

Give one explanation for why patterns presented at low contrast are perceived to move more slowly than when they are presented at high contrast.

Why don't we see the world move when we move our eyes? Describe a relevant piece of evidence for your explanation.

Describe experimental evidence that humans use optic flow to maintain their balance.

What is one difference between the responses of neurons in area MT and MST?

Describe how shading can be used to estimate shape. What assumptions must be made about illumination and reflectance?

Describe two examples where the visual system requires local but not global consistency in its interpretations. What do these examples suggest about vision?

What is Emmert's Law? Describe one instance where it can explain illusions of size or depth.

What geometric fact underlies linear perspective?

What does the hollow face illusion reveal about the perception of motion and the perception of depth?

What are the tradeoffs in having eyes positioned at the front of the head vs. the sides of the head?

Explain the cue used to recover depth from stereopsis.

What is the horopter?

What did the random dot stereogram reveal about where stereopsis occurs in the visual system?

Under what conditions do we experience binocular rivalry?

What is luster, and when do we experience it?

What is different about objects within vs. outside of Panum's fusional area? Why don't you notice this difference in everyday life?
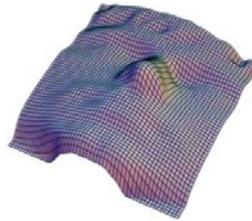
What causes amblyopia?

The image in (a) looks like a three-dimensional face, but could also be explained by the shape shown in (b), if the illumination direction lines up with the shape in exactly the right way. Explain why we see the shape interpretation in (c) rather than the interpretation in (b), in Bayesian terms. Your explanation can use equations or words, or both.

(a)

(b)   (c)

Explain representational similarity analysis, and how it has been used to compare the representations of objects across species and between biological organisms and computational models. What drives much of the structure evident in representational dissimilarity matrices measured from inferotemporal cortex?

What does it mean for a representation to make object identity explicit? Where in the visual system is object identity believed to be made explicit? Describe experimental evidence in support of your answer.

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9.35 Perception
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