9.35 Spring 2023 – practice questions for Midterm 3

Most of these questions are shorter than what we will feature on the midterm, but cover the topics that will be on the midterm. The questions on the midterm will similar in style to those on Midterms 1 and 2.

Note that we might repeat one or two questions from Midterm 2.

Suppose there are two lights, A and B, that are metameric. Define what it means for the two lights to be metameric. Suppose a third light C is added to each of lights A and B. Are these two new lights also metameric? Explain why or why not, in terms of the linear algebra of color transduction. Now suppose we show lights A and B to an organism that has four cone types, each with a distinct spectral sensitivity function. Could A and B be metameric for this organism? Could they not be metameric? Explain your answer.

Discuss evidence that the visual system contains spatial frequency channels. Include in your answer:
-the contrast sensitivity function (draw a graph of what it looks like – label the axes)
-the effects of adapting to a sine wave grating of a particular frequency
-evidence for whether the spatial frequency channels are cortically mediated or not

What is lightness? Why is lightness perception ill-posed? Explain the difference between the explanations offered by Hering and Helmholtz for lightness illusions. Which of them was right?

Describe the sense in which the retina is set up "backwards", the physiological adaptations that enable high-resolution vision despite the backward arrangement, and the relationship to the blind spot. Why do we not normally notice our blind spot?

Discuss the differences between rods and cones, the conditions in which we are dependent on each of them for vision, the properties of "rod vision" and "cone vision", and the link between these properties and the physiology of the retina.

Explain how one computes a spike-triggered average, and describe what it is typically used to measure.

What are the consequences of lesions to the parvocellular and magnocellular layers of the LGN?

Describe how the left and right hemifields (the parts of the visual field to the left and right of fixation, respectively) are represented in the retina, LGN, and visual cortex.

What effect does the dense sampling at the fovea have on the cortical representation of visual space?

Explain how a population code for orientation could enable the estimation of orientation independent of the contrast of an edge.

Describe the Lincoln illusion, and explain what we learn from it.

What are Marr's three levels of analysis for information processing tasks? Describe an aspect of perceptual grouping in terms of two of the levels (you can choose which two).

What is the difference between modal and amodal completion?

Draw an example of relatable and nonrelatable contours.

Where in the visual system do neurons respond to illusory contours? Draw the two key stimulus conditions used to demonstrate these responses.

Name two cues that determine what is seen as figure vs. ground.

What is border ownership, and where in the visual system does it seem to be coded?

What does it mean for a surface to be Lambertian?

Draw a diagram of a Reichardt detector. What is it supposed to detect?

9.35 Perception
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