COGS 101A, Fall 2014
Midterm 1 Study Guide

Our midterm will focus on the material introduced in lecture. The exam will feature a variety of multiple-choice, fill-in-the-blank and short answer questions. It is designed to be completed within roughly 40 minutes or less.

The best way to prepare is to review the lecture slides, read the relevant chapters from the book, and acquaint yourself with the questions in the TED quizzes (solutions are available online). The TED quizzes will give you a good idea of the formulation of the questions. To test your understanding, think of how you could change the questions to arrive at a different answer. Below, we provide some of the key concepts and terms to know for the exam. Note: you want to know the definition of the terms and the larger context in which they fit (i.e. how they are used).

In general, look at the iClicker questions and  symbol for clues on what will be on the exam.

Standard disclaimer: This is not a complete list. It is merely intended to give you an idea of what types of things you are expected to know.

Lecture 2

- Know the stages of the **perceptual process diagram** and how they relate to each other. Where do **proximal** and **distal** stimuli fit in? Why is this distinction important?
- Be able to explain how perception is an **active process**. How is this different than a passive view?
- Understand the role **measurement** plays in empirical studies. What are we interested in and what is actually being measured?
- **Marr's levels of analysis**: understand their purpose, how they differ, and how information from each level can inform (or constrain) explanations at other levels. Be able to *give an example* of methods or explanations fitting each level.

Lectures 3 & 4

- Understand the **psychophysical methods** covered in lecture (both qualitative and quantitative), and when they should be used.
- Know the differences in the methods of **threshold detection** (method of limits, method of adjustment, method of constant stimuli, and adaptive staircase).
- Understand how to measure the **difference threshold** (called DL or JND) & the meaning of Weber's law.
- Know how to evaluate **magnitude estimation** (i.e. understand response expansion and compression, & Steven's power law).
- Understand how **reaction time** is used as a measure in visual search paradigms.

Lecture 5

- Know the path of light and *functional anatomy* from **cornea** to **retina**. (For example, be able to identify and explain the function of the cornea and lens in **accommodation**, the basic function of the **pupillary reflex**, etc.).
- What is the problem of an inverted retina and how is it overcome?

- Be familiar with the failure modes and diseases of the eye (e.g. **presbyopia, myopia, hyperopia, macular degeneration, retinitis pigmentosa, glaucoma, detached retina)**. How are they caused and what are some possible treatments?
- How can we use our knowledge of functional anatomy in product design?

Lecture 6

- Understand the process of visual light **transduction** and how **isomerization** takes place.
- Know the functional differences between rods and cones (e.g. How many are there and where are they concentrated?).
- Understand the **dark adaptation** process for both rods and cones. Know what is happening at the **rod-cone break** and how we get the **Purkinje shift**. Be aware of the role of pigment regeneration.

Lecture 7

- Know what is meant by **primary sensory areas** and where they are located.
- Be able to describe the **neuron doctrine** and the **doctrine of specific nerve energies** in the context of **sensory modularity**.
- Understand how neurons propagate signals via **action potentials** and how we measure this activity.
- Be especially clear on how **IPSPs** and **EPSPs** can influence the firing rate of target neurons. This becomes critical for the formation of **receptive fields**.

Lecture 8

- Review the models of neural **convergence** and understand how these lead to different levels of **acuity** vs. **sensitivity** in circuits of cones and rods.
- Be familiar with **lateral inhibition** and the formation of receptive fields. Know how to explain phenomena like the Hermann grid, Mach Bands, and simultaneous contrast.

Lecture 9

- Be very familiar with the way neural convergence patterns form basic center-surround **receptive fields** in the retina.
- Understand the relationship of **visual fields** for each eye to the path retinal ganglion cell axons take to layers of **lateral geniculate nucleus** (LGN). Know the basic organization and function of LGN (e.g. What information is kept separated and how?).
- Understand the concept of **retinotopic mapping** and where it exists.
- Know the receptive field properties of neurons in retina, LGN, and V1. Understand the role **hierarchical** neural convergence plays in producing the functions of feature detectors (i.e. **simple**, **complex** and **end-stopped cells)** in V1.
- Be able to describe the process of **selective adaptation** in a feature detector and how this is used experimentally.
- Understand how **cortical magnification** affects acuity in a specific area of the retina.

Lecture 10

- Know the difference between **additive** and **subtractive color mixing**.

- Understand how **color matching experiments** were used to support **trichromatic color theory**.
- Be familiar with the different **absorption spectra** of cone pigments and how different combinations of activity can produce **metamers**.
- Know what **afterimages** are and how they are used to support the **opponent-process theory** of color vision.
- Know the different **deficits in color vision**.