

Long Answer Questions (choose 2 of the 4 to answer, and there is one required question at the end). Note: the target length for each response is 1 page.

Question 1: Inductive Biases and Learning/Generalization. Mitchell (1980) explains the role that inductive biases play in abstract learning systems. Using about 1/2 a page, describe the basic intuition behind his argument about the importance of inductive biases. In your explanation be sure to provide a definition of what an “inductive bias” actually is. At a high-level, explain possible ways in which a neural, biological system might implement an “inductive bias.” Mitchell’s discussion comes from computational learning theory, however, it applies much more broadly. In the final part of your response, take two distinct examples from any point in our class (anything we’ve covered this semester) and discuss what the patterns of learning or generalization reveal about the inductive bias of human or animal learners.

Question 2: Multiple Systems in Category Learning. Throughout the semester, a central theme that there are multiple forms of learning and that these might be supported by distinct learning systems in the brain. This was true in the first part of the semester for both classical and instrumental conditioning. In this question, describe the evidence which supports the multiple systems view of categorization. What are the “multiple systems” of categorization? In particular, review three results from the category learning literature that support a distinction between multiple forms of representation or learning. Your response should draw from both behavioral results, cross species findings, and cognitive neuroscience results (imaging, patient data, etc...). This question is more about the specific empirical evidence that supports such distinctions than about the “why” (i.e., hold off for the final, required question for your opinions on the “why”).

Question 3: Episodic Memory. Since the time of H.M., research on episodic memory has focused intensely on the critical role of the hippocampus in forming and consolidating new episodic (cognitive) memories. Be sure to define episodic memory and, using this definition, describe how the hippocampus is thought to accomplish this task - from mechanisms supported by distinct hippocampal subregions as well as synaptic forms of plasticity, describe the transformation of a given input into a memory. Be sure to describe how temporal and spatial context may be coded and integrated into each new memory.

Required Question: Multiple forms of learning... why have them? One of the major themes of the course has been that apparently similar learning behaviors can arise from distinct underlying processes, such as goal directed and habitual instrumental behaviors or rule based and exemplar-based categorization. Using any or all of these examples, discuss why the brain might employ such apparently duplicative and fractious techniques. Isn't there a single best way to solve these problems? In your answer, address why fractionation might arise at each of Marr's levels of analysis.