ComS 610as: Developmental Robotics
Take-home Midterm

Out: Tuesday, October 25
Due: Tuesday, November 1

Choose four of the following five questions and answer them.

1. What is an affordance anyway? Try to give your own definition. Why do you think affordances are a hot topic in robotics these days?

2. List all possible affordances of a stick that you can think of. Try to make this list as long as possible.

3. What is the link between exploratory behaviors and affordances? Suppose that two robots have a non-overlapping set of exploratory behaviors which they use to explore a specific object. Will these robots "understand" the object in the same way?

4. Explain why some researchers (e.g., Visalberghi and Trinca (1989)) make a distinction between the ability of some animals to use tools and their ability to understand the functional properties of the same tools. Can this distinction be made for humans as well?

5. The learning and development of many animals and humans is driven by their curiosity (i.e., their internal drive to explore). Describe what role curiosity should play in developmental robotics. Sketch the main learning loop of a curious robot.

Choose two of the following three questions and answer them.

6. In the paper "What memory is for" Glenberg introduces the concept of "meshing." First, give your own interpretation of this concept. Second, relate this concept to Hawkins' theory. What differences and/or similarities do you see between the two? Finally, describe how meshing can be implemented on a robot.

7. Two of the longest standing open problems is AI are the so called "frame problem" and the "symbol grounding" problem. These problems have been shown to be very hard, if not unsolvable, from the point of view of a human programmer who is encoding the "brain" of an AI system or a robot. Try to reformulate these problems from the point of view of a robot that is using exploratory behaviors to learn about the world. Do these problems become any easier?

8. Gibson argued that children first learn the affordances of objects and only then do they learn their properties/features/qualities. During subsequent developmental stages, however, children can guess the affordances of objects by observing their features only. This allows them, among other things, to select the right tool for a task. Describe how a robot can learn that sticks with hooks are good for pulling things. In other words, how would you solve the shape to affordances mapping problem.