

Computing as Done in Brains and Machines
CLPS 0050A
MWF 10:00-10:50, Metcalf 105

James Anderson

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Both brains and computers compute, but in very different ways. This seminar will discuss the software and hardware of brains and computers as well as the interactions between them, past, present, and future. We will discuss the fascinating intellectual history connecting the two and suggest why these two computing devices have such trouble dealing with each other.

The seminar will provide an introduction to the way brains are organized, the way computers are organized, and why they are good at different things. We will also talk about our current research, specifically the Ersatz Brain Project, our attempt to design hardware and software for "a first-class second-class brain." At a minimum, this seminar will provide some exposure to important ideas in neuroscience, cognitive science, and perhaps computer science.

The instructor of this course is James Anderson, James_Anderson@brown.edu. I can be reached on the telephone (Anderson X32195) as well as physically (Anderson Room 236). Course conference hour is Wednesday at 11, Metcalf 236. I will be available at times other than conference hours but if I am busy I will say so firmly.

Possible Course Topics

1. Brains, minds, eschatology and the Singularity. Real or hype or delusion.
2. How silicon computers work, a little bit.
3. Historical anecdotes and philosophical digressions.
4. Biological background. Brief discussion of neuron function and brain organization.
5. Formal models for the neuron. McCulloch-Pitts, connectionist.
6. *Limulus*: a simple invertebrate visual system.
7. A little biology of learning: Focus on the Hebb synapse.
8. Association, psychology, Western culture, Hebb synapses.
9. Doing better with practice: Error correction algorithms.
10. Very brief superficial discussion of non-linear dynamical systems and attractor networks.
11. Cerebral cortex and cortical data representations.
12. Concepts, ambiguity and disambiguation.
13. Semantic networks.
14. Cognitive applications: Arithmetic, vision.
15. The Ersatz Brain Project: Building a brain from silicon.

Text: *An Introduction to Neural Networks*, James A. Anderson, MIT Press.

Requirements: Several problem sets will be assigned during the term. Students will be asked to write a term paper on a topic of their choice.