

COGS184: Modeling the Evolution of Cognition

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Winter 2010 - Section ID #669659

Tuesday, Thursday 3:30p - 4:50p -- Warren Lecture Hall 2113



Mathematical and computational modeling of the evolution and mechanisms of simple cognitive functions. Theoretical background, including topics in population genetics, behavioral ecology, evolutionary game theory, dynamical systems theory, genetic algorithms and neural networks will be applied to questions concerning the evolution of behavioral strategies, the relation between evolution and learning, and the evolution of cooperation, communication and other aspects of social behavior.

The central text for this course will be **The Major Transitions in Evolution** by John Maynard Smith and Eörs Szathmáry (Oxford University Press, 1995). Now almost 15 years old, but "This was a seminal publication that continues to contribute to ongoing issues in evolutionary biology." ([Wikipedia](#).) Much of the class will be concerned with updating themes from Smith&Szathmáry with new data from molecular biology. We will also make use of two more recent, widely known books: **Guns, Germs & Steel** by Jared Diamond (W. W. Norton, 1997); and **The Botany of Desire** by Michael Pollan (Random House, 2001). These two books should be considered highly recommended (and are pretty easily available second hand). Additional readings will also be assigned.

The catalog description for this class says "Prerequisites: programming ability, calculus, and consent of instructor." With respect to programming, we will be building and using (Python and/or Java) computational models to explore these issues, and familiarity with one of these languages will be important.

The class grade will be based on a series of related programming assignments, an essay, and a final project.

A [list of our primary topics](#) and (tentative!) [schedule](#) of how the lectures, readings and assignments will lay out over the quarter are also available.

If you think you might be interested, feel free to send email to rik AT cogsci DOT ucsd DOT edu . Better yet, register for the class, and you will be able to [start chatting](#) with us about what we should discuss.

Lecture schedule

Lectures, readings, assignments

Date	Day	N	<u>Topic#</u>	Topic	S&S	Assignments	Assmt Due
5 Jan	Tu	1	2	Introduction	1, 4.1-4.3		
7 Jan	Th	2	3	Modeling		SimpleGA	20 Jan
12 Jan	Tu	3					
14 Jan	Th	4	4.2	Evolutionary computation			
19 Jan	Tu	5	5	Eukaryotes		Recombination	1 Feb
21 Jan	Th	6	6				
26 Jan	Tu	7	7	EvoDevo; multicellularity; gene regulation	12-15	Project proposal	8 Feb
28 Jan	Th	8					
2 Feb	Tu	9				Essay	15 Feb
4 Feb	Th	10	8	Behavioral ecology			
9 Feb	Tu	11					
11 Feb	Th	12	9	Evolution & learning			
16 Feb	Tu	13			12-15	OptOutPD	1 Mar
18 Feb	Th	14	10	Eusocial species	16		
23 Feb	Tu	15	11	Game theory			
25 Feb	Th	16	11.1	Prisoner's Dilemma			
2 Mar	Tu	17				Project	15 Mar
4 Mar	Th	18	12	Getting modern	17		
9 Mar	Tu	19					
11 Mar	Th	20		Conclusions			

Main topics

A list of the primary topics we will be discussing.

Over the course of the quarter, we will be walking through the following topics, in approximately this order. Please use the topic numbers, preceded by a hashmark (e.g., "#8.2" to refer to the topic of Optimal Foraging Theory) in your posts, to provide a common set of tokens to pull our discussions on the same together.

1 Meta

2 Intro

3 Modeling

4 Evolution

4.1 Self-replication

4.2 Evolutionary computation

5 Eukaryotes

6 Evol of sex

7 Maturation

8 Behavioral ecology

8.1 Lotka-Volterra

8.2 Optimal foraging theory

8.3 Lizard / insect foraging

9 Evolution & learning

9.1 Evolving neural networks

9.2 Modeling the Baldwin Effect

10 Eusocial species

11 Games

11.1 Game theory

11.2 Prisoners Dilemma

12 Getting to modern humans

12.1 Mammals

12.2 Primates

12.3 Language