

## **Preliminary Course Information for Psychology W2250y. Evolution of Cognition. Spring 2007**

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**I. Course description**, as it will appear in the Bulletin:

### **PSYC W2250y. Evolution of Cognition**

3 pts. H. Terrace. TR 10:35-11:50 Room 614 Schermerhorn Hall

Prerequisite: PSYC 1001 or 1010 or the instructor's permission.

A systematic review of different forms of cognition as viewed in the context of the theory of evolution. Specific topics include the application of the theory of evolution to behavior, associative learning, biological constraints on learning, methods for studying the cognitive abilities of animals, levels of representation, ecological influences on cognition, and evidence of consciousness in animals.

**II. The rationale for giving the course**, its role in the overall curriculum, and its relationship to any specific departmental major, degree program, specialization, or concentration.

Interest in the evolution of cognition has increased dramatically during the last 10 years. New automated techniques for studying animal cognition, discoveries by neuroscientists about the animal brain and the application of the theory of evolution to psychology have motivated many experiments and much theory about the phylogenetic development of cognition. There are presently no courses in the psychology curriculum that focus on the evolution of cognition. The two most relevant courses are seminars (W3420: Animal cognition and W3450: The evolution of consciousness and intelligence). W3420 covers the difference between behavioral and cognitive approaches to the study of animal behavior. The main focus of W3450 is the evolution of language and theory of mind.

PSYC W2250 will fulfill the following degree requirements:

- For the Psychology major or concentration in the College and in G. S., for the Psychology minor in Engineering, and for the Psychology Post-bac, PSYC W2250 will meet the Group I (Perception and Cognition) distribution requirement.
- For the Neuroscience and Behavior joint major, PSYC W2250 will meet the fourth Psychology requirement: *“One additional 2000 or 3000 level psychology course from a list approved by the Psychology Departmental advisor to the program.”*
- For the science requirements of the College and G. S., PSYC W2250 will count as a single term of the requirement, provided that students who do not have the designated prerequisite obtain instructor permission. Typically, students will have taken PSYC W1001 or 1010 prior to PSYC W2250, and will thereby have fulfilled two terms of the science requirement.

We will cap enrollment at 95.

### **III. A full description of the content of the course**

Research on animal cognition during the latter half of the 20th century has shown that traditional models of behavior are too weak to explain animal intelligence. The exclusive focus of such models on various types of conditioned reflexes constrains their ability to account for the complexities of animal memory or the structure of animal concepts -- to cite but two widely studied examples of animal cognition. The goal of this seminar is to characterize discoveries about the cognitive abilities of animals in the perspective of evolutionary theory and contemporary views of human cognition.

After reviewing recent research on animal cognition, the seminar will consider precursors of human cognition, in particular, cognitive processes that do not require linguistic ability. A related topic is the difference between human language and systems of communication that are available to animals. Those differences pose the basic themes of the seminar, how do animals think without language and what properties of mind give rise to language? To answer that question we will consider theories that have attempted to characterize the difference between conscious and unconscious thought and the role of unconscious cognitive processes in both humans and animals.

### **IV. Course Requirements**

Students will be given three exams in class, each covering one third of the material. Students will also write a 10 page essay based on a take home exam that will be due one week after the last day of class. Grades will be computed as follows: in class exams: 25% each; take home final exam: 25%.

## V. Seminar Topics (with tentative readings for the first five weeks)

### Week 1. Historical Background

- Three basic principles of evolution
- The theory of evolution as applied to behavior
- Comparative psychology
- From the anecdotal method to behaviorism
- Romanes, Loeb, Thorndike, Pavlov, Watson, Skinner
- Dominance of behaviorism during first half of 20th century in both animal and human psychology
- Functional and structural approaches in psychology
- Examples of behavioral (as opposed to structural) evolution
- The selfish gene
- The concept of fitness

#### Reading Assignments

- Dewsbury, D. A. (1989). Comparative Psychology, ethology, and animal behavior. *Annual Review Psychology*, 40, 581-602.
- Plotkin, H., *Evolution in Mind: An Introduction to Evolutionary Psychology*. 1997, Cambridge: Harvard University Press. 276.
- Romanes, G., *Mental Evolution in Animals*. 1884, New York: AMS Press, Inc.
- Shettleworth, S.J., *Varieties of learning and memory in animals*. *Journal of Experimental Psychology: Animal Behavior Processes*, 1993. 19: p. 5-14.

### Week 2. Ethology

- Sensory world of animals
- Taxes and kineses
- Properties of instinctive behavior
- Appetitive vs. consummatory behavior

#### Reading Assignments

- Gould, J.L., *Ethology: The Mechanisms and Evolution of Behavior*. 1982, New York, NY: W. W. Norton & Company. Chapter 1, pp. 1-67.
- Griffin, D.R., *Prospects for a cognitive ethology*. *The Behavioral and Brain Sciences*, 1978. 4: p. 527-538.
- Kamil, A.C., *On the proper definition of cognitive ethology*, in *Animal cognition in nature: the convergence of psychology and biology in laboratory and field*, R.P. Balda, I.M. Pepperberg, and A.C. Kamil, Editors. 1998, Academic Press: San Diego.

### Week 3. Pavlov and classical conditioning

- Definition of classical conditioning
- Voluntary vs. involuntary behavior
- Acquisition, extinction and spontaneous recovery
- Generalization and discrimination learning
- Higher order conditioning

#### Reading Assignments

- Rescorla, R.A. and A.R. Wagner, *A theory of Pavlovian conditioning: Variations in the effectiveness of reinforcement*, in *Classical Conditioning II: Current Research and Theory*, A.H. Black and W.F. Prokasy, Editors. 1972, Appleton-Century-Crofts: New York, NY.
- Terrace, H.S., *Classical conditioning*, in *The Study of Behavior*, J.A. Nevin, Editor. 1973, Scott Foresman: New York, NY.

### Week 4. Skinner and operant conditioning

- Law of effect
- Contingencies of reinforcement
- Discriminative stimuli
- Two- and three-term contingencies
- Schedules of reinforcement
- Verbal behavior

#### Reading Assignments

- Domjan, M. and B. Burkhard, *Principles Of Learning and Behavior*. 1998, Monterey, CA: Brooks/Cole Publishing Co. Chapter 5, pp. 124-158.
- Skinner, B.F., *Science and Human Behavior*. 1953, New York, NY: Macmillan. Chapter 5, pp. 59-90.

### Week 5. Animal memory

- Hunter's definition of representations
- How might a behaviorist deal with animal memory?
- Matching-to-sample, delayed matching to sample
- Directed forgetting
- Anterograde and retrograde amnesia
- Serially organized behavior

#### Reading Assignments

- Medin, D.L., *The comparative study of memory*. *Journal of Human Evolution*, 1974. **3**: p. 455-463.
- Roitblat, H.L., *The meaning of representation in animal memory*. *The Behavioral and Brain Sciences*, 1982. **5**(3): p. 353-406.
- Sherry, D.F. and D.L. Schacter, *The Evolution of Multiple Memory Systems*. *Psychological Review*, 1987. **94**(4): p. 439-454

- Terrace, H.S., *The simultaneous chain: A new approach to serial learning*. Trends in Cognitive Science, 2005. **9**: p. 202-210.

## **Weeks 6 - 13**

### **Concept formation**

- Relationship to discrimination learning
- Training concepts in animals
- Exemplar and prototype theories of concept formation

### **Imitation**

- Definitions
- Alternative explanations of imitative behavior
- Motor imitation
- Cognitive imitation

### **Animal communication**

- Insects
- Birds
- Dolphins and whales
- Primate communication

### **Can an animal learn language?**

- Definition of language
- Ape language experiments
- Experiments with dolphins

### **Social cognition**

- Dennett's intentional stance
- What are intentions?
- What is intentionality?
- Machiavellian minds
- Theory of mind
- Non-verbal tests for theory of mind

### **Infant cognition**

- Non-verbal tests of intelligence
- Non-verbal intentional communication

### **Innate abilities**

- Theories of the development of consciousness
- Definitions of consciousness and unconsciousness
- Role of socialization
- Intersubjective communication
- Contribution of joint attention