
The Representation and Acquisition of Concepts
Psychology 747, Section 3836 - Fall 2000
Room 115 Psychology
Meeting Time: Tuesday-Thursday, 2:30-3:45 (until further notice)

Instructors

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Course Description

This graduate seminar will explore issues in concept learning and representation. Topics in cognitive psychology, computational and mathematical modeling, cognitive neuroscience, and artificial intelligence that relate to conceptual structure will be covered. Among other topics, we will discuss exemplar models of categorization, neural networks for concept learning, neurologically-induced individual differences in categorization, novice and expert categorization, latent semantic analysis, case-based reasoning approaches to concept learning, and clustering models. For a full set of topics covered, consult the references below.

The three principal obligations of seminar participants will be to lead one of the fourteen class discussions, read the weekly assignment, and to actively participate in all class discussions. To facilitate the last two obligations, participants are required to prepare a one-page written reaction to the weekly readings.

Leading a Seminar

The purpose of the seminar leader is two-fold - to review the fundamental points of the readings, and to generate and direct active discussion. You should prepare about 25 minutes of instructional monologue. Overhead transparencies and handouts are encouraged. You may assume that everybody has read the material, but you may want to explain aspects of the paper that other students could have difficulty understanding. Do not attempt to cover all of the material in detail. Rather, select a handful of points that seem to be of fundamental importance. Consider time to be a precious resource; do not waste it on digressions. Two ingredients of a successfully run seminar are that the leader focuses his or her comments on critical themes in the material, and opens up discussion so that the seminar participants are actively involved.

Reaction Pages

Late reaction pages will not be accepted (the point of the reaction page is to have participants think about their reaction before the seminar). You will submit your reaction pages using the web-based Annotate system developed by Indiana University's cognitive science program. This system is accessed at:

http://www.psych.indiana.edu/annotate

Annotate has been designed so that students can read each other's reactions, add their comments to the reaction, comment on other students' comments, etc. The professors will also make comments that can be read by all students, and assign grades that can be read by only the receiving student. Reaction pages will be coarsely graded (check minus = unacceptable, check = acceptable, and check plus = outstanding). The most common grade is "check," and do not be surprised if most of your reactions are not rated as "outstanding." We reserve this grade for truly noteworthy and insightful contributions. Given the occasionally overwhelming pressures on students, participants are exempted from preparing reaction pages for three seminars of their choice (so, you should prepare 10 reaction pages).

The purpose of the weekly reaction page requirement is for seminar participants to develop particular perspectives on their readings. As E. M. Forester said, "How can I know what I think until I see what I say [write]?" The act of writing forces thoughts to be more precise and organized than they would otherwise be. The assignment is purposefully open-ended. Appropriate topics for reaction pages may be suggested, but most often, you will be left to select for yourself an interesting topic that relates to the readings in some way.

Once again, space should be considered a scarce resource. You should try to be refine your thoughts such that they can be concisely expressed on a single page. The most successful reaction pages focus on a single topic. Resist the temptation to write a few sentences each on four topics.

What are appropriate topics for reaction pages? You may develop an experiment that is inspired by one of the readings. Describe the experiment briefly, explain how it bears on relevant theories, and make predictions on the results. You may disagree with a particular claim. Explain why the claim is wrong, and why it is important that it is wrong. You may agree with a claim. Describe extensions to the claim, possible applications, formal models that capture the essence of the claim, or future directions for research. You may have nothing to say about a particular article. If so, explain why the article is not relevant to fundamental issues of concept learning or representation. Discuss the assumptions of the article, and why you find them inappropriate. Generally speaking, organizing your reaction page around a claim rather than a question stimulates more interest.

Grading

Grades will be based on the quality of reaction pages, seminar leading, and seminar participation. To get a good participation evaluation, it is not necessary to make many comments. Rare but thoughtful comments suffice.

Weekly readings
Papers are listed in the order you should read them

Week of 8/28: Introductions, overview of readings, class policies .
8/31: 2:30-3:45, Tutorial on computation on memory arrays

Estes, W. K. (1986). Array models for category learning. Cognitive Psychology, 18, 500-549.

Estes, W. K. (1993). Models of categorization and category learning. In G. V. Nakamura, R. Taraban, & D. L. Medin (Eds.) The psychology of learning and motivation: Categorization by humans and machines. San Diego: Academic Press. (pp. 15-56).

Week of 9/4: Overview of Categorization Research

Medin, D.L. (1989). Concepts and conceptual structure. American Psychologist, 44, 1469-1481.

Week of 9/11: Exemplar Models of Categorization I

Estes, W. K. (1994). Classification and Context. New York: Oxford University Press. **Chapters 1, 2, and 3**

Week of 9/18: Exemplar Models of Categorization II

Medin, D. L., & Schaffer, M. M. (1978). A context theory of classification learning. Psychological Review, 85, 207-238

Nosofsky, R. M. (1984). Choice, similarity, and the context theory of classification. Journal of Experimental Psychology: Learning, Memory, and Cognition, 10, 104-114.

Week 9/25: Rules & Similarity

Sloman, S. A. (1996). The empirical case for two systems of reasoning. Psychological Bulletin, 119, 3-22.

Nosofsky, R. M., Palmeri, T. J., & McKinley, S. K. (1994). Rule-plus-exception model of classification learning, Psychological Review, 101, 53-79.

Week of 10/2: Neural Network Models I: Supervised Learning

McClelland, J. L., & Rumelhart, D. E. (1986). A distributed model of human learning and memory. In J. L. McClelland & D. E. Rumelhart (Eds.) Parallel distributed processing: Explorations in the microstructure of cognition (Vol. 2). Cambridge, MA: MIT Press.

Week of 10/9: Neural Network Models II: Unsupervised Learning

Rumelhart, D. E., & Zipser, D. (1985). Feature discovery by competitive learning. Cognitive Science, 9, 75-112.

Week of 10/16: The Neuropsychology of Categorization I

Knowlton, B. J., & Squire, L. R. (1994). The information acquired during artificial grammar learning. Journal of Experimental Psychology: Learning, Memory, and Cognition, 20, 79-91.

Knowlton, B. J., & Squire, L. R. (1993). The learning of categories: Parallel brain systems for item memory and category knowledge. Science, 262, 1747-1749.

Knowlton, B. J., Squire, L. R., & Gluck, M. (1994). Probabilistic classification learning in amnesia. Learning and Memory, 1, 106-120.

Week of 10/23: The Neuropsychology of Categorization II

Nosofsky, R. M., & Zaki, S. R. (1998). Dissociations between categorization and recognition in amnesic and normal individuals: An exemplar-based interpretation. Psychological Science, 9, 247-255.

Kolodny, J. A. (1994). Memory processes in classification learning: An investigation of amnesic performance in categorization of dot patterns and artistic styles. Psychological Science, 5, 164-169.

Week 11/6: Categorization and Expertise

Tanaka, J.W., & Taylor, M. (1991). Object categories and expertise: Is the basic level in the eye of the beholder? Cognitive Psychology, 23, 457-482.

Gauthier, I., Skudlarski, P., Gore, J. C., & Anderson, A. W. (2000). Expertise for cars and birds recruits brain areas involved in face recognition. Nature Neuroscience, 3, 191-197.

Week 11/13: Artificial Intelligence Approaches to Categorization I

Bareiss, R. & Slator, B. M. (1993). The evolution of a case-based computational approach to knowledge, representation, classification, and learning. In G. V. Nakamura, R. Taraban, & D. L. Medin (Eds.) The psychology of learning and motivation: Categorization by humans and machines. San Diego: Academic Press. (pp. 157-186).

Week 11/20: Artificial Intelligence Appraches to Categorization II

Fisher,D., & Park-Yoo, J. (1993). Categorization, concept learning, and problem-solving: A unifying view. In G. V. Nakamura, R. Taraban, & D. L. Medin (Eds.) The psychology of learning and motivation: Categorization by humans and machines. San Diego: Academic Press. (pp. 219-255).

Anderson, J.R. (1991). The adaptive nature of human categorization. Psychological Review. 98, 408-429.

Week 11/27: Concept Learning by Detecting Relations Among Words in Large Corpora

Landauer, T. K., & Dumais, S. T. (1997). A solution to Plato's problem: The Latent Semantic Analysis theory of the acquisition, induction, and representation of knowledge. Psychological Review, 104, 211-240.

Week of 12/4: Wrap-up