Psychology 501
Proseminar in Cognitive Psychology
Emory University
Fall 1997

Time and Location

Tuesdays and Thursdays, 10:00-11:15
Psychology 302

Instructors

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Overview

This course aims to provide graduate students with exposure to state-of-the art research in cognitive psychology. To accomplish this, we will read and discuss articles across the major areas of the field, including high-level perception, categorization, attention, working memory, long-term memory, knowledge, language, thought, and socio-cultural cognition. The specific readings are listed in the course schedule. Besides covering behavioral research, the readings also cover research in computational modeling and neuroscience, given how central these areas have become to cognitive psychology. Two meetings provide tutorial lectures on computational models and neuroscience. In the remaining meetings, we will follow a seminar format, where students will present brief summaries of papers, followed by open discussion. To frame the readings for a given meeting, an instructor will provide brief background, and any needed tutorials, at the end of the previous meeting.

The readings by no means cover all current research in the field—no course could come close to accomplishing this. Instead, the readings aim to give students a sense of what the major issues are, and how researchers currently address them. Besides providing examples of research in the major areas, the readings illustrate the diversity of research across the field.

By focusing on state-of-the-art research, we assume that most students have already had an introductory course in cognitive psychology as an undergraduate. Students who have not had such a course are encouraged to enroll, but they may want to obtain a text on cognitive psychology and read relevant background material prior to each meeting. The instructors will be glad to provide guidance with such materials (the readings for the first meeting constitute several possibilities).

For each set of readings, the course schedule provides some of the central issues facing research in the respective area. These issues may motivate the research, be answered by the research, or remain unanswered. Students are to think about these issues and be prepared to discuss them at the relevant meetings.

Besides structuring the discussion meetings, these issues serve the additional purpose of structuring the exams. After each third of the course, students will receive a take-home exam containing six questions. These questions will either be drawn from the original issues in the course schedule, or they will be derived from them, typically taking more specific forms. Students will have 24 hours to prepare **typed** responses. The second and third exams are not cumulative, only addressing issues from their respective thirds of the course.

A final can be taken, either if students aren't satisfied with the final grade they have earned after the third exam, or if they need to make up an earlier exam (no other make-up exams will be offered). If a student has not missed an earlier exam, the final is optional, but if a student elected not to take an earlier exam, the final constitutes a make up for that exam (this can only be done for one previous exam). The final will include six questions. If a student is *not* making up an exam, the optional final will include two questions from each third of the course. Higher grades on final questions can be used to replace lower grades on questions from earlier exams *in the same third of the course*, thereby raising the student's overall grade. If a student is making up an exam, all questions on the final will be from the respective third of the course, and will only be used to replace scores for the missing exam. Final questions may include questions asked on previous exams, as well as questions not asked. A student can only make up one earlier exam, not two or three. Under extenuating circumstances, such as illness or family matters, flexibility in make-up exams and the final exam are possible.

A paper is not required. The course can be taken for a grade or pass-fail. Regular attendance and presentation of articles will be factored into grading.

Course Schedule

Week 1

9/2: Orientation Meeting

Readings

Each of the following three books provides a good introduction to cognitive psychology, as well as relevant background material.

Gardner, H. (1987). *The mind's new science: A history of the cognitive revolution* (3-45). New York: Basic Books.

Anderson, J.R. (1995). *Cognitive psychology and its implications* (4th Ed., 1-35).

Medin, D.L., & Ross, B.H. (1996). *Cognitive psychology* (2nd Ed., 1-52).

Issues

What's scientific about cognitive psychology?

What are the methods of cognitive psychology?

What are the historical origins of cognitive psychology?

Under the rubrics of cognitive science and neursocience, how is cognitive psychology related to other disciplines?

9/4: High-Level Perception: Features in Vision

Readings

Mishkin, M., Ungerleider, L.G., & Macko, K. A. (1983). Object vision and spatial vision: Two cortical pathways. *Trends in Neurosciences, 6,* 414-417.

Goodale, M. A., & Milner, A. D. (1994). Separate visual pathways for perception and action. In H. Gutfreund & G. Toulouse (Eds.), *Biology and computation: A physicist's choice. Advanced series in neuroscience* (Vol. 3, 606-611). Singapore: World Scientific Publishing Co.

Biederman, I. (1987). Recognition-by-components: A theory of human image understanding. *Psychological Review, 94,* 115-147. [read only 115-129]

Schyns, P.G., Goldstone, R.L., & Thibaut, J.P. (in press). The development of features in object concepts. *Behavioral and Brain Sciences*.

Issues

What are the primitive features that underlie visual processing?

Why is it important to identify the critical features in a perceptual modality, and what methods can be used to do so?

Is it possible to ever identify a complete set of primitive features in a modality?

What does a theory of features have to accomplish and explain minimally?

How is function related to neuroanatomical segregation in the domain of visual perception?

Week 2

9/9: High-Level Perception: Organization and Top-Down Processing in Speech

Readings

Bregman, A. S. (1990). *Auditory scene analysis: The perceptual organization of sound* (Ch. 1, 1-44). Cambridge, MA: MIT Press.

Peterson, M. A., & Gibson, B. S. (1994). Must figure-ground organization precede object recognition? *Psychological Science, 5*, 253-259.

Samuel, A. G. (1997). Lexical activation produces potent phonemic percepts. *Cognitive Psychology, 32*, 97-127.

Issues

Why might evolution have endowed the human cognitive system with mechanisms of perceptual organization?

How do sensory mechanisms and top-down organizational mechanisms work together to produce a perception?

How is organization of the auditory world similar to and different from organization of the visual world?

9/11: Tutorial on Connectionism

Readings

Kosslyn, S.M., & Koenig, O. (1992). *Wet mind* (Ch. 2, 17-51). New York: The Free Press.

Anderson, J.A. (in press). Seven times seven is about 50: Learning arithmetic with a neural network. In S. Sternberg (Ed.), *Invitation to cognitive* science, *(Vol. 4)*. Cambridge, MA: MIT Press.

Bechtel, W. (1988). Connectionism and the philosophy of mind: An overview. *The Southern Journal of Philosophy, 26*, 17-41.

Cummins, R., & Schwarz, G. (1988). Radical connectionism. *The Southern Journal of Philosophy, 26*, 43-65.

Issues

What is new and significant about connectionism as a theoretical tool?

What impact has connectionism had on research in the cognitive sciences and neurosciences?

To what extent are connectionist models faithful to neural mechanisms? To what extent are they idealizations? To what extent are they misconstruals? How important is this issue and why?

Week 3

9/16: Categorization: Top-Down Processing

Readings

McClelland, J.L., & Rumelhart, D.E. (1981). An interactive activation model of context effects in letter perception: Part 1. An account of basic findings. *Psychological Review, 88,* 375-407.

Palmer, S.E. (1975). The effects of contextual scenes on the identification of objects. *Memory & Cognition, 3,* 519-526.

Miller, J.L., & Volaitis, L.E. (1989). Effect of speaking rate on the perceptual structure of a phonetic category. *Perception and Psychophysics, 46,* 505-512.

Issues

What mechanisms underlie top-down processing?

What useful purposes does top-down processing play in cognition, and how can it lead to problems?

Why is bottom-up processing alone insufficient for intelligent cognition?

Why is connectionism a good approach to explaining the integration of bottom-up and top-down processing?

9/18: Categorization: Exemplars

Readings

Nosofsky, R.M. (1992). Exemplar-based approach to relating categorization, identification, and recognition. In F.G. Ashby (Ed.), Mu*ltidimensional models of perception and cognition* (363-393). Hillsdale, NJ: Lawrence Erlbaum Associates.

Allen, S.W., & Brooks, L.R. (1991). Specializing the operation of an explicit rule. *Journal of Experimental Psychology: General, 120,* 3-19.

Issues

What are the advantages and disadvantages of using exemplars for categorization?

What functional or evolutionary significance might the implementation of exemplars in categorization have?

What are the alternatives to using exemplars for categorization? What are the advantages and disadvantages of these alternative approaches?

Week 4

9/23: Tutorial on Neuroscience

Readings

Crick, F. (1994). *The astonishing hypothesis: The scientific search for the soul* (Chs. 7 (81-90), 9 (107-119), 12 (161-175). New York : Scribner.

Kosslyn, S. (1994). *Image and brain: The resolution of the imagery debate* (Ch. 2, 25-51). Cambridge, MA: MIT Press.

Churchland, P. S. (1996). Toward a neurobiology of the mind. In R. Llinas & P.S. Churchland, *The mind-brain continuum: Sensory processes* (281-303). Cambridge, MA: MIT Press.

Issues

What is gained by localizing a cognitive mechanism in a neural substrate? How can neuroanatomy constrain the components of cognitive models?

What are some of the problems and limitations associated with neural measurement?

How can cognitive science benefit from neuroscience, and how can neuroscience benefit from cognitive science?

Is function the best guide to identifying the important regions of the brain and their interconnections? Why or why not?

9/25: Attention: Selectivity

Readings

Posner, M. I. (1995). Attention in cognitive neuroscience: An overview. In M.S. Gazzaniga (Ed.), *The cognitive neurosciences* (615-624). Cambridge, MA: MIT Press.

Treisman, A. (1993). The perception of features and objects. In A. Baddeley & L. Weiskrantz (Eds.), *Attention: selection, awareness, and control: A tribute to Donald Broadbent* (5-35). Oxford: Clarendon Press.

Issues

How do neuroscience data constrain theories of attention and selection?

How does research on selective attention illustrate the interplay between cognitive science and neuroscience?

Why is selective attention important in an intelligent system?

What roles might selective attention play in categorization?

Week 5

9/30: Attention: Automaticity

Readings

Logan, G.D. (1988). Toward an instance theory of automatization. *Psychological Review, 95*, 492-527.

Cohen, J.D., Dunbar, K., & McClelland, J.L. (1990). On the control of automatic processes: A parallel distributed processing account of the Stroop effect. *Psychological Review, 97*, 332-361.

Issues

What are similarities and differences between exemplar and connectionist models of automaticity?

How do models of automaticity illuminate empirical findings in the area?

How is automaticity related to categorization?

10/2: Review for Take-Home Exam 1

Week 6

10/7: Working Memory: Speech Processing

Readings

Carpenter, P.A., Miyake, A., & Just, M.A. (1994). Working memory constraints in comprehension: Evidence from individual differences, aphasia, and aging. In M. A. Gernsbacher (Ed.), *Handbook of psycholinguistics* (1075-1122). San Diego, CA:Academic Press.

Baddeley, A.D., Gathercole, S.E., & Papagno, C. (in press). The phonological loop as a language learning device. *Psychological Review*.

Issues

What roles does working memory play in language processing?

What roles does working memory play in the development of language skills?

How does working memory underlie individual differences in linguistic performance?

10/9: Working Memory: Imagery and Consciousness

Readings

Kosslyn, S.M., Cave, C.B., Provost, D.A., & von Gierke, S.M. (1988). Sequential processes in image generation. *Cognitive Psychology, 20,* 319-343.

Farah, M. (1995). The neural bases of mental imagery. In M,S. Gazzaniga (Ed), *The cognitive neurosciences* (963-975). Cambridge, MA: MIT Press.

Crammond, D.J. (1997). Motor imagery: Never in your wildest dreams. *Trends in Neuroscience, 20,* 54-57.

Weiskrantz, L. (1995). Blindsight: Conscious vs. unconscious aspects. In J. King & K. H. Pribram (Eds), *Scale in conscious experience: Is the brain too important to be left to specialists to study* (49-63)? Mahwah, NJ: Lawrence Erlbaum Associates.

Issues

On what conclusions concerning imagery do cognitive science and neuroscience converge and diverge?

How are the cognitive mechanisms underlying imagery and perception similar and different? How might they be related to the mechanisms that underlie consciousness, dreaming, and psychosis?

How do findings on speech and imagery in working memory illustrate the interplay between cognitive science and neuroscience?

How do measures of working memory capacity reflect the theoretical perspectives of researchers?

How is consciousness related to imagery and perception?

Week 7

10/14: Fall Break

10/16: Long-Term Memory: Explicit Memory

Readings

Schacter, D.L. & Tulving, E. (1994). What are the memory systems of 1994? In D.L. Schacter & E. Tulving (Eds.), *Memory systems* (1-38). Cambridge, MA: MIT Press.

Squire, L. R., Knowlton, B., & Musen, G. (1993). The structure and organization of memory. *Annual Review of Psychology, 44,* 453-495.

Issues

What are the basic systems of memory, and how do we decide what they are?

Do these systems have separable neuroanatomical bases, or are they simply useful scientific constructs for categorizing memory findings?

How does memory research represent the interplay between cognitive science and neuroscience?

Week 8

10/21: Long-Term Memory: Accuracy and Inaccuracy

Readings

Loftus, E.F., Feldman, J., & Dashiell, R. (1995). The reality of illusory memories. In D.L. Schacter (Ed.), *Memory distortions: How minds, brains, and societies reconstruct the past* (47-68). Cambridge, MA: Harvard University Press.

Roediger, H. L., & McDermott, K.B. (1995). Creating false memories: Remembering words not presented in lists. *Journal of Experimental Psychology: Learning, Memory, & Cognition, 21,* 803-814.

Freyd, J.J., & Gleaves, D.H. (1996). "Remembering" words not presented in lists: Relevance to the current recovered/false memory controversy. *Journal of Experimental Psychology: Learning, Memory, & Cognition, 22,* 811-813.

Roediger, H. L.III, & McDermott, K.B. (1996). False perceptions of false memories. *Journal of Experimental Psychology: Learning, Memory, & Cognition, 22,* 814-816.

Issues

What are the limits to the malleability of memory?

Compare and contrast the laboratory and naturalistic approaches to memory distortion phenomena.

What mechanisms underlie inaccuracies in memory?

Might memory inaccuracies serve any important evolutionary purposes, or do they simply respresent weaknesses in the cognitive system?

10/23: Long-Term Memory: Implicit Memory

Readings

Blaxton, T.A., Bookheimer, S.Y., Zeffiro, T.A., & Figlozzi, C.M. (1996). Functional mapping of human memory using PET: Comparisons of conceptual and perceptual tasks. *Canadian Journal of Experimental Psychology, 50,* 42-56.

Schacter, D.L., Cooper, L. A., & Delaney, S.M. (1990). Implicit memory for unfamiliar objects depends on access to structural descriptions.*Journal of Experimental Psychology: General, 119,*5-24.

LeDoux, J. E. (1996). *The emotional brain: The mysterious underpinnings of emotional life* (Ch. 9, 267-303). New York : Simon & Schuster.

Issues

What is the relation of implicit memory to explicit memory?

How do the functions of implicit memory differ from those of explicit memory?

What is the relation of implicit memory to the storage and use of general knowledge, as in categorization, language, and thought?

What is the relation of implicit memory to selective attention and automaticity?

Week 9

10/28: Knowledge: Representation and Processing

Readings

Medin, D.L., Goldstone, R.L., Gentner, D. (1993). Respects for similarity. *Psychological Review, 100,* 254-278.

Barsalou, L.W. (1997). Perceptual symbol systems. Manuscript in preparation.

Issues

What is a concept, and what is a category? How are concepts related to categorization?

To what extent are concepts stable in memory, and to what extent are they dynamic? How can exemplar and connectionist models capture stability and dynamic processing?

To what extent are concepts perceptual, and to what extent are they not?

10/30: Knowledge: Conceptual Combination

Readings

Hampton, J.A. (1988). Overextension of conjunctive concepts: Evidence for a unitary model of concept typicality and class inclusion. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 14,* 12-32.

Medin, D.L., & Shoben, E.J. (1988). Context and structure in conceptual combination. *Cognitive Psychology, 20,* 158-190.

Issues

To what extent do concepts combine compositionally (i.e., linearly)?

At first blush, non-linearity appears to greatly increases the difficulty of processing concepts. Why might non-linearity actually be desirable, and why might it actually not be so difficult to implement in the cognitive system?

To what extent does conceptual combination reflect the rules of logic? To what extent does conceptual combination reflect the statistical processing found in connectionism and exemplar models?

Week 10

11/4: Review for Take-Home Exam 2

11/6: Language: Lexical Processing

Readings

Marslen-Wilson, W. D. (1987). Functional parallelism in spoken word recognition. In U. H. Frauenfelder & L.K. Tyler (Eds.), *Spoken word recognition* (71-102). Cambridge, MA: MIT Press.

Luce, P. A., Pisoni, D. B., & Goldinger, S. D. (1990). Similarity neighborhoods of spoken words. In G.T.M. Altmann (Ed.), *Cognitive models of speech processing* (122-147). Cambridge, MA: MIT Press.

Levelt, W.J.M. (1992). Accessing words in speech production: Stages, processes, and representations. *Cognition, 42*, 1-22.

Issues

What types of information are contained in lexical representations?
What role does top-down processing play in lexical access?
How does the cohort model differ from exemplar and connectionist models?
What is the relationship between word production and perception?

Week 11

11/11: Language: Syntactic Processing

Readings

Bock, K., Loebell, H., & Morey, R. (1992). From conceptual roles to structural relations: Bridging the syntactic cleft. *Psychological Review, 99*, 150-171.

Tanenhaus, M.K., Spivey-Knowlton, M.J., Eberhard, K.M., & Sedivy, J.C. (1995). Integration of visual and linguistic information in spoken language comprehension. *Science, 268*, 1632-1634.

Osterhout, L., & Holcomb, P.J. (1995). Event-related potentials and language comprehension. In M.D. Rugg & M.G.H. Coles (Eds.), *Electrophysiology of mind: Event-related potentials and cognition* (171-215). New York: Oxford University Press.

Issues

To what extent does there appear to be an autonomous module in the brain that underlies syntactic processing?

Do eye movement and ERP data improve on standard behavioral meaures, such as choice and reaction time? Explain.

11/13: Language: Comprehension and Pragmatics

Readings

Bransford, J.D., & Johnson, M.K. (1973). Considerations of some problems of comprehension. In W.G. Chase (Ed.), *Visual information processing*. New York: Academic Press. (optional background reading)

Rinck, M., Hahnel, A., Bower, G.H., & Glowalla, U. (1997). The metrics of spatial situation models. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 23*, 622-637.

Brennan, S. E., & Clark, H. H. (1996). Conceptual pacts and lexical choice in conversation. *Journal of Experimental Psychology: Learning, Memory, & Cognition*, 22, 1482-1493.

Issues

What roles do knowledge and perception play in language comprehension?

What implications do the effects of general knowledge on language processing have for modular accounts of language?

To what extent is it necessary to understand social interaction in order to understand language use?

Week 12

11/18: Thought: Decision Making

Readings

Tversky, A., & Kahneman, D. Judgment under uncertainty: Heuristics and biases: *Science, 185,* 1124-1131.

Gigerenzer, G. (1991). How to make cognitive illusions disappear: Beyond "heuristics and biases." *European Review of Social Psychology, 2,* 83-115.

Kahneman, D., & Tversky, A. (1996). On the reality of cognitive illusions. *Psychological Review, 103,* 582-591.

Gigerenzer, G. (1996). On narrow norms and vague heuristics: A reply to Kahneman and Tversky (1996). *Psychological Review, 103,* 592-596.

Issues

How does human decision making depart from the prescriptions of rational utility theory?

Does the cognitive system treat probabilities and frequencies differently? Explain?

Are probabilities or frequencies more fundamental to thought? Why?

11/20: Thought: Deductive and Inductive Reasoning

Readings

Oaksford, M., & Chater, N. (1994). A rational analysis of the selection task as optimal data selection. *Psychological Review, 101,* 608-631.

Cummins, D.D. (1996) Dominance hierarchies and the evolution of human reasoning. *Minds & Machines, 6,* 463-480.

Issues

What are the differences between deduction and induction, and how might they be related?

To what extent are deduction and induction 'content-free' syntactic processes?

To what extent does the human ability to reason reflect evolutionary pressures?

How might human reasoning abilities be similar to the reasoning abilities of other primates? How might they differ?

Week 13

11/25: Thought: Analogy

Readings

Gentner, D., & Holyoak, K.J. (1997). Reasoning and learning by analogy. *American Psychologist, 52*, 32-34.

Holyoak, K.J., & Thagard, P. (1997). The analogical mind. *American Psychologist, 52*, 35-44.

Gentner, D., & Markman, A.B. (1997). Structure mapping in analogy and similarity. *American Psychologist, 52*, 45-56.

Kolodner, J.L. (1997). Educational implications of analogy: A view from case-based reasoning. *American Psychologist, 52*, 57-66.

Issues

How is analogy in thought related to simple categorization, and also to implicit memory?

What mechanisms are shared? What mechanisms differ?

Why does analogy appear so central to human thought? How might evolution have handled the same task differently?

11/27 Thanksgiving

Week 14

12/2: Socio-Cultural Cognition: Stereotypes and Exemplars

Readings

Greenwald, A.G. and Banaji, M. R. (1995). Implicit social cognition: Attitudes, self-esteem, and stereotypes. *Psychological Review, 102,* 4-27.

Andersen, S.M., & Glassman, N.S. (1996). Responding to significant others when they are not there: Effects on interpersonal inference, motivation, and affect. In E.T. Higgins & R.M. Sorrentino (Eds.), *Handbook of motivation and cognition: Foundations of social behavior* (Vol. 3, 262-321). New York: Guilford Press.

Issues

Do stereotypes serve any useful purposes? Why might the cognitive system have evolved to construct them?

To what extent can social perceivers overcome the use of stereotypes and exemplars in the processing of new individuals? What strategies might be useful?

How do exemplar representations enter into social perception?

Do findings on social categorization contribute new insights into categorization not found in research on object categories?

12/4: Socio-Cultural Cognition: Cultural Universals vs. Specificity

Readings

Au, T. K. (1983). Chinese and English counterfactuals: The Sapir-Whorf hypothesis revisited. *Cognition, 15,* 155-187.

Malt, B.C. (1995). Category coherence in cross-cultural perspective. *Cognitive Psychology, 29,* 85-148.

Issues

To what extent, if any, are there cognitive universals independent of culture?

Is all cognition completely culture-dependent?

Why is it important or not important to study the same cognitive mechanisms across culture? Is this importance greater for some cognitive mechanisms than others? Explain.

Week 15

12/9: Review for Take-Home Exam 3

Week 16

12/16: Review for Optional Final

To: Students in Psychology 501, Cognitive Proseminar
From: Larry Barsalou, Stephan Hamann, Lynne Nygaard
Date: November 19, 1997
Re: Review of Course Expectations

As we draw towards the close of the semester, we believe that this is a good opportunity to review and reflect on our general expectations for the Cognitive Proseminar. As we have stated from the start, our goal has been to prepare you for careers in scientific psychology. For this reason, the format of the course was designed to develop essential skills that you will need to become state-of-the-art research scientists at top research institutions. More specifically, the course format is based on the assumption that you should begin practicing skills in core courses that you will soon be expected to perform in research. Such skills include the reading and comprehension of challenging papers, the analysis and evaluation of research, and the ability to formulate novel arguments and programs of research, where no clearly-specified guidelines exist. As your career progresses, you will constantly find yourselves reading difficult papers and having to extract their content; you will constantly find yourselves having to assess the contributions and flaws of papers; and you will constantly find yourselves having to integrate material to produce innovative research where no clear answers lie.

It is widely recognized that following the undergraduate format in graduate courses is not a viable way to train research skills. Such skills cannot be acquired by listening to lectures, reading textbooks, memorizing correct answers identified by instructors, and reproducing these answers on in-class tests. If one were teaching future instructors for junior college positions, such an approach might be justifiable (probably not), but it is certainly not justifiable as an approach for training future scientists at research institutions. Rather than instructors having the primary responsibility for guiding students through a well-defined memorization process, students need to become responsible for guiding themselves through an open-ended and challenging self-training process that comes to define who they are as researchers.

From this perspective of rigorous graduate training, we emphasize that exams should not be the primary focus of students' attention, although we acknowledge that their evaluative role can at times be anxiety producing. Rather, success on exams should be and is a by-product of a more primary goal: Understanding, assimilating, and discussing core issues in the field. Rather than working hard to excel on exams, successful students work hard to understand the material covered in a course. It may be helpful to think of exams as opportunities to focus thinking, test new ideas, and obtain practice at synthesizing and relating course material. These skills are crucial for success in academia, and they can only be acquired through extensive practice that is often difficult at first.

Along with deemphasizing the significance of exams, we wish to emphasize the importance of the material we are covering, and our interactive approach to covering it. We have selected a diverse collection of material that reflects what we believe are important, influential, and interesting topics within cognitive psychology. In addition, the course format provides an extraordinary opportunity to read and evaluate this material with graduate student and faculty colleagues, who bring different perspectives, knowledge, and expertise to the discussion. Hence, we have experienced much personal excitement about the course.

We further believe the course provides an opportunity for all of us to explore research areas that are not always transparently related to our own. Becoming familiar with other research areas is essential, not only to one's research projects but also to one's growth as a colleague, and as a

member of the broader scientific community. Knowledge of issues outside one's research area not only provides a rich source of ideas, methodologies, and theoretical perspectives, but also provides the knowledge base of a good colleague. Successful applicants at top institutions are not only experts in their own specific area of research, they are also colleagues who are knowledgeable and well-rounded.

The approach that we have taken in this course is far from novel. Indeed, it is commonplace throughout the best departments and best programs across the country and internationally. The programs that place students in the best positions typically implement courses very much like this one. These students receive challenging state-of-the-art articles to read, and they are asked to write intelligently on difficult issues related to them. Not only are there no known answers to these questions, it's not even clear how to best go about answering them. Often such courses are more difficult than ours. For example, students in such courses often do not receive exam questions ahead of time but first confront them on exams. Furthermore, such exams are often given in class and do not allow students to consult copies of the readings. Indeed, many programs implement such training through qualifying exams, where students do not have the luxury of discussing the readings with instructors and other students in a formal course setting. Instead, students simply receive a list of readings, show up for an exam without reading materials, and receive exam questions that they did not prepare for directly. In many settings, only the students who do well on these exams are admitted to Ph.D. candidacy.

No doubt it is difficult making the transition from undergraduate courses to this type of graduate course. Such courses are very difficult for nearly all students in all programs, at least at first. Nevertheless, the students who succeed in top-notch graduate training programs are sufficiently motivated to take up the challenge and master the difficult tasks that foreshadow what they will soon being doing in research. Indeed, the best of these students often understand course readings as well as the instructors, and sometimes better, given they are willing to spend more time reading the articles, talking about them, and looking into related material. Furthermore, these students sometimes write exam answers that contain better ideas than any of those in print. At the least, their answers go far beyond simply reiterating what they read in the papers. Although the creative points of these attempts may sometimes miss the mark, at least students are attempting to shape the material in their own ideas and language.

The three of us have experienced various graduate programs over the years, and we have seen what abilities and accomplishments distinguish graduate students who obtain research positions from those who do not. Consider the number of applications for the last two junior positions that Emory has filled in cognition. For the first position, there were 263 applicants; for the second, there were 287. The candidates who emerge from these applicant pools are the ones who have acquired the requisite abilities for performing state-of-the-art research on their own. Most importantly, these requisite abilities arise out of the basic activities that we have implemented in this course.

We do not paint this picture of graduate student development and competition to disillusion you, nor to imply anything at all about your abilities and accomplishments. To the contrary, we have considerable respect for the ability of every student in the course. Instead, the point is to make you aware of how things work so that you can prepare yourself accordingly. You need to know how the best programs train students, and what abilities these students have on entering the job market. They will be your competition, although, if you prepare properly, you will be theirs.

You might worry that you don't have the intellectual ability to acquire these skills and be competitive. In our experience, however, acquiring these skills and becoming competitive is well within the reach of any student capable of being admitted to a graduate program like ours. More importantly, these skills result from a willingness to be challenged, to take on difficult tasks with an open mind, and to take responsibility for one's own training and development. When students begin tackling these tasks, it is nearly universal to feel ignorant and clueless about how to proceed. Often students feel embarrassed for not being able to cope better with the material. This is normal. Unfortunately, it is a stage that one must go through to achieve later stages where these activities become increasingly easy and enjoyable.

In this spirit, consider the advice of one eminent psychologist who has trained many top-notch scientists. According to this seasoned graduate advisor, success in academic psychology is 20% intelligence and 80% motivation. In his experience, the most successful students are the ones most willing to take on difficult open-ended problems, struggle through them without much guidance, and persist until significant progress results.

In general, the format of the Cognitive Proseminar embodies this spirit. We are attempting to set your expectations and ambitions to a competitive level. We're asking you to perform the difficult tasks essential to the everyday activity of successful research scientists. We're asking you perform these tasks on your own to a large extent, not relying on us for the answers. Should you find these activities challenging and frustrating, it would not surprise us.

We hope that we have made our philosophy of graduate training clear. Not only do we believe in this approach, we believe that implementing it is essential to our responsibilities as instructors at a top research university. It is our obligation to provide you with an opportunity to develop the skills that will make you an effective research scientist. It is our obligation to make you competitive on the job market. It is our obligation to implement a training program that serves the University and the larger scientific community, and that is worthy of their respect.

We recognize that all of you may not feel the same way about the course, nor have the same priorities. We have painted our picture of graduate training and how the course fits into that training with somewhat broad strokes. Therefore, our comments may apply more or less to each individual in the course. Nevertheless, by making our goals and assumptions explicit, we can perhaps make the course more enjoyable and informative for everyone involved.

Should you wish to discuss these issues with us individually or as a group, we would be pleased to do so. We are also open to constructive suggestions for revising the course at any time. Our goal is to design a course that optimally trains students as research scientists, and any advice that you can give us in this regard will be greatly appreciated.