# Cognitive Psychology
## at Colorado State University

# Doctoral Program Brochure

# Doctoral Program in Cognitive Psychology at Colorado State University

Cognitive psychology is an active area of study at Colorado State University, as one of five doctoral programs offered by the Department of Psychology. We are committed to maintaining a nationally recognized program in cognitive psychology and to training first-rate researchers and scholars in the science of the human mind. The research conducted by cognitive faculty members spans a variety of topics, with a focus on human learning and memory, perception, and performance. Several faculty members are also interested in cognitive aging.

A relatively small group of students participate in the Program (typically 2-3 students per faculty member) so as to provide highly individualized graduate education, allow close collaboration with faculty, and promote frequent formal and informal interaction with faculty and peers. At the same time, the Program benefits from the facilities and resources of a large and thriving department at a Carnegie Foundation level-one research institute. There are, for example, opportunities for interdisciplinary education in other academic units, including the Department of Computer Science, College of Engineering, and Program in Molecular, Cellular and Integrative Neurosciences.

The Program is administered according to a mentorship model. New students are matched with a specific faculty member according to area of interest and by mutual consent of the student and faculty member. The faculty advisor serves as a mentor to the student and, with the student's advisory committee, guides the student through the Program.



*Colorado State University is located in Fort Collins, Colorado, a city with about 144,000 people that is rated as one of the best places to live in the country.*

## PROGRAM OBJECTIVES

The general goal of the Doctoral Program in Cognitive Psychology is to train students for productive careers as teachers and researchers in academic settings, or as research scientists and/or applied cognitive psychologists in business and industry. This training goal is achieved through coursework, research experience, teaching experience, and scholarly interaction within and outside of the Department.

All students in the Doctoral Program develop sophistication in research methods, experimental design, and statistical analysis by virtue of courses completed during their first year of graduate study. Additional coursework provides a comprehensive foundation in cognitive psychology, and participation in specialty seminars and research provide specialization within cognitive psychology. In addition, our commitment to interdisciplinary study means that all students take two courses in other areas of psychology, with numerous opportunities for additional interdisciplinary coursework within and outside of the Department.

To foster the development of research skills, students are actively involved in research throughout their time in the Program. Students typically begin research under the supervision of their faculty mentor and then become increasingly more independent as they progress through the Program. Students are expected to publish their work in professional journals and the typical student authors or co-authors several articles by the time they graduate.

To foster the development of teaching skills, all students obtain direct teaching experience through the supervised teaching of two different laboratory courses. One strength of the Program is that there are many additional opportunities to develop teaching skills, if desired. Graduate students may be invited to teach lecture-oriented courses during regular semester sessions or condensed summer sessions. The Department of Psychology also administers a Teaching Fellow Program that involves the supervised instruction of General Psychology. In addition, The Institute for Learning and Teaching sponsor lectures, seminars, and workshops on college teaching.

Scholarly communication and presentation skills are developed through participation in our weekly brownbag meeting. Students are also highly encouraged and may be awarded financial support to attend and present their work at local, national, and international conferences.

Students applying to the Doctoral Program in Cognitive Psychology should be firmly committed to the completion of

*The "oval" on the Colorado State University campus.*

the Ph.D. Although a master's (M.S.) degree is awarded once all M.S. requirements have been met, it is included only as part of the Doctoral Program. The Program is designed to be completed in four to five years of full-time enrollment. Students admitted with a master's degree in psychology can expect to take about three years to complete doctoral requirements.

## PROGRAM OF STUDY

To attain a firm grounding in experimental methodology, statistical analysis, and cognitive psychology, all students in the Doctoral Program are required to complete a research methods course, a two-semester sequence in statistics, and two foundational ("core") courses in cognitive psychology. To attain in-depth education and specialization in cognitive psychology and related disciplines, students must also complete at least three specialty seminars in cognitive psychology. Seminars are typically discussion-oriented and cover specific topics of mutual interest to faculty and students or topics of current interest in the field (e.g., *Metacognition*, *Implicit Learning*, *Cognition and Education*, *Working Memory*, *Embodied Cognition,* etc.). Students also fulfill a distribution requirement through completion of two core psychology courses from two different areas outside of cognitive psychology. It is expected that most course requirements will be completed during the student's first three years of graduate study.

The Program is designed so that students complete and defend a master's thesis by the end of their second (and no later than their third) year of graduate study. Students who successfully complete the thesis plus at least 32 credits of graduate coursework are granted a Master of Science (M.S.) degree in Psychology. During the third (and no later than the fourth) year of graduate study, students complete a Comprehensive Examination to demonstrate their readiness for continuing with the dissertation. The fourth year of graduate study (and fifth, if necessary) is primarily devoted to completion of the doctoral dissertation. The dissertation and any remaining

Program, Department, and University requirements should be completed within two to three years of completion of the M.S. degree. Upon completion of all requirements, students are granted a Doctor of Philosophy (Ph.D.) degree in Psychology.

Research involvement and the development of research skills are an integral part of doctoral training in cognitive psychology. Students must be actively involved in research each semester that they are in the Program and are expected to present (at a colloquium or professional conference) and/or submit (to a professional journal) research in addition to that conducted as part of their thesis and dissertation. Students typically author or co-author several publications and presentations by the time they graduate. New students usually begin research under the supervision of their advisor and then become more independent as their development progresses. *Independent Study*, *Thesis*, and *Dissertation* courses are the mechanism by which academic credit is given for research.

Students develop teaching skills and get direct teaching experience by virtue of the Program's teaching requirement. All students are required to teach one semester of two different laboratory courses from our undergraduate offerings in cognitive psychology, cognitive neuroscience, physiological psychology, and sensation and perception. The student is given primary responsibility for the day-to-day teaching of the course, but is supervised and mentored by a faculty member.

To promote the development of communication and presentation skills and to encourage scholarly interaction with faculty and peers, students are expected to participate in our weekly brownbag meeting each semester throughout their graduate training. Credit for this activity is attained through enrollment in a course entitled *Current Issues in Cognitive and Neural Sciences*.

## COURSE REQUIREMENTS

All students admitted to the Doctoral Program in Cognitive Psychology are expected to complete the following course requirements:

1. A two-semester sequence in statistics.

2. An advanced research methods course entitled *Research Issues and Models*.

3. Two foundational ("core") courses selected from *Cognitive Processes*, *Human Learning and Memory*, *Human Performance,* and *Sensation & Perception*.

4. Two core courses taken from two different areas outside of cognitive psychology (e.g., *Cognitive Neuroscience*, *History & Systems*, *Neuropsychology*, *Social Psychology).*

5. A minimum of three specialty seminars in cognitive psychology.

6. A third core course in cognitive psychology (other than the two used to fulfill Requirement #3), a fourth seminar in cognitive psychology, or some other course approved by the Program.

7. Enrollment in *Current Issues in Cognitive and Neural Sciences* each semester to receive credit for participation in our weekly brownbag meeting.

A typical course schedule is shown below. Note that this schedule is for illustrative purposes only. The specific set and sequence of courses may be tailored to a student's interests and goals. For example, the courses used to fulfill Requirements #3 through #6 commonly vary from student to student. Further tailoring is possible based on the student's selection of electives. In addition, although students usually complete the statistics and research methods courses during their first year, the semester and sequence of enrollment in other courses may vary. Finally, students may petition Program faculty for course substitutions or waivers in order to pursue individual training goals.

## STUDENT EVALUATION

As specified by the Graduate School, each student in the Program forms a graduate advisory committee that consists of the faculty advisor and two to three other faculty members. Committee members are selected by mutual consent of the student and faculty member. The advisory committee assists the faculty advisor in guiding the student through the Program and is also responsible for evaluating

competency on the master's thesis and dissertation. In addition, Program faculty members meet to discuss the progress of new students at the end of each semester during the first year. After the first year, students are evaluated on a yearly basis. The purpose of these meetings is to provide written, constructive feedback about the student's performance with regard to coursework, teaching, research, and timely progress. A formal evaluation is performed after completion of the master's degree to assure that the student is a suitable candidate for doctoral study.

## RESEARCH FACILITIES

Each of the faculty members in the Cognitive Psychology Program has their own dedicated research laboratory housed in our new Behavioral Sciences Building with modern equipment that is suitable for experimentation in cognitive psychology. Individual testing rooms are equipped with computers and other hardware and software for running experiments, with additional computing resources available for experimental design and analysis.

The Program also has access to several shared-use, state-of-the-art laboratory facilities. These laboratories are maintained and upgraded annually using special university funds for enhancing technology and may be used when mentoring undergraduate research assistants and honor's students.

One of our shared-use laboratories is equipped with a research-grade driving simulator for research on the perception and cognition of driving. The simulator includes the full front-seat compartment of a Ford automobile, standard controls and functioning instrumentation,

| COURSE | CREDITS | COURSE | CREDITS |
|---|---|---|---|
| **Fall I** | | **Spring I** | |
| Methods of Research in Psychology I (Statistics) | 4 | Methods of Research in Psychology II (Statistics) | 4 |
| Research Issues and Models | 3 | Cog. Core (e.g., Human Learning & Memory) | 3 |
| Current Issues in Cognitive Psychology | 2 | Current Issues in Cognitive Psychology | 2 |
| Electives (optional) | | Electives (optional) | |
| **Fall II** | | **Spring II** | |
| Cognitive Core (e.g., Cognitive Processes) | 3 | Non-Cognitive Core (e.g., History & Systems) | 3 |
| Seminar | 3 | Seminar | 3 |
| Current Issues in Cognitive Psychology | 2 | Current Issues in Cognitive Psychology | 2 |
| Electives (optional) | | Electives (optional) | |
| **Fall III** | | **Spring III** | |
| Non-Cognitive Core (e.g., Neuropsychology) | 3 | Seminar | 3 |
| Seminar | 3 | Independent Study | 6 |
| Current Issues in Cognitive Psychology | 2 | Current Issues in Cognitive Psychology | 2 |
| Electives (optional) | | Electives (optional) | |
| **Fall IV** | | **Spring IV** | |
| Seminar | 3 | Seminar | 3 |
| Dissertation | 6 | Dissertation | 6 |
| Current Issues in Cognitive Psychology | 2 | Current Issues in Cognitive Psychology | 2 |
| Electives (optional) | | Electives (optional) | |

tactile and proprioceptive feedback, surround sound, and high-resolution wrap-around graphics. As well, our EEG/ERP facility supports research on the electrophysiology of perception and cognition. The facility houses two EEG systems with separate subject-running rooms. One system is a state-of-the-art 128-channel Electrical Geodesic system that supports source localization and uses a technology that allows the cap to be applied and tested in just 10-15 minutes. The second system is a 32-channel NeuroScan system for conducting EEG studies using traditional methods.

In addition, we have a state-of-the art virtual reality system along with a head-mounted display for 3D immersive interaction within virtual reality environments. Also available is a modern eye-tracking system for research in areas such as attention, psycholinguistics, web design, and computer usability, and a Biopac system for collecting physiological data such as galvanic skin response, ECG, EMG, EOG, etc.



*High-density EEG system for research on the electrophysiology of cognition*

## FACULTY RESEARCH INTERESTS

**Dr. Anne Cleary** maintains an active research laboratory that investigates the processes involved in recognition memory. One line of research is aimed at identifying what features of an item or situation can produce familiarity-based recognition. A second line of research is aimed at investigating the neural correlates of the different bases of recognition, including the neural underpinnings of feature-based familiarity. A third line of research is aimed at linking feelings of familiarity in recognition with such day-to-day experiences as the tip-of-the-tongue phenomenon and déjà vu experiences.

**Cleary, A.M.**, Ryals, A.J., & Wagner, S.M. (2016). Recognition during recall failure: Semantic feature matching as a mechanism for recognition of semantic cues when recall fails. iMemory & Cognition, 44, 50-62.

**Cleary, A.M**. & Claxton, A.B. (2015). The tip-of-the-tongue heuristic: How tip-of-the-tongue states confer perceptibility on inaccessible words. *Journal of*

*Experimental Psychology: Learning, Memory, and Cognition, 41*, 1533-1539.

Kostic, B., Booth, S.E., & **Cleary, A.M.** (2015). The role of analogy in reports of presque vu: Does reporting the presque vu state signal the near retrieval of a source analogy? *Journal of Cognitive Psychology, 27*, 739-754.

**Dr. Benjamin Clegg** conducts research investigating a variety of aspects of human performance, including how to apply principles from cognitive psychology to real-world tasks and skills. His work examines issues such as training, automation, and situation awareness. The focus of Dr. Clegg's basic research is on sequencing and sequence learning, including implicit learning.

**Clegg, B. A**., McKernan, B., Martey, R. M., Taylor, S. M., Stromer-Galley, J., Kenski, K., Saulnier, E. T., Rhodes, M. G., Folkestad, J. E., McLaren, E., Shaw, A., & Strzalkowski, T. (2015). Effective mitigation of anchoring bias, projection bias, and representativeness bias from serious game-based training. *Proceedings of 6th International Conference on Applied Human Factors and Ergonomics, 3*, 1558-1565.

Gutzwiller, R. S., **Clegg, B. A**., & Blitch, J. G. (2013). Part-task training in the context of automation: Current and future directions. *American Journal of Psychology, 126*(4), 417-432.

Abrahamse, E. L., Jiménez, J., Verwey, W. B., & **Clegg, B. A.** (2010). Representing serial action and perception. *Psychonomic Bulletin and Review, 17*(5), 603-623.

**Dr. Edward L. DeLosh** investigates basic encoding and retrieval processes in human learning and memory, with an eye toward phenomena and principles that have direct applications to teaching and student learning. A recent focus pertains to the effect of retrieval practice on subsequent memory, as observed in the testing effect. Other work examines the potential mnemonic benefits of elaborative processing (example generation, relational processing, etc.) during encoding and retrieval. These topics are examined from both a theoretical and applied perspective.

Carpenter, S. K., & **DeLosh, E. L.** (2006). Impoverished cue support enhances subsequent retention: Support for the elaborative retrieval explanation of the testing effect. *Memory & Cognition*, *34*, 268-276.

Rowland, C. A., Littrell-Baez, M. K., Sensenig, A. E., & **DeLosh, E. L.** (2014). Testing effects in mixed versus pure list designs. *Memory & Cognition*, *42*, 912-921.

Rowland, C. A, & **DeLosh, E. L.** (2014). Benefits of testing for non-tested information: Retrieval-induced facilitation of episodically bound material. *Psychonomic Bulletin & Review, 21*, 1516-1523.

## Faculty in the Cognitive Psychology Program

**Anne M. Cleary**, Associate Professor
Ph.D., Case Western Reserve University, 2001
Specialization: human recognition memory, metamemory familiarity-based recognition, tip-of-the-tongue states:
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**Benjamin A. Clegg**, Professor
Ph.D., University of Oregon, 1998
Specialization: implicit learning, skill acquisition, applied cognitive psychology
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**Edward L. DeLosh**, Associate Professor
Ph.D., Purdue University, 1996
Specialization: human learning and memory, applications of memory for education
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**Matthew G. Rhodes**, Associate Professor
Ph.D., Florida State University, 2004
Specialization: human memory, metacognition, cognitive aging
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**Carol A. Seger**, Professor
Ph.D., University of California, Los Angeles
Specialization: human learning and memory, categorization, cognitive neuroscience
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**Jessica K. Witt**, Associate Professor
Ph.D., University of Virginia, 2007
Specialization: spatial perception, perception action relationships
http://amplab.colostate.edu/
E-mail: Jessica.Witt@colostate.edu

*Affiliate Faculty:* **Chris D. Wickens,** Affiliate Professor; Ph.D., University of Michigan, 1973
Specialization: attention, decision making, comuptational modeling, human factors, human-automation interaction.  E-mail: Wickens@colostate.edu

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**Dr. Matthew G. Rhodes** examines human memory and metacognition. One line of work investigates how subjective experience is related to memory performance, particularly for tasks such as predicting future memory performance. Other work examines subjective experience and its relation to memory accuracy, including how it pertains to aging populations. Dr. Rhodes also maintains lines of work examining memory for faces, predictors of individual differences in memory accuracy, and recognition memory processes.

Morehead, K., **Rhodes, M. G**., & DeLozier, S.  (2016). Instructor and student knowledge of study strategies. *Memory*, *24*, 257-271.

**Rhodes, M. G**., & Anastasi, J. S.  (2012).  The own-age bias in face recognition: A meta-analytic and theoretical review. *Psychological Bulletin, 138*, 146-174.

**Rhodes, M. G**., & Castel, A. D.  (2008).  Memory redictions are influenced by perceptual information: Evidence for metacognitive illusions. *Journal of Experimental Psychology: General, 137*, 615-625.

**Dr. Carol Seger** studies the neural systems underlying executive functions, decision making, memory, and learning, particularly categorization and sequence learning.  Much of the current research in her lab examines how these cognitive memory processes in the medial temporal lobe and how they interact with the basal ganglia.  The primary research methodologies in her lab are functional magnetic resonance imaging, behavioral testing, and computational modeling.

Braunlich, K., **Seger, C.A.** (2016). Categorical evidence, confidence, and urgency during probabilistic categorization. *Neuroimage* 125: 941-952.

**Seger, C. A.,** Braunlich, K., Wehe, H. S., & Liu, Z. (2015). Generalization in category learning: The roles of representational and decisional uncertainty. *The Journal of Neuroscience*, 35, 8802-8812.

**Seger, C. A** & Miller, E. K. (2010) Category learning in the brain. *Annual Review of Neuroscience, 33*, 203-219.

**Dr. Jessica K. Witt** examines the effects of action on perception.  For example, softball players who are hitting better than others see the ball as bigger.  Objects that are easier to block look to be moving slower than objects that are more difficult to block.  People who are obese see distances as farther.  Her findings demonstrate that perception is not just a function of optical information but is also influenced by the perceiver's body, abilities, and intentions.

Sugovic, M., Turk, P., & **Witt, J. K.** (2016).  Perceived distance and obesity: It's what you weigh, not what you think. *Acta Psychologica, 165*, 1-8.

**Witt, J. K.** (2011). Action's effect on perception. *Current Directions in Psychological Science, 20*, 201-206.

**Witt, J. K**., & Proffitt, D. R. (2005). See the ball, hit the ball: Apparent ball size is correlated with batting average. *Psychological Science, 16*, 937-938.

**Dr. Chris Wickens** does research on attention (& multi-tasking) and decision making, both as individual disciplines and, particularly their interaction: the role of attention in making decisions, and the decisions made when multi-tasking. Two underlying themes in both of the above are computational modeling of the processes involved, and application of both experimental data and modeling to the workplace outside the laboratory, particularly high risk workplaces involving humans interaction with automation. Dr. Wickens does not accept graduate students but he mentors students, serves on thesis committees, and teaches graduate seminars.

**Wickens, C.D.** (2014), Effort in human performance and decision making. *Human Factors, 56,* 1329-1336.

**Wickens, C. D.,** Clegg, B. A., Vienne, A., & Sebok (2015) Complacency and Automation Bias in the Use of Imperfect Automation. Human Factors, 57, 728-739.

**Wickens, C.D.,** Gutzwiller, R., & Santamaria, A. (2015) Discrete task switching in overload: A meta-analyses and a model. *International Journal of Human-Computer Studies***.**

## ADMISSIONS AND FUNDING

Admission to the Doctoral Program in Cognitive Psychology is highly competitive and is based on transcripts, letters of recommendation, a statement of interest, and GRE scores. Students with research experience and a strong background in science are preferred. Students having either a bachelor's or master's degree will be considered.

Contingent on the availability of funding and a student's progress in the Program, students admitted with a bachelor's degree may typically expect to receive funding through their fifth year of training, and those with a master's degree may typically expect to receive funding through their third year of training. We have a very strong record of financial support: Since the inception of the Program, all students who have requested funding have received it. Financial support comes from several sources: teaching and research assistantships funded by the Department and University; research assistantships funded by grants to individual faculty members, and Department- and University-sponsored fellowships for outstanding students. Students who are not in good standing or are not making timely progress in the program receive a lower priority for funding.

## ADDITIONAL INFORMATION

Doctoral Program in Cognitive Psychology:
*http://www.colostate.edu/Depts/Psychology/cognitive/*

Department of Psychology:
*http://www.colostate.edu/Depts/Psychology/*

Colorado State University:
*http://visit.colostate.edu*

Fort Collins, Colorado:
*http://www.ftcollins.com*



*Our driving simulator facility is equipped with a DriveSafety 600c driving simulator. The simulator includes the front half of a Ford automobile, active instrumentation, full driver controls, tactile and proprioceptive feedback, surround sound, and high-resolution graphics.*