



# University of Connecticut

## Ecological Psychology

UConn

An Area of Concentration within the Division of Perception, Action, Cognition

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The ecological approach to perception and action, in the tradition of the late James J. Gibson, sees psychology as continuous with the natural sciences. Just as the behaviors of natural, nonliving systems at the very large and very small scales are approachable in terms of very general principles so, too, are the behaviors of living systems at the intermediate ecological scale—the scale at which animals and their environments are defined. Where the more orthodox strategy in cognitive science is to appeal to special mental processes to impose order and regularity on perception and action, the ecological approach seeks to expose the laws that underlie these capabilities. Proponents do not aim to reduce the phenomena of perception and action to known physical phenomena but to share with the natural sciences the law-based strategy of explanation.

The task of identifying general principles at the ecological scale poses new and exciting challenges to be met by the development of novel tactics within an interdisciplinary framework. The program in Ecological Psychology at the University of Connecticut exploits such a framework. Some special features of our program are described in what follows. Applicants who would like to tour the facilities and talk to students and faculty are encouraged to arrange a visit.

### THE CONNECTICUT TRADITION

For over 35 years, students of Ecological Psychology at the University of Connecticut have received training from leading proponents of the approach. These have included Carol Fowler, Claire Michaels, Robert Shaw, and Michael Turvey. All are now Emeritus in name but not in deed, remaining active in teaching and research. Graduates of the program are now themselves at the vanguard of ecological science at major universities such as Arizona State, Brown, University of California (Merced and Riverside), Cincinnati, Clemson, Illinois State, Indiana, Ohio State, and Northeastern as well as at independent research facilities such as Haskins Laboratories, HRL Laboratories, and the National Defense Institute. One third of the Consulting Editors for the journal *Ecological Psychology* are graduates of the program at the University of Connecticut as are a number of the Consulting Editors of the *Journal of Experimental Psychology: Human Perception and Performance*. The semiannual International Conference on Perception and Action started here in 1981 and has since been hosted at several other sites within the U.S. as well as in Sweden, Italy, Holland, France, Scotland, Canada, Australia, Brazil, Japan, and Portugal.

In 1987, the Board of Trustees established the Center for the Ecological Study of Perception and Action (laboratories are described on the back of this brochure). CESPA provides an organizational structure that allows unparalleled integration of research across specialties, with extensive collaboration among faculty and students. With a strong team of faculty, research scientists, fellows and post-doctoral associates (including specialists in optics, acoustics, haptics, movement, nonlinear dynamics, language, development, social psychology, and physical therapy), the program provides a breadth of training in ecological psychology that is unmatched anywhere. Students in Ecological Psychology at the University of Connecticut will confront conceptual and methodological topics that are at the cutting edge of cognitive science in a program that has long led the way in the development of many of those same topics.

### THE PROGRAM OF STUDY

Students pursue a program of study that will provide them with the intellectual and technical skills demanded by problems in Ecological Psychology. Courses within Psychology include Ecological and Computational Theories of Perception, Control and Coordination of Movement, Ecological Foundations of Psychology, Ecological Social Psychology, Nonlinear Dynamics and Movement Control I and II, Introduction to Complex Systems, Applied Time Series Analysis, Dynamics and Language, Approaches to Emergent Structure, and Evolution and Development. Firm footing in the computational perspective is provided by courses in Sensory Mechanisms, Cognitive Systems Theory, Cognitive Neuroscience, Measuring and Modeling Neural Activity, and Connectionism. Two basic courses in statistical methods are required and may be augmented by courses in Causal Modeling or Measurement and Scaling. Depending on a particular student's interests, courses outside of Psychology are commonly taken and have included biomechanics, computer graphics, embryology, evolutionary biology, neurobiology, philosophy of mind, philosophy of psychology, philosophy of language, philosophy of physics, nonlinear dynamics, differential equations, and tensor calculus.

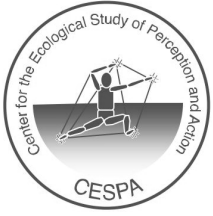
*Perceiving-Acting Workshop* is a weekly research seminar in which faculty, graduate students, and visiting scholars present and discuss current projects. *Friday Afternoon Club* is a forum for theoretical discussions organized around a single topic in any given semester. Topics have included neural networks, qualitative dynamics, morphogenesis, infant perception, ecological human factors, microbial evolution, and physical intelligence. *Special topic workshops* (e.g., Philosophical Issues in Self-Organization, Human and Robot Juggling, Physics of Complexity, Organism-Environment Systems, Ecological and Dynamical Systems Applications in Rehabilitation, Cognition & Dynamics) are held periodically, drawing on scholars from a variety of universities and disciplines.

Teaching is an important part of graduate training. Teaching assistants participate in an eight hour orientation before they get in front of a classroom. For senior graduate students, a formal course in teaching (with an emphasis on the challenges of teaching experimental psychology) is offered by Michael Turvey, award-winning teacher and world-renowned lecturer. Students' assigned lectures, ranging from Introductory Psychology classes to conference presentations and job talks, are critiqued for organization, clarity, and style as well as content. Many survivors of this course have gone on to become award-winning teachers in their own right.

### FINANCIAL AND SOCIAL SUPPORT

Students admitted to the program are provided with financial support beginning at \$18,000 for 12 months. This support is drawn from a combination of teaching, research, and fellowship monies and is augmented by a tuition waiver and health benefits. Students can expect to be supported for 5 years, with annual increases reflecting their progress through the program. A special effort is made to support student travel to conferences to present research and make professional contacts (e.g., all CESPA graduate students travel to at least one international meeting). Applicants with relevant research experience are also encouraged to coordinate with a potential faculty advisor in order to apply for fellowships from agencies such as the National Science Foundation.

The social interaction at CESPA deserves special mention. Friday evening gatherings of faculty and students are a decades-long tradition. Politics, art, and sports can often be heard among discussions of realism, nonHausdorffian spaces, and the individuation of affordances. All this takes place at Sweet William's, the official CESPA pub, which is also host to monthly parties in honor of visiting speakers.



## CENTER FOR THE ECOLOGICAL STUDY OF PERCEPTION AND ACTION (CESPA)

All CESPA laboratories are concerned with the theme of perceiving and acting. This integrated structure promotes an active atmosphere and allows students to move easily among experimental methods and faculty advisors. Faculty and scientists in CESPA include: Tehran Davis (Ecological Psychology), James Dixon (Ecological Psychology), Till Frank (Ecological Psychology), Bruce Kay (Research Scientist), Jeffrey Kinsella-Shaw (Kinesiology), Kerry Marsh (Social Psychology) and Adam Sheya (Developmental Psychology). An outstanding group of emeritus faculty (Claudia Carello, Claire Michaels, Robert Shaw, and M. T. Turvey) actively collaborate with students and contribute substantially to our research programs. Collaborations can also be undertaken with CESPA Fellows (Tony Chemero, Paula Fitzpatrick, Bert Hodges, Ken Holt, Dilip Kondepudi, Chris Palmer, William Mace, and Richard C. Schmidt), regular visitors whose primary

affiliation is with other universities, as well as with post-doctoral associates. The focal laboratories are:

*Vision & Action Laboratory.* As an animal moves relative to objects in the environment, changes in the patterning of reflected light from surfaces are potentially informative about such characteristics as surface composition, extent and slant, about the presence of obstacles or openings, the direction and velocity of relative movement, time to contact with surfaces and the severity of the impending contact. A major focus of our work is on the mathematics and physics of light at the ecological scale as a way to capture the information about such surface and locomotor transformations. Experiments involving dynamic computer displays allow the testing of the usefulness of candidate descriptions for guiding activity as well as the implications of such descriptions for understanding how optical information is detected by the visual perceptual system.

*Dynamic Touch Laboratory.* Transporting objects and manipulating tools requires that properties such as size, shape, and orientation be perceived so that activity can be guided effectively. If vision is absent or simply directed elsewhere, are environmental properties revealed in the tissue deformations that accompany wielding with the hand or exploring with a hand-held object such as a cane? Here's the problem: Muscular forces and object motions vary over time but the properties do not. Our work focuses on time-invariant quantities—moments of the mass distribution—that have been shown to underlie haptic perception of a variety of *functional properties* of objects, properties that reflect how an object can be moved and controlled. Experiments involving manipulations of the mass distribution examine spatial capabilities of dynamic touch and allow comparisons to the informational support for vision and hearing.

*Physical Intelligence Laboratory.* All organisms develop the ability to become capable of perception and action in the service of goals and intentions, no matter how rudimentary. Behavioral scientists have traditionally considered perception and action as properties of higher-order animals, but recent work shows that all living things, including single-celled organisms, plants, and fungi, develop the ability to detect information in their environments and use that information to guide action. The diversity of biological systems capable of perception-action suggests that, rather than reflecting a particular biological specialization, perception-action develops through general physical principles that biology has richly exploited. We use simple self-organizing physical (electrical and chemical) systems to try to discover the thermodynamic principles that underwrite the development of perception-action.

*Coordination Dynamics Laboratory.* Particular time-varying patternings of the limbs characterize activities such as running, juggling, and baseball batting. These movement patterns comprise many degrees of freedom at the neural and muscular level organized as a functional unit. What general principles are at work in their assembly, and what quantities capture their dynamical, macroscopic nature? Movement patterns change to meet task demands, for example, type of pitch (fast ball or curve) or intent of the batter (meet the ball or swing for the fences). Are these changes principled? Given that information guides the assembling of movement patterns, and the execution of acts, how is this information made available in dynamically relevant and task-specific ways, and how is it used? Experiments typically employ rhythmic behaviors to assess the consequences for coordination of varying aspects of the underlying dynamic.

*Social and Interpersonal Coordination.* The environment that constrains our behavior includes not only objects and events but also other members of our species. When we dance or talk or work together to accomplish a goal, our behaviors are guided by information about others within our social niche. Research in this laboratory strives to apply ecological psychology's law-based perspective—in particular, exploiting methods from dynamical systems—to study how we perceive and act with others. Experiments examine transitions from individual to social behavior, including possible influences on the degree of synchrony between two people who may or may not intend to coordinate.

*Collaboratory for Rehabilitation Research (CoRR).* CESPA's basic research focuses on fluent perception and action. Our applied unit focuses on rehabilitation research directed at uncovering how the usually fluid capabilities of perception and action (e.g., manipulating utensils, walking on uneven terrain) might be compromised by changes in the involved muscles and limbs owing to age, disease, or injury. CoRR is a joint effort between the Departments of Psychology and Physical Therapy with the goal to translate basic perception-action research into interventions and tools that optimize safety and ease of function in daily living for older adults and individuals with movement disorders.

*Other Research.* Investigations of topics such as ecological acoustics, affordances, perceptual learning, the dynamics of development, cognitive influences on coordination, postural stability, ecological human factors, and so on, typically emerge from one or more of the focal laboratories, thereby exploiting the richness of their characteristic observables and analytic tools.

## FACILITIES

The Center is housed in 4600 square feet in the Bousfield Psychology Building (with an additional 1000 square feet for CoRR projects in Koons Hall). The computer environment (a mix of Macintosh, PC and Unix machines, as well as a dedicated computing cluster) is upgraded regularly. The Psychology Department has a computer systems manager with two full-time assistants to address software, hardware, and network problems. Dual force platforms, gait mats, electrogoniometers, electromagnetic movement digitizers, and optical tracking systems collect data from posture, bimanual coordination, treadmill and open-field walking, interception, and exploratory behaviors. Customized software includes spectral, correlational, dimensionality, and stability analyses, trial-by-trial information about parameters such as periods of oscillation, amplitudes, and kinetic energy. Standard statistical, word processing, and graphics packages are also available.

*Application materials:*

Psychology Department Admissions Brochure:

[http://psych.uconn.edu/graduate/documents/UConn\\_Psych\\_Admission\\_Brochure.pdf](http://psych.uconn.edu/graduate/documents/UConn_Psych_Admission_Brochure.pdf)

Online application:

<http://grad.uconn.edu/prospective-students/applying-to-uconn/>

*To arrange a visit to CESPA, contact:*

Dr. James Dixon, Director  
james.dixon@uconn.edu

To find out more about CESPA, please visit our website:

<http://ione.psy.uconn.edu>

The application requires transcripts, official Graduate Record Examination (GRE) scores, a personal letter, and three letters of recommendation. Applications should be received by December 1 in order to be considered for financial support.