University of Connecticut

Ecological Psychology

UCONN

An Area of Concentration within the Division of Experimental Psychology

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 25 years, students of Experimental Psychology at the University of Connecticut have received training from two of the leading proponents of the ecological approach, Robert Shaw and Michael Turvey. These students are now themselves at the vanguard of ecological science at major universities such as Arizona State, Brown, California-Riverside, Cincinnati, Clemson, Indiana, Ohio State, and Penn State as well as at independent research facilities such as Haskins 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 10% 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. ICPA-XII will be in Australia in the summer of 2003.

Meanwhile, the Ecological Program at the University of Connecticut has continued to grow. In 1987, the Board of Trustees established the Center for the Ecological Study of Perception and Action (the focal 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 7 Faculty and 8 Fellows (including specialists in optics, acoustics, haptics, movement, nonlinear dynamics, development, ethology, and language), 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 include Ecological and Computational Theories of Perception, Control and Coordination of Movement, Ecological Measurement Theory, Ecology of Language, Social Affordances, Mathematics and Physics for Ecological Psychology, Nonlinear Dynamics and Movement Control I and II, Evolution and Development, and Self-Organizing Systems. (Even the technical courses are within the Department of Psychology—application to perceiving and acting is the organizing theme.) Firm footing in the computational perspective is provided by courses in Sensory Mechanisms, Cognitive Systems Theory, Cognitive Neuroscience, 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. Visitors include physicists, philosophers, mathematicians, and movement scientists in addition to psychologists. *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, and microbial evolution. *Special topic workshops* (e.g., Human and Robot Juggling, Symbols and Dynamics, Serial Order, Physics of Complexity) are held periodically, drawing on scholars from a variety of universities.

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 at $13,000 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 international conferences to present research and make professional contacts. 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. In addition to ecological faculty on UConn's Storrs campus (Claudia Carello, Carol Fowler, Bruce Kay, Claire Michaels, Robert Shaw, and M. T. Turvey) and Hartford campus (Kerry Marsh), collaborative research can also be undertaken with CESPA Fellows (Peter Beek, Paula Fitzpatrick, Ken Holt, Nam-Gyoon Kim, Peter Kugler, William Mace, Kerry Marsh, Gerri Pellecchia, and Richard C. Schmidt), regular visitors whose primary affiliation is with other universities). The four focal laboratories are:

Optic Flow 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. (Kim, Michaels)

Haptic Perception 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 capabilties of dynamic touch and allow comparisons to the informational support for vision and hearing. (Carello, Fitzpatrick, Turvey)

Intentional Dynamics Laboratory. Behavior that is oriented with respect to some goal is said to be intentional. In order for an intention to be fulfilled by a system, whether an individual or a social unit, it must serve as a global constraint on the local actions of that system (e.g., the location of a target constrains how the act of throwing is assembled; the desired facial profile constrains orthodontic treatment planning). Intentional behavior requires prospective, anticipatory control. How can the current dynamics of a system—the forces it must produce, the energy it must use, the number of participants engaged in an act—be constrained by a goal that lies in the future, perhaps years away? What kinds of systems can be considered intentional? Experiments assess the consequences for behavior of manipulating intentions (e.g., navigate a wheel chair through clutter carefully or quickly). (Kugler, Marsh, Shaw)

Action 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. (Kay, Schmidt, Turvey)

Other Research. Investigations of topics such as ecological acoustics, affordances, picture perception, perceptual learning, the dynamics of development, cognitive influences on coordination, posture, 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. Students interested in the ecological approach to language (Fowler) can pursue their studies within either Ecological Psychology or in the Experimental Division's Program in Language and Cognition.

FACILITIES

The Center is housed in 4600 square feet in the Bousfield Psychology Building. The computer environment of SGI, Macintosh, and Pentium machines, connected via local area networks, is upgraded regularly. (The University's mainframe is accessed by ethernet from every CESPA computer and the Psychology Department has a computer systems manager with two full-time assistants to address software, hardware, and network problems.) A large screen projection television (SONY) is used for optic flow displays. Force platforms, electrogoniometers, electromagnetic movement digitizers, and a computerized treadmill collect data from posture, bimanual coordination, walking, 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.

REPRESENTATIVE PUBLICATIONS

Carello, C., Anderson, K. L., & Peck, A. (1998). Perception of object length by sound. *Psychological Science, 9,* 211-214.

Fitzpatrick, P. A., Schmidt, R. C., & Lockman, J. J. (1996). Dynamical patterns in the development of clapping. *Child Development, 67,* 2691-2708.

Fowler, C. A. (1991). Auditory perception is not special: We see the world, we feel the world, we hear the world. *Journal of the Acoustical Society of America, 89,* 2910-2915.

Kay, B. A., & Warren, W.H. Jr. (2001). Coupling of posture and gait: Mode locking and parametric excitation. *Biological Cybernetics*, *85*, 89-106.

Kim, N., Fajen, B., & Turvey, M. T. (2000). Perceiving circular heading in noncanonical flow fields. *Journal of Experimental Psychology: Human Perception and Performance*, *1*, 31-56.

Kugler, P. N., & Turvey, M. T. (1987). *Information, natural law and the self-assembly of rhythmic movement*. Hillsdale, NJ: Erlbaum.

Michaels, C.F., & Carello, C. (1981). *Direct perception*. New York: Prentice Hall.

Michaels, C. F., Zeinstra, E., & Oudejans, R. R. D. (2001). Information and action in timing the punch of a falling ball. *Quarterly Journal of Experimental Psychology, 54A*, 69-93.

Pellecchia, G., & Turvey, M. T. (2001). Cognitive activity shifts the attractors of bimanual rhythmic coordination. *Journal of Motor Behavior*, *33*, 9-15.

Shaw, R. (2001). Processes, acts, and experiences: Three stances on the problem of intentionality. *Ecological Psychology*, 13(4), 275-314.

Turvey, M. T., & Shaw, R. E. (1995). Toward an ecological physics and a physical psychology. In R. Solso & D. Massaro (Eds.), *The science of the mind: 2001 and beyond* (pp. 144-169). Oxford: Oxford University Press.

For application materials, write to:

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Or download the application: **www.grad.uconn.edu**

To arrange a visit to CESPA, contact:

Dr. Claudia Carello, Director
CESPA1@UConnvm.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 January 15 in order to be considered for financial support.