1. Cover Page

Center for the Ecological Study of Perception and Action

Claudia Carello, Director

Budget: $600,000 per year (externally funded)

Participating Faculty:

Claudia Carello, Professor, Psychology
James Dixon, Associate Professor, Psychology
Carol Fowler, Professor, Psychology
Till Frank, Assistant Professor, Psychology
Bruce Kay, Associate Research Professor, Psychology
Kerry Marsh, Associate Professor, Psychology (Hartford Regional Campus)
Claire Michaels, Research Professor, Psychology
Jeffrey Kinsella-Shaw, Associate Professor, Kinesiology
Anjana Bhat, Assistant Professor, Kinesiology
Robert Shaw, Professor Emeritus, Psychology
Michael Turvey, Professor Emeritus, Psychology
2. Unit Description

Overview of the unit's role and mission

The Center for the Ecological Study of Perception and Action (CESPA) was established by the Board of Trustees in 1987. CESPA's primary goal is to understand the formal structure and empirical support for perceiving, acting, and knowing not as achievements of brain but as activities of ecosystems. We see Psychology as continuous with the natural sciences, amenable to the same kind of 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. Research at CESPA involves the application of modern tools for addressing complexity, self-organizing physics, nonlinear dynamics, and relevant mathematics to problems of biological coordination (e.g., locomotion, interceptive behavior, tool use). Collaborators include mathematicians, physicists, philosophers, physical therapists, movement scientists, and cognitive scientists. CESPA provides an organizational structure that allows unparalleled integration of research across specialties, with extensive collaboration among faculty and students. Specialists in optics, acoustics, haptics, coordinated movement, nonlinear dynamics, and language provide a breadth of training in ecological psychology that is unmatched anywhere.

Effectiveness in meeting mission and goals

During the preceding 5 years, CESPA has been particularly active in fulfilling our mission and meeting our goals. The documentation that follows illustrates a high degree of collaboration on grants, publications, conferences and workshops as well as distinguished visibility in terms of invited presentations and federal grant panels.

Our interdisciplinary mission has been extended in an applied domain via a formal collaboration with the Physical Therapy Program in the Department of Kinesiology. The Collaboratory for Rehabilitation Research (CoRR, funded by the provost’s office) established a mechanism for translating basic research on perception and action into interventions and tools that optimize safety and ease of function in daily living for older adults and individuals with movement disorders. This has led to a variety of published manuscripts, conference presentations, post doctoral fellows, an external grant funded by NIMH, as well as a major equipment award from the University of Connecticut Research Foundation.

The long-standing theoretical focus of CESPA—treating perception and action as continuous with the natural sciences, amenable to the same kind of law-based explanation—has recently been recognized with an award from DARPA in the form of the project “Physical Intelligence.” DARPA’s Physical Intelligence Program supposes that the phenomena associated with intelligence and evolution can be understood as natural consequences of complex, open thermodynamic systems. As a subcontract with Hughes Research Laboratories, we are working with physicists, computer scientists, microbiologists, and chemists to bring 30 years of insights
from the ecological approach at the University of Connecticut that anchors perception (construed non-algorithmically) in thermodynamics.

Our success with respect to training graduate students is illustrated by our rich graduate curriculum, which has provided the model for similar programs nationwide, and the success of our graduates in securing positions upon graduation. We train students to be teacher/researchers in the disciplines of ecological science and the application of its modern tools for addressing perception-action-cognition (tools of complexity, self-organizing physics, nonlinear dynamics, and relevant mathematics to problems of biological coordination). We use an apprenticeship style: Students work closely with each other as well as faculty for technical training and intellectual debates. During the past 5 years we have produced 9 Ph.D.s.

We are especially renowned for our level of scholarly interaction, both within CESPA and in the number and variety of special events that we host. CESPA has an international reputation for its intellectual excitement and the hospitality in support of that. These interactions encourage an impressive degree of creativity on the part of our faculty and students, creativity that was the hallmark at our founding and that continues to this day.

3. Scholarly Productivity (past 5 years)

Publications:


Berlin: Springer.


emergency evacuation considering social bond of evacuees. 5th Annual IEEE Conference on Automation Science and Engineering, Bangalore, India, 250-255.
Self-Study Report Fall 2010: Center for the Ecological Study of Perception and Action


Other creative contributions:

None

Contributions to the University's reputation:

Conferences hosted at the University of Connecticut
Society of Experimental Psychologists, Mach 8-10, 2007
A Natural-Physical Perspective on Perception-Action-Cognition, June 18-21, 2008 (funded by National Science Foundation)
New England Sequencing and Timing, March 6-7, 2009

Workshops Hosted
Philosophical Issues in Self-Organization, September 2007
Dynamics in Rehabilitation, November 2007
Ecologizing Al Liberman, January 2008
Perception-Action Development, February 2008
Ecological Human Factors, March 2008
Historical Issues in Ecological Psychology, April 2008
Organism-Environment System, May 2008
Levy Flight Dynamics, October 2008
UConn Workshop on Physical Intelligence (funded by DARPA), June 2010

We have established 4 annual workshops:
August: The UConn Workshop on Cognition & Dynamics (est, 2006)
October: Geraldine Pellecchia Workshop on Cognition & Coordination (est, 2006)
May: Alvin & Isabelle Liberman Memorial Workshop on Current Research on Language (est, 2007)

Keynote addresses delivered
Turvey, M. T. Keynote Address, X1X Symposium of the Spanish Society for the History of
Psychology—Madrid, Spain (2006)
Turvey, M. T. Faculty, Motor Control Summer School—Ligonier, PA (2006)
Turvey, M. T. Keynote Address, International Conference on Progress in Motor Control VI—Marseille, France (2009)
Turvey, M. T. Inauguration of the Center for Motor Control Lecture—Pennsylvania State University, PA (2009)

Invited Presentations

Turvey, M. T. Faculty, Motor Control Summer School—Ligonier, PA (2006)


Turvey, M. T. Invited presentations, 14th International Conference on Perception and Action—Yokohama, Japan (2007)

Turvey, M. T. Distinguished Ohio State University Alumnus Award, Centennial Celebration, Department of Psychology Lecture—Columbus, OH (2007)

Turvey, M. T. Centennial Celebration Lecture, College of Liberal Arts and Sciences, Purdue University—West Lafayette, IN (2007)


Carello, C. “Perceiving attachments to hand and foot.” Invited symposium speaker, 14th International Conference on Perception and Action, Yokohama, Japan (2007)

Turvey, M. T. Invited presentation, International Conference on Coordination Dynamics—Boca Raton, FLA (2007)


Service on State and Federal Panels

CARELLO
National Science Foundation Integrative Graduate Education and Research Training
National Science Foundation Science and Learning Centers Committee of Visitors
National Science Foundation Science and Learning Center Site Visitor (3)

MICHAELS
National Science Foundation Panel Member: Perception, action, and cognition
National Science Foundation Integrative Graduate Education and Research Training
National Science Foundation Program Director, Perception, action, and cognition

DIXON
National Science Foundation Panel Member: Perception, action, and cognition

MARSH
National Science Foundation Integrative Graduate Education and Research Training
National Science Foundation Research Experience for Undergraduates for BCS
National Science Foundation Graduate Research Fellowship Program Evaluation

TURVEY
National Science Foundation Chair, Steering Committee on Integrated Cognitive Science
**External funding:**

In a tabulated form provide a listing of all external funding (from state, federal, foundation or other sources).

<table>
<thead>
<tr>
<th>Agency Name</th>
<th>Project Title</th>
<th>Duration</th>
<th>Total Funding</th>
<th>Direct Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>DARPA</td>
<td>Physical Intelligence</td>
<td>3 yrs (with 1.5 year Phase 3 possible)</td>
<td>$954,872</td>
<td>$642,171</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NIMH</td>
<td>Robot child interactions as an intervention tool for children with autism</td>
<td>2 yrs (with 2-year Phase 2 possible)</td>
<td>$550,000</td>
<td>$404,639</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NSF/MRI</td>
<td>Development of a Gesture Based Virtual Reality System</td>
<td>3 yrs</td>
<td>$782,039</td>
<td>$782,039</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NSF</td>
<td>Haptic Perceptual Instruments</td>
<td>3 yrs</td>
<td>$404,431</td>
<td>$282,520</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NSF</td>
<td>REU Supplement</td>
<td>1 yr</td>
<td>$4328</td>
<td>$3462</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NSF</td>
<td>Dynamics of Rep’l Change</td>
<td>3 yrs</td>
<td>$350,000</td>
<td>$230,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NSF</td>
<td>A Natural-Physical Perspective on Perception-Action-Cognition</td>
<td>1 yr</td>
<td>$20,000</td>
<td>$20,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NSF</td>
<td>Information for Learning</td>
<td>2 yrs</td>
<td>$187,000</td>
<td>$122,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NSF</td>
<td>Information for Learning</td>
<td>3 yrs</td>
<td>$402,419</td>
<td>$276,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cure Autism Foundation</td>
<td>Assessing Synchrony as a Basis for Social Connection in Autism</td>
<td>1 yr</td>
<td>$9,967</td>
<td>$9,967</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NSF</td>
<td>Affordances for Cooperation as a Dynamical System</td>
<td>3 yrs</td>
<td>$327,750</td>
<td>$213,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Self-Study Report Fall 2010: Center for the Ecological Study of Perception and Action**

(Marsh, PI; Carello, Co-PI)

<table>
<thead>
<tr>
<th>Grant</th>
<th>Description</th>
<th>Duration</th>
<th>Amount 1</th>
<th>Amount 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSF Synchrony</td>
<td>3 yrs $194,886</td>
<td></td>
<td>$138,291</td>
<td></td>
</tr>
<tr>
<td>(Fowler, PI; Marsh, Co-PI)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NSF Coordination Dynamics</td>
<td>3 yrs $400,000</td>
<td></td>
<td>$282,149</td>
<td></td>
</tr>
<tr>
<td>(Turvey, PI)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UCRF/MREC 3-D Ecosync</td>
<td>1 yr $238,000</td>
<td></td>
<td>$238,000</td>
<td></td>
</tr>
<tr>
<td>(Carello, PI; Bhat Dixon, Frank, Kinsella-Shaw, Co-I)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Provost Collaboratory for Rehabilitation Research</td>
<td>3 yrs $400,000</td>
<td></td>
<td>$400,000</td>
<td></td>
</tr>
<tr>
<td>(Turvey, PI; Carello, Kay, Kinsella-Shaw, Michaels, Pellecchia, Co-I)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Visiting scholars and Post-docs:**

Miguel Moreno, NIH Post Doctoral Fellow (June 2005 - July, 2006)
Marisa Mancini, CAPES visiting scholar, Brazilian Government (June 2005 - July, 2006)
Sergio Fonseca, CAPES visiting scholar, Brazilian Government (June 2005 - July, 2006)
Yoshi Kobayashi, Post doctoral Fellow, Japan Society for the Promotion of Science, 6 mos, 2010
Rodolfo Benda, Federal University of Minas Gerais, June 3-9, 2010
Harry Heft, Sabbatical scholar Dennison University, 2009
Bert Hodges, Sabbatical scholar Gordon College, Aug 2009-Sept 2010

4. **Plans and direction for the future:**

**What are the unit's strategic goals for the next five years?**

CESPA is a collection of scientists of varied training backgrounds, including not only psychology (social, developmental, and experimental) but physical therapy, physics, physical education, and philosophy. We are dedicated to understanding the behaviors of living systems at the intermediate ecological scale—the scale at which animals and their environments are defined. 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 behaviors at this scale. As noted at the outset, 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.

We are at the beginning of one of the most exciting phases in the 23-year history of CESPA. We have just begun two externally funded projects that bookend our goals. Whereas the Physical Intelligence Project (DARPA) is aimed at the deepest theoretical underpinnings of our approach,
Robot-Child Interactions as an Intervention Tool for Children with Autism (NIMH) addresses the most overtly practical and applied implications of that theory. But as research meetings for those projects demonstrate on a weekly basis, these two projects are intimately connected. The criteria by which one might determine a system, regardless of its composition, to be exhibiting intelligent behavior are not unrelated to those by which one might label a system social (and thereby encouraging of interaction).

During the next 5 years, we would like to build on these successes. Most immediately, we are working to ensure that both of these projects are funded for their next phases. More generally, the two endeavors funded by the University of Connecticut—the Collaboratory for Rehabilitation Research and Dynamics, development and Disability in Ecological Synchrony—have facilitated a give and take between theory and application and given it focus. They have allowed us to use these particular externally funded projects to leverage each other. The Autism Intervention Project provides a practical test-field for general principles when systems are not fluent. The Physical Intelligence Project encourages us to seek a thermodynamic grounding wherever possible and we have taken steps to document the thermodynamics of synchrony of the kind that may be measurable in inter-personal interactions. Interaction between theory and application, therefore, is an explicit goal.

We are also focusing on two formal goals. We hope to identify a minimal ontology that makes first principles explicit throughout our treatment of perception-action. And we really mean first principles: What roles are played by the first and second laws of thermodynamics; what is the status of the so-called fourth law? We are also directing efforts at formalizing the notion of a system for our kinds of problems (pattern-forming systems that are multistable, competitive, and spatially extended). What are the components, how are they organized, and how is the environment to be incorporated as part of the system (not just as an addendum)?

What would be the indicators that will determine whether these goals had been accomplished?

Even our abstract goals work at the interface between theory and implementation. If these goals are accomplished we will have developed new research methods to guide and constrain both our basic and applied research. We will be developing methods that continually measure the multi-scale organization of any system of interest, such that its development (and disability) can be monitored and manipulated via the properties of the ambient energy. This effort will call on all of our theoretical and technical expertise. But if successful, we will see it play out in new directions for our long-standing research endeavors (in dynamic touch and coordination dynamics) as well as in funding domains that are new for us (in rehabilitation, emotion and anxiety disorders). We expect to see thermodynamics explicitly represented in our publications, our grant proposals, our dissertations, and our hosted workshops. Success in meeting our goals will be demonstrated by making our meta-theory explicit.