

Cognitive Science Program

University of Connecticut

Strategic Plan

May, 2006

Cognitive science is the study of how intelligent beings (including people, animals, and machines) perceive, act, know, and think. Its models are formulated using concepts drawn from many disciplines, including psychology, linguistics, logic, computer science, anthropology, neuroscience, and philosophy, and they are tested using evidence from psychological experiments, clinical studies, field studies, computer simulations, and neurophysiological observation. Over the latter half of the 20th century, cognitive science has emerged as an important interdisciplinary field at the forefront of science.

The cognitive science community at UConn is fairly large—well over 30 faculty members consider themselves to be cognitive scientists, and many others work in related fields. Our community includes many undergraduate and graduate students as well. In recognition of our common interests, in 1999 we formed the *Cognitive Science Focus*, an initiative intended to promote both research and education in cognitive science. Our inaugural event was a two-day *University of Connecticut Conference on Cognitive Science*, at which 21 UConn faculty members gave talks on their research interests. Since then, we have organized an annual colloquium series, created a web page and mailing list, offered an undergraduate course (COGS 201, *Foundations of Cognitive Science*), and perhaps most significantly, established an undergraduate major.

Over the last several months, the Cognitive Science Steering Committee has worked to formulate a strategic plan that builds on these efforts. The plan addresses three of UConn's primary missions: undergraduate education, graduate training, and scholarship and research. It is meant to provide a 'big tent' under which cognitive science of all types can flourish while also capitalizing on the distinctive strengths of UConn's cognitive science community. Lastly, it identifies the kinds of investments that will be needed, both in the short and long run, to fulfill our vision for an active, vibrant, and internationally recognized cognitive science program.

Undergraduate Program

A proposal to create an undergraduate major in cognitive science was submitted to the Department of Higher Education in 2001. Students were first accepted into the program in 2002, and final accreditation of the program was granted in March 2006. Since the program was first licensed, approximately 25 undergraduates have declared cognitive science as their major; by the end of the Spring 2006 semester 10 students will have earned degrees in the major.

Since the program's inception, the Steering Committee has continually monitored how well the program has met our students' needs. Thus, while we are in general pleased with the success of the program, we have instituted several changes, including minor modifications of the requirements and, most importantly, the development of a new core course—COGS 201, *Foundations of Cognitive Science*, which presents the main themes of Cognitive Science from both the historical and theoretical perspectives. In the foreseeable future, our efforts to enhance

and promote our undergraduate education mission will be directed along three dimensions: Curriculum, Community, and Recruitment.

Curriculum

Thus far, we have innovated one Cognitive Science course, COGS 201, Foundations of Cognitive Science, co-taught by Tabor (Psychology) and Ryder (Philosophy). This course presents the main themes of Cognitive Science from both the historical and theoretical perspectives; it is designed as an introductory rather than capstone course. This course is now designated as one of the Core courses of the major; therefore, steps will be taken to establish its continuity so that it will be offered once/year. Moreover, the course is currently being revised to qualify as a General Education course; Tabor and Ryder have just received funding from GEOC to support these revisions over the next two years.

Further enhancement of the major will include the development and promotion of at least two additional courses within relevant CLAS departments, one of which focuses on Computational Modeling and the other of which focuses on Cognitive Neuroscience.

- Computational Modeling courses are central to CogSci majors at other universities (including but not confined to the following: UC Berkeley, UCSD, University of Virginia, University of Pennsylvania, Johns Hopkins University, Indiana University, Lehigh University) because they teach students how informative and revealing to the natures of animal, human, and community minds is the process and organization of detailed and intricate modeling. UConn's CogSci major currently lists several such courses (e.g., CSE 282, CSE 259, CSE 298); however, these are usually not accessible to CLAS majors (CogSci majors are predominantly from CLAS) because of the numerous—and sometimes irrelevant—prerequisites from CSE. Another potentially relevant course, Psych 260, was taught by a professor who is now emeritus and has not been offered for at least eight years. Thus, a Computational Modeling course housed in CLAS would make this crucial aspect of CogSci available to all CogSci majors.
- Cognitive Neuroscience courses are also central to CogSci majors at other universities (see above list) because they teach students how cognitive science theories, models, and behaviors might—and might not—be instantiated in the neural organization of animal and/or human brains. Moreover, in the limit all theories, models, and behaviors are constrained by brain organization. There is no currently available course on this topic available at UConn; the ones that approach most closely (Psych 257, PNB 251, PNB 263, PNB262) focus primarily on the cellular/subcortical levels of the brain rather than cortical areas, where many cognitively-related processes occur; moreover, these courses do not cover cognitive processes in either animals or humans in any depth. Thus, a Cognitive Neuroscience course would open a window onto this exciting and cutting-edge area for our majors.

Additionally, we plan to explore the possibility of establishing a Cognitive Science Minor and to develop vehicles for encouraging majors to become more actively involved in research—both their own projects and those of faculty and graduate students.

Community

Common questions among UConn CogSci majors include “Who else is a CogSci Major?” “Where is the CogSci presence at UConn?” and “What can I do with a CogSci major?” We plan to design and promote scholarly, social, and informational events for majors to help the students

feel they are a cohesive group on campus. The planned Cognitive Science Institute will provide a stable location for social and scholarly events, as well as bulletin boards (both actual and virtual) for sharing information. Such events might include (but are not limited to):

- Forums on “What can I do with a CogSci major?” to which speakers who work in both academic and non-academic settings would be invited.
- Pizza parties to facilitate communication and camaraderie among the older and younger/ recently declared CogSci majors.
- Reading groups to read pre-selected papers by upcoming colloquium speakers and then discuss the relevant issues after each colloquium
- Research groups/meetings so that students could present and discuss the research they are working on.

Recruitment

We plan to increase the number of majors (and possibly minors), with a target of 10 majors graduating each year (total census of 30-40). Steps that will be (or recently have been) taken to accomplish this include

- Teaching COGS 201 as a General Education course, thus raising the visibility of Cognitive Science and the major to lower division students.
- Enhancing our presentation at the Open House and Major Fair; new visual/multi-media presentations are in the works.
- Publicizing the forums and meetings described in the *Community* section above to (a) the undergraduate community at large, (b) the Honors program, (c) courses that are part of the Cognitive Science major, (d) the ACES and Independent Major programs, among others. This publicity would raise the visibility and desirability of the Cognitive Science major to non-majors as well.
- Developing a Cognitive Science minor.

Graduate Training

Graduate students can play a central role in developing both the field of Cognitive Science and the program at the University of Connecticut because their research programs are in a formative phase, so they are in a position to make interdisciplinary research their focus. When faculty across departments have interests in common, graduate students can play a critical role in knitting the ideas together into a thesis with depth of thinking and empirical substance.

Currently there is a Linguistics/Psychology/Communications Sciences weekly seminar in which talks are frequently given by graduate students from the three participating departments and which is regularly attended by graduate students. A number of Philosophy graduate students are engaged in collaborative projects with researchers in Psychology. Within Psychology, graduate students are taking the lead on several cross-disciplinary projects that span, among other areas, clinical, developmental, language, and ecological psychology.

We plan three main struts in support of interdisciplinary work by graduate students: (1) supporting interdisciplinary communication by graduate students, (2) providing funding for cross-disciplinary work, and (3) offering a graduate certificate in Cognitive Science. Strut (1) will include both faculty-graduate student communication and communication among graduate students in the absence of faculty---the latter allowing some ideas to gel that might not otherwise.

We also plan to encourage graduate thesis committees to include an advisor or advisors from outside the primary department. Strut (2) may involve establishing UConn-based scholarships that support and reward interdisciplinary work; it will also involve seeking extramural training grants and research grants with graduate funding lines. We believe that Strut (3), the graduate certificate, is the most sensible approach to establishing institutional recognition, and to ensuring both breadth and depth of graduate training. An important element of building the certificate program will be to identify relevant cross-disciplinary coursework and to create synergy among the courses by making participating faculty, as well as graduate students, aware of the relationships between their courses.

Scholarship and Research

A major goal of the Cognitive Science Program is to facilitate and promote scholarship and research in cognitive science at UConn. Through mechanisms such as the *University of Connecticut Conference on Cognitive Science* and our annual colloquium series, we have endeavored to create an intellectually stimulating environment where cognitive scientists from various disciplines can exchange ideas, learn from one another, and, when appropriate, engage in collaborative research. Examples of collaborative projects engendered by the Cognitive Science Program include:

- *Grant proposals:* Boster (Anthro)/Naigles (Psych) UCRF; Snyder (Linguistics)/Magnuson/Tabor(Psych) NSF
- *Publications:* Grela (Communications) / Snyder/Hiramatsu (Linguistics) *Clinical Linguistics and Phonetics* (2005)
- *Projects:* Naigles (Psych) / Snyder (Linguistics) Language acquisition; Grela (Communications) / Magnuson (Psych) Specific Language Impairment;

We believe that increasing awareness of collaboration opportunities and supporting collaborative funding application will facilitate the blossoming of a vigorous, self-aware cognitive science research community.

Described below is our plan for advancing our scholarship and research mission. This plan both capitalizes on distinctive strengths of the UConn cognitive science community and identifies areas for future growth. The goal is to increase the quantity and quality of cognitive science research here at UConn, and in so doing, to enhance the visibility and reputation of our program and its members, yield more external funding, aid in the recruitment of faculty, students, and postdoctoral fellows, and generate more interactions among cognitive scientists and researchers in related fields.

Areas of Emphasis

While we intend to enhance the opportunities and productivity of all members of UConn's cognitive science community, we also believe that it is advantageous to develop a strategic plan that is organized around the extant and potential strengths of our program. We have identified four such areas of emphasis

i. Language. Research on human language has long been a major strength at the University of Connecticut. The Department of Linguistics is recognized as one of the world's leading centers for theoretical linguistic research. The Department of Psychology is home to researchers studying human language from computational (connectionist), developmental, neuropsychological and adult-psycholinguistic perspectives. The Department of Communication Sciences adds the perspectives of developmental and acquired language disorders. Researchers investigating other aspects of the human capacity for language can be found in the Departments of Philosophy, English, Anthropology, and Modern and Classical Languages, to name but a few.

An important opportunity for the UConn Cognitive Science Program is created by the ability and willingness of these researchers to communicate, debate, and collaborate across traditional disciplinary lines. At most universities one finds far greater barriers between the researchers who take theoretical, computational, or developmental approaches, for example. Atop our strong foundation we propose to build an internationally prominent center for research and training in the cognitive science of language.

ii. Evolutionary Approaches. We intend to develop an emphasis in evolutionary approaches to cognition as a way of distinguishing the cognitive science program at UConn from those at other universities and also as a way of increasing the synergy with related interdisciplinary programs at UConn that pull together other combinations of the four elements of mind, evolution, genetics, and humans. Several UConn Anthropologists are leading voices in evolutionary anthropology. Philosophers at UConn have developed the idea that the intentionality of thought and the semantic properties of linguistic expressions can both be understood in terms of their evolutionary functions. Several Linguists are concerned with the emergence and ongoing evolution of human language. Linda Strausbaugh of UConn's Molecular and Cellular Biology Department is organizing an interdisciplinary signature program in applied genomics that includes professors from Anthropology and Psychology. These emphases support a conception of our cognitive science program as embracing the whole range of the chain from ultimate to proximate causality; encouraging collaboration between geneticists, cognitive neuroscientists and neurophysiologists, developmental psychologists, cognitive scientists studying both normal adult capabilities and the effects of pathology, philosophers concerned with the evolutionary nature of knowledge, and evolutionary cognitive scientists and cognitive ecologists.

iii. Dynamical Cognition. Over the past two decades, a new view of cognitive science has been gaining steam. It maintains that the mental structures identified as foundational by traditional cognitive science are, in fact, emergent properties of systems that can be described at a more microscopic and physical level than the traditional approach assumes. The approach emphasizes the interactive, self-organizing, embodied, and distributed (across neurons and people) nature of cognitive systems. UConn is in a unique position to push the frontier of understanding in this new realm: Its Ecological Psychology group has long emphasized the importance of focusing on interactive organism-environment systems. Its Psychology of Language group works with interactive connectionist models and spans the gap between the dynamics-oriented Ecological group and the structure-oriented field of Linguistics. The Linguistics Department itself possesses sophisticated knowledge of the critical language structures and has an unusual strength in experimental approaches. UConn Developmental Psychologists have contributed significant insights on the roles of learning and emergence. A group of Social and Ecological psychologists is providing path-breaking evidence in favor of the self-organizing nature of socially distributed cognitive systems. UConn philosophers are concerned with the evolutionary nature of knowledge, the relation between mind and brain, and

the difference between connectionist models and classical models of mind. Finally, dynamical cognitive science, with its focus on understanding in principle how cognitive processes can arise out of the feedback interactions among many microscopic elements, works in close parallel with cognitive neuroscience, which asks the same question by examining aggregations of real neurons.

iv. Cognitive Neuroscience. Cognitive neuroscience seeks to provide an integrated understanding of the psychological, computational, and neural mechanisms of cognition. Spurred in part by advances in technology (e.g., the development of functional magnetic resonance imaging), over the last several decades cognitive neuroscience has become an increasingly important field. Research at UConn reflects this trend: a number of faculty members are engaged in research aimed at advancing our understanding of either the neural mechanisms of basic cognitive processes (e.g., language and memory) or the biological underpinnings of disorders that are (at least in part) cognitive in nature (e.g., autism, dyslexia and specific language impairment). Moreover, this research is complemented by work conducted under the auspices of UConn's *Program in Neuroscience*, which focuses more on the cellular and molecular aspects of brain function. Thus, the building blocks are in place to serve as the foundation for further growth along these lines, and this growth would be justified in terms of scientific need, the availability of external funding, and our undergraduate and graduate training missions.

Initiatives to support scholarship and research

In order for it to support collaborative cross-department cognitive science research, we plan a variety of steps. While some are continuations of ongoing efforts by the Cognitive Science Focus, others represent moves in new directions. Collectively, these steps are meant to foster communication and collaboration among the members of the program, increase the amount of external funding for our research, encourage contact with other branches of the university, improve our visibility to those outside the University, and to ensure the long-term stability of the program.

Communication. We have already established a website (www.cogsci.uconn.edu) and an email distribution list. We plan to put in place a mechanism for augmenting and regularly updating the website. We want it to function as a 'virtual institute' through which cognitive scientists at UConn and elsewhere can access and discuss work generated by the UConn community and through which the rest of the world can gain access to our work. We plan to convert the email list into a listserv and make sure that all relevant parties have the capability of posting to it, so that it will serve as a reliable source of information on all cross-disciplinary cognitive science events at the university. Most importantly, we plan to increase the mutual awareness and collaboration among researchers in the community by (1) having a working group of the Cognitive Science Program whose job it is to create a map of relationships between cognitive science projects at UConn and to communicate the contents of the map to the entire community; (2) creating forums for interaction among members. Regarding (2), we held, in 1999, an in-house Cognitive Science Conference, which helped members of the Community become aware of one another. We were pleased to lend our support to and interact with the Conference on Literature and Cognitive Science held at UConn in Spring, 2006. The Cognitive Science Colloquium, which has now been running for 8 years and is regularly attended by a wide swath of the community, is also an important mechanism in support of aim (2). Now we plan to develop one or more reading groups among faculty, postdocs, and graduate students which will

have the aim of facilitating collaborations, including collaborative grant writing (see next paragraph). We are looking into the possibility of holding a regional, national, or international conference on a cognitive science topic in which UConn has unusual strengths. The colloquium series, our collaborative publications, and the conferences will all serve to increase the visibility of Cognitive Science at UConn.

Extramural Funding. To facilitate the funding of collaborative research, we will look into a method of organizing the collaborations institutionally. One goal is to provide staff support for grant writing and administration. Some departments (e.g., Psychology) have dedicated staff who help create budgets, provide valuable advice on details of the processes associated with various external funding agencies, and help administer grants that are awarded. The Office for Sponsored Programs performs some of this work as well. We need to provide similar services for interdisciplinary collaborations in cognitive science, either by creating a staff position specifically assigned these duties, or perhaps by negotiating agreements with departments as to how they will contribute resources in return for our efforts at enhancing their funding opportunities.

In addition to providing support for collaborative research, the Cognitive Science Program also intends to seek extramural funding directly. We plan to identify and apply to appropriate funding programs (e.g. NSF, NIH, and McDonnell-Pew training programs) and also work with the University's Development Office to seek contributions from alumni and other donors.

Coordination with Other Interdisciplinary Programs. Another important objective is to coordinate the development of the Cognitive Science Program with other interdisciplinary initiatives at UConn. Several of these initiatives lie at the intersection of the study of mind, the study of evolution, and the study of the genome as they apply to the understanding of what it is to be human. Such initiatives include the collaboration between Linda Strausbaugh (of Molecular and Cell Biology and the Center for Applied Genetics and Technology) and members of the Anthropology department to explore various uses of genetics to understand the history of human evolution, and a related initiative by the Center for Culture, Health, and Human Development to explore similar topics in connection to both development and health. Another relevant interdisciplinary initiative is the Program in Neuroscience, which is closely related to the Cognitive Neuroscience emphasis discussed above. Finally, several ongoing interdisciplinary initiatives that combine basic research and outreach are also concerned with topics related to cognitive science. These initiatives include the Collaboratory for Rehabilitation Research (CoRR), a joint effort between the Departments of Psychology and Physical Therapy, and the Center for Health/HIV Intervention and Prevention (CHIP).

Given these mutual interests, the potential benefits of cooperative interactions with these other initiatives are many. The Cognitive Science Steering Committee will seek ways to foster both intellectual exchanges and collaborative research with members of these other initiatives, as well as ways to maximize resources and strengthen our undergraduate and graduate training programs.

Establishing a Cognitive Science Institute. In the long run, our goal is to secure the external funding and internal support necessary to establish a Cognitive Science Institute. External funding would be sought from both federal (e.g., NSF, NIH, NIMH) and corporate (e.g., Intel, United Technologies) sources to fund workshops and conferences, a graduate research training program, a post-doctoral program, a faculty fellowship program, and collaborative interdisciplinary research. The Institute would be designed along the lines of the Humanities Institute and would be an office complex with offices for visiting scholars and space for

workshops and conferences. We would hope to have the same sort of fellowship support for internal and external candidates, as the present UCHI is not well designed to accommodate the interests of those peripheral to the disciplines of History and Literature.

Required Support

Faculty. One critical issue concerns the staffing of COGS 201. Given the nature of the course, we believe that the course should be team-taught; given its importance for the quality of the undergraduate major and the role that the course is expected to play in increasing the visibility of the program and the recruitment of additional majors, we believe that the course should be offered at least once a year. This spring both Tabor (Psychology) and Ryder (Philosophy) received course credit from their respective departments for co-teaching COGS 201, but neither department was compensated for this support. This situation is less than ideal. A formal agreement between CLAS and the instructors' departments, perhaps involving adjunct funds or other departmental credit, would provide a fair and stable solution and would provide a framework to support the development of additional courses, such as the computational modeling course described above.

A second issue to be considered involves the hiring of new faculty members. There are no faculty lines specifically associated with the Cognitive Science program, and we do not anticipate requesting such lines in the foreseeable future. However, at present the program has no formal role in the hiring of new faculty, and hence we have no direct means of shaping the growth of cognitive science at UConn or ensuring that programmatic needs are addressed. We believe that mechanisms to address this issue should be explored. Such mechanisms should provide a way to coordinate the needs of the program with the needs of specific departments. Coordination across departments is also critical. One possibility is to make cluster hires centered around specific areas of emphasis.

Administrative Support. Our experience to date has made it abundantly clear that staff support should be made available for various administrative tasks. These tasks include: processing of student records (e.g., declaring majors, filing plans of study, record maintenance); the use of the Financial Records System (for expenditures related to colloquia, fellowships, and so forth); support for the creation of grant proposals and for the administration of those grants that are funded; and website construction and maintenance. We strongly urge the administration to provide such support, at a level commensurate with the scope and needs of the program.

Other Funding. An integral component of the program is the Cognitive Science Colloquium series. The operating budget for this series has typically been between \$2000 and \$3000 per year. CLAS has usually provided about half this amount, with the rest coming from UCRF and participating departments. Funding for this series should continue, and the procedure for requesting and receiving the funds should be regularized (perhaps as part of the annual departmental budget requests) and simplified (to eliminate, for example, the need to submit a small-grant proposal to UCRF).

In addition to the colloquium series, some of the other proposals discussed above would, if implemented, also require modest levels of funding. These include conferences and poster sessions, a visiting scholar program, graduate or undergraduate fellowships, and social gatherings to bring together students and/or faculty members.

Space. The bare minimum would be office space for the administrative assistant for the Program, which would be called the Cognitive Science Center. In the long run, the establishment of a Cognitive Science Institute would require a more significant amount of space, including a complex of offices (for both administrative and scholarly use) and space for workshops and conferences.