HAMPSHIRE COLLEGE
School of Cognitive Science

Cognitive Science Technical Report Series

Hampshire College School of Cognitive Science Self Study Report

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Hampshire College
School of Cognitive Science
Self Study Report

February, 2004

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Introduction

This report is the result of a year-long self study process in the Hampshire College School of Cognitive Science. The process was deliberative and participatory, with most members of the school contributing in significant ways.

The process included several meetings of the self study committee (Lee Spector, Eric Anderson, James Miller, Laura Sizer, and Neil Stillings), portions of several School meetings, a day-long retreat dedicated solely to the self study, and a substantial volume of email. Information was gathered from faculty, staff, and students and from the CS School, Dean of Faculty, and Institutional Advancement offices.

Each member of the self study committee was primarily responsible for drafting a section of the report and the drafted sections were subsequently edited and integrated by the Dean (Spector). The organization of the resulting report is sufficiently different from that of the draft that it would be misleading to associate sections of the final report with individual drafters, with one notable exception: “Section IV: Students” was researched and written by the committee’s *student* member, Eric Anderson, and appears in the final report with only minor editing. It should be noted that Eric was responsible for the design, execution, analysis, and documentation of the questionnaire study in this section.

I. History and Impact

Section outline:

1) Cognitive Science at Hampshire as an experiment in undergraduate education
2) A brief history of the School of Cognitive Science & its current status
3) Cognitive Science graduates in academia
4) The national role of the School of Cognitive Science
5) Recent acclaim

1) Cognitive Science at Hampshire as an experiment in undergraduate education

From its inception in 1970 the School of Cognitive Science (CS) has presented a new interdisciplinary field to undergraduates as a distinctive mode of inquiry and a central area of knowledge that should be a part of every student's education and that can serve substantial numbers of concentrators. It is one of Hampshire's most ambitious curricular experiments.

Throughout the School's history the CS faculty has considered its work to be of national significance and has worked to redefine its curriculum and approaches to teaching in response to changes in the field and to what it has learned from working with successive generations of students.

The chance that the college took with cognitive science has been rewarded by the explosive growth of research in the field, its public prominence, and the establishment of cognitive science programs at colleges and universities throughout the country. The growth of the cognitive science community has made it possible for the School to play a role in a national conversation. The School retains a distinctive voice that derives from its long experience and its unique position as a cognitive science program that plays a central role in the curriculum of a liberal arts college.

2) A brief history of the School of Cognitive Science & its current status

In the five years of planning prior to Hampshire's opening in the fall of 1970 a novel conception of an interdisciplinary faculty group emerged. This curricular unit would address the following kinds of issues: Relationships between mind, brain, and machine; logic, meaning, and truth; the nature and structure of human language; the influence of technology on the interchange of information and representations in society; and the possibility of machine intelligence. During the planning period, this initiative was shaped by a group of founders of the college: President Franklin Patterson, Mount Holyoke College Professor of Philosophy Roger Holmes, mathematics faculty members William

Marsh and John LeTourneau, communications faculty member Richard Muller, and founding director of the library Robert Taylor.

The idea was in step with then recent developments in psychology (the cognitive revolution), linguistics (the Chomskyan revolution), computer science (the first working artificial intelligence systems), philosophy (functionalist philosophy of mind; linguistically-oriented philosophy of language), and sociology (theories of mass communication). More radically, however, the planners suggested that these new developments constituted a new mode of inquiry that should be co-equal with the humanities and the social and natural sciences. They argued that this new mode of inquiry should occupy a substantial place in the liberal arts curriculum.

When the college opened in 1970, what is now the School of CS was known as the *Program in Language & Communication*. It became the *School of Language & Communication (L&C)* in 1972. In keeping with developments in the field, the School was renamed *Communications and Cognitive Science (CCS)* in 1984. In 1995 the rise of cultural studies as a paradigm for understanding mass communication led to the further revision, *Cognitive Science & Cultural Studies* (still abbreviated *CCS*). In 1998 the cultural studies faculty moved from CCS to Humanities and Arts, and the School became *Cognitive Science*.

Today, the School of CS, one of five organizational units of the faculty, has 12 faculty members (out of roughly 100 in the college). This number is well below the expansive concept of the School's founders (who envisioned 20-25% of the faculty), but, although it constrains what the School can do, it has been sufficient to represent the main intellectual currents in the field and to develop a number of cutting-edge pedagogical experiments. The future size of the School in relation to its ability to continue to innovate is a potential issue for this review.

3) Cognitive Science graduates in academia

The breadth of the CS curriculum and the involvement of CS faculty in the work of students with interests that range well beyond cognitive science has insured that the graduates of CS have gone on to many different pursuits. The CS faculty takes some pride, however, in having trained a number of students who were able to gain admission to top graduate programs and to go on to success in academia. To some extent these students, all of whom graduated since 1973, validate the quality of education that CS has offered in core cognitive science. A partial list follows:

Helen Apthorp, Principal Researcher, Mid-continent Research for Education & Learning
Lorraine Bahrick, Professor of Psychology, Florida International University
Andrew Barss, Associate Professor of Linguistics, University of Arizona
George Bonanno, Associate Professor, Counseling & Clinical Psychology, Teachers College, Columbia
Fred Conrad, Research Associate Professor, Joint Program in Survey Methodology, University of Maryland

Samuel Epstein, Professor of Linguistics, University of Michigan
Andrew Forsyth, Program Director, NIMH Center for Mental Health Research on AIDS
Gianluca Gallo, Professor, Dept. of Neurobiology & Anatomy, Drexel University College of Medicine
Andrew Gordon, Associate Professor**,** Biobehavioral Studies, Teachers College, Columbia
Raymond Gibbs, Professor of Psychology, University of California at Santa Cruz
Gary Marcus, Professor of Psychology, New York University
Mark Reinitz, Assoc. Professor of Psychology, University of Puget Sound
Susan Sugarman, Professor of Psychology, Princeton University
William Warren, Professor of Cognitive and Linguistic Sciences, Brown University

4) The national role of the School of Cognitive Science

The School has succeeded in participating in the national development of cognitive science education, through publications and presentations, organizing workshops, and consulting. Some of the high points of these efforts are as follows:

- 1987. Organized and ran a national workshop on teaching cognitive science. Held at Hampshire under a grant from the Alfred P. Sloan Foundation.
- 1987. Six members of the School's faculty, and a faculty member at UMass, Amherst, published the first comprehensive textbook in cognitive science: *Cognitive Science: An Introduction,* MIT Press.
- 1993. Organized and ran a national workshop on undergraduate cognitive science. Held in Washington, DC under a grant from the NSF. Final report at http://helios.hampshire.edu/~nasCCS/nsfreport.html. The practical gist of the report is summarized in a check-list for new cognitive science programs at http://helios.hampshire.edu/~nasCCS/prog_chklist.html
- 1995. 2nd Edition of *Cognitive Science: An Introduction* was published. Through its two editions the book was widely used in undergraduate and graduate courses and by individuals learning the field. The book sold well in Europe and was translated into Japanese and Greek.
- 2000 to the present. Participation in The Mind Project, a web-based cognitive science curriculum, being developed under an NSF grant to Illinois State University and Indiana University (See http://www.mind.ilstu.edu/).
- 2003. Collaboration with the Schools of Natural Science and Social Science at Hampshire to found the Culture, Brain, & Development Program (CBD), a 5-year curriculum development project funded by The Foundation for Psychocultural Research. (See http://www.hampshire.edu/cms/index.php?id=2480)

In addition to the above landmarks, individual CS faculty members have served on many national committees (for the NSF and a number of professional societies) and departmental review committees concerned with cognitive science education, have given presentations at numerous cognitive science education meetings, and have published papers on cognitive science education. Individual faculty members have also received several federal grants for laboratory and curriculum development.

5) Recent Acclaim

Following are just a few examples of high-profile CS activities that have received media attention during the development of this self-study report:

- Ray Coppinger's research on the evolution of canine behavior was featured in a February, 2004 Nova TV special, *Dogs and More Dogs*.

- Mark Feinstein discovered a method of measuring stress in sheep through recording and analyzing their vocal behavior. This research, which may have positive economic and humane consequences as well as shedding new light on the vocal signals of sheep, was picked up by numerous media outlets in the United Kingdom, Australia, New Zealand, the United States, and India including the BBC, NPR, Dublin Radio, Radio, New Zealand, Australian Broadcasting, and the Associated Press.

- Richard Weiss's course, titled "Is Big Brother Watching?: Privacy and Security on the Internet," was featured in the *Chronicle of Higher Education*. This course uses current controversies related to computer privacy and security to draw less technically minded students into the computing curriculum.

- Lee Spector received the highest honor bestowed by the National Science Foundation for excellence in both teaching and research, the *NSF Director's Award for Distinguished Teaching Scholars*. His project, *Open-Ended Evolution in Visually-Rich Virtual Worlds*, will produce software that provides research opportunities for fields ranging from evolutionary biology to optimization theory.

- The Foundation for Psycho-cultural Research awarded $1 million to the new *Culture, Brain and Development program*, a cross-School program linking neuroscience, anthropology, psychology, and related fields.

II. Curriculum

Section outline:

1) Curriculum overview
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2) Descriptions of specific disciplinary curricula
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4) Representative divisional examination titles
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    B. Division III

1) Curriculum overview

A. How cognitive science is defined at Hampshire

The curriculum of the School of Cognitive Science is broadly interdisciplinary. It is rooted in the scientific study of the mind but it has branches across the academic spectrum. It constitutes a central area of knowledge and liberal arts learning and offers a critical perspective on human nature, on the nature of knowledge itself, and on our possible futures in the digital age.

The School's curriculum has traditionally been described in terms of three, broad interlocking areas: Mind and Brain; Knowledge and Language; and Computing Technology. While accurate, these categories are also somewhat artificial, and the School's curriculum is perhaps more complex, interconnected, and dynamic than these terms by themselves suggest.

The diagram in Figure 1 presents a more nuanced picture of the current CS curriculum and its interconnections with the curricula of the other four Schools in the College. This diagram was developed as a brainstorming aid for a curricular retreat and is not

comprehensive, but it does illustrate some of the School's major curricular foci along with many of the interdisciplinary intersections within which teaching and research are conducted. The geometric constraints of the page make it impossible to represent all of the intersections without visual clutter—for example "Developmental Psychology" should be linked to "Evolutionary Theory," and "Language" should be overlapped by "IA"—and it was therefore necessary to omit certain connections for the sake of clarity.

Research forms an integral part of the CS curriculum. The role of research in the curriculum is documented in Section II.3 below (Representative courses), and in Section IV (Students), which describes research collaborations between faculty and students. Faculty research is also described in Section III (Faculty) and in individual faculty vitae in the Appendix.

Because all entering students are required to take a CS course in their first year, and because CS is a major division of the college's faculty, cognitive science is defined more broadly at Hampshire than at some other institutions, where it may be one of 20-50 co-equal departments or programs. The School's faculty and curriculum does, of course, cover the traditional core areas of cognitive science, including cognitive psychology and development, cognitive neuroscience, linguistics, analytic philosophy, and artificial intelligence. CS was also somewhat prescient in bringing an ethologist onto the faculty well before the recent rise of comparative cognition and evolutionary psychology. Because of the School's curricular responsibilities, introductory CS courses in these core areas are designed to appeal to a broader range of students than is sometimes the case at other institutions, and intermediate-to-advanced courses sometimes make more extensive connections to fields outside of cognitive science.

CS is fully responsible for computer science at Hampshire. Thus, the CS curriculum contains courses that might well be in the computer science or mathematics departments at other colleges. The computer science curriculum is also tilted toward the more cognitive topics in the field. For example, courses on neural networks or computer vision are a perfectly good place to learn concepts about data structures, object-oriented programming, or languages. In connection with this concentration on computer science, CS also includes the study of the science, art, and social implications of digital media and the digital age. This emphasis on digital media allows CS to make crucial cross-curricular connections with the arts and social sciences, as well as to explore social and technological dimensions of core cognitive science. The School has recently created a new position in and hired a faculty member who has developed a rigorous and popular program in media arts and sciences.

CS has also recently hired a faculty member in education and developed curriculum in cognition and education. This development has allowed the School to develop community outreach programs, to bring principles of cognition to students interested in educational technology, and to make additional connections with the social sciences. It has also allowed CS to play a well-defined role in teaching and advising students who wish to become teachers.

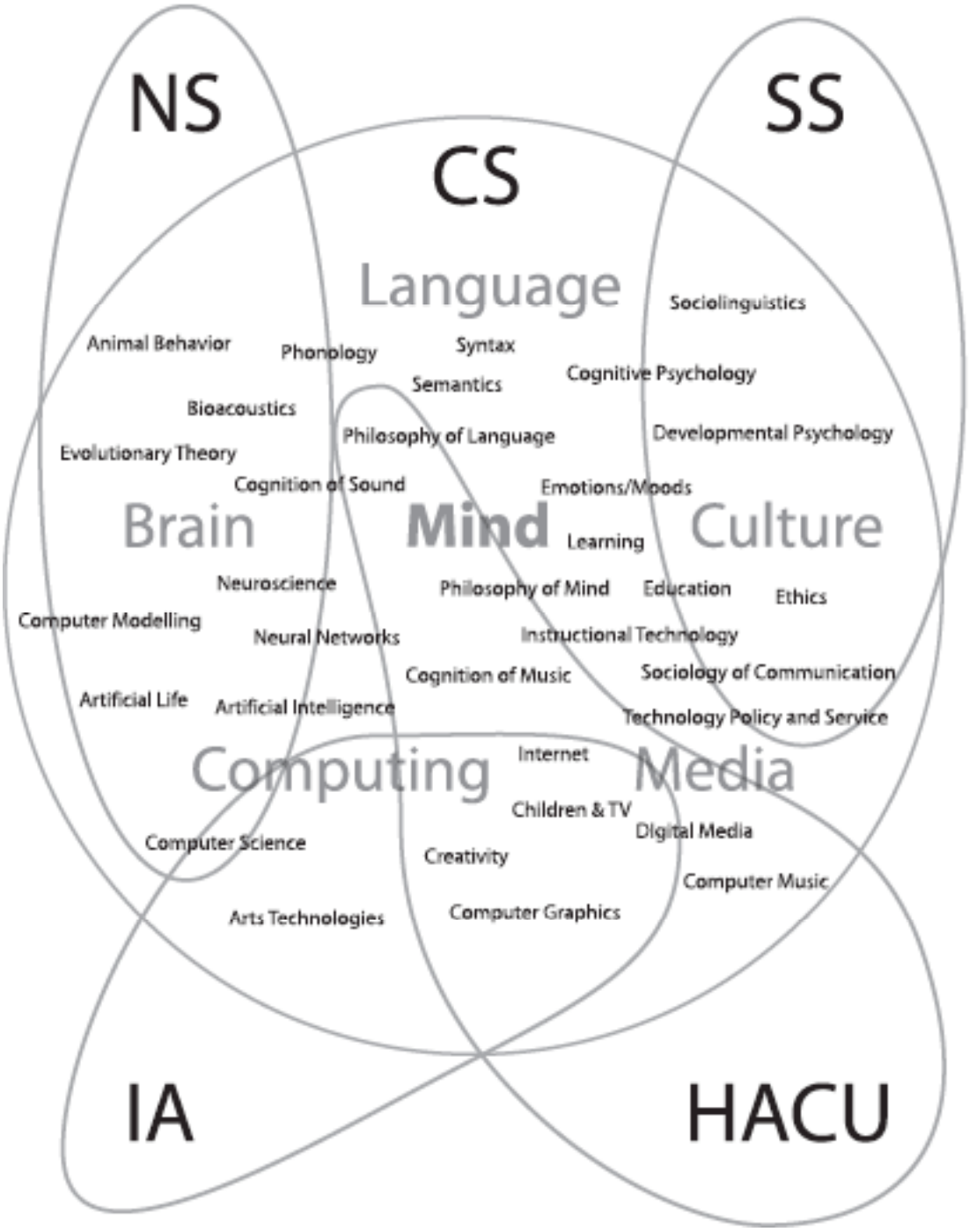

Figure 1. A view of the curriculum of the School of Cognitive Science and its interconnections with the curricula of Hampshire College's other four Schools.

B. Divisional Levels

The School's faculty strives to maintain a learning environment of the highest quality that appropriately supports and challenges undergraduates in their explorations of the content and methods of cognitive science. In tune with the College's educational program, the CS faculty has striven to involve students with active and critical inquiry in cognitive science throughout their undergraduate careers. This mission has specific implications for different levels of instruction:

- Division I: First Year. All first-year students take a course in cognitive science as part of their Division I distribution requirement; this is one component of the College's recently adopted "first year plan," other components of which are discussed later in this report. The School must therefore offer courses that are attractive to the full range of beginning college students and that meet the college's goal of involving these students in active, critical inquiry. It should be noted that the requirement to offer such courses to all first-year students places a disproportionate burden on the smaller Schools, like CS. As a result, CS course offerings are over-weighted toward 100-level courses; this issue is discussed further in Section IV: Students and Section VI: Open Questions. The course enrollment data graphed in Figure 2 shows the skewed distribution of students that results, in part, from the high demand for 100-level course seats in small Schools under the recently adopted first-year plan.

- Division II Concentration: Second & Third Years. Hampshire students design their own concentrations with the guidance of two-person faculty committees. The School of CS, therefore, does not impose a standard set of requirements for concentrations involving cognitive science nor does it organize its course curriculum around staffing a set of requirements. CS faculty members must have the knowledge and intellectual flexibility to work with students on many different types of concentrations within cognitive science as well as on concentrations that combine cognitive science with other fields (e.g. cognitive science and music or cognitive science and biology).The faculty must offer intermediate and advanced courses that provide students with opportunities to deepen their knowledge of key areas of cognitive science and to practice methods of inquiry that are central to their concentrations.

- Division III Thesis Project: Final Year. All Hampshire students complete a year-long independent thesis project in their final year. The projects are comparable to honors thesis projects at many other colleges and include an expectation that the student will do original research or development. Projects in CS take on a number of typical forms, including empirical studies in cognitive psychology, cognitive neuroscience, or animal behavior, analyses of linguistic phenomena, studies in neural network modeling or genetic programming, software development projects, computer animation projects, analyses of philosophical problems, or studies of policy issues related to the digital age. Some projects are originated by the student, others are related to a faculty member's research, and still others are carried out at field sites under the supervision of researchers at the sites. The requirement to supervise

undergraduate research requires that faculty members maintain a high level of mastery of their fields and a significant involvement with research and relevant scholarly communities.

Students who concentrate and complete thesis projects in cognitive science have followed a number of paths following graduation. Graduate school in cognitive science, psychology, linguistics, philosophy, neuroscience, animal behavior, education, or computer science has been a common choice. Some graduates have continued on to medical school or other health science professions. Others have gone into computer or media based industries, education, or have founded their own businesses.

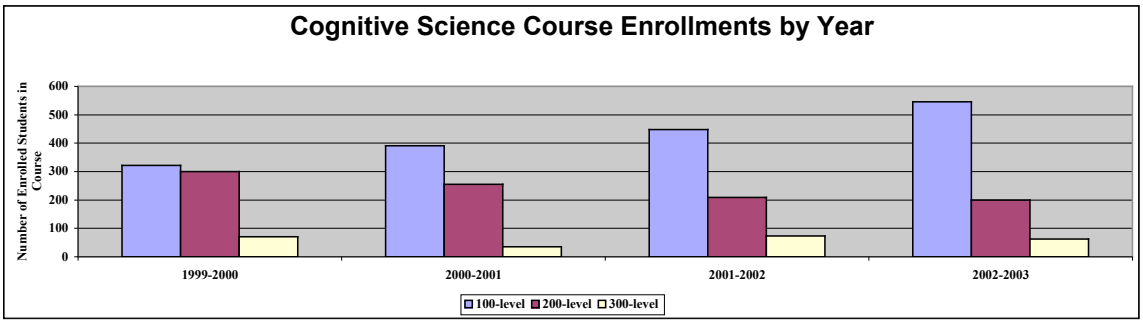

Figure 2. Course enrollment data demonstrating the increasing emphasis on 100-level teaching that is due, in part, to the disproportionate impact of the new first year plan on smaller schools.

C. Stability and fluidity of the CS curriculum

Since 1970 the School has maintained a focus on involving students in inquiry in cognitive science, beginning in the first year and progressively deepening their involvement as they progress. The approach depends on the facts that all courses at Hampshire have small enrollments and that all students are required to complete undergraduate thesis projects. The strategies for engaging students have been consistent over time. They include introducing students to the critical analysis of primary literature in their first year, assigning substantial literature review or research projects within courses, and involving students in faculty members' research programs. Faculty members have encouraged students to develop their own research ideas and have developed skills in mentoring students in their research efforts. The faculty's dedication to helping students to shape their personal intellectual engagement with cognitive science and to push that engagement toward a professional level of accomplishment has defined the character of a Hampshire Cognitive Science education throughout the college's history.

The School has maintained a policy that faculty members are free, within very general constraints, to change existing courses or design new courses. This flexibility is made possible in part by the fact that the School does not have to maintain a roster of required courses and in part by the college's membership in the Five-College Consortium, which allows gaps in the curriculum to be filled by courses at the other colleges. The result has been an unusual degree of experimentation and innovation in the course curriculum. Faculty members are able to develop new interests through teaching, to integrate their teaching and research, to respond to emerging student interests, and to experiment with new pedagogies.

The School's curricular flexibility also led to the use of co-teaching as the primary means to explore the interdisciplinarity of cognitive science. Faculty members trained in different disciplines frequently co-teach courses in which they bring their knowledge and expertise to bear on a common topic or set of questions.

The content of the CS curriculum has shifted considerably over time. For the first half of the 1970's the School's program was focused fairly narrowly on linguistics, logic and computation theory, analytic philosophy (particularly epistemology and philosophy of language and mind), cognitive psychology (mainly psycholinguistics and visual perception), and the sociology of mass communication. The School had no computers and a single psychology laboratory room with equipment that was borrowed from other colleges. Today, with appropriate changes in content, linguistics, analytic philosophy, cognitive psychology, and mass communication remain prominent in the School's curriculum. The linguistics curriculum has been broadened to encompass bioacoustics and animal communication. Cognitive development has become a key part of the psychology offerings, which have also been dramatically extended by the addition of cognitive neuroscience, education, and comparative cognition and behavior. Logic and theory of computation have become elements of a rich curriculum in artificial intelligence, computer science, and digital media. The School now has a substantial physical infrastructure, including wired and wireless networking, two electronic classrooms equipped for teaching computer science and digital media, a psychophysiology lab equipped with a 32-channel Neuroscan EEG/ERP system, a child development lab, and a server room supporting the network and equipped with two Beowulf clusters for high-performance computing applications, including research on genetic programming and neural networks.

To a large extent these changes reflect developments in the cognitive sciences over the last thirty years, including the integration of cognitive science and neuroscience, the increasing influence of evolutionary and cross-species perspectives, the growth of artificial intelligence and simulation-based research, and the advent of applied cognitive science in education and digital media. They also reflect the School's mandate, as one of the college's five curricular units, to provide a broad and flexible range of opportunities to students.

2) Descriptions of specific disciplinary curricula

A. Computer Science

Computer science provides a few courses in the traditional curriculum (e.g., Data Structures, Software Engineering), while focusing most teaching resources on bridges to the study of cognition (through artificial intelligence) and to media arts and sciences (primarily through computer graphics). As a means to attract students with little or no prior technological or scientific experience into quantitative study of computation, an introductory (no prerequisites) programming course is offered each term, along with advanced courses in artificial intelligence and graphics topics that are research or production based. Introductory-level courses that combine serious computer science with other disciplines have also been taught. Examples are *What Computers Can't Do*, which includes philosophy and public policy components, *Quantum Computing with No Prerequisites of Any Kind*, which includes a fair amount of physics, and courses on cryptography that could potentially forge new connections to the School of Social Science.

The existence of four neighboring excellent computer science programs means that computer science concentrators can easily take the standard courses they need off campus. The sequencing and the programming language requirements of these courses, however, can sometimes be complex. The College must take care not to create first-year requirements that prevent students from taking necessary prerequisites in their first year.

B. Education

Research in cognitive science is the source of many new and influential ideas about classroom learning, approaches to teaching, testing and assessment and the potential of educational technologies. Education studies explores how theories of learning and cognition are being applied to education. There are also courses on research methods to test educational theories and for learning about and evaluating classroom applications, i.e. curriculum and instruction. In addition some courses are addressed to students wishing to be certified for teaching.

There is some tension between student demand for courses that meet the state standards for certification and the desire to place the study of education in a liberal arts context. Trying to strike a balance, the education courses that have a strong base in the cognitive science literature also examine applications for teaching and learning (e.g., How People Learn, The Social Foundations of Learning: Theory and Practice). Courses that are geared mainly toward meeting the standards for certification (Instructional Methods for Inquiry Based Instruction) require that students not only learn about curriculum and instruction, but that they read educational research and theory. Emphasis is on ensuring students know the literature base in making instructional choices. Still other courses focus on the reading, understanding and doing of educational research, partly in preparation for Division III projects.

Students are encouraged to develop programs of study that help them tie practice to both educational research and theories of cognition. A new 100-level course will examine the classroom, with components about research, cognition and curriculum. One goal is to attract students to related cognitive science areas. Also in the planning stages is a new program in Child Studies and Education, a joint project of CS and the School of Social Science. The Hampshire College Children's Center (infant, toddler, and preschool daycare) provides integrated academic/work experiences for many students in this area.

C. Ethology

Ethology is the study of behavior in animals. Historically ethologists have limited their attention to the study of innate "instincts." Our approach is to cover a wide range of issues on the nature of behavior, learning and information-processing. By studying the developmental and evolutionary processes that shape the lives and minds of animals, the field provides an important comparative perspective on the general study of cognition.

Students have integrated their work in ethology with all of the core areas of cognitive science – psychology, neuroscience, computer science, linguistics and philosophy. The field also provides important links to students interested in genetics, ecology, agriculture and environmental science.

A regular set of core courses at the 100-level is offered: Animal Behavior, Animal Cognition and Sound in Nature. At the 200-level, there are classes in Cognitive Ethology, the Evolution and Behavior of Domesticated Animals, Bioacoustics, and general evolutionary theory. There is ample opportunity for collaborative teaching and research with other faculty in cognitive science. Examples include courses on play, on learning and innateness and on "animals and animats" (computational simulacra of animals).

Regular 300-level seminars include reading groups that focus on issues in the professional literature; others engage students in field or experimental work. The Hampshire College Farm Center has provided an attractive laboratory setting for many of these activities, including a decades-long project on the behavior of livestock guarding and herding dogs, and a more recent study of vocalization in captive New Guinea Singing Dogs.

D. Linguistics

Linguistics is the scientific study of the structure of language. Because it is a central feature of human cognition, language has long been the focus of attention in many parts of cognitive science, from experimental psychology to artificial intelligence to philosophy. In addition to providing an important and successful example of a well-developed formal theory of cognitive capacity, the systematic study of language also

raises a host of exciting questions about cultural diversity, social behavior, human creativity, learning and the biological basis of human nature.

The core of the linguistics curriculum is a series of introductory (200-level) courses that are collectively called Theory of Language; in a given semester, syntax, phonology or semantics will be offered. Because all three are not always offered during the two years of a given concentrator's Division II work, many of our students study one or more of these subjects at the University of Massachusetts, which has a world-class linguistics program. Some concentrators take graduate classes there. Next year there will be a more compressed introductory linguistics course that covers the three main areas in a single semester. Periodic 200-level courses are offered in psycholinguistics, language acquisition, neurolinguistics, computational linguistics, the biology of language, language and society and the philosophy of language.

Our 100-level courses are designed to be enticements into the field. These include classes in linguistic relativity (the Whorf Hypothesis) and other issues relating to meaning, mind and culture; socially-oriented courses such as Endangered Language, on the rapidly-increasing diminution of linguistic diversity; and Changing Language, a no-background intensive look at issues in historical linguistics and the evolution of language. Field Methods courses (100-level), in which students do hands-on data collection and analysis of such unfamiliar languages as Khmer, Twi and Ahomya (Assamese) are offered, in addition to 100-level classes in bilingualism, brain and language and animal communication.

E. Media

The CS media curriculum covers several topics in the psychology and sociology of mass media along with a developing emphasis on the emerging area of "media arts and sciences."

Courses in the psychology of media focus on issues related to children and television, which is the primary research interest of our developmental psychologist, and on the psychology of music, a long-standing interest of our senior cognitive psychologist. Courses in the sociology of media explore social institutions that bear on the media, such as the law, public policy and corporations, examining media phenomena historically and comparatively. Additional topics covered in this area include the sociology of content producers (such as journalists), First Amendment protections for public expression through the media, the history of new media innovation and adoption (which connects to the computer science curriculum), and the nature of mediated political culture. Courses in this area are periodically co-taught with other CS colleagues, such as a course on "living digitally" with a computer scientist and a course on children and violent media depictions with a developmental psychologist. Future co-taught courses might involve a cognitive psychologist to investigate the ways in which people see/read/interpret different images or image sequences.

The emerging field of "media arts and sciences" investigates media technologies from engineering and artistic perspectives. Programs at other institutions, such as the MIT Media Lab and Stanford's Center for Computer Research in Music and Acoustics, present a similar perspective and also link this work to the study of cognition, but Hampshire's embedding of this curriculum within an undergraduate, inquiry-based, liberal arts context is unusual if not unique.

The focus of current CS media arts and sciences courses is on two- and three-dimensional digital imaging technologies. Some courses provide an under-the-hood understanding of them, including fundamental algorithmic and representational material. Others connect this material with traditional computer science and with simulation and artificial intelligence technologies, to encourage the conception and development of new media technologies. Still others explore the hands-on use of these media forms for creative and communicative ends. All told, these courses explore the interactive relationship between media technologies and the creative process.

A substantial number of faculty and student projects have also been undertaken in the intersection of computer science and music. This includes projects by two faculty members on the production of music by genetic algorithms, along with several student projects related to music and chaos theory, fractals, and other mathematical topics.

Some media arts and sciences students are mainly interested in production and want to use digital media technologies in making music or photographic, video, film or animation images. Another group is primarily focused on engineering and computer programming, and wants to learn how computers make, store, display and transmit images and sounds. Others have primary interests in the social sciences or humanities. Especially for Division I students of the last category, media arts and sciences may provide their only CS course experience.

F. Philosophy

Philosophy is one of the disciplines that is represented in several Schools of the College, with three philosophers in Humanities and Cultural Studies and one Visiting faculty member in Social Science. Philosophy in the School of Cognitive Science addresses theoretical, methodological and epistemological issues about the study of mind, brain, language and cognition, and asks important questions about the relationships between the various cognitive sciences. The study of philosophy also helps students develop necessary analytical thinking and writing skills and to formulate arguments in support of their own claims about philosophical issues. A larger goal is to encourage students to pose questions that span across, and in some cases unite, the cognitive sciences. This attention to both the subject matter and the methodologies of cognitive science places philosophy at the center of defining and directing our conceptions of that evolving field.

Philosophy classes in CS contribute to each of the School's three major curricula areas. For example, classes such as "Minds, Brains and Machines," "Philosophy of Mind,"

"Emotions," "Happiness," "Moral Psychology," "Philosophy of Technology" and "Consciousness" pertain to the Mind and Brain curriculum. Courses in philosophy of language and future courses planned on the philosophy of science contribute to Knowledge and Language. Courses that address issues in philosophy of mind and philosophy of technology ask questions about the status of artificial intelligences and other computer models of mental phenomena, contributing to the Computing Technologies area. In addition, we regularly offer courses in ethical theory and applied ethics.

Most philosophy courses in CS have been offered at the introductory level although 200-level courses in traditional subject areas are taught regularly. Demand for introductory instruction can only increase, owing to the new first-year program. This situation has made it necessary for advanced students to take many of their higher-level courses off campus. At the same time our increasingly numerous advanced students would often prefer to continue their philosophy studies in the Hampshire environment. The presence, during the past couple of years, of a second, soft-money appointment in philosophy has helped relieve some of this pressure, but only temporarily. Future courses, some of which students have requested, include philosophy of science/biology, epistemology, moral psychology, personal identity and free will.

G. Psychology

Psychology is one of the traditional disciplines that has been split between two Schools in Hampshire's organization. The positions in the School of Social Science (normally three to four) have been filled by people trained in child development, social/cultural psychology and clinical psychology. In CS the positions (three) have been filled by people trained in cognitive psychology, cognitive neuroscience and cognitive development. Psychology has contributed both methodologies and bodies of theory to the study of mind, and is clearly central to the field of cognitive science.

Psychology courses are offered in such familiar areas as Cognitive Psychology, Cognitive Development, Introduction to Experimental Psychology and Child Language (which, of course, involves quite a bit of linguistics). Other courses have a more interdisciplinary flavor, for example, the sequence Brain and Cognition I and II, which involves students in cognitive neuroscience and in developing original research in our ERP lab. The Introduction to Cognitive Science course led to a jointly authored introductory textbook.

Psychologists supervise at least three kinds of student concentrations. The first is a concentration in cognitive science, often with some degree of focus on a discipline or area of study, such as cognitive psychology or language. A second is a general psychology concentration. A third type combines cognitive science with another field, such as biology, music or mathematics. Most Division III psychology projects are laboratory experiments, although some students have done observational research or computer-based modeling studies.

3) Representative courses

This section is not intended to replicate our course catalog but rather to indicate, through selected examples, the range of courses and of the degree of innovation in the CS curriculum. A complete listing of the courses offered in CS since Fall, 2001 is included in the Appendix.

A. 100-level

CS112 Is Big Brother Watching?: Security and Privacy on the Internet
Richard Weiss (computer science)
This course introduces students to computer programming, computer security, and the trade-offs between protecting individual privacy and providing security to society. This course is also a way of making computer and communication technology relevant to a general audience. Because these technologies are so pervasive in modern life, it is necessary to understand the technical issues involved so as to make informed decisions.

CS 115 Neural Networks
Jaime Davila (computer science)
Artificial neural networks (ANN) are computational devices based on the brain. Basic nodes perform a very simple computation, and complex behavior emerges only after connecting a high number of these neurons to each other. ANNs have been used to perform tasks such as pattern matching, image processing and language understanding. A key property of ANNs is their ability to learn from example, without the need for pre-specified high-level rules. This course presents an introduction to artificial neural networks and their applications.

CS 116 Introduction to Digital Imaging
Chris Perry (media arts and sciences)
This course will introduce students to the theory and practice of digital imaging: the process of creating and manipulating images with computers. About one half of class time will be spent on theory, covering the mathematical and computational fundamentals of the field. This material will include image representation and storage, sampling, matte extraction and creation, compositing, filtering, computer-generated imaging, and time-based image manipulation. The theory section will also include discussions of the perceptual issues at play in the creation and observation of digital images. The other half of class time will be spent learning off-the-shelf software so that these theories can be explored in practice. Students will be expected to use the software to complete a number of short, creative projects during the first two thirds of the semester, culminating in a final project during the last third. Knowledge of advanced math is NOT required.

CS 123 Computational Linguistics
Steven Weisler (linguistics) and Jaime Davila (computer science)
Computational linguistics is an interdisciplinary field investigating the use of computers to process or produce human language (also known as "natural language," to distinguish it from computer languages). To this endeavor, linguistics contributes an understanding of the special properties of language data, and provides theories and descriptions of language structure and use. Computer science contributes theories and techniques for designing and implementing computer systems that generate and parse linguistic input. In this course, students learn about the syntax and semantics of natural languages, as well as how to implement parsers and generators in the Perl programming language.

CS 132T: Minds, Brains and Machines: An Introduction to the Philosophy of Cognitive Science (first-semester tutorial)
Laura Sizer (philosophy)
This class explores current issues in the philosophy of cognitive science that allow us to address questions about the nature of minds and mental processes. These include, Is the mind the same thing as the brain? Can or could computers think? Feel? Have emotions? What role do emotions have in cognition? What is consciousness? Discussions concern academic articles from philosophy and the other cognitive sciences, but also draw from science fiction movies and television shows.

CS 135 Sound, Music and Mind
Neil Stillings (psychology)
This course is an introduction to the cognitive science of sound and music. We study the physical nature of sound, the biology of the auditory system and the cognitive psychology of auditory perception, beginning with the perception of basic acoustic qualities, such as pitch and loudness, and moving on to the perception of complex auditory events, which can involve memory and learning. A main goal of the course is to illuminate the perception of music through a basic scientific understanding of sound and hearing. Musical knowledge is not a prerequisite for the course, although it is welcome. This is a core course in the Culture, Brain and Development Program.

CS 142 The Classroom
Laura Wenk (education)
Most of us have spent a great deal of time in classrooms. We have opinions about what makes for a good classroom for learning. This course examines the theory and research base about classroom learning, and the ways to structure classrooms in terms of this knowledge. Students read theory and research as well as do numerous classroom observations (K-16).

CS 155 New Media: Innovation, Adoption, Diffusion
James Miller (media)
In this course we examine aspects of the development of new media in the US, their adoption and widespread diffusion, focusing on several historical case studies: the telegraph, the telephone, videotex and the Internet. We also study instances in which people actively resist new media technologies and services – such as the Amish - and, contrariwise, we read forecasts for digital utopias. The main perspective of the course is the "social shaping of new media technologies."

CS 161 Sex, Drugs, Rock 'n' Roll and Seatbelts: Individual Liberty, Morality and Politics
Ernie Alleva (philosophy)
Individual liberty is a core value in modern liberal democratic societies. What is liberty? What are different interpretations of liberty? Why do people think liberty is important? How might it be justified as a value? When and for what reasons can it be legitimately constrained? This course examines alternative approaches to interpreting and valuing liberty, connections and conflicts between liberty and other values (e.g., justice, equality, well-being, privacy, and community), and various contemporary public policy controversies involving issues of individual liberty (e.g., drug use, sexual behavior, pornography, hate speech, prostitution, surrogate/contract motherhood, suicide and voluntary euthanasia, seatbelt laws, among others).

CS/NS 164 Gender Issues in Science Education
Marie Evans (psychology), Merle Bruno (biology)
When asked to name their favorite subject, many elementary school-aged girls answer "science." Often by college these same girls say "I'm not a science person." What happens in between? This course will consider why girls lose interest in science, particularly during the middle school years. We will relate this to children's development more broadly, by reading developmental psychology research. In hands-on activities, students will work with methods and materials designed to engage all students in active inquiry. Students will also participate in Girls Day in the Lab, a Hampshire program designed to support and encourage middle school aged girls' interest in science.

CS 167 Moral Panics: Children, the Media, and Violence
Marie Evans (psychology) and James Miller (media)
The connection, if any, between depictions of violence and violent behavior has been debated for decades. Often times the debate takes the form of a moral panic: the sudden, nearly irrational public fear that violent media content is causing youthful media consumers to act in unacceptably violent ways. Fear of media's influence on young people has developed a familiar pattern: outrage (maybe triggered by a crime), impassioned charges that the media provide influential bad examples, an investigation (formal hearings, studies, a public policy-oriented report), and new laws or regulations. This course examines selected examples of this pattern. Our goal is to determine what was known scientifically about media's influence on children's violent behavior and the role of this knowledge in the moral panic.

CS 175 What Computers Can't Do
Lee Spector (computer science)
This course explores the limits of computation from philosophical, logical, mathematical and public-policy perspectives. It is divided into three segments of approximately equal length but rather different content, classroom activities and assignments: 1. computers and minds (philosophy of artificial intelligence; discussions, short reaction papers), 2. limits of computation (computability and complexity theory; lecture, problem sets) and 3. limits and society (public policy issues; cooperative group work, panel presentations).

CS 182T Bilingualism (first semester tutorial)
Marie Evans (psychology) and Joanna Morris Florack (psychology)
America is a multilingual society. Many children grow up in an environment where at least two languages are spoken. This course explores how children learn language and, more specifically, two languages. The following questions are considered: What does it mean to learn a language? How does learning two languages differ from learning one? How does bilingualism effect cognitive development? Should there be bilingual education in schools?

CS 191 Sound in Nature
Mark Feinstein (linguistics)
The natural world is a very noisy place--filled with bird calls and human speech, the rumble of thunder and of elephants, the howling of wind and wolves, the singing of desert sands and whales. Sound is a favorite way for animals to communicate and regulate their lives in nature, and it provides a remarkably rich source of information about the world we live in. In this course, we will explore the new field of bioacoustics, from the joint perspectives of biology, physics and cognitive science, with the goal of understanding what sound is, how it is produced and perceived by biological organisms, how it conveys information and influences behavior. Students will be expected to engage in one major project--to collect data, to learn to record and analyze sound phenomena, and to read and write about how scientists explore relevant issues in the professional literature.

B. 200-level

CS 240 Instructional Methods for Inquiry-Based Instruction
Laura Wenk (education)
In this course students learn what inquiry-based instruction is and how to teach by engaging their students in inquiry. In addition to examining the structure of inquiry, they examine how to create questions and activities to engage young people in higher order thinking and the development of inquiry skills. Students complete library research on inquiry and complete micro-teaching lessons for the class. They are evaluated on their lesson plan development, a series of short papers on inquiry and instruction, and a final portfolio with reflection.

CS/NS 241 Computational Models of Biological Systems
Lee Spector (computer science) and Michelle Murrain (neurobiology)
Computational models of biological systems are now in widespread use in several disciplines, primarily for two purposes: to understand biological systems better and to enhance computing capabilities by borrowing successful strategies from nature. This course investigates the extent to which current models fulfill either of these purposes. The course focuses on computational models of behavioral, neural, environmental and genetic systems, and looks briefly at immune system models. The tools that we will use for our modeling work include Lego robots, cellular automaton programming packages (including StarLogo), and code libraries in Lisp and MatLab for neural networks and genetic algorithms.

CS 248 Biology of Language
Mark Feinstein (linguistics)
The human capacity for language is deeply rooted in our biological make-up. In this course we will examine evidence for the view (associated with Noam Chomsky and others) that our linguistic ability is genetically determined. In so doing we will explore the physiological and anatomical systems (the brain, the auditory system, and the vocal tract) that underlie that ability, and investigate developmental phenomena and evolutionary perspectives on language. We will also consider genetic disorders relating to language and neuropsychological conditions such as aphasia. Students are expected to have some background in linguistic theory, cognitive science, and/or biology. A major paper on a research topic of the student's choosing will be required.

CS 260 Cognitive Ethology
Ray Coppinger (ethology)
Cognitive ethology is the study of animal behavior from a slightly different perspective. Instead of asking how and why an animal moves through time and space, it explores the internal states of the animal. Do they have intentional states or a representational content about the world they move in? Do they have beliefs about the environment they move in? Are they conscious and aware of what they are doing? Do they have minds? If there are non-human minds, what is the nature of them and how did they get them? Lectures, discussions, recommended readings, papers, research projects. Prerequisite: Division I passed in either Cognitive Science, Natural Science or Social Science. Psychology-equivalent experience considered.

CS 262 The Social Foundation of Cognition: Theory and Practice
Laura Wenk (education)
Together, Vygotskian and Piagetian traditions are responsible for surges in learner-centered practices in classrooms from k-16 and beyond. Students in this course read foundational literature on communication and cognition and examine classroom practices in a number of disciplines and grade levels. Students write a series of short papers, design collaborative learning activities, make classroom observations, and complete a final paper or project on one of the course topics.

CS 173/273 Consciousness Considered/Consciousness Reconsidered
[This is a 2-semester sequence]
Laura Sizer (philosophy) and Philip Kelleher (psychology, quantitative skills center)
Description for first semester (CS 173): As you read this sentence, you are, at some level, conscious of what you are doing, where you are and perhaps also of events happening around you. If you stop to consider this consciousness of yourself and the surrounding world, you may feel that it is something with which you are intimately familiar. Yet, through history, the nature of consciousness has proved to be an elusive and perplexing problem for those who have attempted to understand it. In this course, we will explore various approaches to the problem of consciousness, drawing on the work of philosophers, psychologists and neurologists. This course can be used to fulfill the prerequisite for CS 273 and is a core course in the Culture, Brain and Development Program.
Description for second semester (CS 273): This course continues the study of consciousness begun in CS 173, broadening the scope of our examination of consciousness to include topics such as special states of consciousness (e.g., dreams, meditation, and chemically-induced altered states), the development of consciousness in children, conscious will, non-Western perspectives on consciousness, animal consciousness and the possibility of machine consciousness. Focus is on understanding consciousness from a multitude of perspectives and in all its variations. This is a core course in the Culture, Brain and Development Program.

CS/NS 280 Interdisciplinary Teaching
Laura Wenk (education studies) and Merle Bruno (biology)
Students work in teams developing interdisciplinary units. They teach our class and perhaps students in local K-12 classrooms. Through reading and class discussion, students examine a range of models of interdisciplinary teaching. Projects might require skills in art, writing, science, math, technology and social studies, providing interesting ways for students to apply these subjects. Students explore and adapt existing curriculum materials that encourage active participation of all students.

CS 287 Evolution of Neurally Controlled Robots
Jaime Davila (computer science)
This course introduces students to hands-on work in the artificial intelligence topics of neural networks and evolutionary computation. Attention is placed on virtual robots and distributed agents. Students have access to a recently acquired, state-of-the-art computing cluster and several software packages that allow them to simulate virtual worlds or implement evolutionary computation algorithms, including Breve, an advanced neural network interface for the virtual environment. Students design their own experiments, modifying software as necessary. Examples include creatures that play a 3D version of soccer - actually quidditch from the Harry Potter books - and simple prey-predator systems.

CS 290 Special Visual Effects
Chris Perry (media arts and sciences)
Special effects have been a major part of film since the invention of the medium, and their role continues to grow as digital imaging technologies facilitate their creation. In this course, students will examine the science, art, ethical implications, and practice of creating visual effects in early films such as 1902's "A Trip to the Moon" through modern effects masterpieces. Class work will cover both traditional and contemporary techniques including in-camera effects, miniatures, matte paintings, chroma- and luma-keying, wire/rig removal, motion control photography, rotoscoping, split screens, stop-motion animation, and 3D computer-generated effects. Prerequisites include CS 116 (Introduction to Digital Imaging) or its equivalent, and an introductory production course in either film or video.

CS/SS 296 Freedom of Expression
James Miller (media) and Lestor Mazor (law)
Should there be limits to what people can say in speech and writing, through the media and in other forms of social communication? Libertarians argue that in a truly free society there ought to be none. Hardly anyone, however, would make the case that falsely shouting "Fire!" in a crowded theater ought not to be prohibited. This course investigates a range of legal and communications issues relating to free speech for individuals, groups and the mass media, including some comparison with other countries' approaches to freedom of expression. The crucial context of history is emphasized. Special emphasis is given to implications for journalistic work, mass media regulation and policy and the special case of the Internet.

C. 300-level

CS 313: Brain and Cognition II: An introduction to Electroencephalography
Joanna Morris Florack (psychology)
In this course, students learn how to use electroencephalography hardware and software to record and analyze elecroencephalographic data. They acquire the required technical background through reading and discussing primary literature. Students design and conduct an independent project using ERP methodology to investigate cognitive phenomena in either attention, perception, memory or language. These research projects are publicly presented to the Hampshire community at the end of the term.

CS 334: Computer Animation III
Chris Perry (media arts and sciences)
In this course, advanced students will form one team and produce an animated short film with the tools of three-dimensional computer graphics (CG). The class will take the film all the way from story pitches through scripting, storyboarding, character and set design, voice recording, scoring, modeling, layout, shading, animation, lighting, and rendering. Students will be required to specialize in one or more of these areas and must demonstrate their experience and ability in their area(s) of interest to gain admittance to the course. In addition to students with CG production experience, the course also

requires students to serve in one or more of the roles of screenwriter, drawer/designer, painter, sculptor, producer, sound engineer, Web programmer, asset manager, and general technology expert. Interested students should bring a portfolio of relevant work to the first class. Instructor permission is required.

CS 335 Current Issues in Cognitive Science
Lee Spector (computer science)
This course is appropriate for all concentrators and advanced students in cognitive science, regardless of discipline (psychology, philosophy, linguistics, computer science, education, etc.). Each week we will examine a current issue in cognitive science, focusing on recent journal articles and essays. We will seek to make the issues comprehensible to one another across disciplinary divides and to highlight potential areas for interdisciplinary collaboration. Students will be expected to write a brief reaction paper each week, to engage in intensive discussions during the single weekly meeting, and to produce an extended written discussion of one of the issues by the end of the term.

CS 140/CS 340 Children and Animals at Play
[This course follows our occasional practice of combining beginning and advanced students in single, project-based course.]
Ray Coppinger (ethology) and Marie Evans (psychology)
Play is ubiquitous in mammals. But have you ever stopped to consider why? When children and animals play, are they doing the same thing? Do adults and children play for the same reasons? This course examines the nature and significance of play in children and animals. Students read research articles about how exploratory and play behaviors change with age and consider the ways in which play both reflects and facilitates cognitive development throughout the life span. This course will be taught in conjunction with CS 340. Additional work will be required of students registered for CS 340.

CS 370 *Brain, Mind, & Culture*
Neil Stillings (psychology) and Barbara Yngvesson (anthropology)
The human brain is highly similar to the brains of other primates, and it has not evolved since the ice age. Yet human culture has displayed remarkable variation across groups and over time. This course considers the origins of culture in fundamental human neural capacities as well as what the evolution and variation of cultures can tell us about the nature of those capacities. It considers how processes of individual neurological and psychological development are related to processes of cultural stability and change. The course attempts to integrate insights from neuroscience, psychology and anthropology to develop a more subtle account of human nature than any of these disciplines has been able to give on its own. This is an advanced seminar in the Culture, Brain, and Development Program.

4) Representative divisional examination titles

A. Division II

Cognitive Science: From Neurons to Qualia
Developing in Context: Child Development, Psychology and Culture
Fabrication, Design, and Cognitive Science: Where Man and Technology Meet
Elements of Computer Game Design: Cognitive and Artistic Explorations
Cognitive Neuroscience: Consciousness Revealed Through Biology
Quantitative Models of Natural Systems: Mind in World
Visions of the Good: Comparative Studies in Ethics and Aesthetics
On the Value of Philosophy
Adolescent Psychology and the Media's Effect on Behavior
Cognitive Neuroscience and Art
Computer and Video Game Journalism
Foundations of Cognitive Science
Biology, Behavior and Environmental Policy
Language, Culture and Meaning
The Interaction Between Research and Clinical Study in Psychology
Learning about the Self through Psychology and Theatre
Foreign Language and Electronic Arts
Journalism and Industrial Design
New Media and Social theory
Digital Media Studies
Metaphysics in Western and East Asian Perspectives
The Concept of Time
The Truth About Human Nature
Law on the Bleeding Edge of Technology: Privacy, Security, Property Rights
A Study of Education and Language Theory
Exploring the Universe through Physics and Astronomy: An Educator's Perspective
Improvisation: Structure and Freedom in Education and Dance
Mathematics and Computer Music
Computer Science: Software Development
Technology and the Future of Magic
Media Production with a Focus in Computer Animation
Applied Computer Simulation of Biological and Ecological Systems
General Studies In Computer Science
Cinematography and Computer Animation

B. Division III

Do Dogs Have Object Permanence?: An Experiment Using Piagetian Tasks

Improving Education: Moral Development and Philosophy in High School English Classrooms

Development of Tool Use in Children

Encoding Versus Retrieval: Determining the Memory Mechanism Responsible for Selective Recall

The Changing Self: Reflections on a Computer-Mediated Existence

Making a Creative Art Creative: Teaching Music Through Inquiry

Behavioral and Electrophysiological Correlates of Face Processing: An ERP Study

A Comparative Study of Mother and Infant Signature Whistles in the Atlantic Spotted Dolphin

Mind Onto Matter: Using Robotics to Explore the Cognitive Implications of Marking the Environment

Recreating the Roles of Children in Technology Development and Technology

Human Alienation and the Allegory of the Cave: Plato and Marx on the Good Life

Behavior and Environment: Will Mirrored Kennels Reduce Negative Behaviors and Help More Dogs Find Good Homes?

Virtual Witches and Warlocks: Computational Evolution of Teamwork and Strategy in a Dynamic, Heterogeneous, and Noisy 3D Environment

Interactive Multimedia: A Digital Design Experiment

The Philosophy of Courage: Redefining Courage to Include the Female Experience

Toddlers' Predictive Reaching for Hidden Objects

Sociopaths and the Law

Freedom of Expression: A Comparative Look at Germany and the United States

An Understanding of Writing Ability Through Early Language Experiences

The Design of a New Operating System

Recent Theories of Proto-Indoeuropean Consonantism

An Empirical Comparison of Social Value Orientations and Environmental Ethics: Is a Feeling of Interconnection Going to Save the Planet?

In the Gate: An Analysis of Mogul Skiers' Preparations for Competition

E-Book Publishing as an Agent of Social Change

Vocal and Behavioral Analysis of a New Guinea Singing Dog in Captivity

The Effect of Depression on Cognitive Abilities: Memory Storage, Operation or Processing Space?

Opening the Windows: Adapting the Reggio Approach to U.S. Public Elementary Schools

Children's Picture Books in Spanish: Assessing Linguistic and Cultural Representation in Translated Texts

Digital Eavesdropping: Defying Laws in the New Millenium

Genetic Programming: Theory, Implementation, and the Evolution of Unconstrained Solutions

(in)Compatibilism: Finity and Faith: Exploring Explanations of Human Behavior, and Human Behavior as Explanation

III. Faculty

Section outline:

1) Organization of the faculty
2) Faculty roles and responsibilities
    A. Teaching and curriculum design
    B. Advising and examinations
    C. Governance and other committee work
    D. Outreach
    E. Research
3) Descriptions of individual faculty and staff members

1) Organization of the faculty

The faculty of the School of Cognitive Science (CS) are roughly organized into the seven disciplinary areas described in Section II.2 ("Descriptions of specific disciplinary curricula") with several faculty who can serve advising and teaching needs in a number of different areas. Because of the intertwining nature of the disciplines in cognitive science, the disciplinary boundaries within the School are rather fluid and do not demarcate isolated sub-fields or majors within the School, but rather areas of faculty expertise and training.

In addition to the **twelve** permanent, full-time faculty members of CS, the School also has **four** long-term, visiting faculty, **four** instructors, and **four** staff/faculty associates. *Permanent, full-time faculty* are faculty members who have long-term contracts of 3-10 years and who are on the regular reappointment and promotion track[1]. These faculty assume full advising, governance and teaching loads.

Long-term visiting faculty are faculty members who have contracts of 1-3 years and are not on the reappointment and promotion track. They perform limited advising duties, and their eligibility to chair Div II or Div III committees is subject to negotiation.

[1] In lieu of tenure, Hampshire College awards permanent full-time faculty renewable 10 year contracts, after an initial 3-year, followed by a 4-year contract. The timing and review process associated with the awarding of the first 10 year contract is similar to the tenure clock and process at other institutions. Faculty become eligible to stand for promotion to Associate Professor and the awarding of a 10 year contract in approximately their 6th year at the institution. The process includes a full review of the faculty member's file with respect to teaching, research and governance by other members of the School, College and outside reviewers in the faculty member's field.

Instructors are faculty members who are contracted to teach specific classes, usually as replacement for faculty on temporary leave or to meet a short-term demand for course seats. They are not on the reappointment and promotion track. They perform no advising duties and are not eligible to chair Div II and Div III committees.

Staff/faculty associates are persons whose primary appointment at the College is in a full-time staff position, but who teach or provide other services to the School and are closely associated with the School. Staff/faculty associates attend School meetings and are sometimes active in discussion and decision-making in the School. They perform limited advising duties and are not eligible to chair Div II and Div III committees.

The list below includes full-time, permanent faculty and long-term visiting faculty. Instructors and staff/faculty associates are not included. Faculty who can serve advising/teaching needs in an area aside from their primary area are indicated in brackets in their secondary area. More detailed descriptions of each faculty member as well as instructors and staff/faculty associates are included at the end of this section of the report.

Cognitive psychology: Marie Evans (cognitive developmental psychology), Joanna Morris Florack (cognitive psychology, cognitive neuroscience, psycholinguistics), Neil Stillings (cognitive psychology).
Education Studies: Laura Wenk (Education) [Neil Stillings].
Visiting faculty in this area include Theo Dawson (Education, Human Development), and Loel Tronsky (Educational Psychology)
Philosophy: Laura Sizer (philosophy of mind/cognitive science) [Steve Weisler].
Linguistics: Mark Feinstein (linguistics, biology of language, general bioacoustics), Steve Weisler (linguistic theory, philosophy of language) [Joanna Morris Florack]
Computer Science: Jaime Davila (computer science, neural networks), Lee Spector (artificial intelligence, artificial life, genetic and evolutionary computation) [Chris Perry].
Visiting faculty in this area includes Richard Weiss (Computer Science, Mathematics)
Biology/Ethology: Ray Coppinger (biology, ethology); Mark Feinstein (biology of language, animal cognition and communication).
Media: Jim Miller (social, legal aspects of new media technologies), Chris Perry (computer graphics and animation) [Lee Spector].

The current CS faculty is diverse both with respect to gender and with respect to race. This is particularly noteworthy because it was not true historically; throughout its history the School has sought diversity through a number of deliberate recruitment strategies, which have been successful in recent years.

Although budget constraints have largely eliminated the appointment of visiting faculty to replace faculty on sabbatical leaves College-wide, a visiting faculty appointment has always, until very recently, been made to replace each faculty member serving as School Dean (a position which rotates among permanent faculty of the School). Last year CS agreed to forgo the Dean's release on a short-term basis to facilitate the immediate hiring of a new professor of media arts and sciences. This is workable for the present (because of grant support and other factors) but is clearly not sustainable.

2) Faculty roles and responsibilities

A. Teaching and curriculum design

Faculty teach two courses per semester and have a significant amount of leeway in the courses they teach. This leeway is slightly constrained by a number of factors, including the need to provide adequate numbers of introductory and advanced courses, to insure that each of the above disciplines is adequately represented, and the need to attract and meet the needs of students. CS faculty have designed and taught a wide range of innovative classes, including many classes that are co-taught with other faculty, both within and outside of CS (see Section II.3: "Representative courses").

The faculty devote several school meetings a year to discussions of the next academic year's course offerings, with most decisions about courses made or confirmed in those meetings. Many informal discussions occur outside of these meetings as well. For instance, the faculty representing a sub-field, such as Computer Science or Education Studies usually get together to coordinate the course offerings in their area. Also, faculty who have colleagues in their discipline but in other schools (e.g. Philosophy) may also try to coordinate with those faculty concerning the needs of that particular discipline. These discussions are friendly and informal.

B. Advising and Examinations

Advising and Examination (Division II and Division III) loads vary widely across the School and over time, reflecting the interests of the student body, changes in faculty and a variety of other factors.

Under a new system associated with the new 'First Year Plan', each faculty member is assigned a group of 8-12 incoming first year students whom they advise for three semesters – through their first year at Hampshire and through a transition semester during which the students formulate their Division II studies and pick a Division II committee. In addition to mentoring these 8-12 first year advisees, faculty sit on Division II and Division III committees. The faculty chairs of these committees usually (but not always) serve a primary advising role. The number of Division II and Division III committees that faculty serve on has varied significantly in the past. Workload caps were recently instituted to better distribute advising load. These new caps limit faculty to chairing five Division II committees and five Division III committees that complete in any academic year, and likewise limit committee memberships to five each for Division IIs and Division IIIs. This means that, at maximum, an individual faculty member would be responsible for 8-12 first year advisees, chair five Division II committees and five Division III committees and serve as a member on five Division II and five Division III committees. Historical data on Division II and Division III chairs and memberships is included in the Appendix (but note that these numbers to not reflect the recent changes due to workload caps).

While Division II and Division III committees are sometimes comprised of several faculty within the same discipline in CS (for example, a committee whose chair and member are both computer scientists) faculty more often serve on committees with colleagues in different disciplines, both within CS and across schools. For example, Joanna Morris Florack (cognitive psychology) and Laura Sizer (philosophy of mind) have served on Div II and Div III committees together. Likewise, Joanna Morris Florack and Marie Evans (developmental psychology) frequently share students.

Most of the Cognitive Science faculty also regularly serve on committees with faculty in other Schools. For example, Chris Perry (computer graphics and animation) regularly sits on committees with Tom Haxo (sculpture) and Bill Brayton (drawing, sculpture) in Interdisciplinary Arts and with Bill Brand (film) in Humanities, Arts, and Cultural Studies. Marie Evans (cognitive developmental psychology) shares students with Amy Chang (Social and Cultural Psychology) and Rachel Conrad (Developmental Psychology) in Social Science. Laura Sizer (philosophy of mind) regularly works on committees with Christoph Cox (19^{th} & 20^{th} c. European philosophy, intellectual history, aesthetics) and Mario D'Amato (Philosophy of Religion, Buddhism) in Humanities, Arts and Cultural Studies.

The time and effort faculty put in to their committee work is difficult to quantify or characterize as it varies with the individual faculty members involved and the needs of the student. Some Division II and Division III students require or ask for a great deal of individual attention, whereas others prefer to work more independently. The quantity and kind of interaction that occurs between a faculty member and Div II or Div III student is negotiated by the student and faculty members of the committee.

C. Governance and other committee work:

As with each of the schools of the College, the School of Cognitive Science provides faculty representatives for a number of College-wide committees and functions. *Governance committees* are defined as those committees for which College-wide elections for membership are held. In addition, faculty participation is needed on a variety of other College committees and School committees, such as hiring committees. Because of the small size of CS relative to 3 of the 4 other schools, the burden of these assignments is heavier on CS faculty, with each faculty member having to serve on more committees than faculty in larger schools. Committee assignments are made during the first school meeting of each academic year, with some assignments made at other times, as needs arise. Faculty are asked to volunteer for particular assignments, with the expectation that each faculty member will shoulder his or her part of the load. Historical data on governance committee membership are included in the Appendix.

D. Outreach

Hampshire College is committed to community-based learning and service and every Hampshire student's education involves a community service component. Many CS faculty members are involved in projects that reach out to and involve the wider community, particularly projects that are revolve around innovations in education and learning. Following are brief descriptions of some of these outreach activities.

Collaboration for Excellence in Science Education (CESE): This program aims to build bridges between Hampshire College and the Springfield Public School system by helping high school teachers bridge connections between students' learning and their understanding of physical science concepts. In exchange for data collection on student learning, the CESE team (Neil Stillings, Laura Wenk, Theo Dawson, and Vanessa Paulman) conducts professional development workshops for 9th grade physical science teachers that focus on content support and pedagogical development. Outreach is a particularly crucial aspect of this project, as having staff to develop and maintain relationships within the partnering school district, enables the research team (Theo and several students) to conduct critical inquiry into student epistemologies and their conceptual understanding of scientific concepts. Likewise, Laura's expertise in education and the relationships developed through this project provide material for future research projects, funding prospects, and service opportunities that could help improve teaching and learning in the nearby urban school district.

The *Program in Culture, Brain and Development* was founded in 2003 with a grant from The Foundation for Psycho-Cultural Research. It provides an arena in which perspectives from a range of disciplines are brought to bear on questions about what is considered innate, how the social and the biological influence one another and how experience is integrated into the developing architecture of the human brain. The program formally links the Schools of Cognitive Science, Social Science and Natural Science. With core and advanced courses in each of the three schools, the program sponsors seminars, public lecture series (including talks by Daniel Dennett and Vilayanur Ramachandran this semester), summer institutes, colloquia and conferences, as well as collaboratively taught, cross-School courses.

Day in the Lab for Urban Middle School Students and Day in the Lab for Junior High Girls: These programs enhance the abilities of students from the wider community to explore teaching, acquire valuable community service and deepen their own understanding of concepts being explored through their coursework. The one-day event is designed to engage middle school students in inquiry based science opportunities led by Hampshire faculty and students as they conduct interdisciplinary, scientific labs and field experiments. Examples of labs conducted by Cognitive Science concentrators include teaching students to design simple web pages using Dreamweaver, to explore sheep brain function, and to understand acoustics and sound. In addition, *Day in the Lab* events provide faculty with the opportunity to form or maintain relationships with secondary school teachers that often lead to other outreach projects or new learning opportunities

for their students. This program is organized and run by Vanessa Paulman, with help from various CS faculty.

Digital Day in the Lab: This program took place in the Spring of 2002 with the work of Jaime Davila, Neil Stillings and Joanna Morris Florack (a former Staff/faculty Associate, Ryan Moore and a student, Jesse Doane were also involved). A group of inner city high school students from Springfield were invited to spend a day at our facilities, being exposed to the research and type of teaching that our faculty and students are involved in. Around 50 students had the opportunity to learn about our work in music perception, artificial neural networks, computer graphics, and other topics. In addition, they received information about the process and opportunities for applying for admission to our College. The activity also served to develop working relationships with high school teachers and administrators involved in math and science education. These relationships were later on developed further in other programs, such as the Science Outreach Project.

The Science Outreach Project: This program was run by Chris Perry, Ryan Moore and Jaime Davila, with administrative help by Steve Weisler and Neil Stillings. It had as its goal to expose high school computer science instructors with instruction techniques based on student-centered approaches. Several groups of high school teachers were identified, who were then put in contact with members of our faculty working in related fields. These contacts led to conversations around curriculum development, pedagogical approaches, and new course designs oriented towards better exposing high school students to inquiry based learning. As part of the Science Outreach project, two community groups from Holyoke were engaged in researching the problem of asthma in their neighborhoods. This included performing background research on the topic, designing the best way to communicate information to their peers, carrying out interviews, as well as filming and editing a short documentary. The project had the dual effect of exposing community learners to research skills, as well as allowing Hampshire personel to continue learning about community based learning.

The Digital Newsroom: The Digital Newsroom project was organized by former Visiting Assistant Professor Tom Murray, with help from Jaime Davila. It involved high school students from the inner city of Holyoke in the design and implementation of a community newspaper. In the process, students learned writing skills, developed self esteem, learned web page building skills, and gained knowledge about post high school education. Many students in the program went on to design and build web sites for community groups in their neighborhood. Based on students' self reporting, their interest in school matters and their self esteem increased as a result of the project.

The *University of Massachusetts-Five College Cognitive Science Colloquia Series* is organized by Joanna Morris Florack. Since 1978, this lecture series has invited annually four or five prominent researchers from outside and within the Five Colleges to speak to a Five College audience, reporting on cutting-edge work. Moreover this seminar has been quite effective in promoting interdisciplinary collaboration among Five College Faculty; in the last five years, several books and numbers articles in cognitive science have been written across institutional lines.

The local National Public Radio affiliate, *WFCR-FM* (Five College Radio), is overseen by an advisory board that includes representatives from each of the Five Colleges. Hampshire's representative is James Miller, who also helped found the initial board about 20 years ago.

As a visiting fellow at Smith College's Kahn Liberal Arts Institute during 2001-2002, James Miller participated in the Europe's Others, Other Europes project. This led to his continuing as a member of a small planning group, which has recently proposed the establishlishment of a new, potentially Five College-wide graduate certificate program, *Transatlantic Studies*.

E. Research

As is typical of elite liberal arts colleges, the School of CS has aspired to sustain a faculty that not only excels in teaching but also stays active in research. The School's goals of introducing students to cognitive science inquiry and of providing research opportunities for students can only be met by a faculty that does research.

The faculty of the School of Cognitive Science are active in their respective fields of research, and several faculty have achieved notable research profiles in their fields. Research projects undertaken by individual faculty members are described briefly in section III.3 below, in the section on research with students (IV.2), and in individual faculty vitae in the Appendix. Here we focus on collaborative projects that tie the faculty of the School together and to the broader research community.

The rich interdisciplinary environment at Hampshire and in CS in particular has spawned a number of research endeavors that involve faculty from different disciplines working together to realize creative, new projects. Faculty members regularly present their work to each other, across disciplinary boundaries, in a series of informal talks held throughout the semester (twice a month, schedule permitting).

Following are examples of some of the collaborative projects in which CS members participate:

- The NSF project *Inquiry-Based Science Education: Cognitive Measures and Systems Support* was a collaboration among faculty members and researchers in the Schools of Cognitive Science and Natural Science and at the University of Massachusetts to develop research inquiry-oriented educational software. Collaborators included Neil Stillings, Steven Weisler, and Lee Spector in CS, Larry Winship and the late John Reid in Natural Science, and Bev Woolf in Computer Science and the University of Massachusetts.

- Joanna Morris Florack is pursuing several research projects with faculty at Tufts University in Boston. She is also actively involved with the Berkshire Hills Music Academy (an institution devoted to musically educating and working with children and adults with Williams Syndrome) and is a member of CORA (the committee to oversee Five College research partnerships with the BHMA). Professor Florack has also co-chaired the Five College Cognitive Science Colloquium Series for the past two years.

- Marie Evans is collaborating with the new Center on Media and Child Health, at Children's Hospital, Boston. The Center includes faculty from Harvard Medical School, Harvard School of Public Health, and Harvard School of Education. As stated in the 2003 Annual Report, "The Center on Media and Child Health (CMCH) was founded in October, 2002 through the generous support of the Anschutz Foundation, Cinemark, the Pepsico Foundation, and the Hallmark Foundation. Its mission is to advance scientific research, clinical interventions, and education on the subject of media and their effects, positive and negative, on the physical and mental health of children and adolescents. Its inaugural project is to collect and organize a comprehensive database of the existing research on media and child health, focusing on media violence, and to mount this research library on the World Wide Web for access and use by researchers, clinicians, and the public at large." Marie is a research scientist at and consultant to the Center.

- Lee Spector (computer science), Chris Perry (computer graphics, animation) and Mark Feinstein (animal cognition), along with Hampshire graduate and Senior Research Assistant Jon Klein, have worked together to model and display collective behavior, resulting in the paper, "Emergence of collective behavior in evolving populations of flying agents", published in *Proceedings of the Genetic and Evolutionary Computation Conference* (GECCO-2003). This paper won a Best Paper Award and an expanded version of the paper will be published in the journal *Genetic Programming and Evolvable Machines*.

- Lee Spector (computer science) has worked with Natural Science faculty member, Herb Bernstein (physics) to publish several articles on quantum computing. He is also currently involved in a research project with Ray Coppinger (biology, cognitive ethology) and Lynn Miller (biology, School of Natural Science) on the evolutionary dynamics of mitochondrial DNA. He also conducted a series of research projects on human and machine planning with Mary Jo Rattermann (developmental psychology) and Jordan Grafman (neuropsychology, NIH/NINDS). In addition, he collaborates with David Jensen (computer science, U. Massachusetts), Oliver Selfridge (MIT), and Wallace Feurzeig (BBN) on work related to his DARPA grant (see below).

- Neil Stillings (psychology), Laura Wenk (education) and Mary-Anne Ramirez (education) have collaborated on researching inquiry-based learning in science classrooms, with several papers and conference presentations resulting. Stillings and Wenk also collaborate on the NSF project, *Development of Scientific Thinking and Conceptions of Science in College Science Students*.

- Laura Wenk (education) and other members of the Education studies program do work in and with the Springfield Public Schools. She also collaborates with Biology and Chemistry faculty at University of Massachusetts at Amherst on studies on conceptual science learning. In addition, she works with faculty in Earth and Environment Studies at Mt. Holyoke in examining their curriculum and student outcomes.

- Richard Weiss (computer science) works with Brian Levine and Mark Corner of UMass to develop instructional modules for teaching information assurance and computer security. These modules could be incorporated in both introductory and advanced courses in computer science. They have submitted a joint proposal to NSF for doing additional work.

- Richard Weiss is working with Andras Moritz (UMass) on a variety of problems in computer architecture related to synchroniztion of multiprocessor systems. This is an expanding area of research as more commercial systems become available.

- Richard Weiss has collaborated with Nicholas Howe (Smith College) on problems related to motion estimation in computer vision. They have jointly supervised students to find more computationally efficient algorithms.

- Richard Weiss has been collaborating with Iris Bahar, Brown University on research in computer architecture. They have been working together for two years to design microprocessors that use electrical power more efficiently and have published two papers together. They have a three-year NSF grant to continue this work.

F. Grants

Faculty in the School of Cognitive Science have been successful in attracting grant funding to the College. Some of the more notable recent grants include the following:

Foundation for Psycho-cultural Research: ***Culture, Brain & Development*** ($1 million over five years; Neil Stillings, Barbara Yngvesson, and other co-PIs). This grant was awarded to assist in funding the new Culture, Brain & Development program at Hampshire College. This program fosters interdisciplinary research and teaching across the domains of psychology, anthropology, neuroscience, philosophy, linguistics, sociology and other disciplines.

National Science Foundation, Learning & Intelligent Systems Program: ***Inquiry-Based Education: Cognitive Measures & Systems Support*** ($1,100,000; Stillings, Spector, Weisler, Winship & Woolf, co-PIs). The goals of this project were describe and characterize a college-level inquiry curriculum, to develop software to support inquiry-oriented instruction and learning, to assess hypotheses underlying inquiry-oriented instruction, and to bring theoretical issues in cognitive science into an applied domain.

DARPA program on Agent Based Computing: ***Multi-type, Self-Adaptive Genetic Programming for Complex Applications*** ($295,936 + subsequent supplement of around $100,000; Lee Spector, PI). The aim of this project is to develop improved genetic programming techniques and to apply these techniques to difficult, unsolved computational problems. Of particular interest in this project are problems involving control and adaptation in heterogeneous, dynamic environments.

National Science Foundation, Major Research Instrumentation program and Research in Undergraduate Institutions program: ***Acquisition of Instrumentation for Research in Genetic Programming, Quantum Computation, and Distributed Systems*** ($99,751; Lee Spector, PI). Under this grant the College purchased a 26 CPU high-performance cluster computer system for use in student and faculty research. This is a research tool that is not typically found at the undergraduate level, and as such it supports the School's commitment to fostering undergraduate original research as a fundamental part of the liberal arts degree.

National Science Foundation, Director's Award for Distinguished Teaching Scholars ($300,000; Lee Spector). Open-Ended Evolution in Visually Rich Virtual Worlds: Implementation, Analysis and Use in Undergraduate Education. This project involves the development of evolutionary computation systems that support faculty and student research projects.

National Science Foundation: ***Combining hardware and software monitoring for improved power and performance tuning*** ($160,000; Bahar and Weiss, Co-PIs). This grant is for the study of combining software and hardware techniques to predict the computational resources required by a program at a fine granularity. This information is then used to reconfigure the processor to use less power without reducing the performance.

3) Descriptions of individual faculty members (including current instructors and staff/faculty associates)

Ernest Alleva: Instructor, First-Year Program, Philosophy
Ernest Alleva received his Ph.D. in philosophy from Columbia University. His main interests are in moral and political philosophy, the philosophy of education, and the history of philosophy. Professor Alleva's current projects include work on philosophical issues regarding work, contemporary controversies about freedom of expression, and recent work on liberal political theory.

Raymond Coppinger: Professor of Biology
Raymond Coppinger holds a Four College Ph.D. (Amherst, Mount Holyoke, Smith, University of Massachusetts) and joined the college faculty in 1970. Professor Coppinger co-founded and directed Hampshire's Livestock Dog Project and the Farm Center. He has conducted research at the Woods Hole Oceanographic Institution, the Smithsonian Astrophysical Observatory, U.S. Fish and Wildlife Service, and Beebe Tropical Research Station in the West Indies. His extensive study of canine behavior includes the recent writing and hosting of a CBC documentary that filmed working dogs in England, Scotland, Italy, Tanzania and Zanzibar. He is a former New England sled dog racing champion. His work in forestry and ecology includes recently published reports on the environmental impact of Canada's James Bay hydroelectric project and is the author of several books including, *Fishing Dogs* and *Dogs: A Startling New Understanding of Canine Origins, Behavior and Evolution* (co-authored with Lorna Coppinger). His work on dogs has also been featured in *Smithsonian Magazine* and a program for NOVA.

Jaime Davila: Assistant Professor of Computer Science
Jaime Davila obtained his Ph.D. from the City University of New York. His main research interest is in the area of genetic optimization of neural networks for human-like tasks. He currently works developing artificial autonomous agents that play a variety of collective games in virtual worlds, as well as others that perform and perceive music. He has also written about the Digital Divide, looking at issues surrounding the disparity in access to technology among different social groups. In addition, Jaime is also interested in the ways in which community-based technology centers in inner cities, and the best ways to use them to enhance the educational experience of high school students. His papers have been presented at conferences such as the Joint International conference on Neural Networks, the International Conference on Artificial Neural Networks and Genetic Algorithms, the Conference of the American Association for Artificial Intelligence and the CUNY Conference on Human Sentence Processing. He is the recipient of a 2002 STEMTEC Fellow award by the NSF.

Danné Davis: Five College Fellow
Danné Davis earned her B.S. from Northeastern University and her M.S. in Early Childhood and Elementary Education from Wheelock College. She is a Ph.D. Curriculum and Instruction candidate at the Lynch School of Education at Boston College. Her

dissertation, Learning to Teach Among Schoolchildren of Color, examines the influence of the schoolchildren on incipient practice as a way to prepare teachers for working in urban classrooms. The study also seeks to challenge the notion of deficit thinking about the urban context, a setting where she has taught K-12 grade for many years. Other research interests include critical pedagogy, diversity, social justice, and qualitative methods. Recent related publications appear in *The Handbook of Research on Multicultural Education* (2003), and in *Multicultural Perspectives: an Official Journal of the National Association for Multicultural Education* (2002). Ms. Davis is a recipient of awards from several organizations including the Anti Defamation League: A World of Difference Institute (1999) and the Public Employees Roundtable (2000).

Theo Linda Dawson: Visiting Assistant Professor of Education
Theo Linda Dawson received her Ph.D. in Human Development from U.C. Berkeley in 1998. In 1999 she received the APA Division 7 Outstanding Dissertation Award. Dr. Dawson has recently completed a 4-year project, funded by the Spencer Foundation, in which she developed a computerized method for investigating conceptual development across the life-span. She is presently working with Neil Stillings, Laura Wenk, and Mary Anne Ramirez on an NSF grant studying inquiry oriented instruction in science and its impact on students' conceptions of the epistemology of science. Her research interests include life-span conceptual development, linguistic development, developmental assessment, and statistical models of developmental processes.

Jamie Elkin: Instructor, Media Arts & Sciences
Jamie Elkin holds a B.A. in Philosophy from SUNY/Buffalo, along with a B.S. in Human Biology and a D.C. (Doctor of Chiropractic) from the National College of Health Sciences. He has operated Zoestoes Animation Studio for the past decade. His work has been presented in museums, on PBS, and in nationally distributed videos and CD-ROMs. A lifelong fan of animation, he has focused primarily on educational applications that leverage the power of multimedia to teach complicated concepts to a wide range of audiences. He is also interested in animation as a tool for political and spiritual growth.

Marie Evans: Assistant Professor of Psychology/Cognitive Development
Marie has a B.A. in Psychology and English from Georgetown University and a Ph.D. in Developmental Psychology from the University of Massachusetts at Amherst. She has been teaching at Hampshire College since 2002. Courses taught include: Cognitive Development, Children and Television, Children and Animals at Play (with Ray Coppinger), Bilingualism (with Joanna Morris Florack), and Gender Issues in Science Education (with Merle Bruno). Marie primarily studies the effects of media on children's (especially infants' and toddlers') development. Other interests include the development of children's play and symbolic abilities and the development of attention in children. She has presented several posters at the Society for Research in Child Development's (SRCD) biannual conference and at the International Conference on Infant Studies (ICIS). She has presented a paper at the International Communication Association (ICA) as well. She has been a reviewer for ICA and for the journal Media Psychology. She has published in the *Journal of Communication* and *Zero to Three*, and she has a chapter each in 2 recent books, *The Wired Homestead* (MIT Press) and *Children and television: 50 years of*

research (Erlbaum). Marie is currently a consultant and research scientist at the Center on Media and Child Health, Children's Hospital, Boston. Marie has also been a consultant to Sesame Workshop.

Mark Feinstein: Professor of Linguistics/Animal Communication and Cognition
Mark Feinstein received his Ph.D. in Linguistics from City University of New York Graduate Center, 1977. He has been at Hampshire College since 1976, and served as dean of the school from 1982-1986, and again from 1992-1996. From 1996- 2001 he was Hampshire's Dean of Advising. Professor Feinstein specializes in phonology, phonetics, bioacoustics, animal communication and cognition. He teaches courses in phonology, linguistic change and variation, but for the past 15 years his primary teaching and research interests have focused more broadly on acoustic communication in non-human animals and on animal cognition in general. He has done research on domestic dogs, wild canids and sheep. His co-authored article on barking in dogs (with Ray Coppinger), published in the *Smithsonian* magazine, sparked a continuing debate on that familiar but poorly-understood vocal behavior. His work on stress and vocalization in sheep, carried out on sabbatical as a visiting scientist with the Irish national agricultural research organization, has received world-wide media attention. He was a co-author of the collaborative textbook *Cognitive Science: an introduction* (MIT Press) and has published in a diverse range of journals, from *Linguistic Inquiry* to *Contemporary Psychology* to *Environmental Values*. Most recently, his work on New Guinea Singing Dogs appeared in the *Journal of Zoology*.

Joanna Morris Florack: Assistant Professor of Psychology/psycholinguistics
Dr. Florack graduated *summa cum laude* from Dartmouth College with a major in Psychology. In 1990, she was awarded a Rhodes Scholarship which enabled her to pursue an M.Phil. in Theoretical Linguistics at Wolfson College ,Oxford University. She received her Ph.D. in Psychology from the University of Pennsylvania in 1998. She is interested in applying ERP and chronometric techniques to the investigation of cognitive phenomena. She is particularly interested in the role that phonology plays in lexical processing and in the structure of lexical representations. Her thesis work consisted of investigating the relationship between orthography and lexical stress in English. She is currently looking at the relationship between morphological and syntactic processing, using ERP methodology, particularly the P600 and the LAN to compare syntactic and morphological violations.

Luke Jaeger: Instructor, Media Arts & Sciences
Luke Jaeger holds an MFA from Massachusetts College of Art and a BFA from the School of the Museum of Fine Arts, Boston. His award-winning animated films have been shown in festivals and theatres worldwide, and his commercial credits include work for MTV, AOL, and Sesame Street. A professional PhotoShop artist since version 2.0, he also works with natural 2D media and coin-operated sculpture.

Philip Kelleher: Director of the Quantitative Resource Center and Staff/Faculty Associate
Philip Kelleher holds an A.B. in chemistry and physics from Harvard, and an A.M. and Ph.D. in psychology from Harvard University. He has taught and worked at IBM, The Harvard Business School, Northern Michigan University and Vermont Alcohol Research Center. His academic interests include individual and group decision making, learning and adaptation, and the philosophy of science and history.

Jon Klein: Senior Research Assistant
Jon Klein received his B.A. from Hampshire College and his M.S. in complex adaptive systems from Chalmers University in Gothenburg, Sweden, where he is currently a Ph.D. candidate. His Master's thesis work, which extended his Hampshire CS Division III work, involved the development of the BREVE simulation environment for complex artificial life simulations. He is currently working as a grant-funded research assistant for Lee Spector and co-teach "Artificial Intelligence in 3D Virtual Worlds," which uses his BREVE software.

Kathryn Lord: Instructor, Animal Behavior
Kathryn Lord received her B.A. from Hampshire College. She is currently a pre-doctoral student at the University of Massachusetts in the Department of Organismal and Evolutionary Biology. Her studies focus on the development and maintenance of species typical behaviors in the captive environment, using dogs as a model. Kathryn has conducted research at the Seeing Eye Inc. in Morristown, New Jersey, and is currently working with the Pioneer Valley Humane Society on designing a state-of-the-art kennel facility. Recently she co-wrote a book on kennel enrichment, outlining the current problems and possible solutions.

Madelaine Marquez: Director of the Center for Innovative Education and Staff/faculty Associate
Madelaine Marquez has an Ed.D. in Multicultural and Bilingual Education from the University of Massachusetts and a B.A. from Brandeis in History. Professor Marquez is the Coordinator of Education Studies and other innovative K-16 programs, and has been involved in the field of education for over 25 years. She has taught school at the elementary and secondary level in both public and alternative schools, developed educational programs for underserved students in high school and college, implemented programs for high-achieving students at the university level, and participated in national research projects on student achievement. She also served as Vice Chair of the Massachusetts Board of Education. Most recently, Dr. Marquez has turned her attention to teacher preparation and development at Hampshire.

James Miller: Professor of Communications
James Miller received his Ph.D. from the Annenberg School of Communications, University of Pennsylvania. His principle interests concern aspects of new media technologies and services, such as on-line journalism, media law and policy and he diffusion of media innovations. His current work focuses on media and democracy in the cases of on-line politics and Western-style journalism in Central and Eastern Eurpose.

His comparative study of new media in Canada and Western Europe includes a Fulbright research appointment in Paris. He has chaired the annual international Telecommunications Policy Research Conference and edited its published proceedings. Other publications include work in the journal *Media, Culture and Society*, and contributions to several books, including *State Policies and Techno-Industrial Innovation*, and *Culture and Communication: Language, Performance, Technology and Media*, vol. IV. He has recently been elected by the American Press Institute to serve as a Journalism Educators Fellow. He is a member of the Five College programs in Legal Studies and Peace and World Security Studies.

Christopher Perry: Assistant Professor of Media Arts and Sciences
Chris Perry holds an M.S. in Media Arts and Sciences from the Massachusetts Institute of Technology and a B.A. in physics and astronomy from Amherst College. His primary research interests are in computer graphics and visual storytelling – particularly the intersection of the two. He has developed software and produced computer generated imagery for TV commercials, feature films and theme park attractions. He participated in the writing of two high-level animation/deformation systems that are still being used at Pixar Animation Studios and Rhythm & Hues Studios. He worked as a technical director on the films, *Finding Nemo*, *A Bug's Life* and *Toy Story II*, and has presented his work at several conferences and festivals including SIGGRAPH and the Northampton Independent Film Festival.

Laura Sizer: Assistant Professor of Philosophy
Laura Sizer received her Ph.D. in philosophy from the University of Wisconsin-Madison in 2000. Her research interests include affect, consciousness, and issues in personality/personal identity. Her research is currently focused on happiness, with an emphasis on how happiness is related to biological states of well-being. She teaches courses in philosophy of mind, philosophy of science and cognitive science, philosophy of language, applied ethics and environmental ethics. Professor Sizer has published in *The British Journal for the Philosophy of Science* and *Philosophical Psychology*. She is currently working on a book on moods.

Lee Spector: Dean of the School of Cognitive Science and Associate Professor of Computer Science
Lee Spector holds a Ph.D. in computer science from the University of Maryland and a B.A. in philosophy from Oberlin College. His main interests are artificial intelligence and the connections between cognition, computation, and evolution. He is also interested in the use of technology in music and other arts. His recent research involves the development of new genetic programming techniques and the use of artificial intelligence technologies in the study of quantum computation. Other projects include the interdisciplinary study of human and machine action planning and the development of technologies to support inquiry-based education. He recently received the highest honor bestowed by the National Science Foundation for excellence in both teaching and research, the NSF Director's Award for Distinguished Teaching Scholars. He is an active editor, reviewer, and organizer in the artificial intelligence and evolutionary computation communities. Professor Spector has held the College's MacArthur Chair and has also

served as the elected faculty member of Hampshire's Board of Trustees. He is currently serving as the Dean of the School of Cognitive Science.

Neil Stillings: Professor of Psychology
Neil Stillings received his Ph.D. in psychology from Stanford University in 1973, and his B.A. in psychology from Amherst College. He has taught at Hampshire since 1971 and is a co-founder of the cognitive science program at Hampshire College. He is also a member of the graduate faculty at the University of Massachusetts, Amherst. Professor Stillings is nationally known for his work in undergraduate education in the natural and cognitive sciences, and is the first author of *Cognitive Science: An Introduction* (MIT press, 1st edition 1987, 2nd edition 1995), the first comprehensive textbook in cognitive science. He has organized and run national workshops on teaching cognitive science for the Sloan foundation, the National Science Foundation, and the Cognitive Science Society, and currently directs the Center for Research in Education and Learning (REAL) at Hampshire. He is the recipient of numerous grants and is currently principal investigator for a project titled The Development of Scientific Thinking and Conceptions of Science in College Science Students, funded by the NSF Research in Educational Policy and Practice Program. He was Principal investigator for a recently-completed project funded by the NSF Learning & Intelligent Systems program entitled Inquiry-based Science Education: Cognitive Measures and Systems Support. He has been an invited member of NSF panels that reviewed the Foundation's priorities in undergraduate education (1996), educational research (1996), and instructional technology (2002). He has done research in psycholinguistics, visual cognition, and foundations of cognitive science, and is currently researching music perception and the psychology of science.

Loel Tronsky: Visiting Assistant Professor of Psychology
Loel Tronsky received his Ph.D. in Educational Psychology from the University of Massachusetts at Amherst. Currently he is working with Professor Stillings, Professor Wenk, and Professor Ramirez on an NSF grant studying inquiry-oriented instruction in science and its impact on students' conceptions of the epistemology of science. Professor Tronsky's main teaching and research interests center around numerical and mathematical cognition as well as learner differences in the domains of reading, spelling, and math and the impact that instructional practices and other factors have on these differences.

Steven Weisler: Dean of Academic Development and Professor of Linguistics
Steven Weisler obtained his Ph.D. from Stanford and was a Sloan Post-Doctoral Fellow in Cognitive Science at the University of Massachusetts at Amherst. He also holds an M.A. in Communication from Case Western Reserve University. He is founder and director of Hampshire's Innovative instruction Laboratory, which explores educational applications of multimedia technology, and has produced for MIT Press a CD-ROM edition of *Theory of Language*. He is co-author of the 1987 and 1995 editions of *Cognitive Science: An Introduction*, the first undergraduate textbook in the field. He has been a recipient of several grants and was a contributor and consultant on The Mind Project Web Site. His main interests lie in semantics, syntax, language acquisition and the philosophy of language.

Richard Weiss: Visiting Assistant Professor of Computer Science
Richard Weiss received a Ph.D. in mathematics from Harvard University and an A.B. from Brandeis University, before becoming interested in computer science. He has taught at Tufts University, Dartmouth College, Smith College, UC Santa Cruz, University of Massachusetts at Amherst, and Simmons College. He was also a visiting member of the Newton Institute at Cambridge University. He has worked for Digital Equipment Corporation and Compaq Computer Corporation, where he contributed to the design of the Alpha microprocessors. He is the co-recipient of an NSF grant for combining hardware and software monitoring for improved power and performance tuning. His research interests include computer vision, robotics, computational geometry, differential geometry, cryptography and computer architecture.

Laura Wenk: Assistant Professor of Education
Laura Wenk has an Ed.D. in Curriculum Studies, an M.Ed in secondary science education, and an M.S. in Botany, from the University of Massachusetts, Amherst, and a B.S. in plant pathology from Cook College/Rutgers University. She has been teaching at Hampshire since 2000. Before coming to Hampshire, Professor Wenk taught high school biology and physical science for six years. As a faculty member in Education Studies she supports students who are interested in education – whether their interests lie in teaching or in studying educational environments. She is engaged in outreach projects to area K-12 science teachers, helping them to develop and implement inquiry-based curricula and improve their teaching strategies. In addition, Dr. Wenk is involved in research and evaluation of science programs across the Five Colleges. She encourages her students to become involved in these, and other, research and outreach efforts. Professor Wenk's current research is on inquiry- oriented instruction in science and its impact on students' conceptions of the nature of science and on their scientific reasoning. She has an article submitted to the *Journal of Research in Science Teaching*, the *Journal of the National Association for Research in Science Teaching* and regularly presents at their annual conference.

Stephanie Willen Brown: Database and Cognitive Science Librarian and Staff/faculty Associate
Stephanie Willen Brown received her MS from Simmons College Graduate School of Library and Information Science in 1999 and has worked at Hampshire College since summer 2000. She purchases books and journals for cognitive science, teaches library research in cognitive science classes, and provides individual research assistance to cognitive science students at all levels of their educational work at Hampshire. Stephanie's research interests include web site usability and providing instruction to students; she has published in both of these areas. Stephanie teaches as an adjunct for Simmons Graduate School of Library and Information Science.

IV. Students

Drafted by Eric Anderson (CS Student Member)

Assistance from Philip Kelleher (Director, Quantitative Resource Center, CS Staff/Faculty Associate)

Section outline:

1) Questionnaire study on student impressions
    A. Methods
    B. Results
    C. Discussion
2) Examples of student & faculty research or art collaborations

1) Questionnaire study on student impressions

A. Methods

A questionnaire was designed to gather data from students enrolled in Cognitive Science classes at Hampshire College (see Appendix). The primary goal of the questionnaire was to elicit students' impressions about the school of CS. The first part of the questionnaire collected information about students' academic history. The second section asked students to answer five questions (Table 1) by rating them on a six point scale (Excellent, Good, Satisfactory, Fair, Poor, or Not Applicable).

Table 1. The five quantitative questions asked in the questionnaire.

1. How would you rate the quality of classes in the School of Cognitive Science?
2. How would you rate the selection of classes available at **Hampshire College** to Cognitive Science concentrators?
3. How would you rate the selection of classes available through the **Five Colleges** to Cognitive Science concentrators?
4. How would you rate your interaction outside the classroom with the faculty in the School of Cognitive Science?
5. How would you rate your opportunities to participate in research (your own or a professor's) in the School of Cognitive Science?

The third part of the questionnaire was a set of open-ended questions that asked students what classes they would like to have offered and what their future career plans were.

After reading over the responses, student answers were coded into the categories listed in the graphs below.

The questionnaires were distributed in 11 upper-level Cognitive Science classes (200 or 300 level) at the end of the 2003 fall semester. This was all of the upper-level CS classes with the exception of Biology of Language (CS-0248) and Freedom of Expression (CS-0296). Upper-level classes were targeted because they were more likely to contain students who had experience with the School of CS and, as such, were more qualified to evaluate the school. All students in the classes were asked to complete the questionnaire whether they were first year students, non-concentrators, or CS concentrators. Their responses were confidential, and no record was kept of who participated. 96 questionnaires were completed. Of these, three were not useable because they were filled out incorrectly (although they were used for class area requests, Figure 2).

B. Results

For quantitative analysis of ratings, students were grouped in four categories depending on how much of their divisional work was done in the School of CS. Division 1 students where kept in a separate category (N = 35). Students who reported that all or most of their divisional work was in CS were grouped together as Strong-Concentrators (N = 24). Those who reported that some of their divisional work was in CS were labeled Weak-Concentrators (N = 22). Those who reported little or no work in CS were grouped together as Non-Concentrators (N = 12). The average ratings for the five questions mentioned above (Table 1) are given in Figure 1.

One of the open-ended questions asked students to list those areas in which they would like to see more courses offered, or to give specific courses they would like to see offered. Students were allowed to specify more than one area. The majority of these requests (N = 49) came from students who were concentrating in CS. All student responses (N = 88) were coded into the nine academic areas listed in Figure 2.

Another finding that was not coded or quantified was that many students requested more upper-level classes. Many asked for courses that went beyond introductory skills and knowledge. Some students also gave recommendations for unusual and specific class topics, such as: philosophy of time; philosophy of science; religion and brain; art and psychology; nanotechnology; and community, culture and education.

The final section of the questionnaire asked about students' career plans. Students' answers were coded into the seven categories listed below in figure 3. For this analysis Strong-Concentrators and Weak-Concentrators were combined (N = 39).

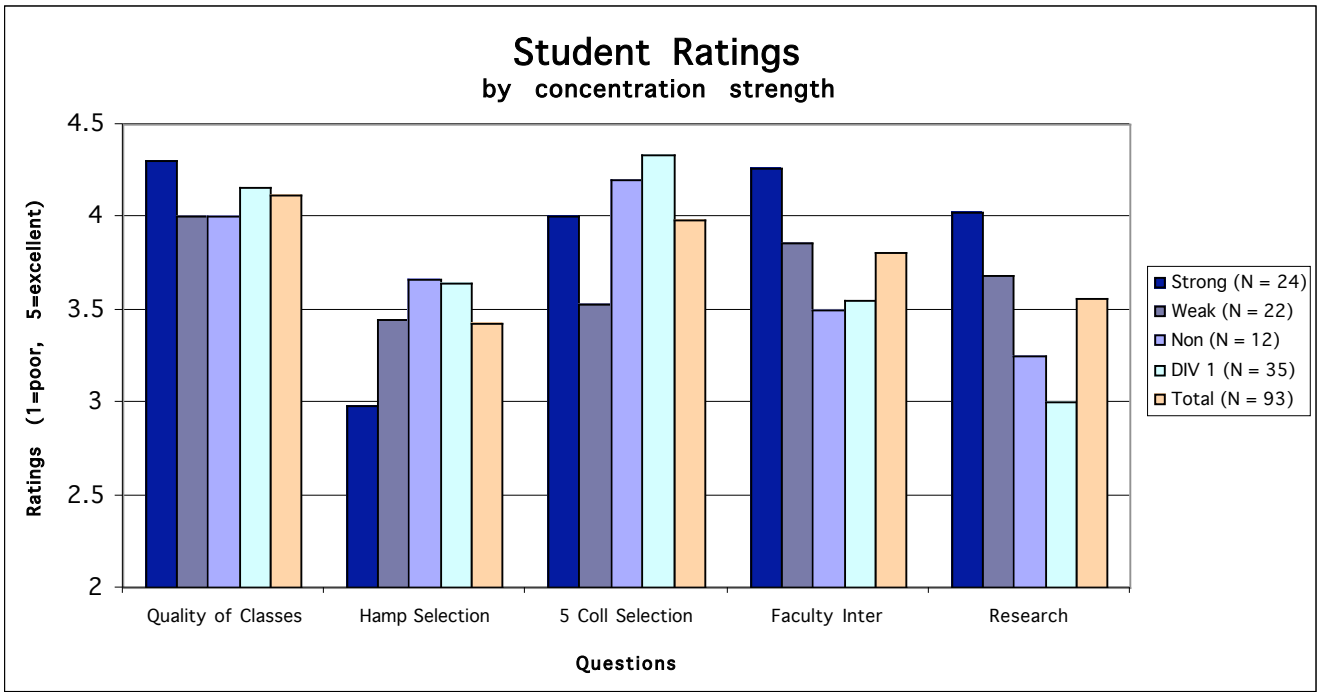

Figure 1.

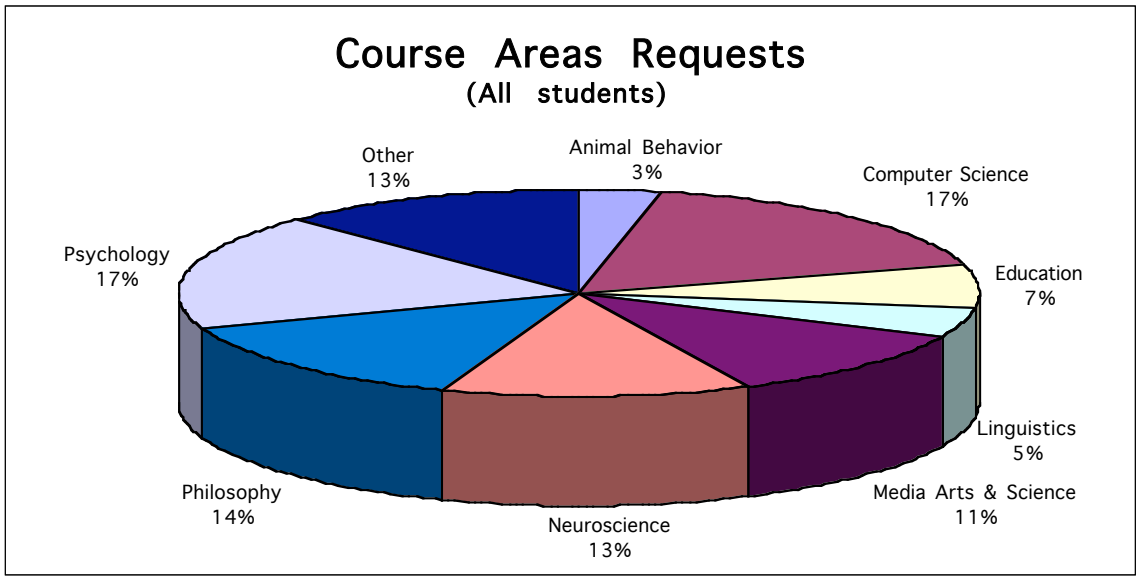

Figure 2.

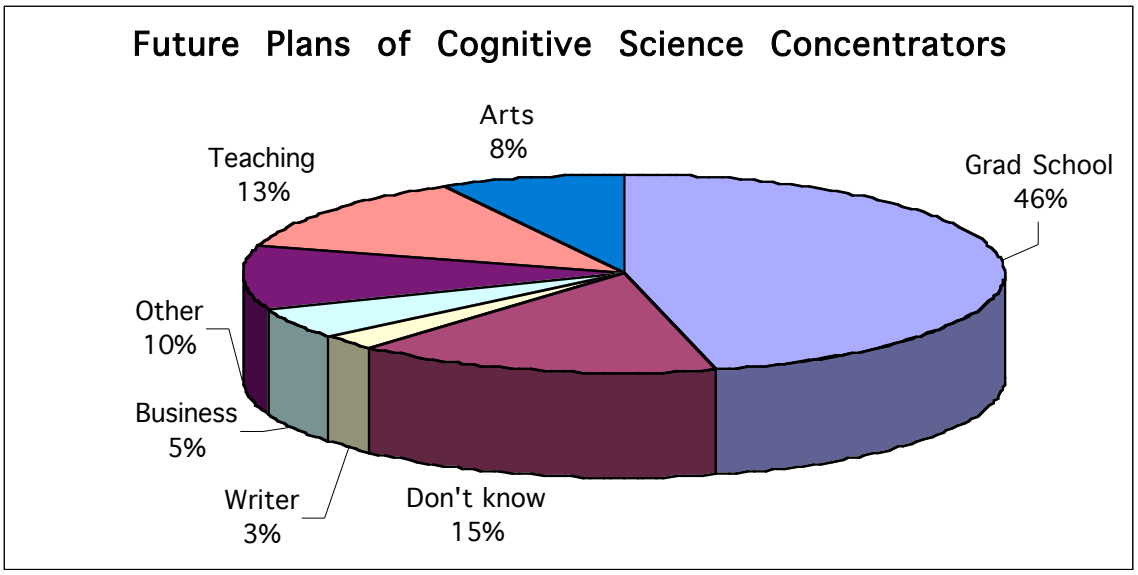

Figure 3.

C. Discussion

Figure 1, which shows students' average ratings to the five questions in Table 1, provides several useful pieces of information. The first question, *How would you rate the quality of classes in the School of Cognitive Science?,* received a high score from all students, with Strong-Concentrators giving the best score. This suggests that students think the quality of the courses offered in the School of Cognitive Science classes is quite good.

The second question, *How would you rate the selection of classes available at* ***Hampshire College*** *to Cognitive Science concentrators?,* received much lower ratings. All students agree that the selection is worse than the quality of classes. Furthermore, the more time students spent in CS, the lower they rated the class selection. Division 1 students and Non-Concentrators gave the best selection rating; Weak-Concentrators gave a lower rating; and Strong-Concentrators gave the lowest rating.

It is easy to see why this might be the case. Due to the small size of the school, few upper-level classes can be offered each semester. In addition, the proportion of courses at the 100-level has increased over the last several years (see the course enrollment data in Section II), in part because of the demands placed on the School by the recently adopted College-wide first-year plan. This plan requires all first-year students to take a 100-level course in each school. While this creates an equal demand for 100-level course seats in all schools, the sizes of the schools vary considerably, and the impact on the smaller schools is therefore much greater.

As an example, in the 2003 Fall semester thirteen 200- and 300-level courses were taught in the School. Because the School curriculum covers at least eight distinct disciplines

(Animal Behavior, Education, Linguistics, Neuroscience, Philosophy, Psychology, Computer Science, Media Arts & Science) it is only possible for the School to offer one or two upper-level courses per discipline per semester. An upper-level student focusing in one of these disciplines must therefore turn to the other institutions in the Five Colleges for the majority of their courses, and it common for CS concentrators to do so. Non-Concentrators, on the other hand, only take a few cognitive science classes and so do not run out of classes in this way.

The third question asks, *How would you rate the selection of classes available through the **Five Colleges** to Cognitive Science concentrators?* All students gave this a good rating, with the exception of Weak-Concentrators. It is not clear why Weak-Concentrators feel that the Five College class selection is so poor; perhaps they have not had the motivation to study the Five College offerings in detail. In general, it is good that the ratings for this question are so high, since they partially offset the poor selection ratings given to Hampshire classes.

One set of suggestions arising from the results for questions #2 and #3 concerns the unequal burden on small schools presented by the College's new first-year plan. Possible approaches might involve the gradual equalization of school sizes via the allocation of new faculty positions. This is obviously a delicate proposition, on which many other considerations also bear. But it is possible that the upper-level course selection issue can be addressed through relatively modest growth of the small schools. Another approach might be to alter the requirements of the first year plan, although it is probably too early in the life of that plan to consider major changes. A completely different approach to the upper-level course selection problem would be to enhance the coordination between Hampshire's School of Cognitive Science and the various Five College departments that cover related disciplines, for example to ensure that certain core courses are taught on a regular basis and without problematic overlaps. Considering the large number of departments (and cultures) that would be involved, this would be a major undertaking that would certainly require additional administrative and staff support.

The final two questions were, *How would you rate your interaction outside the classroom with the faculty in the School of Cognitive Science?* and: *How would you rate your opportunities to participate in research (your own or a professor's) in the School of Cognitive Science?* The ratings for these questions showed similar trends. The more time students spend in the School of CS, the higher they rate both faculty interaction and opportunities to do research. Strong-Concentrators gave the highest ratings, followed by Weak-Concentrators, and finally Non-Concentrators and Division 1 students. This is exactly the pattern of ratings one should expect. Division 1 students and Non-Concentrators spend little time in CS and so do not have much of a chance to interact with faculty or get involved with research. However, Strong-Concentrators, who spend most of their time in the School of CS, get to know their professors and feel like there are plenty of opportunities to conduct research.

Figure 2 shows the course areas requested by students. Before interpreting this graph, it is important to note that it is highly sensitive to the population of students questioned. All

students sampled wanted more classes in their academic areas. If you ask psychology students what classes they think should be offered, they want more psychology classes; computer science students want more computer science classes. Therefore, the classes that were sampled become an important consideration. No linguistics classes filled out the questionnaire, so it should not be surprising that not many students requested linguistics classes. But that does not mean that there are not a lot of linguistics students who want more classes. They were simply not polled.

Nonetheless, Figure 2 does have one clear message. Students want more classes in all areas. Specifically, they want more upper-level classes in all areas. There is not simply one area that needs more classes.

Finally, Figure 3 shows the future career plans of current cognitive science concentrators. If we consider "Graduate School," "Teaching, " and "Arts" (presumably Media Arts and Sciences) to indicate career plans that would directly extend CS-based concentrations, then 67% of the respondents indicated such plans.

2) STUDENT FACULTY RESEARCH

Following is a list of examples of student & faculty collaborative research or art, as reported by individual faculty members. This list is representative, not exhaustive.

Faculty names are in *italics*. Student names are in **bold.**

Steve Weisler:

Wil Doane, *Slavko Milekic*, and I did a textbook on CD:ROM for MIT PRESS (2000). Slavko was a visiting professor. Wil was a student who helped with content, graphics, and undertook the entire programming burden for this undergraduate linguistics text, that was published by MIT Press. Later, after graduating, he converted several chapters to a web version for The Mind Project, a cognitive science web site (2003): http://www.mind.ilstu.edu/curriculum/language/weisler/tolwebrm/pages.html

Chris Perry:

In the fall of 2002 I taught a 300-level course for 16 students from across the valley, including art students, computer animation students, film students, etc. The goal of the class was to produce a high-quality computer animated short film. I ended up writing and directing the piece, with the students doing everything else (design, layout, storyboarding, modeling, animation, editing, sound, etc. etc.). We rendered film-resoultion frames and got it printed on 35mm. It has since been shown in 2 festivals.

The best example of this kind of collaboration can be found at http://www.bitfilms.com.

Lee Spector:

- Collaborative research connecting a student's Div III to my ongoing work on the development of new evolutionary computation techniques, leading to a journal article:

Spector, L., and **A. Robinson. 2002**. Genetic Programming and Autoconstructive Evolution with the Push Programming Language. In *Genetic Programming and Evolvable Machines*, Vol. 3, No. 1, pp. 7-40. http://hampshire.edu/lspector/pubs/push-gpem-final.pdf

Related work also led to the following conference paper:

Spector, L., **and A. Robinson**. 2002. Multi-type, Self-adaptive Genetic Programming as an Agent Creation Tool. In *Proceedings of the Workshop on Evolutionary Computation for Multi-Agent Systems, ECOMAS-2002*, International Society for Genetic and Evolutionary Computation. http://hampshire.edu/lspector/pubs/ecomas2002-spector-toappear.pdf

- Collaborative work with a student in a CS class, building the student's final project for the class into a conference paper:

Crawford-Marks, R., and *L. Spector*. 2002. Size Control via Size Fair Genetic Operators in the PushGP Genetic Programming System. In W. B. Langdon, E. Cantu-Paz, K. Mathias, R. Roy, D. Davis, R. Poli, K. Balakrishnan, V. Honavar, G. Rudolph, J. Wegener, L. Bull, M. A. Potter, A. C. Schultz, J. F. Miller, E. Burke, and N. Jonoska (editors), *Proceedings of the Genetic and Evolutionary Computation Conference, GECCO-2002*, pp. 733-739. San Francisco, CA: Morgan Kaufmann Publishers. http://hampshire.edu/lspector/pubs/size-control-toappear.pdf

- Several students were involved in our NSF/LIS grant in various capacities, particularly programming. In at least one case this led to a publication with a student co-author (**Roger Bellin**):

Weisler, S., **R. Bellin**, *L. Spector*, and *N. Stillings*. 2001. An Inquiry-based Approach to E-learning: The CHAT Digital Learning Environment. In *Proceedings of SSGRR-2001, the International Conference on Advances in Infrastructure for Electronic Business, Science, and Education on the Internet*. Scuola Superiore G. Reiss Romoli, L'Aquila, Italy. Proceedings ISBN: ISBN:88-85280-61-7, http://hampshire.edu/lspector/pubs/stevenweislerssgrr-2001.pdf

- Collaborative, interdisciplinary work on genetic programming and Jazz, which emerged out of Division I and course work with a student and resulted in two co-authored publications:

Spector, L., and **A. Alpern**. 1994. Criticism, Culture, and the Automatic Generation of Artworks. In *Proceedings of the Twelfth National Conference on Artificial Intelligence, AAAI-94*, 3-8. Menlo Park, CA and Cambridge, MA: AAAI Press/The MIT Press.

Spector, L., and A. **Alpern. 1995**. Induction and Recapitulation of Deep Musical Structure. In *Working Notes of the IJCAI-95 Workshop on Artificial Intelligence and Music*. pp. 41-48. http://helios.hampshire.edu/lspector/pubs/IJCAI95mus-toappear.pdf

- A student ran computer-based experiments on children of various ages as part of a collaboration between a computer scientist (*Spector*) and a developmental psychologist (*Rattermann*), leading to a publication co-authored with the student (**Prentice**):

Spector, L., M. J. Rattermann, and **K. Prentice**. 1994. Ordering Relations in Human and Machine Planning. In *Proceedings of the Twelfth National Conference on Artificial Intelligence, AAAI-94*, 80-85. Menlo Park, CA and Cambridge, MA: AAAI Press/The MIT Press.

- A student verified and analyzed quantum algorithms discovered by genetic programming, leading to publications co-authored by faculty and the student (**Swamy**):

Spector, L, H. Barnum, *H.J. Bernstein*, and **N. Swamy**. 1999. Abstract for Invited Presentation: Quantum Computing and AI. In *Proceedings of the Sixteenth National Conference on Artificial Intelligence, AAAI-99*, AAAI Press.

Spector, L., H. Barnum, *H.J. Bernstein*, and **N. Swamy**. 1999. Finding a Better-than-Classical Quantum AND/OR Algorithm using Genetic Programming. In *Proceedings of the 1999 Congress on Evolutionary Computation*, pp. 2239-2246. IEEE Press. http://helios.hampshire.edu/lspector/pubs/spector-cec99.pdf

Raymond Coppinger:

Coppinger, R. and **J. Zucccotti**. (1999) Kennel enrichment: exercise and socialization in dogs. *Journal of Applied Animal Welfare Science* 2:281-296.

Coppinger, R., L. Coppinger and **E. Skillings** (1998) Observations on assistance dog training and use. *J. Applied Animal Welfare Society* 1:133-144.

Warner, S., M. Feinstein, R. Coppinger and **E. Clemence** (1996) Global Population Growth and the Demise of Nature. *Environmental Values* 5:285-301.

Coppinger, R. and **R Schneider** (1995) The Evolution of Working Dog Behavior. Ch 3 *in The Domestic Dog I* (J.A. Serpell, ed) Cambridge University Press.

Jaime Davila:

I have designed several courses that basically have students working directly with the type of thing I do research in. One is the "Evolution of Genetically Controlled Robots" class I taught last semester. It was a small class (4 students) that ended up running very much like meetings with student researchers. They would do a substantial amount of work between our meetings, and then we would discuss our progress during our meetings. Students are still working with the subject right now, as demonstrated by the activity on the class email list.

Early in the course, students were introduced to the main topics of both neural networks and genetic algorithms, and then they were asked to choose a project that involved the evolution of neural brains to control virtual creatures. They were given access to the computing cluster we acquired a year ago, and to the code that I have developed to do evolution of neural networks, as well as to the source code for Breve, built by Jon Klein. In addition to working on their own research projects (one of which is the student's Division III) they developed code to interface breve into a powerful neural network simulator called SNNS. This plugin will be made available to the public free of charge.

Joanna Morris Florack:

Face perception: the N170
This project, begun by **Alan Robinson** (98F), aims to examine the nature of the N170 an evoked potential that appears to be produced by exposure human faces. In his project Alan demonstrated an N170 response to 180 degree rotated heads, that is head without faces, or any facial features such as eyes, a nose or mouth which have often assumed to be the salient feature of faces and the trigger for the N170 response. This project was picked up an extended by **Eric Porges** (F99) who argued that the study in which N170 components were elicited to images of the back of the head presented full-frontal face images during the same block as the back-of-the-head images, leading to the possibility of a facial priming effect. To further explore the specificity of the N170 component and its relation to non-face head stimuli, Eric designed a study in which back-of-the-head images were presented to subjects with no other face stimuli. The other images used were those of cars and butterflies, which have been definitively shown not to elicit the N170. Eric found that an N170 elicited for the back-of-the-head stimuli but not for the car or for the butterfly images. On the basis of these data, Eric concluded that the most specific that the N170 is not specific to facial features and that the original N170 found to back-of-the-head stimuli was unlikely to be the due to a priming effect. This work was presented at the 43rd Annual Meeting of the Psychonomic Society in Kansas City, MO in November 2002.

Homophone processing: the N400
This project, the work of **Mara Breen** (97S), examines the degree to which reading depends on the activation of phonological, as opposed to purely orthographic, representations. This is a long-standing debate within the visual language processing literature and is of central importance to theories of reading. In her project, Mara hopes

to use the N400 evoked potential to shed light on some of these contentious issues. The N400 is a negative potential that is evoked by all words. However, the N400 is greater to words that are semantically incongruous, given the context, that to words that fit seamlessly into the semantic context. Thus if homophones of semantically acceptable words (words that are semantically incongruous given the context) show a large N400 we have evidence supporting the hypothesis that phonology probably does not play a role in the initial phases of word recognition and semantic integration, as the phonological representation for the semantically incongruous word is identical to its semantically appropriate homophone. This work was presented at the 14th Annual Convention of the American Psychological Society, in New Orleans in June, 2002

Garden-path sentences in music: the P600.
This project, the idea of **Meagan Curtis** (99F), tests the hypothesis that musical structures are processed in much the same way as are linguistic structures. Research has shown that structural violations of musical "sentences" show a P600 potential, the same as is shown by subjects listening to ungrammatical linguistic sentences. In this project Meagan and her colleagues, hope to find similar effects with musical structures that are not technically violations but that appear to be because listeners are temporarily "garden-pathed", i.e. they misanalyse a structure and are subsequently forced to go back to re-analyse a previously processed portion of the musical phrase. Research in the language processing literature has shown that sentences of this type, although not technically ungrammatical, also elicit a P600. A similar finding in the music perception domain would strengthen the case for the similarity of processing mechanisms for both music and language and would be a very significant finding. This work was presented at the 41th Annual meeting of the Psychonomic Society, New Orleans, LA.

The N400 in Mental Arithmetic
This research project was the work of **Eric Anderson** (F01) Eric was interested in investigating the neural mechanisms underlying mental arithmetic. It has been proposed that people use at least two different types of mathematical processing which take place in different regions of the brain. In solving multiplication problems, people tend to retrieve answers that have been learned by rote and hence mental multiplication is an operation that relies heavily on language. In contrast, approximate arithmetic is hypothesized to rely on magnitude oriented processing and may be used for other types of mental arithmetic such as addition. Previous research has also shown that when participants are presented with multiplication problems followed by incongruent answers, an N400 component is generated--similar to those elicited in language paradigms when subjects are presented with sentences ending with a semantically inappropriate word. Eric designed a study in which he combined these two areas of research by testing for an N400 component in both exact and approximate arithmetic tasks. Eric hypothesized that if exact arithmetic relies on verbal pathways, then an N400, which is primarily a linguistic component could be generated. However if approximate arithmetic relies on different visuo-spatial pathways, it seems unlikely that approximate addition would generate an N400. Eric designed three mental arithmetic tasks, each of which was designed to encourage the use of a particular mental process. Eric hypothesized that dot addition would trigger approximate calculations, multiplication would trigger

exact calculations, and that subtraction might use elements of both types of processes. He also included a verbal working memory interference task to further test for the use of verbal as opposed to visuo-spatial pathways. In line with his expectations, Eric found an N400 for the dot addition task, and no N400 for the subtraction task. However contrary to expectations, there was a hint of an N400 for the multiplication task. Eric presented these findings at the 25th Annual Meeting of the Cognitive Science Society in Boston, MA in July.

Syllable Effects in English Word Recognition

In addition to students at Hampshire, there has been some collaboration with researchers at UMass. **Jane Ashby**, a UMass graduate student, together with **Andrea Martin** (F01) has used the lab to investigate the nature of the phonological representations used during reading, specifically to examine whether readers represent syllable level information when silently reading isolated words? In eye-tracking studies, it has been shown that first fixation durations are shorter when readers received a syllabically congruent preview rather than an incongruent preview. In their study, Jane and Andrea found that brain potentials indicate increased negativity in the response to targets that are preceded by syllabically incongruent primes. This suggests that readers represent detailed phonological information in a multi-layered phonological representation. However, they found that the time course of the syllable effect varied. Potentials to CV initial words registered a prime-target discrepancy in syllable structure around 150 ms and around 200 ms, while potentials to CVC initial words registered that discrepancy later around 340 ms. This suggests that representing syllable information for CV initial words occurs earlier in the word identification system. They also found that patterns of lexical stress affected the representation of phonological information in two ways; (1) potentials to CV targets with initial syllable stress (SW) registered prime-target syllable discrepancies over an extended time period (200- 320 ms) compared to CV targets with second syllable stress and (2) potentials to CV & CVC targets with initial syllable stress (SW) registered letter effects around 70 ms after target onset, while CV targets with second syllable stress did not elicit such a response. This work was presented at the Architectures and Mechanisms for Language Processing (AMLaP) Conference in August in Glasgow, Scotland, and at the 44th Annual Meeting of the Psychonomic Society in Vancouver, BC in November.

V. Facilities and Support

Section outline:

1) Overview
2) Staff
3) Space
4) Budgets

1) General issues

Through a combination of talented and dedicated staff members, grant-getting acumen, the timely construction of an adequate building, and access to the library resources of the Five-College Consortium, CS has a strong infrastructure and is well supported, given the college's modest endowment. To a large extent this section spells out a record of success. Nevertheless, several issues and recommendations are highlighted in the discussion below:

- The School's office and IT support staff is stretched and is partially supported by grant funds, which are not guaranteed.
- The School's further development is severely hampered by lack of space. Over the next five years CS must acquire significant added space, either within its current building (ASH) or by moving to a new building.
- CS has been forced to provide much of its own infrastructure through grants, but the college has made changes in its handling of grant funds that undercut the School's ability to continue and that suggest a failure to understand the mechanism and incentives that were actually in place over a period of many years.
- The college's need to respond aggressively to the rising importance of digital media for library services is an issue for CS.

2) Staff

The office staff for the School currently consists of two positions. The CS administrative assistant (Leni Bowen) is a full-time high-level staff position funded by the college. The administrative assistant manages the School's budget, oversees the student payroll, and staffs numerous processes in the School such as curriculum planning, class scheduling, narrative evaluation preparation, and faculty searches. The Grants Coordinator (Paula Harmon) is funded by overhead from federal grants and by direct costs from the grant supporting the Culture, Brain, and Development Program. The Grants Coordinator manages grant budgets, oversees the appointments and payroll for students and research staff on grants, assists in the preparation of new proposals, and coordinates the research and curricular activities associated with grants. The Grants Coordinator is also

significantly involved in the day-to-day operation of the CS office, taking on the odd task, answering the phone, dealing with walk-in traffic, and keeping printers, copier, and fax machines running. The Grants Coordinator splits her time with the School of Natural Science.

The CS office, which also provides some services to faculty members from other Schools with offices in Adele Simmons Hall, requires at least the presence of two highly-trained staff members much of the time. Although the Grants Coordinator has been entirely supported out of soft money for several years, it is important that the College have a commitment both to return adequate indirect costs to CS to continue this support and to support the position directly during funding dry periods. The current rapid growth of the CBD program raises questions about whether another program and grant support staff member will have to be added to the staff.

For the past few years the College's Information Technology Department has provided a School Support Specialist to CS (Ryan Moore, shared with other units) who staffs the School's network and computing infrastructure. The School Support Specialists provide a crucial stabilization of services that the schools had worked to provide for themselves in previous years. The current level of support is adequate for the basic networking and computer infrastructure of the School, but further support may be needed to support the School's computing-intensive research projects. The college should consider returning to the School a higher percentage of indirect costs on the relevant grants for this purpose.

In keeping with the college's general commitment to individualized, inquiry-oriented learning, the library assigns a librarian to work directly with the faculty members and students in each School. The School librarians form personal relationships with faculty members and many students and are a critical component of instruction at Hampshire. The liaison to Cognitive Science (currently Stephanie Willen Brown), teaches research skills in classes and works closely with individual students as they pursue research at all levels of their course of study within CS. The CS librarian, in consultation with the faculty, purchases books, journal subscriptions, and databases in support of the interdisciplinary work undertaken by the School. She also participates in School activities and has the status of faculty/staff associate within the School.

3) Space

CS in its current form was significantly enabled by the construction of Adele Simmons Hall (ASH) in 1989. The building is appropriately named, because Adele Simmons, at the time Hampshire's third President, had the foresight to see the potential of constructing a classroom building oriented toward the needs of CS. ASH was designed to contain laboratory and classroom space for the school. Prior to that time the School had a single laboratory room and no ability to configure classrooms for its instructional needs. Currently ASH includes a developmental psychology lab (with separate testing and observation/prep rooms), an ERP lab, a general cognitive psychology lab, and two electronic classrooms that support computer science and digital media instruction. A

small addition to the building, funded by an education grant from the Department of Energy and constructed in 2002-03, has provided space for CS's server room and for the College's educational research and outreach programs, with which CS is significantly involved.

The physical needs of academic departments evolve, of course, and CS's once state-of-the-art facilities in ASH have now become one of the biggest impediments to the School's further progress. CS has no room for expansion and has already had to reduce lab space to house new faculty members and grant staff. The School's problem in this respect seems to reflect a general space crunch in the College, which has several pressing capital construction needs. Within the next five years, one of two things must happen if CS is to continue to realize its potential: (1) CS could be allowed to assume control over all of the space in ASH, which would require that non-CS faculty currently in the building be moved to a new building; or (2) a new building could be constructed that is designed, perhaps among other things, to house CS for the next 20 years.

What are some specific ways in which CS is currently hampered by lack of space? We cannot currently provide:

- Office and lab space for new faculty members.
- Social and study space for students and staff.
- Office space for expanded support staff.
- Increased office space for grant-supported staff and graduate students.
- Graphics and animation lab.
- Eye tracking lab.
- Sound-isolated psychoacoustics and music perception lab.
- Robotics lab.

The school has current resources and grant-getting capacity to support several of the above facilities, but they cannot be pursued because of lack of space.

4) Budgets

The College provides CS with a modest operating budget for programs and materials, which defers faculty members' expenses on their courses and some additional expenses for discretionary purchases, replacements and repairs. The College funds a number of campus-wide software licenses that benefit the School, e.g. Microsoft Office and PhotoShop. The college offers every faculty member a serviceable desktop or laptop computer and has occasionally offered start-up funds on the order of $5,000 to new faculty members in CS. The College funds about half of the equipment in one electronic classroom (on a 4-year replacement cycle). CS has funded the bulk (the percentage is hard to compute accurately, but is probably 80-90%) of its own equipment through grants and indirect costs from grants returned to the School from the college. Grant-funded purchases include nearly all of the equipment in CS's labs, office infrastructure (such as printers and fax machines), over half of the equipment in the two electronic classrooms,

and the laptop computers of two faculty members. Throughout its history, then, CS has been expected by the college to fund much of its capital infrastructure through grants from outside agencies. For over twenty years the School has been remarkably successful in securing grants and in using grant-related funds to build and sustain the School's infrastructure. That success was due in part to the college's policy of returning 50% of the indirect costs on federal grants to the School (25% to the faculty member and 25% to the School's general fund). This policy made sense, because the college was not in fact supporting the school's infrastructure at the level required by departments that pursue research and development in science and science curriculum. The 50% figure was recently reduced to 25%, a decision that raises a host of issues. Most directly, it could lead to the inability of the School to continue to support its own capital needs. It also signals a lack of recognition by the college of its own implicit policy of self-support by CS. The 50% return coupled with the lack of support from the college's normal operating budget created a unique and highly successful set of incentives for faculty members, which benefited both the School and the College. The college should make a commitment to restoring the 50% rate of return if/when it becomes necessary. The college should also recognize that there will probably be times when CS will be less successful attracting grants and will therefore require a period of increased direct support.

As noted in the staff section above, the provision of a School librarian is an invaluable asset to CS. Because the college was founded in 1970 and has built its endowment from near zero, the library has had a difficult time building and maintaining collections adequate to a research-oriented curriculum, particularly in rapidly-changing fields such as cognitive science. The four mature libraries within the Five-College Consortium, which have joint borrowing privileges, therefore constitute a major source of infrastructural support to CS (and to Hampshire generally). The main issue of concern to CS faculty and students currently is the college's strategy for providing maximum electronic access to journals. On-line access to journals seems tailor-made for Hampshire's curriculum. On the one hand the library has made rapid strides in providing access, and, on the other hand, it has fallen behind more well-funded libraries. This is an area requiring sustained college-wide attention.

Open Questions

CS faces a number of issues, some of which are perennial to small-college departments and some of which arise from the maturing of the School's unique curricular mission. An initial list might include the following:

Size of the School: As CS is one of the college's small Schools, a reasonable topic for consideration is whether its contribution to the College could be significantly enhanced by a small increase in the number of faculty. From a purely practical point of view CS is currently at the lower limit of the number of faculty members required to fulfill its curricular responsibility to the first-year program and its governance responsibilities.

Areas for faculty expansion: If the faculty of the School is to grow, in what disciplines should new hires be made? Areas that have been suggested include, neuroscience (for which we are currently searching to fill a 3-year visiting position funded by the Culture, Brain, and Development program), social psychology, philosophy, animal cognition, education, and media arts and sciences. Additional faculty in any of these areas would allow us to meet high student demand and to build new bridges to other programs in the College. By what process should this decision be made?

Faculty development: Hampshire is a demanding work environment for faculty. Does the School have adequate mechanisms for faculty development and for mentoring junior faculty? Should the mechanisms that we do have (such as co-teaching) be employed more systematically? Should practices used elsewhere in the college (such as the SS “buddy system”) be adopted in CS?

Teaching, research, and service: Tensions among teaching, research, and service, and the consequent stress on faculty members, seem to typify faculty life at small colleges and are certainly present at Hampshire. Managing these tensions, particularly for junior faculty members, is a possible issue for further review.

Numbers of upper-division students: After the first year students at Hampshire are free to choose their areas of study and, to a large extent, the faculty members who serve on their Division II and III committees. An appropriate question for this review is whether the School is managing its overall workload successfully. Is it attracting a sufficient number of students, and is it distributing work among its faculty equitably?

The upper-level curriculum: There is some concern that the demands of the first-year program, the diversity of interests in our upper-level students, and the highly individualized instruction in Division III projects has undercut the School's ability to offer a rich and coherent upper-level curriculum. To what degree is this true? If so, what are some possible new approaches?

Cognitive science as a central area of the liberal arts: At Hampshire cognitive science is conceived of as a major division of a liberal arts curriculum rather than as a single, relatively narrow academic discipline. Has CS sufficiently articulated its intellectual core in these terms? Does it offer skills of inquiry and perspectives that are of value to a broad range of both beginning and advanced students? Even if the School's vision of its intellectual project is coherent and compelling, does it have sufficient resources to implement that vision?

Individualism vs. commonality in students' programs: From a bureaucratic point of view a cognitive science concentrator at Hampshire is a student whose Division II committee is chaired by a member of the CS faculty. Every such student has worked with some members of the CS faculty and has been exposed to some chunk of the School's curriculum, but is there anything that all, or even most, of these students share? If there is a significant lack of overlap, should the School work toward the implementation of some sort of core curriculum?

Basic academic skills: Along with many other colleges and universities, Hampshire has become concerned with the issue of insuring that its graduates acquire basic intellectual tools of reading and library research, critical thinking, writing, and quantitative reasoning. Has CS attended to this issue appropriately for its own lower and upper-level courses?

Tracking students and graduates: In preparing this report we sought to present information on the career trajectories of our graduates, but we found that the records on graduates maintained by the College, which were collected primarily for use in Institutional Advancement, were inadequate for our purposes. How can we better collect and maintain this information so that we can better assess our long-term impacts on students? We also found much of the data collected by the Dean of Faculty office on student concentration areas and demographics to be problematic either for reasons unique to Hampshire (for example because course and project disciplines may be hard to discern) or because of more mundane record-keeping issues. Should the college strengthen its resources for institutional records and research?

Web publicity: Can the information gathered in this self study process be leveraged to enhance the presence of CS on the internet in ways that will attract more students and appeal to funding agencies?

Broader impacts: What should the School do to sustain its contribution to the continuing development of cognitive science education nationally and internationally? The Culture, Brain, and Development program is a positive development. Can it, or other initiatives, be built into school-wide efforts with significant, visible output?

Sustaining assessment and improvement: The process that produced this self study report was valuable but rare. Even if such reviews are regularized by the College they will only happen at intervals of several years. How can the School ensure that critical self-evaluation and improvement processes occur more continuously?

Appendix

Outline:

1) Course lists
2) Governance participation data
3) Division II/III workload data
4) Student questionnaire
5) Faculty vitae

1) Course Lists (Fall, 2001–Spring, 2004)

FALL 2001

CS 101 ANIMAL BEHAVIOR
Raymond Coppinger

CS 108 ICONOGRAPHY AND MEMORY
David Gosselin

CS 109 COMPUTING CONCEPTS: CREATIVE MACHINES?
Lee Spector

CS 115f NEURAL NETWORKS
Jaime Davila

CS/HACU 116 INTRODUCTION TO DIGITAL IMAGING
Christopher Perry

CS 123 COMPUTATIONAL LINGUISTICS
Jaime Davila and Steven Weisler

CS 128f COGNITIVE SCIENCE: AN INTRODUCTION
Neil Stillings

CS 136 LOVE, SEX AND DEATH
Laura Sizer

CS 139f ANIMAL COGNITION
Mark Feinstein

CS 145 PSYCHOLOGY OF LANGUAGE
Joanna Morris

CS 148f LANGUAGE AND SOCIETY
Mark Feinstein

CS 160 COGNITIVE APPROACHES TO LEARNING
Loel Tronsky

CS/SS 173 CONSCIOUSNESS CONSIDERED
Philip Kelleher

CS/HACU 174 COMPUTER ANIMATION I
Christopher Perry

CS/NS 198 EVER SINCE DARWIN
Lynn Miller

CS 202 PHILOSOPHY OF MIND
Laura Sizer

CS 231 DIVERSITY EQUITY AND OPPORTUNITY IN U.S. SCHOOLS
Madelaine S. Marquez

CS/HACU 256 DIGITAL HUMANITIES
Ryan Moore and Bethany Ogdon

CS/SS 259 ECOLOGICAL ECONOMICS: THE CANADIAN AMERICAN EXPERIENCE
Raymond Coppinger and Stanley Warner

CS 281 HISTORY OF PSYCHOLOGY
Joanna Morris

CS 284 SEMINAR IN ARTIFICIAL INTELLIGENCE: EVOLUTIONARY COMPUTATION
Lee Spector

CS/NS 288 INTERDISCIPLINARY TEACHING
Laura Wenk and Merle Bruno

CS/NS 316 LINEAR ALGEBRA
Kenneth Hoffman

CS/SS 321 BRIDGING THE DIVIDE: SERVICE LEARNING PRACTICUM
Tom Murray and Mary Bombardier

CS 343 COMPUTER GAME DESIGN AND PRODUCTION
Ryan Moore

CS 363 ADVANCED ANIMAL BEHAVIOR SEMINAR
Raymond Coppinger

SPRING 2002

CS 118 EMOTIONS
Laura Sizer

CS 121 LEARNING REVOLUTIONS: EDUCATIONAL SOFTWARE AND INQUIRY LEARNING
Tom Murray

CS 127 MEMORY, LEARNING AND EXPERTISE: APPLICATIONS TO THE CLASSROOM AND BEYOND
Loel Tronsky

CS 133 ARTIFICIAL LIFE
Ryan Moore

CS 134 BRAIN AND COGNITION
Joanna Morris

CS 135 SOUND, MUSIC, AND MIND
Neil Stillings

CS 153 PROGRAMMING WITH THE INTERNET
Ryan Moore

CS 165 INTRODUCTION TO EXPERIMENTAL PSYCHOLOGY
Joanna Morris

CS 175 WHAT COMPUTERS CAN'T DO
Lee Spector

CS 203 COGNITIVE DEVELOPMENT
Marie Evans

CS 207 SOFTWARE ENGINEERING FOR ARTIFICIAL INTELLIGENCE TASKS
Jaime Davila

CS 219 THE BEHAVIOR AND EVOLUTION OF THE DOMESTICATED ANIMALS
Raymond Coppinger

CS 222 DATA STRUCTURES AND PROGRAMMING PARADIGMS
Jaime Davila and William Doane

CS 223 COMPUTER GRAPHICS TOPICS FOR PROGRAMMING
Christopher Perry

CS 247 ENVIRONMENTAL ETHICS
Laura Sizer

CS 248 DATA STRUCTURES IN JAVA
Roger Bellin

CS 260 COGNITIVE ETHOLOGY
Raymond Coppinger

CS 262 THEORIES AND PRACTICES OF LITERACY INSTRUCTION
Nancy Harrington and Kathy Itterly

CS/HACU 266 COMPUTER ANIMATION II
Christopher Perry

CS 303 DIGITAL GRAPHICS DESIGN AND TYPOGRAPHY
David Gosselin

CS 317 PHONOLOGY TUTORIAL
Mark Feinstein

CS 320 SEMINAR IN EDUCATIONAL RESEARCH DESIGN
Laura Wenk

CS 375 LEARNING, COGNITION, AND EDUCATION
Neil Stillings

CS 380 STUDENT TEACHING
Madelaine Marquez

FALL 2002

CS 101 ANIMAL BEHAVIOR
Raymond Coppinger

CS 103 INTRODUCTION TO COMPUTER PROGRAMMING USING LISP
Ryan Moore

CS 110 CHILDREN AND TELEVISION
Marie Evans

CS 112 IS BIG BROTHER WATCHING?: PRIVACY AND SECURITY ON THE INTERNET
Richard Weiss

CS 116 INTRODUCTION TO DIGITAL IMAGING
Christopher Perry

CS 117 PHILOSOPHY OF EDUCATION
Ernest Alleva

CS 131T LIVING DIGITALLY
Jaime Davila and James Miller

CS 132T ISSUES IN THE PHILOSOPHY OF COGNITIVE SCIENCE
Laura Sizer

CS 138 THE ETHICS OF REPRODUCTION AND TECHNOLOGY
Falguni Sheth

CS 140 CHILDREN AND ANIMALS AT PLAY
Raymond Coppinger and Marie Evans

CS 142 LANGUAGE, MEANING, AND THE MIND
Marcin Morzycki

CS 145 PSYCHOLOGY OF LANGUAGE
Joanna Morris

CS 147
TURTLES, TERMITES AND TRAFFIC JAMS: COMPUTER MODELING AND SIMULATION
Jonathan Klein

CS 154T INTUITIVE JUDGMENTS AND RATIONAL DECISIONS
Philip Kelleher

CS 160 COGNITIVE APPROACHES TO LEARNING AND INDIVIDUAL DIFFERENCES IN READING AND MATHEMATICS
Loel Tronsky

CS 205 INTRODUCTION TO COMPUTER SCIENCE
Richard Weiss

CS 211 MORAL EDUCATION AND DEVELOPMENT
Theo Linda Dawson

CCS 240* INSTRUCTIONAL METHODS FOR INQUIRY-BASED TEACHING
Laura Wenk

CS 253 JOURNALISM IN CRISIS
James Miller

CS 291 SOFTWARE ENGINEERING
Jaime Dávila

CS 313 BRAIN AND COGNITION II
Joanna Morris

CS/NS 316 LINEAR ALGEBRA
Kenneth Hoffman

CS 334 COMPUTER ANIMATION III
Christopher Perry

CS 340 CHILDREN AND ANIMALS AT PLAY
Raymond Coppinger and Marie Evans

SPRING 2003

CS 108 ARTIFICIAL LIFE
Jonathan Klein

CS 115 NEURAL NETWORKS
Jaime Davila

CS 118 EMOTIONS
Laura Sizer

CS 127 MEMORY, LEARNING, AND EXPERTISE: APPLICATIONS TO THE CLASSROOM AND BEYOND
Loel Tronsky

CS 151 THE READING BRAIN
Jane Ashby

CS 153 INTERNET PROGRAMMING
Ryan Moore

CS 155 NEW MEDIA: INNOVATION, ADOPTION, FUTURE
James Miller

CS 161 SEX, DRUGS, ROCK 'N ROLL, AND SEATBELTS: INDIVIDUAL LIBERTY, MORALITY, AND POLITICS
Ernest Alleva

CS 174 COMPUTER ANIMATION I
Christopher Perry

CS 180 THE 'LINGUISTICS WARS': AN INTELLECTUAL CONFLICT AND ITS CONSEQUENCES
Marcin Morzycki

CS 203 COGNITIVE DEVELOPMENT
Marie Evans

CS 210 MEANING AND REPRESENTATION: INTRODUCTION TO PHILOSOPHY OF LANGUAGE
Laura Sizer

CS 212 PHILOSOPHY OF TECHNOLOGY: MACHINES, MEGALOMANIA, AND MORALS
Falguni Sheth

CS 213 MEDIA AND DEMOCRACY
James Miller

CS 219 THE BEHAVIOR AND EVOLUTION OF DOMESTIC ANIMALS
Raymond Coppinger

CS 229 COMPUTER VISION
Richard Weiss

CS 231 COMPUTER GAME THEORY AND DESIGN
Ryan Moore

CS 260 COGNITIVE ETHOLOGY
Raymond Coppinger

CS 263 ARTIFICIAL INTELLIGENCE
Jaime Davila

CS 290 SPECIAL VISUAL EFFECTS
Christopher Perry

CS 299 THE ASSESSMENT OF CONCEPTUAL DEVELOPMENT: A RESEARCH PRACTICUM
Theo Linda Dawson

CS 307 CHILDREN AND TELEVISION II: ADVANCED RESEARCH SEMINAR
Marie Evans

CS 320 EDUCATIONAL RESEARCH AND EVALUATION
Laura Wenk

CS 331 COMPUTER GAME THEORY, DESIGN, AND PROGRAMMING
Ryan Moore

FALL 2003

CS 101 ANIMAL BEHAVIOR
Raymond Coppinger

CS 101-2 ANIMAL BEHAVIOR
Kathryn Lord

CS 106 CHANGING LANGUAGES
Mark Feinstein

CS 112 IS BIG BROTHER WATCHING?: PRIVACY AND SECURITY ON THE INTERNET
Richard Weiss

CS 116 INTRODUCTION TO DIGITAL IMAGING
Luke Jaeger

CS 117t PHILOSOPHY OF EDUCATION
Ernest Alleva

CS 128t COGNITIVE SCIENCE: AN INTRODUCTION THROUGH VISION
Neil Stillings

CS 134 BRAIN AND COGNITION
Joanna Morris Florack

CS 137 IS THE UNEXAMINED LIFE NOT WORTH LIVING? PLATO ON MORAL AND POLITICAL PHILOSOPHY
Ernest Alleva

CS 139 ANIMAL COGNITION
Mark Feinstein

CS 143 MEDIAWORK
James Miller

CS 171 COMPUTER PROGRAMMING PROJECTS FOR BEGINNERS
Jaime Davila

CS 173 CONSCIOUSNESS CONSIDERED
Laura Sizer and Philip Kelleher

CS 176T PHILOSOPHY OF TECHNOLOGY
Falguni A. Sheth

CS 182t BILINGUALISM
Marie Evans and Joanna Morris Florack

CS 199 EXPORTING AMERICAN JOURNALISM
James Miller

CS 202 PHILOSOPHY OF MIND
Laura Sizer

CS 203 COGNITIVE DEVELOPMENT
Marie Evans

CS 205 INTRODUCTION TO COMPUTER SCIENCE
Richard Weiss

CS 208 HOW PEOPLE LEARN: AN INTRODUCTION TO COGNITION AND EDUCATION
Neil Stillings and Laura Wenk

CS 220 EDUCATIONAL RESEARCH METHODS: EXAMINING ENVIRONMENTS FOR LEARNING
Laura Wenk

CS/NS 243 NEUROPATHOLOGY
Brad Crenshaw

CS 248 BIOLOGY OF LANGUAGE
Mark Feinstein

CS 266 COMPUTER ANIMATION II
Jamie Elkin

CS 278 EVOLUTION OF NEURALLY CONTROLLED ROBOTS
Jaime Davila

CS 296 FREEDOM OF EXPRESSION
James Miller

CS/NS 316 LINEAR ALGEBRA
Kenneth Hoffman

CS 335 CURRENT ISSUES IN COGNITIVE SCIENCE
Lee Spector

CS 363 ADVANCED ANIMAL BEHAVIOR SEMINAR
Raymond Coppinger

SPRING 2004

CS 103 Endangered Language
Mark Feinstein

CS 125 INNATENESS
Joanna Morris Florack

CS 135 SOUND, MUSIC, AND MIND
Neil Stillings

CS 153 PROGRAMMING FOR THE INTERNET
Richard Weiss

CS/NS 158 EVOLUTION OF BEHAVIOR
Kathryn Lord

CS/NS 164 GENDER ISSUES IN SCIENCE EDUCATION
Marie Evans and Merle Bruno

CCS 166 THEORY OF LANGUAGE: SYNTAX
Steven Weisler

CS 167 MORAL PANICS: CHILDREN, THE MEDIA, AND VIOLENCE
Marie Evans and James Miller

CS 172 HAPPINESS
Laura Sizer

CS 174 COMPUTER ANIMATION I: COLLABORATIVE
Jamie Elkin

CS 191 SOUND IN NATURE
Mark Feinstein

CS 209 EDUCATIONAL EXPERIENCE: A HAMPSHIRE COLLEGE CASE STUDY
Jessica Payne

CS 212 BRAIN AND COGNITION II
Joanna Morris Florack

CS 223 COMPUTER GRAPHICS FOR PROGRAMMERS
Richard Weiss

CS 240 INSTRUCTIONAL METHODS FOR INQUIRY-BASED INSTRUCTION
Laura Wenk

CS 258 LEARNING FROM CHILDREN
Danne Davis

CS 262 THE SOCIAL FOUNDATION OF COGNITION: THEORY AND PRACTICE
Laura Wenk

CS 263 ARTIFICIAL INTELLIGENCE IN 3D VIRTUAL WORLDS
Lee Spector and Jonathan Klein

CS 270 TOPICS IN MORAL AND POLITICAL PHILOSOPHY
Ernest Alleva

CS 273 CONSCIOUSNESS RECONSIDERED
Laura Sizer and Philip Kelleher

CS 292 DATABASE-DRIVEN WEBSITES
Jaime Davila and Dan Parker

CS 306 POLITICAL CULTURE
James Miller

CS 329 ADVANCED ANIMAL COGNITION
Mark Feinstein

CS 334 COMPUTER ANIMATION III
Jamie Elkin

CS/NS 358 EVOLUTION OF BEHAVIOR
Kathryn Lord

CS/SS 370 BRAIN, MIND, AND CULTURE
Neil Stillings and Barbara Yngvesson

2) Governance participation data

99-00

	Jim Miller	CCFRAP
*	Ray Coopinger	Academic Freedom and Procedures Committee
	Joe Cruz	Executive Committee of the Faculty
*	Neil Stillings	Appeals and Hearing Board
*	Lee Spector	Compensation Committee
	Joanna Morris	Educational Policy Committee
	Carter Smith	IRB
	Joanna Morris	IRB
	Neil Stillings	IRB
*	Jim Miller	Fulbright Committee

00-01

	Jim Miller	CCFRAP
*	Ray Coppinger	Academic Freedom and Procedures Committee
	Carter Smith	Executive Committee of the Faculty
	Joanna Morris	Educational Policy Committee
	Steve Weisler	Educational Policy Committee
*	Jim Miller	Fulbright Committee
*	Jim Miller	Judicial Council

01-02

	Neil Stillings	CCFRAP
	Jim Miller/ Neil Stillings	Executive Committee of the Faculty
	Mark Feinstein	Educational Policy Committee
	Steve Weisler	Educational Policy Committee
*	Jim Miller	Fulbright Committee
*	Jim Miller	Judicial Council
	Joanna Morris	IRB
	Neil Stillings	IRB

02-03

	Neil Stillings	CCFRAP
	Lee Spector	Executive Committee of the Faculty
	Steve Weisler	Educational Policy Committee
*	Jim Miller	Fulbright Committee
	Joanna Morris	IRB
	Neil Stillings	IRB

* These committees are not currently active or run out of the Dean of the Faculty office.

3) Division II/III workload data

The charts on this page show Division II/III chairs and memberships by faculty member and year.

F99-S00

		CS Chair	CS Chair
Instructor		II	III
1	Coppinger, Ray	0	2.5
2	Cruz, Joe	3	1
3	Davila, Jaime		1
4	Evans, Marie		
5	Feinstein, Mark	2	3.5
6	Miller, Jim	3	1
7	Morris, Joanna	0	1
8	Perry, Chris		
9	Sizer, Laura		
10	Smith, Carter	3	2
11	Spector, Lee	7	10
12	Stillings, Neil	0	0
13	Weisler, Steve	3	3.5
14	Wenk, Laura		
Count		9	10
Median		3	1.5
Total		21	25.5

F00-S01

		CS Chair	CS Chair
Instructor		II	III
1	Coppinger, Ray	2	1
2	Davila, Jaime	3	3
3	Evans, Marie		
4	Feinstein, Mark	3	0
5	Miller, Jim	4	3
6	Morris, Joanna	0	1
7	Perry, Chris	2	2.5
8	Sizer, Laura		
9	Spector, Lee	2	1
10	Stillings, Neil	2	1
11	Weisler, Steve	3	1
12	Wenk, Laura		2
13			
14			
Count		9	10
Median		2	1
Total		21	15.5

F01-S02

		CS Chair	CS Chair
Instructor		II	III
1	Coppinger, Ray	0	1
2	Davila, Jaime	3	4
3	Feinstein, Mark	2	1
4	Miller, Jim		
5	Morris, Joanna	5	4
6	Perry, Chris	2	4
7	Sizer, Laura		
8	Smith, Carter		
9	Spector, Lee	3	4
10	Stillings, Neil	2	4
11	Weisler, Steve	0	3.5
12	Wenk, Laura	1	2
13			
14			
Count		9	9
Median		2	4
Total		18	27.5

F02-S03

		CS Chair	CS Chair
Instructor		II	III
1	Coppinger, Ray	3	1
2	Davila, Jaime	5	5
3	Evans, Marie	1	1
4	Feinstein, Mark		
5	Miller, Jim	2	3
6	Morris, Joanna	4	1
7	Perry, Chris	6	5
8	Sizer, Laura	0	3
9	Spector, Lee	1	2.5
10	Stillings, Neil	6	1
11	Weisler, Steve	4	2
12	Wenk, Laura	1	3
13			
14			
Count		11	11
Median		3	2.5
Total		33	27.5

F99-S00

		CS Mem	CS Mem
Instructor		II	III
1	Coppinger, Ray	1	1
2	Cruz, Joe	2	1
3	Davila, Jaime	1	
4	Evans, Marie		
5	Feinstein, Mark	6	5
6	Miller, Jim	0	0
7	Morris, Joanna	0	0
8	Perry, Chris	1	6
9	Sizer, Laura		
10	Smith, Carter	0	1
11	Spector, Lee	5	1
12	Stillings, Neil	1	1
13	Weisler, Steve	1	4
14	Wenk, Laura		
Count		11	10
Median		1	1
Total		18	20

F00-S01

		CS Mem	CS Mem
Instructor		II	III
1	Coppinger, Ray	1	0
2	Davila, Jaime	1	2
3	Evans, Marie		
4	Feinstein, Mark	7	4
5	Miller, Jim	0	1
6	Morris, Joanna	4	2
7	Perry, Chris	5	7
8	Sizer, Laura		
9	Spector, Lee		1
10	Stillings, Neil	4	1
11	Weisler, Steve	3	0
12	Wenk, Laura	1	6
13			
14			
Count		9	10
Median		3	1.5
Total		26	24

F01-S02

		CS Mem	CS Mem
Instructor		II	III
1	Coppinger, Ray	0	0
2	Davila, Jaime	1	3
3	Feinstein, Mark	4	4
4	Miller, Jim		1
5	Morris, Joanna	1	1
6	Perry, Chris	4	1
7	Sizer, Laura	1	
8	Smith, Carter	2	
9	Spector, Lee	0	6
10	Stillings, Neil	0	0
11	Weisler, Steve	0	3
12	Wenk, Laura	2	3
13			
14			
Count		11	10
Median		1	2
Total		15	22

F02-S03

		CS Mem	CS Mem
Instructor		II	III
1	Coppinger, Ray	3	0
2	Davila, Jaime	1	0
3	Evans, Marie	3	2
4	Feinstein, Mark	2	1
5	Miller, Jim	0	0
6	Morris, Joanna	2	
7	Perry, Chris	6	5
8	Sizer, Laura	2	0
9	Spector, Lee	0	2
10	Stillings, Neil	2	3
11	Weisler, Steve	3	1
12	Wenk, Laura	4	1
13			
14			
Count		12	11
Median		2	1
Total		28	15

4) Student questionnaire

The following two pages contain the questionnaire distributed to students for the study presented in Section IV: Students.

School of Cognitive Science Review Questionnaire—Fall 2003

This questionnaire asks you to tell us about your experiences with the School of Cognitive Science. Please consider each question carefully and answer honestly and thoughtfully. We will keep your responses strictly confidential; no one's individual responses will be disclosed. This information will be part of an external review of the School of Cognitive Science.

Part A Background Information

For each of the following questions, please answer by either circling your response or filling in the blank.

1.	Year at Hampshire:	1st	2nd	3rd	4th	5+
2.	Current Division Level:	I	II	III		
3.	If you are Division II or Division III, how many of your committee members are from the School of Cognitive Science?	Chair and all members	Chair and one member	Chair only	One member only	None
4.	If you are Division II or Division III, how much of your divisional work (courses, projects, etc.) falls within the School of Cognitive Science?	All	Most	Some	Little	None
5.	If you are Division II or Division III, and Cognitive Science is a major part of your divisional work, which area(s) are you studying? (Circle all that apply.)	Animal Behavior	Computer Science	Education	Linguistics	Media Arts And Sciences
		Neuro-Science	Philosophy	Psychology		
6.	Number of courses you have taken in the School of Cognitive Science:	_____				

Part B School Ratings

For each of the following questions, indicate your rating by filling in the appropriate circle on the following scale: Excellent, Good, Satisfactory, Fair, Poor, No Opinion or Not Applicable.

		Excellent	Good	Satisfactory	Fair	Poor	No Opinion or Not Applicable
8.	How would you rate the quality of classes in the School of Cognitive Science?	○	○	○	○	○	○
9.	How would you rate the selection of classes available at **Hampshire College** to Cognitive Science concentrators?	○	○	○	○	○	○
10.	How would you rate the selection of classes available through the **Five Colleges** to Cognitive Science concentrators?	○	○	○	○	○	○
11.	How would you rate your interaction outside the classroom with the faculty in the School of Cognitive Science?	○	○	○	○	○	○
12.	How would you rate your opportunities to participate in research (your own or a professor's) in the School of Cognitive Science?	○	○	○	○	○	○

↓ Continue on other side ↓

School of Cognitive Science Review Questionnaire—Fall 2003

Part C General comments

13. In what areas do you think the School of Cognitive Science needs to offer more courses? Are there any specific courses you would like to see offered?

14. How would you describe your interaction outside the classroom with the faculty in the School of Cognitive Science?

15. How would you describe your opportunities to do or participate in research in the School of Cognitive Science?

16. In a few sentences, what are your future plans after graduating from Hampshire?

17. What are some of the most positive things about the School of Cognitive Science?

18. What are some of the least positive things about the School of Cognitive Science?

If you have any questions about this survey, please contact Eric Anderson, student representative on the School of Cognitive Science Review Committee, eca01@hampshire.edu

5) Faculty vitae

The following pages contain the curriculum vitae of the School's regular and visiting faculty.