

HUMAN COMPUTER INTERACTION

Interdepartmental Graduate Program

Human Computer Interaction is an interdepartmental graduate program that seeks to improve the way individuals and groups use computers through an understanding of the social and cognitive aspects of the design and use of computational devices. Students in the program learn about cognitive psychology, graphic design principles, the impacts of technology on society, evaluating system usability, and cutting edge computer programming for computational perception and language parsing.

Student research projects have explored the latest in virtual reality studies, improving natural interaction through touch screens and 3D camera gesture controls, virtual engineering using force feedback devices, and many other projects at the bleeding edge of technological innovation. Graduates of the program have gone to work at many of the largest technology firms in the US and abroad while others have gone on to positions in academia.

Degrees are offered for the Master of Science (MS) and Doctor of Philosophy (PhD) degrees with a major in Human Computer Interaction (HCI). A Graduate Certificate and an Online Master of Science degree in Human Computer Interaction are also offered; these degrees are especially targeted for the benefit of students working in business and industry wanting education in this field. The graduate program in Human Computer Interaction (HCI) welcomes applicants from a diverse collection of technical and creative fields whose unifying characteristic is the desire to develop new ways to bridge the gap between human and machine. The students must demonstrate skill in software development and proficiency in high-level, object-oriented programming. These skills can be acquired after admission to the program. Other entrance requirements will include an undergraduate degree and transcripts, test scores and other indicators that the applicant can be successful at the graduate level. All students admitted to the MS or PhD program on campus must secure a graduate assistantship.

All programs of study for the PhD must include:

1. one core course of their choice from each of the categories of Implementation, Design, Evaluation and Phenomena, if not completed as part of the student's Masters program
2. two more courses of their choice from a list of recommended electives
3. four semesters of HCI 591 Seminar in Human Computer Interaction
4. a minimum of nine research credits.

The MS degree calls for 30 credits of course work including appropriate credit for the Master's thesis. MS students must take one core course of their choice from each of the categories of Implementation, Design, Evaluation and Phenomena. MS Students must also take two semesters of HCI 591 Seminar in Human Computer Interaction.

The Online HCI MS program is most appropriate for individuals with a bachelor's degree in a scientific, engineering, business, or artistic discipline, who are pursuing a professional career, and who already have a strong base of information technology skills. Requirements for the Online Master of Science Program include 27 credits of coursework, plus

a three-credit capstone course, with a final presentation at the end of the degree program.

Requirements for the HCI Graduate Certificate program include three core HCI courses plus one elective.

Information on applications procedures and specific requirements of the major can be obtained from the following Internet address: <http://www.hci.iastate.edu/Academics/index.php>.

Courses primarily for graduate students, open to qualified undergraduates:

HCI 504: Evaluating Digital Learning Environments
(Cross-listed with C I). (3-0) Cr. 3. S.

Prereq: C I 501

Principles and procedures to plan, design, and conduct effective evaluation studies (formative, summative, usability) in different settings are studied. Opportunities to engage in real or simulated evaluation projects of substantial scope are provided. Create evaluation instruments, develop methods with which to evaluate a product or program, conduct try-outs or usability sessions, analyze the data, report the findings, and recommendations are some of the course activities.

HCI 515: Statistical Natural Language Processing
(Cross-listed with ENGL, LING). (3-0) Cr. 3. F.

Prereq: STAT 330 or equivalent, recommended ENGL 219 or LING 219, or ENGL 511 or LING 511

Introduction to computational techniques involving human language and speech in applications such as information retrieval and extraction, automatic text categorization, word prediction, intelligent Web searching, spelling and grammar checking, speech recognition and synthesis, statistical machine translation, n-grams, POS-tagging, word-sense disambiguation, on-line lexicons and thesauri, markup languages, corpus analysis, and Python programming language.

HCI 520: Computational Analysis of English
(Cross-listed with ENGL, LING). (3-0) Cr. 3. S.

Prereq: ENGL 510 or LING 510, and ENGL 511 or LING 511

Concepts and practices for analysis of English by computer with emphasis on the applications of computational analysis to problems in applied linguistics such as corpus analysis and recognition of learner language in computer-assisted learning and language assessment.

HCI 521: Cognitive Psychology of Human Computer Interaction
(Cross-listed with PSYCH). (3-0) Cr. 3.

Prereq: Graduate classification or instructor approval

Biological, behavioral, perceptual, cognitive and social issues relevant to human computer interactions.

HCI 522: Scientific Methods in Human Computer Interaction
(Cross-listed with PSYCH). (3-0) Cr. 3. Alt. S., offered odd-numbered years.

Prereq: PSYCH 521 and STAT 101 or equivalent

Basics of hypothesis testing, experimental design, analysis and interpretation of data, and the ethical principles of human research as they apply to research in human computer interaction.

HCI 525: Optimization Methods for Complex Designs

(Cross-listed with M E). (3-0) Cr. 3. F.

Prereq: M E 160, MATH 265

Optimization involves finding the 'best' according to specified criteria. Review of a range of optimization methods from traditional nonlinear to modern evolutionary methods such as Genetic algorithms. Examination of how these methods can be used to solve a wide variety of design problems across disciplines, including mechanical systems design, biomedical device design, biomedical imaging, and interaction with digital medical data. Students will gain knowledge of numerical optimization algorithms and sufficient understanding of the strengths and weaknesses of these algorithms to apply them appropriately in engineering design. Experience includes code writing and off-the-shelf routines. Numerous case-studies of real-world situations in which problems were modeled and solved using advanced optimization techniques.

HCI 558: Introduction to the 3D Visualization of Scientific Data

(Cross-listed with COM S, GEOL). (2-2) Cr. 3. Alt. F., offered even-numbered years.

Prereq: Graduate-student standing in the mathematical or natural sciences or engineering; basic programming knowledge

Introduction to visualizing scientific information with 3D computer graphics and their foundation in human perception. Overview of different visualization techniques and examples of 3D visualization projects from different disciplines (natural sciences, medicine, and engineering). Class project in interactive 3D visualization using the ParaView, Mayavi, TVTK, VTK or a similar system.

HCI 570: UX Lab Studies: Eyetracking & Other UX Tools

(1-0) Cr. 1.

Practical introduction to User Experience (UX) tools and how to use them for research: Designing a UX study; developing meaningful user tasks; how to plan a research study that integrates eyetracking measures, UX measures, behavioral measures, surveys, interviews and IRB applications; analyzing UX data; and presenting UX study results.

HCI 571: Augmented Reality

(3-0) Cr. 3.

Prereq: M E 557/CPR E 557/COM S 557, or equivalent computer graphics experience

Fundamental technologies enabling augmented reality (AR) application development. Assessment and integration of the hardware and software systems necessary for AR including, tracking, image processing and rendering. Programming skills in C++ and GPU-based optimization are developed to enable evaluation of interaction devices and modalities afforded by AR.

HCI 572: Experimental Computer Game Prototyping

Cr. 3. SS.

Prereq: Permission from instructor.

A discourse on interactive game design concepts through the rapid prototyping of video games. Topics discussed include interdisciplinary views on fundamentals of game play, emergence, emotional affect, behavioral learning, player progression, optimal experience and others. Discussions on interactivity as an art form and its implications to various fields of human computer interaction.

HCI 574: Computational Implementation and Prototyping in HCI

Cr. 3. S.

Fundamental concepts of software programming and the practical use of the Python programming language. Assignments include user interaction and interface design, information visualization, as well as other computational HCI tools. Intended for graduate students without prior background in software development. Requires programming during class lectures.

HCI 575: Computational Perception

(Cross-listed with COM S, CPR E). (3-0) Cr. 3. S.

Prereq: Graduate standing or permission of instructor

This class covers statistical and algorithmic methods for sensing, recognizing, and interpreting the activities of people by a computer. This semester we will focus on machine perception techniques that facilitate and augment human-computer interaction. The main goal of the class is to introduce computational perception on both theoretical and practical levels. Participation in small groups to design, implement, and evaluate a prototype of a human-computer interaction system that uses one or more of the techniques covered in the lectures.

HCI 580: Virtual Environments, Virtual Worlds, and Application

(Cross-listed with M E). (3-0) Cr. 3. F.

Prereq: Senior or Graduate status.

A systematic introduction to the underpinnings of Virtual Environments (VE), Virtual Worlds, advanced displays and immersive technologies; and an overview of some of the applications areas particularly virtual engineering.

HCI 585: Developmental Robotics

(Cross-listed with CPR E). (3-0) Cr. 3. Alt. S., offered odd-numbered years.

Prereq: knowledge of C/C++ programming language.

An introduction to the emerging interdisciplinary field of Developmental Robotics, which crosses the boundaries between robotics, artificial intelligence, developmental psychology, and philosophy. The main goal of this field is to create autonomous robots that are more intelligent, more adaptable, and more useful than the robots of today, which can only function in very limited domains and situations.

HCI 589: Design and Ethics

(Cross-listed with ARTGR). (3-0) Cr. 3. F.S.

Prereq: Graduate classification or permission of instructor.

Issues in ethics and decision-making as they relate to technology, design, design research, HCI, and the design industry.

HCI 590: Special Topics

Cr. arr. Repeatable.

Investigation of problems of special interest in human computer interaction.

HCI 591: Seminar in Human Computer Interaction

Cr. 1-3. Repeatable.

HCI 592: Entrepreneurship Workshop

(1-0) Cr. 1. F.

Students will be taken step-by-step through activities that must be undertaken when attempting to commercialize a technology or start their own company. Speakers will be brought in to introduce relevant topics, provide resources, answer questions, and provide working examples.

HCI 594: Managerial Application of Collaborative Technologies and Social Media

Cr. 3. SS.

Prereq: Graduate classification.

Building, managing, and using collaborative technologies. Collaborative uses of social media such as blogs, wikis, picture and video sharing, social networks, Second Life, and other new media. Exposure to concepts and hands on use and management of several collaborative technologies.

HCI 595: Visual Design of HCI

Cr. 3. SS.

Human interaction design as it applies to HCI. Aspects of audience analysis, design methodologies for creating concepts and solutions, techniques of concept prototyping, and the fundamentals of visual design such as color, type, symbolism, and grid structure. Class discussions, tutorials, and hands-on projects.

HCI 596: Emerging Practices in Human-Computer Interaction

Cr. 3. SS.

Prereq: HCI 521

Usability evaluation with emphasis on requirements gathering, rapid prototyping, evaluation, and communicating results through report writing along with emerging practices.

HCI 597: Scientific Information Design

Cr. 2. SS.

Use of principles of visual design such as color, typography, photography, graphs, charts, and layout to create effective poster and power point presentations. Experience with design software, create posters and presentations from their own data, and evaluate design solutions with regard to their visual and verbal communication. Principles of design and communication theory will be introduced.

HCI 598: HCI Design, Implementation and Implications

Cr. 3. F.S.

Prereq: 21 credits in human computer interaction or permission of the instructor

Capstone course in HCI. Through a significant design project, students demonstrate their mastery of core courses in HCI. This course is the final course for students in the HCI Online MS program.

HCI 599: Creative Component

(3-0) Cr. 3.

Creative component for nonthesis option of Master of Science degree. Offered on a satisfactory-fail basis only.

Courses for graduate students:**HCI 603: Advanced Learning Environments Design**

(Cross-listed with C I). (3-0) Cr. 3. S.

Prereq: C I 503

Exploration of advanced aspects of the instructional design process. Application of analysis, design, development and production, evaluation, implementation, and project management principles. Focus on the production and use of instructional technology with an emphasis on the instructional design consulting process. Theory and research in instructional technology provides the foundation for design decisions.

HCI 655: Organizational and Social Implications of Human Computer Interaction

(Cross-listed with MIS). (3-0) Cr. 3.

Prereq: Graduate classification

Examine opportunities and implications of information technologies and human computer interaction on social and organizational systems. Explore ethical and social issues appurtenant to human computer interaction, both from a proscriptive and prescriptive perspective. Develop informed perspective on human computer interaction. Implications on research and development programs.

HCI 681: Cognitive Engineering

(Cross-listed with I E). (3-0) Cr. 3.

Prereq: I E 572 or I E 577 or PSYCH 516 or HCI/PSYCH 521 or equivalent

Provides an overview of human cognitive capabilities and limitations in the design of products, work places, and large systems. Contexts vary broadly and could range from simple use of mobile devices to an air-traffic control or nuclear plant command center. Course focuses on what we can infer about users' thoughts and feelings based on what we can measure about their performance and physiological state. Covers the challenge of designing automated systems.

HCI 697: HCI Internship

Cr. R. Repeatable.

*Prereq: Permission of Director of Graduate Education, graduate classification***HCI 699: Research**

Cr. arr. Repeatable.