HCI at New Mexico State University

Douglas J. Gillan
Department of Psychology
New Mexico State University
Las Cruces, NM 88003
(505) 646-1408
INTERNET: gillan@crl.nmsu.edu

ABSTRACT

HCI at New Mexico State University has a dual focus -- the development of cognitive theory in a real-world context and the application of cognitive principles and methods to interface design. Graduate training exhibits that dual focus, with general training in experimental psychology and statistical methods, as well as specialized training in HCI design, prototyping, and evaluation. Faculty research centers around the development of cognitive models of computer users, with particular emphasis on multivariate methods for modeling user knowledge, such as Pathfinder networks.

KEYWORDS

Organization overview, University, Cognitive models

INTRODUCTION

As a major state university and land-grant institution, New Mexico State University (NMSU) has two principal, and equally important missions -- research and the education of undergraduate and graduate students. Research and education focused on human-computer interaction (HCI) at NMSU is multidisciplinary, but strongly centered around cognitive science. Faculty whose work addresses issues in HCI are in the departments of Psychology, Computer Science, and Industrial Engineering, and in the Computing Research Laboratory (CRL), with most of the faculty residing in or associated with the Engineering Psychology and Cognitive Psychology programs of the Psychology department.

The approach taken to HCI at NMSU involves two parallel tracks. First, we are concerned with HCI as an important context in which to study perceptual/cognitive processes. The central areas of perception and cognition -- including attention, memory, thinking, reasoning, problem-solving, language, and motor control -- consist of both general processes (such as, schematic processes in memory) and context-specific processes (e.g., eye movements during reading). Consequently, one purpose of studying people using computers is to develop and test ecologically-valid theories of cognition that specify the interactions between those general and specific processes. The second track of the approach focuses on the application of cognitive principles and methods to the design of user interfaces. Given that cognition is central to HCI, we believe that understanding cognitive processes in the context of using computers will lead to improvements in the design of interfaces and interactions with users. These two tracks influence both the education of graduate students and research. As Table I below shows, the faculty members involved in HCI work have substantial and varied interests in HCI domains; all of the faculty listed have broad interests across cognitive science as well.

Faculty Members

<table>
<thead>
<tr>
<th>Faculty Members</th>
<th>HCl Domains</th>
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<tbody>
<tr>
<td>Nancy J. Cooke (Psych)</td>
<td>A/E, T, G, E, M, D, O</td>
</tr>
<tr>
<td>Douglas J. Gillan (Psych)</td>
<td>A/E, T, E, IT, M, TT, G</td>
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<tr>
<td>Adrienne Y. Lee (Psych)</td>
<td>A/E, E, G, M, D</td>
</tr>
<tr>
<td>James E. McDonald (Psych)</td>
<td>A/E, T, ASD, E, IT, M, D</td>
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<tr>
<td>Kenneth R. Paap (Psych)</td>
<td>A/E, E, M</td>
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<tr>
<td>Roger Schvaneveldt (Psych)</td>
<td>T, E, IT, M, C</td>
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<tr>
<td>Laura A. Thompson (Psych)</td>
<td>ASD, M, E, C</td>
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<tr>
<td>Deborah Winters (Psych)</td>
<td>S, E, D, G, I</td>
</tr>
<tr>
<td>Arthur I. Karshmer (CS)</td>
<td>S, ASD, E, IT, C</td>
</tr>
<tr>
<td>Bill Ogden (CRL)</td>
<td>A/E, ASD, TT</td>
</tr>
<tr>
<td>Edward Pines (IE)</td>
<td>A/E, G, L/S, TT, D</td>
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KEY FOR HCI DOMAINS: A/E = Analysis and evaluation techniques, T = Development tools, L/S = Legal issues and standards, G = Group Work, S = Societal impact, ASD = Application-specific designs, E = Education, IT = Interaction technology, M = Models of the use, TT = Technology transfer, D = Design problem-solving, G = Graphics design, C = Interface components, O = Organizational context

Table 1. Domains of interest for HCI-related faculty members and researchers at NMSU

GRADUATE TRAINING

Courses. The Psychology Department offers both Masters and Ph.D. degrees. Both degree programs require students to complete general survey (i.e., Core) courses and statistics courses. In addition, students typically take specialty area courses covering a wide range of topics in Psychology and HCI. Table 2 lists selected courses and provides a brief description of their content. The courses provide a balance between training in basic psychology, applied cognitive psychology, and practice-related issues, such as design, prototyping, and interface evaluation.

Thesis and Dissertation. Graduate training extends beyond the classroom to provide students with expertise in designing, conducting, and analyzing research. Accordingly, all students work with faculty members on research of mutual interest throughout their graduate careers. In addition to their collaborations with faculty members, masters students must complete an independent research thesis, and doctoral students must complete an independent research dissertation. Research training has three beneficial effects for work in HCI: (a) providing...
students with research design and data analysis skills, (b) training students to set up tests and run subjects, and (c) giving students experience observing people performing complex tasks. Bailey [1] has recently shown that people with Human Factors backgrounds design more usable interfaces than do those with computer science training. All three benefits of research listed above may contribute to the advantage shown by Human Factors experts. (Bailey’s research was done as part of his dissertation in the Engineering Psychology program at NMSU.)

**Internships.** In addition to their training in the classroom and the laboratory, Ph.D. students in the Engineering Psychology program are required to complete an internship of at least three months in an industry, government, or other laboratory setting. The internships provide students with hands-on, concrete experience in which they can (a) apply the abstract knowledge learned in the classroom, and (b) learn new skills and concepts not covered in their academic experience. Recent internships have been at Microsoft, Claris, Hewlett-Packard, IBM, SunSoft, and U.S. West.

**FACULTY RESEARCH**

The defining characteristic of the research program at NMSU is a focus on developing and evaluating cognitive models. The faculty have used cognitive models to address a diverse set of problems in HCI, including users' semantic and procedural knowledge, perceptual processes, expertise, natural language processing by humans and computers, transfer of training, and user interfaces for persons with special needs. The approaches for analyzing users' models are also diverse -- from thinking aloud protocols to multivariate statistical methods. NMSU has been in the forefront of developing and applying one particular multivariate method -- Pathfinder networks [e.g., 8]. Pathfinder allows researchers and designers to use ratings, co-occurrences of behaviors, or other measures to develop a network representation of a computer user's cognitive structures or behaviors.

Recent research projects include the following:

- Detailing users' procedural knowledge [2]
- Modeling the perceptual and cognitive processes involved in users' interactions with graphical displays [3]
- Determining how people learn artificial grammars [4]
- Examining the transfer of skill from software debugging to electronics troubleshooting [6]
- Interfaces for users with visual impairments [5]
- Design of hypertext from users' knowledge structures [7]
- Auditory/visual speech comprehension and its application to user interfaces (9).

Current grants and contracts include development of computer-based aids for translating human languages (Ogden), development and evaluation of multimedia educational software (Lee and Gillan), troubleshooting knowledge (Cook), usability testing procedures (Schvaneveldt and McDonald), and development of a course in ergonomics for engineering graduate students (Pines).

**REFERENCES**