University of British Columbia

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Brian Fisher is an adjunct professor in computer science and commerce, and associate member of the Department of Psychology, Institute for Computing, Intelligent and Cognitive Systems (ICICS), and E-Commerce Research Bureau. He was a researcher with the Telelearning Network of Centers of Excellence and served on the conference program committee for the Cognitive Science Society and ED-MEDIA, the World Conference on Educational Multimedia, Hypermedia and Telecommunications. He teaches Human-Computer Interaction (HCI) in Computer Science and Entrepreneurship and New Venture Creation in Commerce. He is a cofounder of ThoughtShare Communications Inc. and the New Ventures BC Association.

The University of British Columbia is the largest university in western Canada, with an enrollment of 35,000 students and offerings of both undergraduate and graduate degrees. An interdisciplinary HCI institute supports HCI teaching and research and is coordinating a proposed interdisciplinary master of science degree in HCI. A new downtown campus will offer a range of educational options in HCI, from executive certificates through master's-level programs.

Philosophy of Design Education

The central focus of our program is multidisciplinarity—using cognitive, social, and perceptual science theories and methods to create multiple perspectives on the interaction of human and machine. We look at technology as a medium of communication and as an environment for perceptual and cognitive processes as well as a tool for performing a set of tasks. With this perspective, we can better explore alternative interface approaches such as real-time, immersive, and attentive systems; environments that support cognitive processing (e.g., decision support and knowledge management); collaborative work and learning spaces; and novel media control and display technologies.

Our philosophy of education is to guide students through the process of developing a personal praxis. We use a series of hands-on projects to help students learn to select and integrate theories and approaches from the broader literature with the realities of their practice. Our goal is to train practitioner-scientists who can integrate research, theory, and application. Course problems vary from term to term and are usually provided by ongoing university research and industry projects.

Our HCI program centers on four core courses: User Interface Design (www.cs.ubc.ca/~cs444/) and Human-Computer Interaction (www.cs.ubc.ca/~cs544/home.shtml) in the Department of Computer Science, and Human-Computer Interfaces in Engineering Design and Human Interface Technologies (www.ece.ubc.ca/~elec596) in the Department of Engineering. These courses focus on multidisciplinary team work; synergies between science and design; and analysis and synthesis using approaches such as contextual and collaborative design, task analysis, usability inspection, observation and field methods, and experimental approaches. The courses have a case-based structure influenced by Schön's Reflective Practitioner model. Central to the learning process is a structured approach to project work, in which instructors support learners' iterations through cycles of reflection and inquiry described in four stages:

- **Framing** the problem by formulating answerable questions about the most effective approach to understanding and improving the interaction.
- **Seeking** relevant information from the broader literature—psychology, kinesiology, communication theory—as well as HCI publications that apply to the problem.
- **Operationalizing** design hypotheses and their constructs in a prototype and method for evaluation.
- **Testing** the prototype or application within technological, physical, and organizational constraints using appropriate tests, field studies, and examination methods.

This approach extends iterative design methods by better integrating theory-driven

About the Organization

Departments/ programs

HCI offerings at UBC can be found in the Computer Science, Engineering, and Commerce departments. UBC's recently founded Institute for Computing, Information and Cognitive Systems (ICICS) offers a specialized master's degree in software systems. ICICS is organized into eight clusters:

- Modeling Humans and Their Environment
- Creating Human Experience and Multimodal Interfaces
- Multi-Agent Systems

research and the specific needs of the practice situation. After the completion of the cycle, students are asked to critically examine the ways in which the process of framing, seeking, operationalizing, and testing were applied to this specific design situation. This will help them to better focus their efforts on subsequent iterations and on future projects. We believe that human-centered design of new technologies plays a role in the entrepreneurial process from company inception onward and can contribute to formulating business plans and securing investment as well as developing new products. As a result, our program has an entrepreneurial aspect that is supported by links with the UBC Faculty of Commerce and e-Commerce Research Bureau. The information technology management chair in the Faculty of Commerce focuses on HCI in e-commerce, with projects looking at Web interface design and emotions, virtual products, social presence, and trustworthiness in e-business transactions.

Preparing Students for User Interface Careers

In recent years we have placed increased emphasis on outreach to the growing British Columbia technology community and collaboration with industry associations (such as BC Technology Industries Association, Young Presidents Associations) and other universities in the region (Simon Fraser University (SFU), Tech BC). New developments of note are the founding of a downtown campus with industry seminars, certificates, and executive programs, and NewMIC (www.newmic.com), a provincewide university-

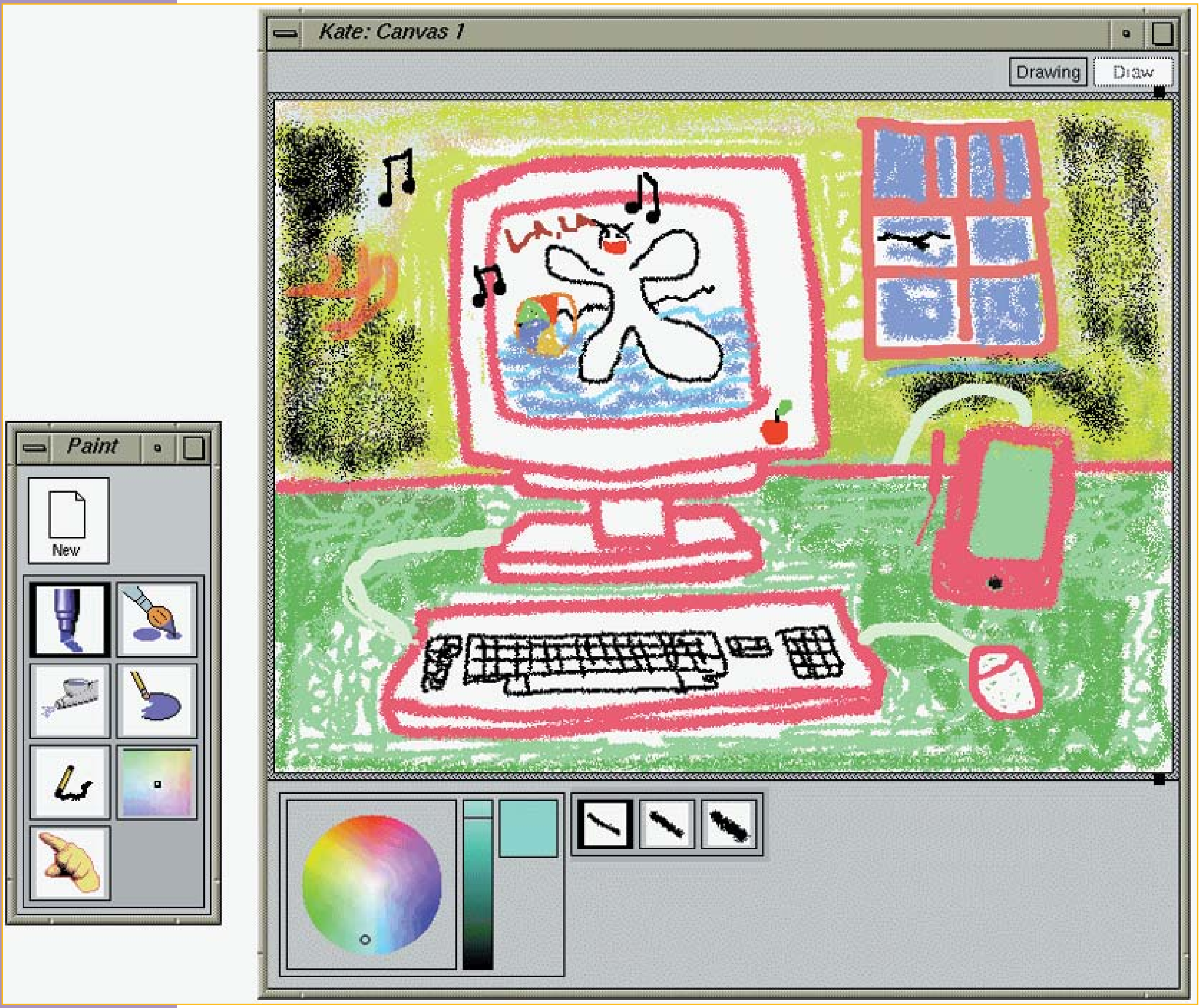

Figure 1. Distance art therapy interface by Kate Collie, Davor Cubranic, and Kellogg Booth. The interface is restricted to free-form drawing and simplified color and brush selection to better support the therapeutic process and for accessibility for novice computer users. (See Collie, Cubranic, and Booth 1998 for details.) Students adapted this interface to increase accessibility for disabled participants as discussed in the text.

industry think tank with industry and government support. NewMIC provides a structure for collaboration and training for industry personnel and university students as well as time sharing on special-purpose facilities such as an immersive theatre and a state-of-the-art usability lab.

Work with early-stage start-ups is facilitated by our involvement with New MIC's technology company incubator and small business clusters and our relationship with a $50,000 technology-based business plan competition run by the New Ventures BC Association. We also have a variety of research initiatives in air traffic control, automotive telematics, immersive computer-aided design, collaborative media spaces, e-learning, and attentive systems. Some of these take place in the Institute for Computing, Information and Cognitive Systems (ICICS) or NewMIC labs, while others are conducted in individual faculty laboratories in collaboration with SFU and industry partners. Industry partners include international companies such as Boeing, HRL, Immersion, Nissan, and Sun Microsystems as well as Canadian companies such as ThoughtShare Communications Inc. and Recombo Inc. NewMIC adds to this with industry clusters that include IBM, Nortel, Sierra Wireless, Telus, Electronic Arts, and Sony as well as many innovative small companies.

Our primary focus is to build the skills needed for self-education and continued professional growth as scientist-practitioners in the evolving HCI world, and to adapt to the changing role of HCI professionals in industry.

We expect that the tools and techniques used by HCI practitioners will continue to evolve in response to changing technologies and organizations. Our students are trained in a range of current techniques and are familiar with current literature on HCI. Our primary focus, however, is to build the skills needed for self-education and continued professional growth as scientist-practitioners in the evolving HCI world and to adapt to the changing role of HCI professionals in industry. An emphasis in interdisciplinarity and collaboration is reflected in the diversity of students enrolled. Typically about 50 percent of the students in the graduate core course are in the computer science program, and the rest are drawn from commerce, engineering, and library science graduate programs. The course is usually jointly taught with instructors from SFU at a downtown location. This adds to the mix SFU computer science, engineering, and kinesiology students and NewMIC industry professionals.

Sample Design Project

The most difficult aspect of HCI for students in computer science, engineering, and information Systems is often coping with a real-world project that is defined by its goals rather than a set of specifications. This term, students in HCI were given a class assignment to build on a distance art therapy environment developed by Professor Kellogg Booth, and graduate students Kate Collie and Davor Cubranic (Figure 1). The need to take into account communicative and therapeutic aspects made this a challenging assignment. Students were asked to design an approach to extending the application to make it more

- Global Information Systems
- Computational Models of Complexity
- New Paradigms and Applications
- System-on-a-Chip Technologies
- Social and Behavioral Sciences

We plan to develop an interdisciplinary master's program coordinated between the various departments by ICICS and Cognitive Systems. ICICS HCI research links can be found at www.icics.ubc.ca/hci.

Course titles
Courses in Computer Science, Engineering, and Commerce apply HCI techniques to artificial intelligence, e-learning, visualization, virtual reality, and other application areas. In addition to the courses mentioned in the text, course offerings include the following:

- Topics in HCI
- Topics in Artificial Intelligence
- Human Factors Psychology
- User-Adaptive Systems and Intelligent Learning Environments
- Physical Interface Design and Evaluation
- Software Engineering Computer Graphics
- Computer Graphics, Hardware and Visualization

Practitioner's Workbench

Resources
The ACM, Cognet, and IEEE digital libraries are central to my practice and my teaching. All of my courses are on the Web, and access to the libraries is a central part of my classes. Other sources are the following.

1. Cole, M. *Cultural Psychology, a Once and Future Discipline.* Harvard Press Cambridge MA, 1996.

2. Clark, H.H. *Using Language.* Cambridge, Cambridge MA, 1996.
3. Fodor, J.A. *Modules of Mind.* MIT Press, Cambridge MA, 1983.
4. Hutchins, E. *Cognition in the Wild.* MIT Press, Cambridge, MA, 1995.
5. Pylyshyn, Z.W. *Computation and Cognition.* MIT Press, Cambridge, MA,1984.
6. Schön, D. *Educating the Reflective Practitioner.* Jossey-Bass Inc., San Francisco, CA, 1987.
7. Simon, H.A. *The Sciences of the Artificial.* MIT Press, Cambridge, MA, 1996.

Tools
Pencils, colored pens, whiteboards, paper, yellow sticky notes; Apple PowerBook® with Inspiration®; Adobe FrameMaker®; and Macromedia Dreamweaver®

accessible to disabled participants. This was the first project of the term and served as an introduction to the reflexive practitioner cycle as an approach to dealing with an ill-formed interaction problem. The assignment was left deliberately unspecific, so the first task of the students was to independently frame the problem: how to add the greatest accessibility for the least effort. The successful students sampled the literature, examined statistics on the relative frequency of different types of disabilities, and chose to address a high probability disability and response with an appropriate solution. Examples of disabilities selected included gross- and fine-motor–control limitations, quadriplegia, low vision, and deafness. One student even attempted to create an art interface for the blind and visually impairedusing a visual-to-haptic approach. Technical solutions included alternative input pointing devices, screen magnification, voice-to-text, and a novel haptic sketch pad and pen for blind users. The most successful approach was to adopt a single solution (such as voice input) that could compensate for a variety of disabilities. They then applied their knowledge in a preliminary design; testing was left for the second class assignment, dealing with motor performance. The instructor served as a resource and a coach, described the process and gave some suggestions, but volunteered little information unless directly requested. This was a new approach to the first class project but showed promise as a way to quickly (if painfully) introduce the students to the reflective practitioner cycle and the problem of framing. We judged that the project met its objectives.

Reference

Collie, K., Cubranic, D., and Booth, K. Participatory design of a system for computer-supported distance art therapy. In *Proceedings of the Participatory Design Conference* (Seattle, WA, 1998), 1998, pp. 29–36.