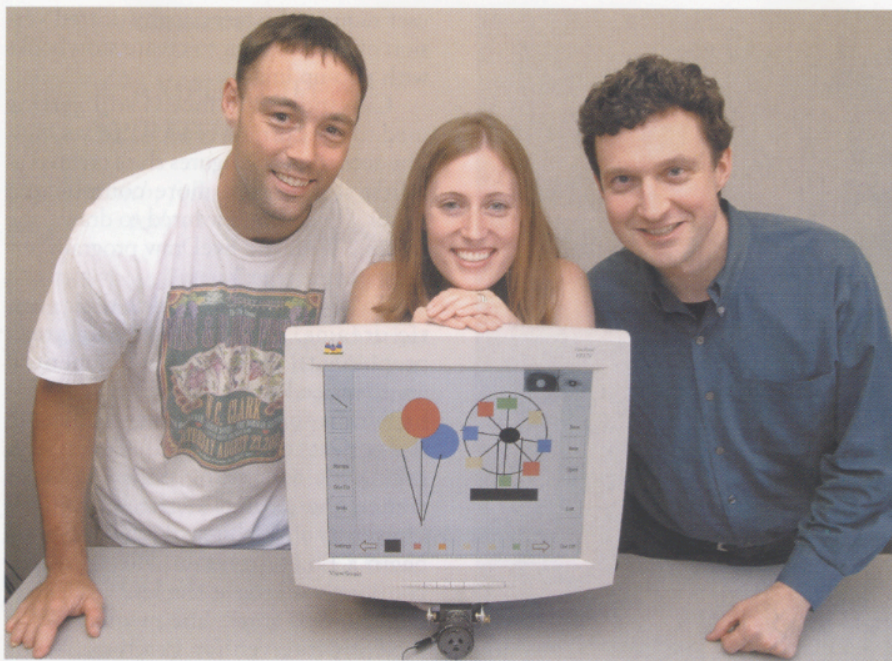




Rob Hoselton, Anna Cavender, Anthony Hornof, and EyeDraw.

Jack Liu

COMPUTER AND INFORMATION SCIENCE

THE EYES HAVE IT

UO undergrads develop tool for disabled artists.

ANNA CAVENDER '04 AND ROB HOSELTON '04 are turning Cassandra Province's computer screen into a sketchpad. Province was born with cerebral palsy eighteen years ago and has never been able to pick up a crayon. Although she's learned to type using her eyes and a computer, she's been frustrated by her inability to express herself through art. "Drawing is important to me because sometimes I can't get my feelings out into sentences or words," she writes. Cavender and Hoselton designed a software program, called EyeDraw, that can help.

Province is not the only person who recognizes the software's significance. When Cavender unveiled the program at a computer-human interface symposium earlier this year in Vienna, conference delegates queued to try it firsthand. In Washington, D.C., the Computing Research Association named Cavender North America's 2004 Outstanding Female Undergraduate in Computer Science and Engineering.

The award recognizes Cavender's extraordinary commitment to public service, says Anthony Hornof, UO assistant professor of computer and infor-

mation science and EyeDraw project supervisor. "People with severe Lou Gehrig's disease and cerebral palsy have limited control over their body," he says, "but many still retain normal control of their eyes."

In June 2003, Hornof recruited Cavender to the project because she had already established an impressive undergraduate track record. She won the UO's Erwin & Gertrude Juilfs Scholar in the Arts and Sciences. For about a year she worked for the UO computer and information science department developing a database to handle graduate applications. She also acted as lead programmer for a software project encouraging middle-school girls to consider careers in math or computers.

Cavender suggested Hoselton, her study partner, as co-programmer. Under Hornof's direction, they began writing software for an eye-tracking camera mounted to the bottom of a computer screen. Their idea was simple: Users like Cassandra Province would select tools—lines, shapes, clip-art, and colors—not by double clicking on icons with a mouse but by staring at them. Province would then direct these tools

around the screen by moving her eyes and fixating on a spot to start or finish a line or place a shape. Changing tools would be a matter of staring at a new one. A significant challenge, Hoselton says, was writing software that could distinguish between Province drawing and Province just looking at the computer screen to find the right tool or ponder her work.

The EyeDraw program is an offshoot of Hornof's main National Science Foundation-funded research project. In his Cognitive Modeling and Eye Tracking Laboratory, he uses cameras to map the eye movements of subjects who are scanning computer screens for information such as desktop icons. Then, he determines how to manipulate that information to exploit the eyes' search capabilities.

Expanding his interest in the human-computer interface, Hornof flipped those parameters around: He considered how eye movement could manipulate a computer the same way a keyboard or a mouse does. He contacted representatives from the eye-tracker's manufacturer, which caters to disabled users, to ask them what kinds of software programs were in demand.

They were looking to expand the company's software options beyond EyeType, the program disabled people, like Province, learn to use as children. The company wanted a drawing program, Hornof explains, because during early, formative years, disabled kids need to learn to communicate and express themselves. He found the idea intriguing, he says, "because I've always had an artistic interest in drawing and painting."

After Cavender and Hoselton tested EyeDraw's artistic possibilities on themselves, they put it to a more rigorous test. They sent it to disabled people at six locations across the United States, asking for feedback. Cavender says this is an important part of designing software because disabled users and their caregivers found flaws that she and Hoselton could not have anticipated.

For example, they needed to expand the area users must stare into to accommodate people who have trouble keeping their heads still while drawing. Other improvements included capturing the eye's gestures, not just the lines they draw, to distinguish between slow, deliberate strokes and speed drawing. One

user requested a more sophisticated version of the program to create storybooks with pop-up images.

Cassandra Province is still getting used to the current version of EyeDraw. She sees the stick figures she's created as a first step toward more complicated works. "I've always wanted to draw," she writes. "With the EyeDraw program, my dream came true."

To allow others to realize their artistic dreams, Hornof is writing grant proposals to fund the development of an advanced version of EyeDraw. But he'll have to recruit other students to the project team. This fall, Cavender is taking the computing skills and experience she gained at the UO to the University of Washington, where she will begin a Ph.D. program. Hoselton will continue working at the UO College of Education as an on-line programmer in the Early Intervention Program. "In the beginning I thought the EyeDraw project would be great experience . . . a chance for Anna and I to work together on a substantial project," says Hoselton. "But I never thought it would turn out like this."

—MICHELE TAYLOR MS '03