Collaborative Development of
New Access Technology and Communications Software

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Development of new technology for assistive communication benefits from collaboration among technologists, educators, speech and language specialists, family, and other caregivers, and the people who actually use the technology. Technologists always are in danger of spending a lot of effort to produce technology that is not useful. At Boston College, we are fortunate to have a close collaboration between the faculty and students of the Computer Science Department, and the faculty, staff, parents, and students of the Campus School, a day-time school for 42 children with severe physical disabilities. The Campus School is part of the Lynch School of Education at Boston College and is located on the main university campus.

During the past eight years this collaboration has produced three new technologies to allow people with severe physical abilities to access the computer.

EagleEyes [1,2] is a technology that allows people to access the computer by moving their eyes. Five electrodes are placed on the face around the eyes. The electrodes sense the horizontal and vertical movements of the eyes. The electrodes are connected to two physiological amplifiers, which are connected to a data acquisition board in the computer. The EagleEyes software moves the mouse pointer in accordance with the eye movements. If the person looks to the left, the mouse pointer moves to the left. Mouse clicks are generated using "dwell time", by holding the mouse pointer in a location of the screen for half a second.

The Camera Mouse [3,4] is a technology that allows people to access the computer by slight movements of the face or thumb or toe. A standard videoconferencing camera is connected to a computer. The camera is placed above or below the monitor, facing the person. The computer tracks a selected feature, for example the tip of the nose, and moves the mouse pointer accordingly. If the person moves the nose to the left, the mouse pointer moves left. Again, mouse clicks are generated using dwell time.

In response to a young man who can not voluntarily move his head or his eyes but seems to be able to blink voluntarily, we developed a system [5] that uses a video conferencing camera to detect voluntary blinks and issues a mouse click whenever a voluntary blink is detected.

The larger purpose of the project is to enable people to develop and contribute to their fullest. Technology augments people's capabilities. Education is an active process. In order to be able to become educated people must learn to communicate. For some individuals, the universal and common formal school experience has not yet been realized because developments to date have not been able to provide the means for communication to develop.

The three access technologies developed act as mouse replacements in Windows-based systems. They can be used with any of the standard assistive communication software. We and our students have developed several varieties of custom "spell and speak" communications software.

EagleEyes and Camera Mouse act as standard point-and-click access devices. Undergraduates without physical disabilities learn to use EagleEyes within 30 minutes and Camera Mouse in less than 5 minutes to spell out messages using an onscreen point-and-click keyboard containing all of the letters. People with severe disabilities can require more time to learn to use the technologies and might not achieve the same level of spatial accuracy. If they can reliably point and click on any of 30 buttons on the screen then they can use a full onscreen keyboard. If they can reliably click on 6 buttons on the screen, with the buttons being somewhat larger and spaced around the screen, then they can use a two-level system to spell messages. First they select a group of letters (A, B, C, D or E, F, G, H and so on). Then from a new screen they select the letter within that group. We have experimented with a dozen variations on this theme. If people have no vertical control and very limited horizontal control and can reliably move only to the left quarter of the screen or the right quarter of the screen or the center half of the screen then a different type of communications software must be used that requires a longer sequence of choices to make a final selection.

With the blink system a mouse click is issued when a voluntary blink is detected. This can act as a switch press with either a standard scanning assistive communication program or with a custom program we have developed.

There are a couple of dozen EagleEyes and Camera Mouse systems in use outside of the Boston College campus, mostly in northeastern United States but also at the Holly Bank School in West Yorkshire, England.

The key to successful development for us is close collaboration with all of the people involved. The technology benefits from daily observation, feedback, and suggestions.

References

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