Family Center on Technology and Disability

News and Notes

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AT Research: Creating Cutting-Edge Technology to Make Things Simpler

Feature creep -- when designers add more and more features to a high-tech device to beat competitors -- is the bane of technology research. The result is often an incomprehensible collection of high tech bells and whistles that serve only to thrill hard-core techies but intimidate more casual users. In cutting-edge assistive technology research, however, many designers now resist the urge to abet feature creep and instead use the power of technology to make things simpler for those who most need the equipment to connect with the world around them and to build a foundation for independent living. Increasingly, AT designers are guided in their research by the principles of Universal Design (UD) to meet the need for simplicity in order to create usable equipment that helps those with various disabilities to use their strengths and circumvent their weaknesses. This issue examines cutting-edge AT research and the resources available to acquire information about its impact and progress.

Steve Stock Speaks

According to Stephen A. Stock, partner and vice president of AbleLink Technologies, Inc., the person who best understands special education is the person who grew up with his arm around his or her friend who was a special ed student. By extension, the equivalent can be said of those who grew up in a household with a parent or sibling with disabilities. Steve Stock and his AbleLink partner and founder Dan Davies fit that profile. Davies' brother was severely intellectually disabled. Stock was visited often by his uncle, who was also intellectually disabled and suffered from spina bifida. Every year, Stock says, his uncle lived with Stock's family for extended periods. For both AbleLink partners, their youthful, deep connection to a family member with disabilities was a seminal experience that ultimately begat careers in AT research. After earning his bachelor degree in social work from Northern Michigan University and a Masters in public administration from the University of Colorado, Stock began his career focusing on vocational and behavioral aspects of the disabilities field, while Davies, according to Stock, "was working on the next generation air traffic control system." In the late 1980s, Davies was developing a computerized automatic teller machine (ATM) trainer and Stock was running a shelter workshop and converting the workshop into a community placement agency when Davies approached Stock seeking to test his ATM training software. Stock liked the Davies-designed software and signed on as a partner in the fledgling organization that would become AbleLink Technologies, a company that researches and designs AT for individuals with cognitive and intellectual disabilities. Recalls Stock, "That was 28 projects ago."

Supporting our interview with Steve Stock are resources to assist parents and others in furthering their knowledge of current and emerging AT research. We also feature members of our ***Knowledge Network***.

The members spotlighted this month focus on various aspects of AT research. We invite you to contact these members for further information.

Please share this newsletter with other organizations, families and professionals who may benefit from it. We invite you to contact us at http://www.fctd.info. We welcome feedback, new members and all who contribute to our growing knowledge base.

The Keywords of AT Research: Adaptation, Adaptation – and Universal Design

An Interview with Stephen A. Stock, AT Research Executive

How do you get to Carnegie Hall? Practice. Practice. Practice.

What are the three most important words in real estate? Location. Location. Location.

What are the keywords that best describe the often rocky road that assistive technology must travel from concept to customer? Adaptation. Adaptation. And Universal Design.

According to Steve Stock, vice president and partner of AbleLink Technologies, Inc., much of cutting-edge assistive technology research begins with mainstream technology that is adapted by AT-oriented designers and software engineers for purchase by service providers for use by children, youth and adults with disabilities. The challenge, he emphasizes, is to adapt the most appropriate mainstream technology, to convince service providers, who may not be technology-savvy, to adapt to the new technology that is based on principles of Universal Design (UD), that avoids feature creep and is geared to simplicity and optimum end-user utility.

For Stock and his longtime partner, AbleLink founder Dan Davies, Universal Design (UD) is the key to adaptation. Says Stock, "All our AT research themes pertain to Universal Design. We use a lot of text on the screen and encourage residual reading, but we try not to be too dependent on literacy skills because that defeats the purpose of what we are trying to accomplish, which is to emphasize the strengths that individuals with cognitive disabilities have as opposed to their weaknesses, one of which is literacy."

UD, he insists, "is the future of assistive technology." In his opinion, "UD is all encompassing in its influence on everything that we do." However, he cautions, UD-oriented AT "needs to be drilled down to the next level -- and cognitive disability, he warns, "is usually at the bottom rung of the disabilities ladder when it comes to the availability, and acceptance, of appropriate cutting-edge assistive technology."

UD, he explains, "usually means physical access for those with vision and hearing impairments; it doesn't really speak to those with cognitive impairments." UD, he remarks, "is generally about incorporating text," which can be an impediment to persons with cognitive disabilities.

Meeting the AT Needs of All Users

His company strives to incorporate concepts of UD, "but if you make something for everyone it works 'kind of' for everybody but not very well for anyone," Stock observes. What he and other companies like AbleLink attempt to achieve, he explains, "is to create those configuration utilities where the look and feel of the software can be customized" to help meet

the needs of all users – which, he admits, is often easier said than accomplished.

He cites the example of a product created by the Coleman Institute, an organization Stock holds in high esteem, that failed to achieve its desired objective because it was too sophisticated for the users it was intended to aid. The product, he recalls, was dubbed "I-mail" by the Institute. I-mail, he explains, was an email program designed to be accessible to everyone. Unfortunately, despite the designers' good intentions, "the I-mail configuration was too overwhelming for *anyone* to use; it was just too much."

However, he adds, the concept of UD "means capitalizing on the things that the disability population is good at." For example, "We [at AbleLink] don't rely on reading but we certainly encourage it whenever we can. We look at trying things that are age appropriate."

Among the proven techniques in teaching individuals with cognitive disabilities, he notes, are consistency and repetition. "Do it over and over again and do it the same way every time." Computers, he remarks, are by nature consistent and repetitive. "Computers fit into that concept so well," Stock exclaims. "We talk about linear programming, which may be a seven-step process to perform a specific task on the computer, or a three-step process to send an email, but it's always the same process."

Once he examines an interface, he says, "we don't really look at a reply feature." Instead, the user selects a person's picture from the in-box and has an audio process for recording an e-mail, attaching it and sending it – "but we don't do reply because it's not consistent and repetitive and it's a feature we could add as a set-up."

The Power of Technology Should Make Things Simpler

Feature creep, Stock claims, is a characteristic of mainstream technology that should have no place in AT research. "The designer's goal should not be to keep adding features to ace out the competition; the goal ought to be to design something usable." Stock and partner Dan Davies "debate the real feasibility of every feature we consider adding." He does not fault designers for yielding to the feature proliferation urge. "It's a software engineer's nature to say 'I can make [the software] do this, or that.' However, if "this" and "that" are added "the irony is that the software may not be usable."

Stock and Davies proudly adhere to the Bill Gates dictum that "software doesn't have to do many things well, but it should do just one thing very well." Their motto throughout their long association, Stock says, is "We use the power of technology to make things simpler."

Research that results in simple, usable AT products is best based on first-hand experience with kids and young adults with disabilities, either friends or siblings. "That's the most reliable way to achieve success," Stock emphasizes. Too often, he states, "I've seen research institutions try to create technology for people with cognitive disabilities when there is no one there who is intimately familiar with the population." It is vital to have research references, he concedes, "but it is equally vital that you know the population."

All his organization's research, he reveals, is based on following a standard process. "Often our approach is to look at what's out there and then try to figure out how to make an accessible version of what we like, be it an Internet program, a web browser or a menu planning system. We try to make it

usable by utilizing error minimization features."

The Benefit of a Hands-On Relationship with the User

"Our process is that we determine what the user requirements are, what the equipment needs to do, and then we build a prototype." When he and Davies created a web track browser, Stock recalls, "We compared it to Internet Explorer; we created a very structured 'search-for-website-go-to-website-save-it-go-to-another-website-return-to-retrieve-the-first-one'." Using these "typical Internet processes," he remarks, "we were able to demonstrate that [the technology] we adapted for AT purposes was significantly more usable" than the mainstream version on which it was based. Without employing the processes that make for successful adaptation that achieves true usability, what is created "is just marketing sizzle minus the steak of utility."

As a for-profit company, he explains, "we have an inherent tendency to want our research to be successful, so we always have inner observer reliability measures during data collection." The company's mission, he adds, "is to help people be more independent. If we don't do the research right, we don't build the prototypes right, we don't build systems right, then we are not achieving that mission." Therefore, he states, "incorporation of people with disabilities into that process from beginning to end is critical."

Cross-pollination of Research Improves AT

Research from other fields, Stock notes, has yielded promising results or research hypotheses for the AT field. He cites global positioning systems (GPS) as an example. "GPS came from the military," notes Stock, "which slowly releases more and more of the functionality."

Stock knows of at least two AT products that are GPS-based systems for the vision-impaired to assist them in navigating various venues. Says Stock, "They are just like the navigation system in your car that tells you, 'Turn left on Elm Street."

The units are hand-held and are particularly effective at helping the severely vision-impaired to navigate while they are walking. The Coleman Institute, Stock notes, has a project underway -- "and we have a couple we're trying to get funding for" – that helps persons with developmental disabilities navigate a city bus system.

Stock claims that it is "great" that GPS technology is trickling down to the developmental/cognitive disability field "but there again is the tendency for this field to be on the lowest rung of the ladder of progress." As an industry, as a field, declares Stock, "we have struggled greatly. These GPS products have been out there for three years and it's time for people with disabilities to benefit from this technology."

AbleLink's funding for its GPS-based product has not yet come through, "but we'll get it," Stock predicts. "We'll get it."

Voice Recognition Technology: a Case Study for Mainstream Research

In a reversal, Stock points out, voice recognition technology is a "case study" for mainstream research. "It really started out as a disability product," he adds "and the Microsofts of the world are trying very hard to develop it into a mainstream product – and it's happening."

Think about it, he says, "You can't pick up a phone anymore without saying 'one' or 'two' into the phone." For persons with vision impairments, he alleges, voice technology is plentiful. Again, though, for those with developmental and cognitive disabilities, "their voices are in a greater range of being

different." In addition, "there are requirements to read passages on the screen." The reality, according to Stock, is that "folks with cognitive and developmental disabilities cannot read very well and they won't be able to read those on-screen passages." Moreover, "there's someone whispering into their ear which causes them to pick up distracting ambient noise."

According to Stock, AbleLink is attempting to obtain funding to develop a voice recognition computer control system that is independently usable by individuals with cognitive disabilities. Explains Stock, "Our engineers are talking about how IBM has developed some new text-to-speech voices." Some of the voices, "like Microsoft Mary," are difficult for people with cognitive and developmental disabilities to understand, he notes. "But these new IBM voices are very clear, very human sounding. They're also very expensive to license. But the price will come down."

Personal digital assistants (PDAs) are a case in point, Stock insists. "We have a system called Pocket Coach that we created in 1995. We developed a little hardware unit, small like a backpack, that enables us to record a series of audio instructions." By pressing a button, he adds, the user can play the back the audio instructions sequentially. The device, he says, "is not unlike a tape recorder but you can replay messages without rewinding. You can reset it at step one if you're doing a repetitive task like packaging, for instance."

The second-generation prototype of Pocket Coach, he says, was an audio-based cueing system. The first prototype, Stock explains, "was a jumble of boxes and wires, but this second one was actually a senior engineering project by a couple of students at the University of Colorado/Colorado Springs and was jokingly referred to as 'Backpack Coach' because of its size."

According to Stock, the first Pocket Coach production units were dedicated hardware units that "we built in runs of 50, which makes buying parts expensive – compared to mainstream manufacturers' orders for, perhaps, 10,000 parts at a time."

The Coolness Factor

The product, he states, "was different enough looking to have a stigmatizing effect, instead of the 'coolness factor'" of the Pocket PCs that serve as the platform for the current generation Pocket Coach software. A new, much improved version will be out later this year or in early 2005.

When PDAs emerged, recalls Stock, "we said that we needed to develop a software program that performs like Pocket Coach but runs on a PDA platform." He adds, "We needed to do this because PDAs are so much cooler; they're a social prosthesis instead of 'What is that weird looking thing you have?'" The uncoolness factor, he remarks, is why many individuals with disabilities do not like to use augmentative communication devices. The devices make the users stand out when what the users want is to blend in with their peers or to stand out because they are perceived as being cool. "So now there's a cool factor to the PDA". Beyond coolness, he asserts, is utility: "The device has a memory capacity, a built-in audio recorder, a built-in touch-screen."

PDAs, he remarks, represent another example of mainstream technology adapted to the disability world. "There are PDA-based augmentative communication devices now," he notes. "These GPS systems are PDA-based." Still, as Stock points out, "the gap between mainstream technology and its adaptation for use by people with disabilities seems to be less than the gap between disabilities technology actually being used by people with disabilities."

Stock cites Dr. June Downing's observations in the May 2004 FCTD Newsletter as dovetailing with his. "I think Dr. Downing really had it down," he asserted. "She talked about technology needing to be designed specifically to meet the needs of the kids with disabilities who actually use it. This relates to drilling down UD to another level. She talked a lot about attitudinal barriers, which Dan and I also have strong feelings about."

Surmounting the Service Provider Barrier: Moving the Beanbag Chair

While Stock believes that the approach to working with new technology is about the same in the mainstream and disability communities, the latter contains a barrier to technology adaptation that is not prominent in the mainstream community: the layer of service providers who make technology purchasing decisions for users of all ages, from elementary school to assisted living and adult nursing facilities. In his experience, "too often the staff are not especially technology savvy themselves. They say, 'if I can't use it, how can a person with cognitive disabilities – or a senior citizen with dementia or Alzheimer's -- use it?'" Consequently, users, who need the equipment that is made specifically for their needs, not the needs of the staff, too often do not get the equipment they need, according to Stock.

For Stock, this buyer/user paradox presents a challenge unique to the disabilities community. "The person with cognitive disabilities uses our equipment, but we need to sell it to the service provider" who makes the buy decision. "In each transaction, we have two sales to make to customers whose interests are not necessarily the same."

Declares Stock, "We approach the adaptation of technology by the cognitive disabilities world as if we were pushing a beanbag chair. The best way to move a beanbag chair is to pull it. We don't have that option. Instead we push it, and it bulges out somewhere else. Then you push there and it bulges out elsewhere. Yet, very slowly, eventually, it does move forward. That's how the cognitive disabilities sector is adapting to AT."

Using their beanbag moving approach, Stock and Davies attempt to push technology adaptation in the cognitive disabilities field. From the start, pushing has been a struggle. "It's been very slow. Our first project together was a more accessible version of something like Quicken. It was for budgeting. It was very picture-oriented. It would actually print a check for someone who could not write." Ten years have passed since then. Sometimes, Stock declares, "We look back at those 10 years and the most significant aspect of those 10 years is that they have passed."

In other areas of disability, such as vision, mobility and hearing, adaptation appears to be faster than in the cognitive disabilities area. Yet, frustration, he insists, hampers neither his enthusiasm nor his optimism. "When you're pushing that beanbag chair," he explains, frustration is a hindrance." Patience, on the other hand, "is a virtue," with a payoff in eventual user satisfaction. "We see people who can't read come in here, work on a computer and say, 'I'm going to go home and tell my dad that I can use a computer!'"

The end-result for users with cognitive disabilities is accomplishment and needed self-esteem. "So many times I've heard someone with cognitive disabilities say, 'I've been looking from the outside at a computer for 10 years and someone finally let me try it!'"

The euphoria he experiences at such moments rarely lasts long. "Then I go to a high school and visit a special ed class where they're using a seven-year-old computer that's got about 16 megabytes of RAM on it, and the school wants me to install our software on it." These episodes serve to confirm what he knows to be true: "The service provider segment of the cognitive disabilities world is not there yet; it's not ready for what cutting-edge technology can do."

Equipment abandonment is a related issue, Stock claims. "It's been on the hotplate for years. Part of that stems from the fact that the folks with cognitive disabilities are not the ones making the purchase decision. When you do make the purchase decision, even if it's not a perfect fit, there's some ownership there. The problem is that some service providers are force-fitting technology, so the software is not doing what it was intended to do."

Voice Recognition Systems: Will the Cognitive Disabilities Community Be Left Behind?

Stock is not optimistic that the ongoing gains in voice recognition technology will ultimately benefit the cognitive disabilities community. "I've seen some of the eye-gaze systems," he remarks, "and I don't think they've reached their early adopters yet." In his opinion, "Eye-gaze and brainwave technology are going to leave the cognitive disabilities community behind." Like voice recognition technology, he explains, the interface is too complex. "You can gaze at a letter A or a letter C or D or you can look at the start button but to know what to look at…I mean you're still dealing with the Windows interface, which is too complex for a lot of folks with cognitive disabilities."

In addition, he cautions, "There must be an awareness of cognitive control over where the user is looking." The user, he adds, "can intentionally look away for a period of time and it's a normal pause, but the user has to know how to pause and then consciously return to what he or she was gazing at on the screen." For individuals with cognitive disabilities, he declares, "that level of awareness is just not there."

Brainwave technology, he continues, also requires more cognition than those with cognitive disabilities are able to muster. Perhaps, he states, "voice recognition might be more achievable for the cognitive disabilities population in the future." After all, he points out, the technology remains in the formative stage and its practical application remains largely untested.

He compares voice recognition technology to the development of PDA technology in terms of its practical application in the cognitive disabilities population. "I look at the curve that voice recognition technology has followed, beginning in the disabilities community and then migrating to mainstream applications. We're still using voice recognition technology [in the cognitive disabilities community] but it's already leaving us. It's the same now with PDA technology." In the disabilities arena, he insists, "we'd never have been able to build the kind of hardware devices that are increasingly cheaper, more powerful and faster. There's just not a big enough market for that."

The solution, he states, is to closely examine the research being conducted by mainstream designers and engineers. "The number of people doing research in the mainstream is a hundred times greater that the number of people doing research in AT. We need to take advantage of that." Often, he notes, AT adapters can simply rewrite an interface to simplify it or can capitalize on other aspects of the technology that

correspond to the strengths of those in the cognitive disabilities community.

PDA: A Promising Area of Research

Stock says that he and Davies are attempting to obtain funding to create a picture-based cell phone on a PDA. "We've done some initial research and have found it to be a very successful approach for people in terms of knowing who's calling and being able to call when numbers are difficult for the user or if the user is unable to dial."

Their company, he adds, recently received funding for two innovative PDA-based products. One, he says, is called Rocket Reader, which is related to the e-reader devices run on PDAs "that enable the user to either look at the e-book and read it on-screen or have the device read an audio book to the user." The interfaces with these PDA devices, he explains, "are very text-based and complex, requiring menu navigation and other complicated tasks. "They provide a lot of features that may or may not be important." AbleLink has obtained funding to develop an e-reader that is usable by people with cognitive disabilities, including individuals who are unable to read.

Explains Stock, "We'll do a prototype and develop a test comparing it to one of the mainstream readers and have users go through a series of typical e-reading tasks to retrieve a book, to get to a certain page and see if we can't develop something that's more accessible than what is currently out there."

Stock is also excited about a project aimed at those who cannot master reading. "We're looking at people who, because of their level of cognitive disability, are not going to master reading. They don't understand phonemes [the smallest unit of language, consisting of just one or two letters], which means they're not going to understand words or sentences, nor can they comprehend." These non-reading individuals, he notes, perceive their world through listening.

"There are many listening assessments that are out there," he observes. These assessments are staff facilitated and require much teacher time. "That's why a lot of teachers don't get training on this concept, because it's a one-to-one arrangement with the student and they simply don't have the time." AbleLink, he says, is seeking to implement a multimedia software version of the one-to-one approach "where the device may read a paragraph to the user and then the user answers questions that test content comprehension. The program, he adds, will read a passage and present questions to the user and "will then read the answers as the user mouses over them." This system, he notes, resembles an earlier successful version created by AbleLink that is Internet-based.

Could It Work for the Vision Impaired as Well?

There are times, he remarks, when Universal Design principles fly in the face of a disability's realities and the benefits of available technology. For example, Stock explains, "We [at AbleLink] extol UD but we don't depend on reading because our users, people with cognitive disabilities, can't read." Similarly, "people with vision impairment also don't depend on reading because of their vision disabilities."

It was with this commonality in mind that AbleLink developed its audio-based PDA prompting system that emphasizes the simplest sounds and provides step-by-step instructions. In its simplest playback mode, the PDA's entire touch screen "is one big button that the user presses consecutively to hear the messages." Stock says that his company has sold several of these PDA-based audio prompting devices to schools

for the deaf and vision-impaired. However, the device has proven most effective with the vision impaired "who can feel the screen when they're tapping and hear it as well because the tap is audible."

Stock concedes that his company's for-profit status has inhibited his designers and software engineers from adding features to the device that might help those with vision impairments to further capitalize on their strengths, "but we haven't done it because it's just not our development market. That's not our research area."

AbleLink is currently developing an independence assessment tool for ARC (formerly known as the Association for Retarded Citizens) aimed at determining how much choice and control these individuals exercise over their lives. "We want to make an independently accessible version in which the device will read questions to ARC members so they can take the assessment themselves." Currently, he says, "someone interviews them and the interviewer has to coax an answer out of them and then record their response. Invariably there's bias introduced in that process, so we're trying to eliminate some of that bias."

Another concept under consideration involves augmentative communication devices, "little gadgets that people carry that have pictures on them; users tap a picture and the device says, 'I would like a glass of milk.'" The devices, he explains, are created for people who are unable to speak. However, the devices, Stock asserts, "are clunky." Each device may display as many as 10-12 pictures on the screen that carry 10-12 different messages. Stock remarks, "That's really not enough to get anyone very far." So layers have been added enabling the user to flip a switch or push a button to change the picture sheet, which provides a wider selection of phrases.

Using the GPS

According to Stock, mental retardation, not deafness, is the leading cause of speech impairment throughout in the world. "Yet there's not a single augmentative communication device for those with cognitive disabilities that gives them both the ability to use it independently and to meet their needs in a variety of situations in the community."

To fill that gap, Stock's designers and engineers created a device that employs a Global Positioning System (GPS) that can "set coordinates at the front door of the school that would automatically change to the school's set of messages as the user arrives there. You could have another set for, say, McDonald's when the user arrives there for work. It would automatically change the school messages to the McDonald's messages." The GPS approach, he asserts, "may be a little Big Brotherish but it is yet another way to provide more independence to people who need as much as they can handle."

According to Stock, there is now speech translation software that runs on PDAs and analyzes sound waves. "The typical application is, for instance, if I go to Germany and want to know where the bus stop is, the software listens to my question, analyzes the wave and responds in German for me." In some of these devices, he notes, "a little training is necessary so the device knows the user's voice or the user must speak a phrase the program already knows." The software analyzes a voice wave, finds a match and translates in the user's desired language.

This mainstream software offers another example of likely adaptation for use by persons with cognitive disabilities, Stock asserts. "There are a lot of people with cognitive disabilities who speak very purposely but unintelligibly. We see people

like this in our office all the time. In fact, my uncle was that way. You couldn't understand a word he said but, boy, was he saying something! He'd say it exactly the same way every time. We used to joke that the only words we could understand were cusswords! But these individuals are consistent in their utterances."

He is curious about whether such a person "could speak that utterance consistently enough into one of these units and someone for whom these utterances are comprehensible could record the understandable version of it." This tack, he declares, "represents a whole different approach" to augmentative communication.

A New Area for AT Research: Seniors with Dementia

Stock views the segment of the senior citizen population afflicted with dementia and Alzheimer's as one that might benefit from AT research now underway on behalf of the cognitive disabilities population.

His company has allied itself with a Denver-based organization called "It's Never Too Late" to provide software for accessible computer labs in nursing homes and assisted living centers. "The software is simple," Stock says, "A lot of these seniors can still read, albeit in big text, but it makes more sense for them to listen and hear instead. They can touch a picture of their son or daughter on a touch screen and listen to their kids speak an email in a recorded voice in which there's emotion." If technology can provide so much help for children or young adults in this area, he asks, "Why can't we accomplish as much for individuals at the other end of the age spectrum?"

Touch Screen Technology is Workable, Intuitive and Effective

According to Stock, the touch screen is by far the most effective and workable alternate interface technology to help people with cognitive disabilities control the computer. The touch screen, he explains, "eliminates the cognitive need to connect this hand that I'm moving around with what I see on the screen." The good news, he adds, is that "the price of technology is coming down because the need for touch screen technology in mainstream society is going up."

The touch screen, he continues, "is very intuitive and there's not a big training curve. It just makes sense to employ it. It's an interface whose use will increase in the cognitive disabilities community if it increases in the mainstream population."

For years, he recalls, "We've been using Lexmark touch screens that fit over a regular monitor. For many years they were just a novelty." The screens, he asserts "are now more ubiquitous but aren't yet an interface of choice."

Helping to Make the Web More Accessible

In its efforts to enhance web accessibility, the AbleLink objective was not to create new websites but, instead "to make existing websites more accessible in a different way." For example, "we approached the web accessibility issue from a different angle than the World Wide Web Consortium (W3C) and Bobby, whose accessibility requirements mainly address vision and hearing issues."

Instead, he adds, "we created a whole different way of attacking web accessibility that would be helpful for the cognitive disabilities community." For example, he explains, "Our web browser opens up to a home page which is not on the web but instead is a series of picture buttons." The designers, he says, "created a simple way that users can go to a website and click on a picture on a website and it automatically

puts the picture of one of these buttons on the favorites list. So now the user has a picture-based favorites list, and the picture is from the website itself. It's intuitive. There's not a lot of generalization or having to navigate a text menu to get back to a favorite website." Basically, he concludes, "if a user wants to get back to his Denver Broncos website he touches the picture of the Denver Broncos logo and he'll go there. It has screen reading built into it."

In addition, he continues, "We created a picture-based search engine which, like any other search engine, has nested categories but, instead, uses pictures. You click on a picture of what you want, the search engine inputs the word for the user, talks to the user and announces, 'When you're ready just click the search button." The user is provided with three options: a Google text list; a display of buttons which, when clicked, will read that link to the user and a third option which, Stock emphasizes, is the most powerful of the three for non-readers. "It actually returns a preview of each page starting with the first hit. It's a preview of a small screen and the user can see what the page looks like." A user can click on a "Next" button and can then click through all the pages until the desired page is located. Finally, the user clicks on that page and receives a view of a full screen."

A Glimpse of the Future

Gazing a decade ahead, Steve Stock glimpses the following developments in the cognitive disabilities area:

- AT will continue to be incrementally adapted by people with mental retardation, brain injury, significant learning disabilities, and their respective service communities. "I think that special education and student accommodations will probably continue to lead the way in those areas."
- The use of technology in aging and dementia will increase more dramatically, for three reasons:
- a) Baby boomer demographics will force efficiencies, as even now entities such as the National Institutes on Health appear to be pushing the research agenda in that area; b) More money is available for investing in technology related to seniors, including Federal, insurance, and personal wealth/private expenditures; c) Unlike the cognitive disabilities community where those making the purchasing decisions (staff and parents) may not be as technically savvy, purchasing decisions in the senior community may more often be made by adult children of seniors who regularly use email and other technologies and could see the benefits for their parents.
- As for the development of technology itself, "I look forward to increasing practical applications for people with disabilities of emerging and maturing technologies such as voice control, GPS, integration of wireless technologies, and even things like virtual reality applications and new mobility hardware.

Each research breakthrough, he declares, takes the edge off any residual frustration caused by the need to constantly confront and surmount attitudinal barriers to adaptation and acceptance. "When I get frustrated I'll look back at the past 10 years and remember how dramatically things have changed and how much progress the cognitive disabilities community has made thanks to advances in technology. You know it's your life's work and if you just keep going at it – good things will happen."

RESOURCES

Research Resource Centers and Clinics

Assistive Technology Research Group / UNC-Chapel Hill

The ATRG at the University of North Carolina-Chapel Hill conducts research in several AT-related project areas: the Blind Audio Tactile Mapping System (BATS), which aids visually impaired individuals in the exploration of spatial information so that they can literally map out their daily travels; Hark the Sound, a simple sound game for visually-impaired children; and Audio Enriched Links, which provide previews of linked web pages to visually-impaired users. The ATRG website also features resource information for AT developers.

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Adaptive Technology Resources Centre / University of Toronto

The ATRC advances universally accessible information technology by highlighting research, development, education, proactive design consultation and direct service. The Center also assists in choosing assistive technology for individuals and trains them so they can get the most out of it. The Center is part of the Resource Centre for Academic Technology at the University of Toronto.

For more information, contact:
Adaptive Technology Resources Centre
J.R. Robarts Library, First Floor
University of Toronto
130 St. George Street
Toronto, Canada M5S 1A5
Phone: (416) 978-4360
Fax: (416) 971-2629
Email: general.atrc@utoronto.ca
http://www.utoronto.ca/atrc/

Assistive Technology Research Clinics

Housed at the Stanford University School of Medicine and dedicated to the application of AT and to augmentative and alternative communication (AAC), the Clinics feature research in the following areas: AT evaluation and consultation services; optimizing AT delivery service with video teleconferencing (VTC); toddler and pre-school AT clinical service; AT network and information referral service; and childhood motor impairment and assisted communication.

For more information, contact:
Assistive Technology Research Clinics (ATRC)
1023 Corporation Way
Palo, Alto, CA 94303
Terrence Stanger, Ph.D., Judy Henderson, MA co-Directors
http://www.med.stanford.edu/ataac/index.html

Center for Outcomes Research and Education (CORE)

Affiliated with the Department of Occupational Therapy at the University of Illinois-Chicago (UIC), CORE is one of two centers of research in occupational therapy. CORE is an interactive community of

scholars consisting of five UIC faculty members and 14 research fellows from other universities in the U.S., Canada and Sweden. The 19 scholars attend symposia on outcomes research in OT and then develop large-scale grant proposals for outcomes studies to demonstrate the impact of OT practice worldwide. Under the Current Activities section of the website, there is an extensive listing of CORE fellows' publications on a wide-range of disabilities and assistive technology.

For more information, contact:
Center for Outcomes Research and Education (CORE)
Department of Occupational Therapy
College of Applied Health Sciences
University of Illinois at Chicago
1919 Taylor Street
Chicago, IL 60612-7250
http://www.uic.edu/ahs/OT/CORE/coreindex.htm

Traumatic Brain Injury (TBI) National Data Center

The Center conducts TBI research and maintains a publications registry, produces TBI Model Systems publications and performs TBI Model Systems research. For more information contact:
Traumatic Brain Injury National Data Center
Kessler Medical Research and Education Corp.
1199 Pleasant Valley Way
West Orange, NJ 07052
Phone: (973) 243-6971
http://www.tbindc.org/

Projects

The Archimedes Project

Founded at Stanford University in 1990, the Project examines barriers to accessing and using information, computers and information appliances and designs solutions, including accessors, that promote universal access. Archimedes teams of multidisciplinary faculty, researchers, students, information technology engineers combine and interact to forge meaningful solutions that benefit individuals with disabilities and those with limited literacy skills. The project upholds a commitment to making information technology available to all.
http://archimedes.stanford.edu/contact.html

Improving Research Information Dissemination and Utilization to Promote Independent Living (The RIIL Project)

Project highlights include the following features: a consumer-driven database containing independent living (IL) research reviews; research reviews written in non-researcher language; descriptions of products to assist researchers in writing research results for non-researchers; research primers to assist consumers and non-researchers to better understand the power of research and how to use it; ongoing newsgroups to discuss IL research; and discussion groups to review specific research for which the study's researcher is available.

For more information, contact:
The RIIL Project
University of Kansas
4089 Dole Center
Lawrence, KS 66045-7555
Phone: (785) 864-4095 (Voice)
http://www.getriil.org/

Research Utilization Support and Help Project (RUSH)

RUSH develops and tests models for increasing the effective use of NIDRR research results. The project assesses utilization successes in terms of benefits produced for intended user audiences which include families of individuals with

disabilities, disability researchers and disability service providers.

For further information, contact:
Research Utilization Support and Help Project (RUSH)
Southwest Educational Development Laboratory
211 East Seventh Street
Austin, TX 78701-3253
Phone: (512) 476-6861 (Voice); 1.800.761.7874 (TTY)
Email: mlinder@sedl.org
http://www.researchutilization.org

Tots 'n Tech Research Institute (TnT)

TnT is an inter-university collaboration between Thomas Jefferson University (TJU) of Philadelphia and Arizona State University (ASU). The project conducts a national research program focusing on the use of AT to enhance the learning and development of infants and toddlers with disabilities.
http://tnt.asu.edu/home_files/r_obj.html

KNOWLEDGE NETWORK MEMBERS

AbleLink Technologies, Inc.

AbleLink Technologies was founded in 1997 specifically to address the need for well-researched cognitive support technologies for individuals with intellectual disabilities. The company's researchers represent the following fields of expertise: human services, human factors, rehab technology, software engineering, occupational therapy and clinical and experimental psychology. The company is headquartered in a 100-year-old Victorian home north of downtown Colorado Springs, CO, adjacent to the campus of Colorado College.

AbleLink researchers have received more than 25 research and development grants to investigate, research, and develop technology applications for individuals with intellectual disabilities. The company's research findings have been published in research journals such as *Education and Training in Developmental Disabilities*, *The Journal of Developmental and Physical Disabilities* and *Mental Retardation*.

AbleLink's research collaborators include well-known disabilities organizations, including The Beach Center on Disability at the University of Kansas, the Joseph P. Kennedy, Jr. Foundation, the National Institute on Disability and Rehabilitation Research, and the Westchester Institute for Human Development at New York Medical College.

For more information on AbleLink, contact:
AbleLink Technologies, Inc.
528 North Tejon, Suite 100
Colorado Springs, CO 80903
Phone: (719) 592-0347
support@ablelinktech.com
http://www.ablelinktech.com/
Contacts: Daniel K. Davies, President/Founder; Stephen A. Stock, Vice President/Partner

Center for International Rehabilitation Research Information and Exchange(CIRRIE)

CIRRIE maintains an international rehabilitation research database in all areas of rehabilitation. Users can access information on non-U.S. organizations that conduct rehab research. The CIRRIE website features Rehab Talk, which enables rehabilitation professionals to

select from a comprehensive collection of electronic discussion lists to converse with colleagues.

CIRRIE assists rehabilitation research conference organizers in the U.S. in including an international component at domestic U.S. conferences by involving prominent colleagues from other nations. CIRRIE also aids non-U.S. research organizations in sponsoring U.S. rehab experts to speak overseas.

The organization disseminates information to rehab service providers on cultural issues in order to meet the needs of recent immigrants to the U.S. The CIRRIE Monograph Series helps rehab professionals gain cultural perspectives via *The Rehabilitation Providers Guide to Cultures of the Foreign Born*, which focuses on culture brokering and the major foreign-born populations in the U.S.

For more information in CIRRIE, contact:
Center for International Rehabilitation Research Information and Exchange (CIRRIE)
State University of New York at Buffalo
515 Kimball Tower
Buffalo, NY 14214-3079
Phone: (716) 829-3141 ext. 149
Fax: (716) 829-3217
http://cirrie.buffalo.edu

Eugene Research Institute (ERI)

ERI research serves both basic and applied purposes, with a particular focus on special education, technology and social policy. The institute's members, who include researchers from the University of Oregon's College of Education, have completed several U.S. Department of Education grants and have been published in diverse journals including Journal of Learning Disabilities, Exceptional Children, American Psychologist, American Educational Research Journal and Equity and Excellence. Located in Eugene, OR, ERI facilities can accommodate a wide range of research methods and activities.

ERI AT-related research includes the following projects:

Information Technology Access for Adults with Cognitive Disabilities, participatory development of a model for software accessibility, training and support. The project's purpose is to improve software accessibility, training and user support for individuals with significant cognitive disabilities by building on ERI's previous development of accessible life skills software and formulating a participatory model for effective consumer training and support. This project is aimed at aiding individuals with significant cognitive disabilities who are excluded from the benefits of information technology despite the development of new devices and specialized software that support physical access.

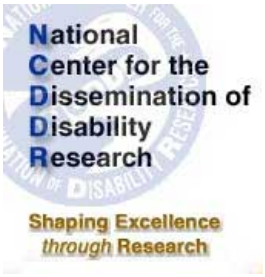
A Model for a Technology-Based Life Skills Curriculum for Secondary Students with Cognitive Disabilities, which develops and implements a model for technology-based life skills curriculum for secondary students with significant cognitive disabilities, to evaluate the effectiveness of the model using multiple quantitative and qualitative methods and to replicate the model in a range of settings. Key anticipated outcomes include a field-tested, comprehensive, technology-intensive approach to development of life skills.

For more information on ERI, contact:

Eugene research Institute (ERI)

99 West 10th Street
Eugene, OR 07401
Phone: (541) 342-1553
Fax: (541) 342-4310
http://www.eugeneresearch.org
Contact: Thomas Keating, Ph.D., Senior Research Associate

National Center for the Dissemination of Disability Research (NCDRR)



Established in 1995, the National Center for the Dissemination of Disability Research (NCDDR) works with more than 400 disability and rehabilitation research teams and product developers.

The NCDDR's goals are, first, to deepen federally funded researchers' understanding of how consumers seek and use information; and second, to model strategies and techniques that researchers can use to reach different targeted consumer audiences. To accomplish its goals, NCDDR identifies, develops, and demonstrates successful dissemination and utilization (D & U) strategies that connect potential beneficiaries with research-based information.

The wide range of research and related activity priorities the NCDDR works with include: Employment outcomes research, Health and function research, Technology for access and function research, Independent living and community integration research, Associated disability research, Knowledge dissemination and utilization activities, Capacity building for rehabilitation research training activities, Americans with Disabilities Act technical assistance programs, State technology assistance projects.

"SEDL's NCDDR resources increase consumers' awareness and use of disability research findings," says Dr. John Westbrook, NCDDR Director. The Web site provides access to NIDRR-funded projects, NIDRR's research priorities, a calendar of NIDRR project events, and other NIDRR-related information. There are also links to NCDDR-produced information (by topic) and to a variety of products and resources.

The NCDDR has compiled a searchable online database, the Electronic Library**,** to facilitate access to information that has been produced through NIDRR-funded research activities and is currently available in an electronic online format. The *Biblioteca Electrónica* is a second database that presents online materials in Spanish, developed by NIDRR-funded projects.

The NCDDR also fosters growth in the research community's ability to meet practitioners' and consumers' emerging information needs. Collaborating with several NIDRR-funded researchers, the NCDDR has developed three *Guides to Resources Produced by NIDRR Grantees* in the areas of: Substance Abuse and Disability Resources; Traumatic Brain Injury Resources; and Infants, Children, and Youth with Disabilities.

The NCDDR engages in survey activities to help increase the knowledge base regarding the dissemination and utilization of disability research findings. A key focus of survey activities is to learn about what kinds of disability-related research are important to consumers, how consumers prefer to receive disability research information, and how computers and the Internet/Web are helping consumers to find information they can use. The knowledge gained helps to inform researchers from the NIDRR community concerning how consumers with disabilities and their families obtain and use disability research information.

Visit the NCDDR's Publications page to find materials and products including *The Research Exchange* technical assistance newsletter, *FOCUS* technical briefs, posters and brochures, literature reviews, special reports, success stories, and survey reports.

Contact Information:
Lin Harris, Information Specialist
lharris@sedl.org
National Center for the Dissemination of Disability Research (NCDDR)
Southwest Educational Development Laboratory (SEDL)
211 East Seventh St., Room 448
AUSTIN TX 78701-3253
Toll Free/TTY: 800-266-1832
Voice/TTY: 512-476-6861, ext. 230
Fax: 512-476-2286
Email: NCDDR@sedl.org

The Coleman Institute for Cognitive Disabilities

Founded in 2001 by William and Claudia Coleman, the CI supports research, development, dissemination and education in cognitive disabilities on the campuses of the University of Colorado (CU) in Boulder, Colorado Springs and Denver. CI defines cognitive disabilities as mental retardation, developmental disabilities, acquired brain injury, Alzheimer's disease and severe and persistent mental illness.

The Institute supports 14 research projects led by investigators at CU's campuses. Several of the projects emphasize the application of computing technologies to cognitive disability in areas that include animated learning tools, memory aiding prompting systems, smart transportation system development and web-based research for teachers and parents. Other research initiatives focus on neural cell transportation, fine motor coordination and visual performance in Down's syndrome, the application of neuroinformatics to cognitive disability and support for graduate and undergraduate research experience in computer science and cognitive disability.

CI assists CU faculty in providing funding for pilot projects and by providing challenge grant funding for Coleman Graduate Assistantships in federal research grant applications. The Institute supports several major conferences on cognitive disability research, including its annual university of Colorado system-wide event that brings together 200 faculty researchers, disability leaders, federal agency heads and prominent scientists and engineers from beyond the CU system. These Coleman conferences are designed to explore research frontiers and partnerships in cognitive disability and technology.

For more information on the Coleman Institute, contact:
The Coleman Institute for Cognitive Disabilities
University of Colorado
SYS 586
4001 Discovery Drive, Suite 210
Boulder, CO 80303-0586
Phone: (303) 492-0639
Fax: (303) 735-5643
http://www.cu.edu/ColemanInstitute/index.html

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