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VA Research Currents

RESEARCH NEWS FROM THE U.S. DEPT. OF VETERANS AFFAIRS

Photo by Mitch Mirkin

Finding a way

Researchers explore new technologies to help the blind get around

While the seeing eye dog and long white cane are likely to endure as trusted wayfinding aids for the blind, a new generation of digital aids is emerging. Nowadays, it's not uncommon to see people with vision loss using "talking" handheld GPS devices—often along with a guide dog—to navigate along city streets.

GPS has its limits, though. Directions for pedestrians can be off by 50 or even 100 feet in certain instances. Clouds or tall buildings can block signals. Indoors, GPS may not work at all. And even under ideal conditions, a consumer GPS device is usually accurate to only about 10 feet. For a blind user, that can mean the difference between walking on the sidewalk and veering off into the street.

A VA-funded group of researchers is designing a computer vision system to bridge these limitations and offer added mobility and independence for blinded Veterans and others with vision loss.

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High-tech vision—Lee Stearns is one of several University of Maryland students helping VA investigators build a webcam-based computer vision system for navigating indoors or outdoors, recognizing currency, and locating lost objects.

Alzheimer's imaging study expands

The Alzheimer's Disease Neuroimaging Initiative, led by a VA researcher, aims to enroll 1,000 older volunteers at 55 sites in the U.S. and Canada over the next five years. More than 800 people are already being followed.

The study aims to learn about the subtle changes that scientists believe take place in the brains of older people years before symptoms of Alzheimer's appear. Lead investigator is Michael Weiner, MD, of VA and the University of California, San Francisco.

"By determining how brain scans, biomarker measures and cognitive testing results relate to each

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Research Week set for May 2 – 6

"Discovery and Collaboration for Exceptional Health Care" will be the theme of National VA Research Week 2011, to be commemorated May 2 – 6. The focus will be on research that VA has conducted in partnership with its academic affiliates—universities nationwide that are linked to VA in research and clinical care—and with federal partners such as the National Institutes of Health and the Department of Defense. Watch *www.research.va.gov* in early 2011 for more details.

Research on the move—At VA's Center for Restorative and Regenerative Medicine, Dr. John Simeral (right) checks data from a BrainGate study, and a volunteer runs on a treadmill in the Gait and Motion Analysis Lab, his legs taped with reflective markers that are tracked by motion-capture cameras.

Providence VA dedicates new home for research center

The Providence VA Medical Center held a dedication ceremony and open house on Nov. 12 for the new home of its Center for Restorative and Regenerative Medicine. The research center, founded in 2004, is a collaboration among VA, Brown University and the Massachusetts Institute of Technology.

The new facility has nearly 24,000 square feet of basic science and clinical research space dedicated to rehabilitation studies. VA provided more than $6 million to pay for the new construction, on top of $7 million it initially provided to fund the center. Research at the center focuses on areas such as neurotechnology, prosthetics, skeletal biology, regenerative medicine and advanced rehabilitation techniques.

One of the high-profile projects now under way there is a study involving the DEKA arm, a new state-of-the art upper-limb prosthesis; and BrainGate, a technology aimed at enabling people to control electronic or robotic devices directly with their thoughts. Researchers will attempt to marry the two technologies, such that DEKA users will be able to control the high-tech arm just by thinking about it. Prosthetics experts envision this as a highly intuitive, efficient control system.

The DEKA arm, developed through funding from the Defense Advanced Research Projects Agency (DARPA), is now being tested with Veterans at several VA sites in an "optimization" study. Various methods other than neural control are currently used to operate the arm, such as shoe-embedded sensors that the user presses on with his foot.

BrainGate, aside from its potential use with the DEKA arm, has been undergoing testing with patients who are paralyzed due to ALS, spinal cord injury or stroke. In studies so far, patients have been able to move a computer cursor or maneuver a robotic arm to pick up a glass. The system currently calls for an implanted brain electrode to be wired to an external decoder, but the researchers hope to eventually go wireless and miniaturize the components so everything can be internal.

Another key project that has been partly supported by the center is a bionic foot-ankle prosthesis, developed by Hugh Herr, PhD, at MIT, that recently became available for Veterans.

The PowerFoot prosthetic ankle is now available for Veterans.

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103 S. Gay Street, Rm. 517
Baltimore, MD 21202
(410) 962-1800, ext. 223
research.publications@va.gov

Editor: Mitch Mirkin

Show me the money—Lee Stearns (left), a graduate student in computer science at the University of Maryland, and lead investigator Dr. Cha-Min Tang of the Baltimore VA Medical Center demonstrate a computer vision system that promises to aid the blind with recognizing currency, navigating indoors or outdoors, and finding lost objects.

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"We envision combining our system with technologies such as GPS," says Cha-Min Tang, MD, PhD, of the Baltimore VA Medical Center and the University of Maryland. A neurologist with a technology bent, he is pursuing his inventive ideas with the help of VA rehabilitation engineer David Ross, MEd, MSEE, at VA's Atlanta Vision Loss Center. Also at the core of the effort is a talented, enthusiastic group of computer science students from the University of Maryland, College Park, under the mentorship of Rama Chellappa, PhD, MSEE.

How does the system work? A blind person wears stereo headphones and attaches a small webcam and microphone to his lapel. The devices are wired to a small laptop carried in a backpack. (In the future a smartphone may be able to handle the computing.) When the user says "find the restroom," for example, the computer compares the webcam's view with still images of the area around the target that have been preloaded onto the computer. Beeps and other audio signals, in stereo, indicate how he needs to proceed. Computer-generated speech provides additional feedback, such as how far he is from the target.

Google maps or street images could complement system

For indoor navigation, still images are needed for every 15 to 20 feet along each path the user might follow. The idea is that a sighted volunteer would snap these ahead of time and upload them onto the user's computer. Tang believes large public sites such as universities or medical centers could eventually offer downloadable libraries containing images of high-traffic areas on their campuses: entrances, elevators, hallways, restrooms, cafeterias, possibly nearby bus stops or train stations.

For outdoors, a different approach is needed. Graduate student Lee Stearns says one idea is to rely on GPS to let the user know roughly where he is, and then call up a small set of relevant images for that location. At that point, computer vision would take over and give more precise guidance.

Similar libraries of location-specific still images are increasingly available in Street View, a relatively new feature of Google Maps. The images are taken with multiple-lens cameras that capture 360-degree views. The company describes it as "the last zoom layer on the map—when you've zoomed all the way and you find yourself virtually standing on the street."

Another option, says Stearns, is to add an inertial navigation unit, or INU, into the mix. About the size of a flash drive, INUs

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Smoking cessation and PTSD— Integrating smoking cessation treatment into mental health care is more effective than standard smoking cessation clinics for Veterans with PTSD, says a VA study. The trial involved 943 Veterans at 10 VA medical centers. Almost all were male, and the majority were Vietnam-era Veterans. Among those randomly assigned to integrated care—in which the same mental health therapist provides treatment for both PTSD and smoking cessation—almost 9 percent were able to quit for at least a year, versus 4.5 percent of those in standard smoking-cessation care. Outcome measures based on shorter time periods found quit rates of about 18 versus 11 percent. The researchers used periodic breath and urine tests to verify abstinence. The integrated approach is now being piloted at six VA medical centers. Veterans with PTSD smoke at especially high rates—between 30 and 50 percent, about double the rate of VA patients and U.S. adults in general—and tend to have stronger nicotine addictions that make quitting especially difficult. (*Journal of the American Medical Association,* Dec. 8, 2010)


Photo by Science Photo Library/Getty


Photo by Larry Gilstad

Solving hormone mysteries—Nobel laureate Dr. Andrew Schally and colleagues found that slowing the release of growth hormone, which seems to play a complex role in the body, may boost longevity and pose other health benefits. See story below.

Lab study sheds light on growth hormone effects—Nobel laureate Dr. Andrew V. Schally at the Miami VA Medical Center, still active in research at age 85, was senior author on a study that found that slowing the release of growth hormone yields an array of health benefits, at least in mice. The study found longer life, fewer tumors, better learning, heartier cells, and an increase in the enzyme telomerase, which repairs DNA. Human growth hormone has been touted and used widely to combat aging, but its actual benefits remain uncertain. In fact, two clinical trials found that replacing the hormone—it decreases with age—in older adults actually increased mortality. In light of this and other research, Schally's team, which included colleagues at the Puget Sound and St. Louis VA medical centers, tested the theory that blocking the release of growth hormone could boost longevity. They used a compound called MZ-5-156 to slow the release of growth hormone by blocking a helper hormone that controls its secretion. (*Proceedings of the National Academy of Sciences,* online Dec. 6, 2010)

New clinical education method enhances prostate cancer screening—B. Price Kerfoot, MD, EdM, a urology surgeon at the VA Boston Healthcare System and an associate professor of surgery at Harvard Medical School, has pioneered an approach to continuing medical education called "spaced education." His team tested

whether the method could help prevent inappropriate screening for prostate cancer—specifically, the ordering of prostate-specific antigen (PSA) tests for men below age 40 or above age 76 who do not have any symptoms of the disease. The trial involved 95 physicians, nurse practitioners and physician assistants responsible for primary care at eight VA hospitals in the New England region. Spaced education involves presenting and repeating information over spaced intervals, rather than at a single time point. In this case, clinicians received periodic emails with clinical scenarios and multiple choice questions, followed by immediate feedback. The questions were repeated at intervals. Over the 36-week intervention, the percentage of inappropriate tests among clinicians who received the emails was around 11 percent, versus 14 percent for those who did not receive them. Notably, during the 72 weeks following the intervention, the spaced-education group continued to order fewer inappropriate tests: 8 versus 13 percent. (*American Journal of Preventive Medicine,* Nov. 2010)

DHA supplement fails to slow Alzheimer's—A clinical trial led by Joseph Quinn, MD, of the Portland VA Medical Center and Oregon Health and Sciences University compared DHA supplements against placebo in 402 older people with mild to moderate Alzheimer's disease. Over 18 months, the treatment boosted blood and brain levels of DHA but did not prevent the worsening of Alzheimer's symptoms. MRI scans showed that the daily two-gram DHA supplement—about the amount in eight ounces of salmon—also did not slow the rate of brain atrophy. The results "do not support the routine use of DHA for patients with Alzheimer's," Quinn said. DHA, abundant in the brain, is the most widely known of the omega 3 fatty acids, a group of essential fats people need in their diet to be healthy. Some people get extra DHA by taking supplements that are based on fish oil or derived from algae. Studies have confirmed DHA's benefits for the heart, but researchers are still trying to pin down its therapeutic potential with respect to mental decline and dementia. In an editorial that accompanied the Quinn article, VA researcher Kristine Yaffe, MD, said the study illustrates the "high-quality investigation" needed for progress but also underscores the lack of effective interventions for the disease. *(Journal of the American Medical Association,* Nov. 3, 2010)

Virtual reality for PTSD: What do therapists think?

A team at VA's Little Rock-based Center for Mental Healthcare and Outcomes Research held focus groups with 18 VA mental health providers—psychiatrists, psychologists, social workers and others—to learn which factors they believe support or hinder the use of virtual reality for assessing and treating Veterans with PTSD. With the technology, Veterans are gradually exposed to realistic animated scenes on a computer that are designed to remind them of their traumatic combat experiences. Some systems even incorporate smells associated with combat zones, or chairs equipped with subwoofers that produce a rumbling sensation so users can feel like they're riding in a Humvee or experience a jolt when an "explosion" goes off. The technology has been studied as an aid to exposure therapy—a standard evidence-based treatment for PTSD—but has not yet come into wide use. The focus groups revealed a range of attitudes: The "most robust facilitator," according to the study authors, is the popularity of gaming and other computer technology among younger Veterans. Concerns exist, though, about issues such as resources, the impact of the technology on the therapeutic relationship, and possible overreactions on the part of patients. (*Psychiatric Services,* Nov. 2010)

The Honolulu VA Medical Center's Dr. Sarah Miyahira and other VA investigators have been studying the use of virtual reality software as an aid to prolonged exposure therapy for PTSD.

'MOVE!' program helps Veterans shed pounds—A team at the Miami VA Medical Center evaluated the effects of VA's "MOVE!" program—designed to improve Veterans' diet and exercise habits—on a group of 862 patients at the center. Over the five-year period before their enrollment in the program, the Veterans, on average, were gaining a little over four pounds a year. After enrollment, those who attended only the initial two-hour workshop were able to keep their weight stable over the following year. Those who also completed 10 weekly group sessions saw an average weight loss of 3.5 pounds for the year. (*Obesity,* online Dec. 2, 2010)

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have gyroscopes, accelerometers and magnetic sensors. They are used to aid navigation on airplanes and submarines. "You might be able to get a Google map and use GPS to tell you more or less where you are—say, within 100 feet—and then the INU and the camera will tell you how you're moving and exactly where you are on the map," says Stearns.

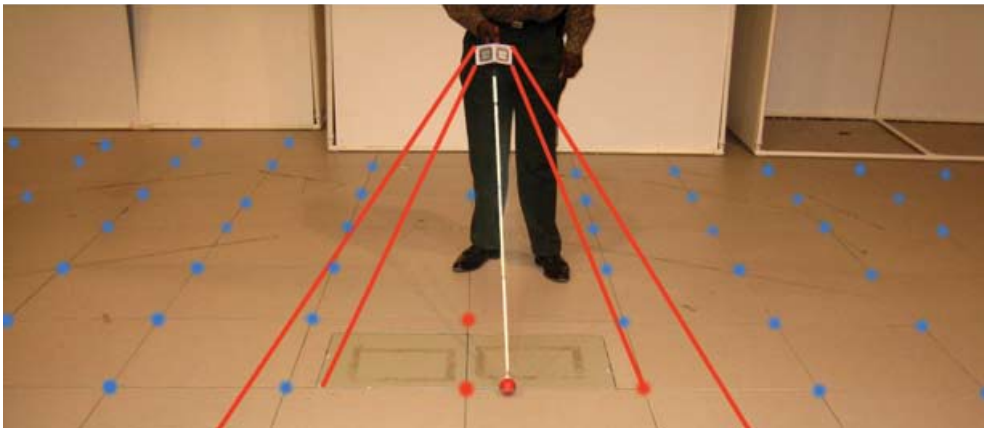
Researchers at the Atlanta VA, meanwhile, are evaluating an alternative approach. It relies on a smartphone to stream video frames to a central server. The server analyzes the images and sends back navigation data. The plus is that users don't have to carry their own computer. The minus is that connection speeds can affect how fast the system works.

"Both approaches have their advantages," notes Tang. "I think the ultimate solution is to build a combined system using complementary technologies. What is most important from the perspective of the blind is that the system be reliable under a wide range of conditions."

Building a platform for multiple tasks

Wayfinding is just one of the tasks handled by Tang's proposed system. "There are a lot of groups working on isolated tasks, such as money recognition, obstacle detection or navigation," he says. "What we want is a platform that will be able to integrate a variety of tasks as they are developed in the future. With that in mind, we've spent considerable effort on building a better interface between the user and the computer."

Natural speech is one of the keys to that interface, says Stearns. "You could ask it, how far to this destination, where's the nearest place to eat, where's the bathroom, where are my keys?" Various applications could be triggered by the user's voice, and guidance would likewise be given back, in most cases, through computer-generated speech. Money recognition is one example. For this task, the students have used an established algorithm known as SIFT. Demonstrating the technology to a visitor at the Baltimore VA, Tang hands a ten-dollar bill to Stearns, who is outfitted with the webcam. The camera detects the money in under a second and announces "ten dollars" in Stearns' headphones.



More wayfinding projects—Among the approaches being tested at VA's Atlanta Vision Loss Center is one that uses floor-embedded RFID tags. Read more at *www.research.va.gov/Currents*.

"You can hold any U.S. paper money and the system will instantly recognize it," says Tang. "Any denomination—even a two-dollar bill. You can even cover up most of the bill and the system will still recognize it. It will also be easy to train it for other currencies."

Some blind people already use handheld money scanners, but "the problem is that they're an expensive device that people have to carry around just for that one task, as opposed to a system that can recognize money as well as help in wayfinding and other tasks," explains Stearns.

The system Tang envisions can also be trained to help find lost objects. A sighted person would take pictures of the user's personal effects and upload them to the computer, along with keywords. If the user were to misplace his cane or cell phone, he could simply say those words and the webcam would scan the environment for the visual information matching the uploaded image.

Tang and the students have no shortage of ideas on how to move their system to the next phase and pull in yet more technologies. Their conversation is peppered with references to the latest high-tech devices and applications.

Showing off their system at a recent demonstration, Tang and Stearns had a lively debate over the potential merits of using two webcams instead of one. The cameras, each about the size of a ping pong ball, would be worn about 12 inches apart on the user's chest or shoulders.

Says Tang: "A two-camera system will offer a wider field of view and give you depth and precise measurement of distance. Parallax can be calculated by the computer very quickly." Stearns counters, "You can also get depth from a single camera, as long as you're moving, and it would be smaller and less expensive." Tang: "But that's not as accurate." Stearns: "You may have to combine them. That's part of what my master's thesis is going to be on."

The team also plans to tap existing software—and add algorithms of their own—to enable facial recognition and expression analysis. "Without sight," says Tang, "you don't know if the person talking to you is facing you or paying attention. Is he smiling, angry, expressionless? Our webcam can give continuous feedback."

White House honor

President Obama will honor two VA investigators, along with researchers from other federal agencies, with Presidential Early Career Awards for Scientists and Engineers,

Pamela J. VandeVord, PhD, and Rachel M Werner, MD, PhD, are slated to receive the prestigious award for their "pursuit of innovative research at the frontiers of science and technology and a commitment to community service."

Established in 1996 as America's highest honor for early-career researchers, the Presidential Early Career Awards for Scientists and Engineers are given every year in a ceremony at the White House. The date for the upcoming event has not yet been announced.

VandeVord works as a rehabilitation investigator at the John J. Dingell VA Medical Center in Detroit and is an associate professor of biomedical engineering at Wayne State University. Her work has focused on how traumatic brain injury damages neurons and other cells and tissues in the human brain. Her team has also studied the natural repair processes of peripheral nerves. The work may potentially help injured troops recover sensation in their hands and feet. In addition to her TBI research, VandeVord has published several articles on biomarkers for breast cancer and other tumors.

Werner, based in Philadelphia, is an investigator with VA's Center for Health Equity Research and Promotion and an assistant professor of medicine at the University of Pennsylvania. She is a physician and health economist who mixes her clinical and economic knowledge to promote health care quality. Werner has developed a program that evaluates how tracking the performance of health care providers improves the quality and equity of medical care. Her work has also examined the effects of quality-improvement incentives at hospitals and nursing homes nationwide. Partly as a result of Werner's studies, the Centers for Medicare and Medicaid Services now includes information about patient outcomes in its quality reports.

Drs. Rachel Werner (left) and Pamela VandeVord will receive Presidential Early Career Awards for Scientists and Engineers.

Both researchers are active in serving their communities and peers. Werner regularly mentors research fellows at the Philadelphia VA Medical Center and organizes and chairs sessions at national scientific meetings. VandeVord volunteers as a science mentor and instructor for the Detroit public school system.

Psychologist cited for telehealth work

Peter Tuerk, PhD, a psychologist at the Charleston VA Medical Center, received the 2010 Olin Teague Award from VA for his groundbreaking achievements treating posttraumatic stress disorder in combat Veterans. Tuerk, an assistant professor of psychiatry and behavioral sciences at the Medical University of South Carolina, runs the first VA clinic in the country to offer prolonged exposure therapy to Veterans via videoconferencing.

In prolonged exposure therapy, patients gradually re-experience the traumatic event in a controlled clinical setting—for example, by recounting the details of how they were injured. Repeated exposure to the thoughts and emotions surrounding the event helps reduce the power they have to cause distress. The therapy is one of the leading evidence-based psychotherapies used to treat PTSD.

According to studies by Tuerk and others, the therapy can be delivered safety and effectively via videoconferencing. Tuerk says this option allows Veterans to get into treatment faster, and many prefer it because it saves them a long drive to a clinic for weekly sessions. He says a number of VA clinics nationwide are now implementing the approach, and more research is ongoing. He told *Nextgov* that "the technology fades into the background" as treatment progresses and patients grow comfortable with the approach, at which point "the machine is not a big deal."

Photo by John C. Burroughs

Dr. Peter Tuerk has helped spearhead the use of video-conferencing to deliver PTSD treatment.

Veterans Health Administration
R&D
VA Research Communications
103 S. Gay Street, Ste. 517
Baltimore, MD 21202

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other and to the symptoms a person is having, we are getting a much clearer picture about the onset and progression of this devastating neurodegenerative disorder," says Weiner.

The study is the largest public-private partnership to date in Alzheimer's research. It is spearheaded by the National Institute on Aging, part of the National Institutes of Health, through a grant to the nonprofit Northern California Institute for Research and Education, which helps support research at the San Francisco VA Medical Center. Funding is also provided by a host of other public, private and nonprofit contributors.

Along with tests of cognitive function and various medical exams, study volunteers will undergo brain scans to measure glucose metabolism and the buildup of beta-amyloid protein, a hallmark of Alzheimer's disease. Researchers will also take blood and cerebrospinal fluid samples to measure proteins that may be biomarkers of cognitive decline and to look for genetic variations linked with the condition. They hope to identify who is at risk for Alzheimer's, track progression of the disease, and devise tests to measure the effectiveness of potential therapies.


Photo by TSgt. Sean M. Worrell/U.S. Army

Consortium will foster research on military suicide

The VA Eastern Colorado Health Care System is part of a new consortium set up by the Army to mesh military and civilian research on suicide prevention. The effort will complement other VA and Department of Defense research on the topic.

Co-directing the Military Suicide Research Consortium will be Peter Gutierrez, PhD, of the Mental Illness Research, Education and Clinical Center at the Denver VA Medical Center, and Thomas Joiner, PhD, of Florida State University. "Assessing risk for suicide has been the focus of extensive research in the civilian sector. However, very little is currently known about how relevant existing tools are when applied to the military," says Gutierrez. "The consortium will allow us to determine how best to screen and assess personnel, develop effective interventions and ultimately reduce suicides."

Army officials say they expect the work to bolster the evidence base for policy recommendations and clinical practice guidelines aimed at preventing suicide among troops, as well as yield strategies applicable for the Veteran and general population.