

Wearable computers and accessibility: the next step in mobile technology

Accessing Higher Ground 2014

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This presentation was created for the Accessing Higher Ground conference November, 2014. It highlights the potential and reality of wearable computers and how they can improve accessibility.

photo: Wearable Technology by Keoni Cabral <https://www.flickr.com/photos/keoni101/7069578953/>

Wearable Computers



photo: skin-pressure by Clonny <https://www.flickr.com/photos/clonpop/54765165/>

History of wearable assistive technology



Masks made by Mrs. Ladd, of the American Red Cross, Paris.



66-5

Driver F.

Facial prostheses, 1919

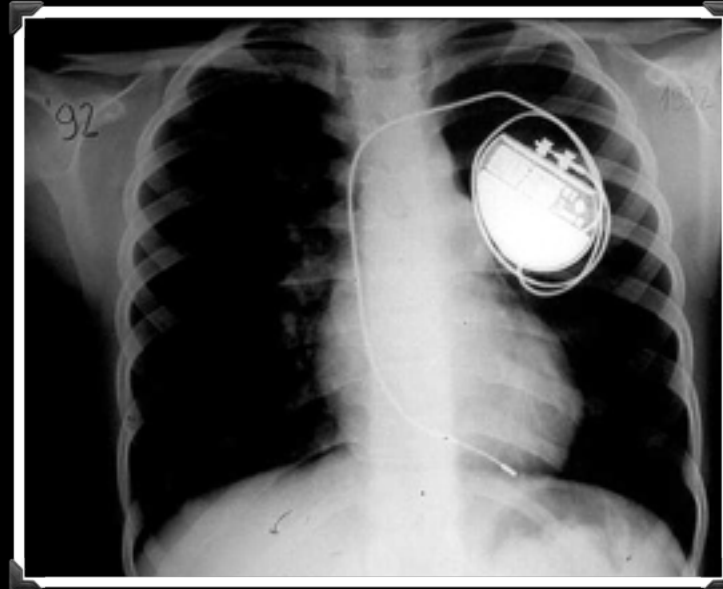
Anna Coleman Ladd fashioned much-admired face masks for WWI soldiers in the European theater. Facial prosthetics and reconstructive surgery advanced significantly because of the war.

<http://everybody.si.edu/technology/war>

Pacemakers

Pacemakers deliver small electric impulses to the heart to regulate heart beat rhythm.

- Introduced in 1958
- Remote monitoring
- Hackable



http://en.wikipedia.org/wiki/Artificial_cardiac_pacemaker

<http://www.forbes.com/sites/singularity/2012/12/06/yes-you-can-hack-a-pacemaker-and-other-medical-devices-too/>

Obstacle Detection in 2004



obstacle detection device from 2004 <http://www.hitl.washington.edu/projects/wlva/>

The prototype WLVA consists of three major components: a head mounted display (HMD), backpack mounted equipment, and software. The HMD incorporates the scanning fiber display and optics mounted in a tube on one side of a spectacle frame, and a video camera with IR light emitting diodes mounted on the other side. The backpack-mounted equipment consists of a laptop computer, an embedded processor, and hardware to drive the scanning fiber display.

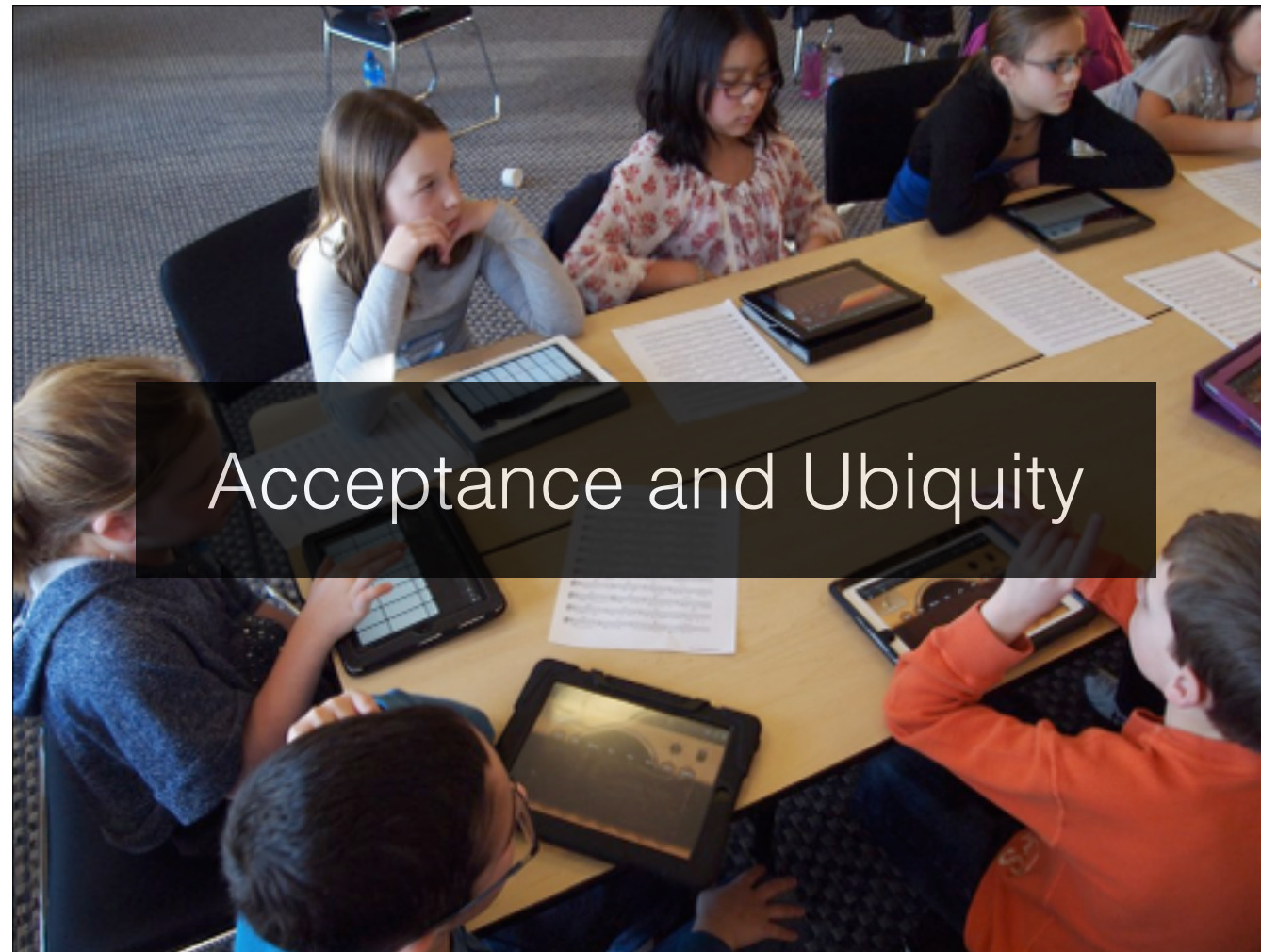


iGlasses have obstacle detection and vibrate when the user gets close to a low hanging branch or other object. <http://ambutech.com/iglasses>



photo: Google Glass by Lubomir Panak <https://www.flickr.com/photos/drakh/9896425204/>

Google patent on eye frame based obstacle detection <http://www.google.co.in/patents/US3654477>



Which of these kids is using an assistive technology device? Tablets, phones, and assorted mobile devices are so common that stigma associated with earlier devices has diminished.

photo: student iPad school by Brad Flickinger <https://www.flickr.com/photos/56155476@N08/6660001925/>



Complexity in
the right place

“What made the Rio and other devices so brain dead was that they were complicated. They had to do things like make playlists, because they weren’t integrated with the jukebox software on your computer. So by owning the iTunes software and the iPod device, that allowed us to make the computer and the device work together, and it allowed us to put the complexity in the right place.” -Steve Jobs

photo: Seele der Musikindustrie by ken fager <https://www.flickr.com/photos/kenfagerdotcom/4398922649/>

Internet of Things



IPv6 allows every object to have its own ip address. Wearable devices can surround and work within your body and be uniquely defined.

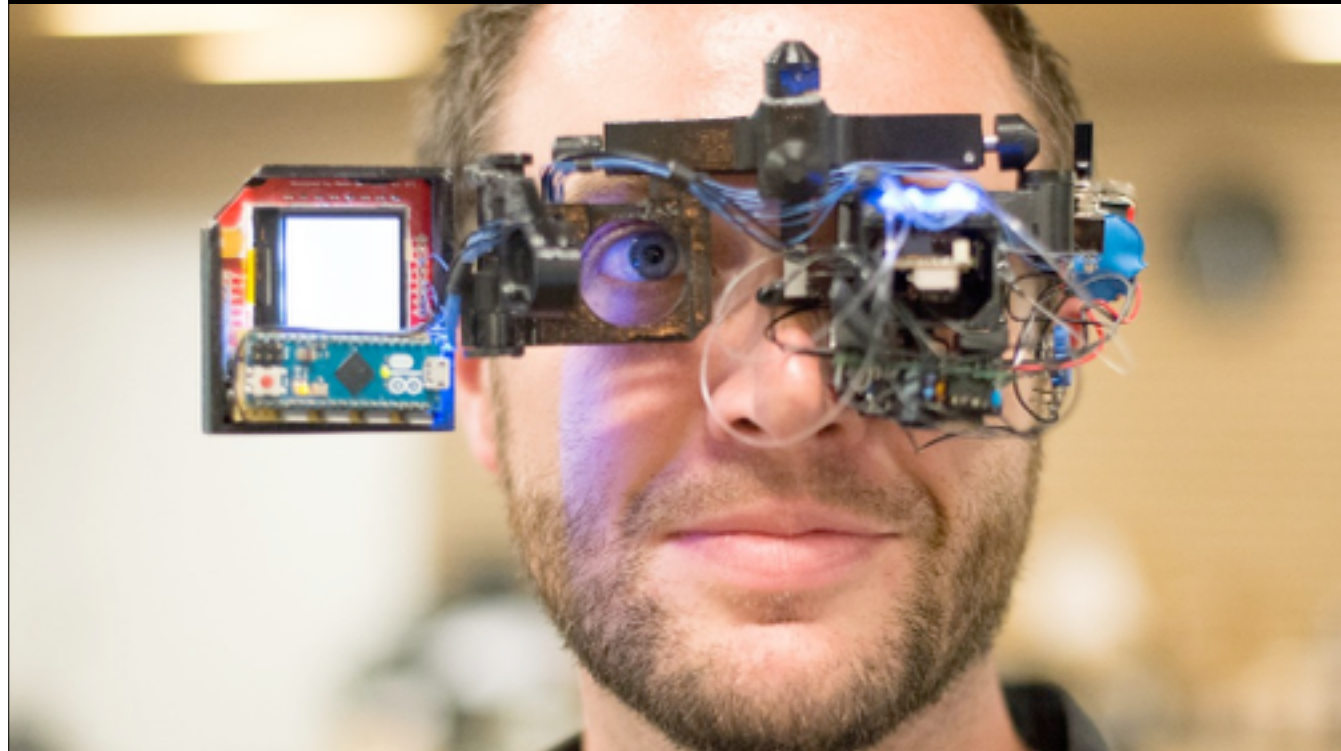
lamprey inspired nano-robots are being developed that can migrate through your body for healthcare.

<http://www.popsci.com/technology/article/2012-03/cyberplasm-micro-robot-modeled-after-sea-lamprey-could-swim-around-inside-you>

photo: pacific lamprey by USFWS Pacific <https://www.flickr.com/photos/usfwspacific/7129322663/>

Sensors

Vision



- MIT's Media Lab has been innovating the vision-based computers for many years.
- Eye-based wearables follow the head and the user's point of interest.
- Eye tracking allows hands free. Sensors are at head level instead of floor level (cane)

photo: <http://cameraculture.media.mit.edu/>

Hands Free



Hands free control is what makes wearable accessibility devices mainstream. Handsfree control works for drivers, people carrying objects, provides alternative gesture support, and helps those with physical disabilities.

<http://www.usatoday.com/story/tech/2013/10/22/google-glass-aids-disabled/3006827/>

photo: no hands by Jack Zalium <https://www.flickr.com/photos/kaiban/6838891054/>



The tilt control function is available on gitHub to integrate with other applications.

github.com/kaze0/tiltcontrol <http://www.fastcompany.com/3027054/most-innovative-companies/look-ma-no-hands-tilt-control-brings-touchless-navigation-to-googl>

This is just one example of using Glass and other devices to control the user's environment and computers without their hands.

Watch for more work towards hands-free devices at <https://www.facebook.com/googleglassaccessibility>

Piercings

Tongue
Drive



RFID implants

Tongue piercing as a switch device: <http://www.washingtonpost.com/blogs/innovations/wp/2013/12/02/the-wheelchair-driven-by-a-tongue-piercing-cool-concept-faces-uphill-battle/>

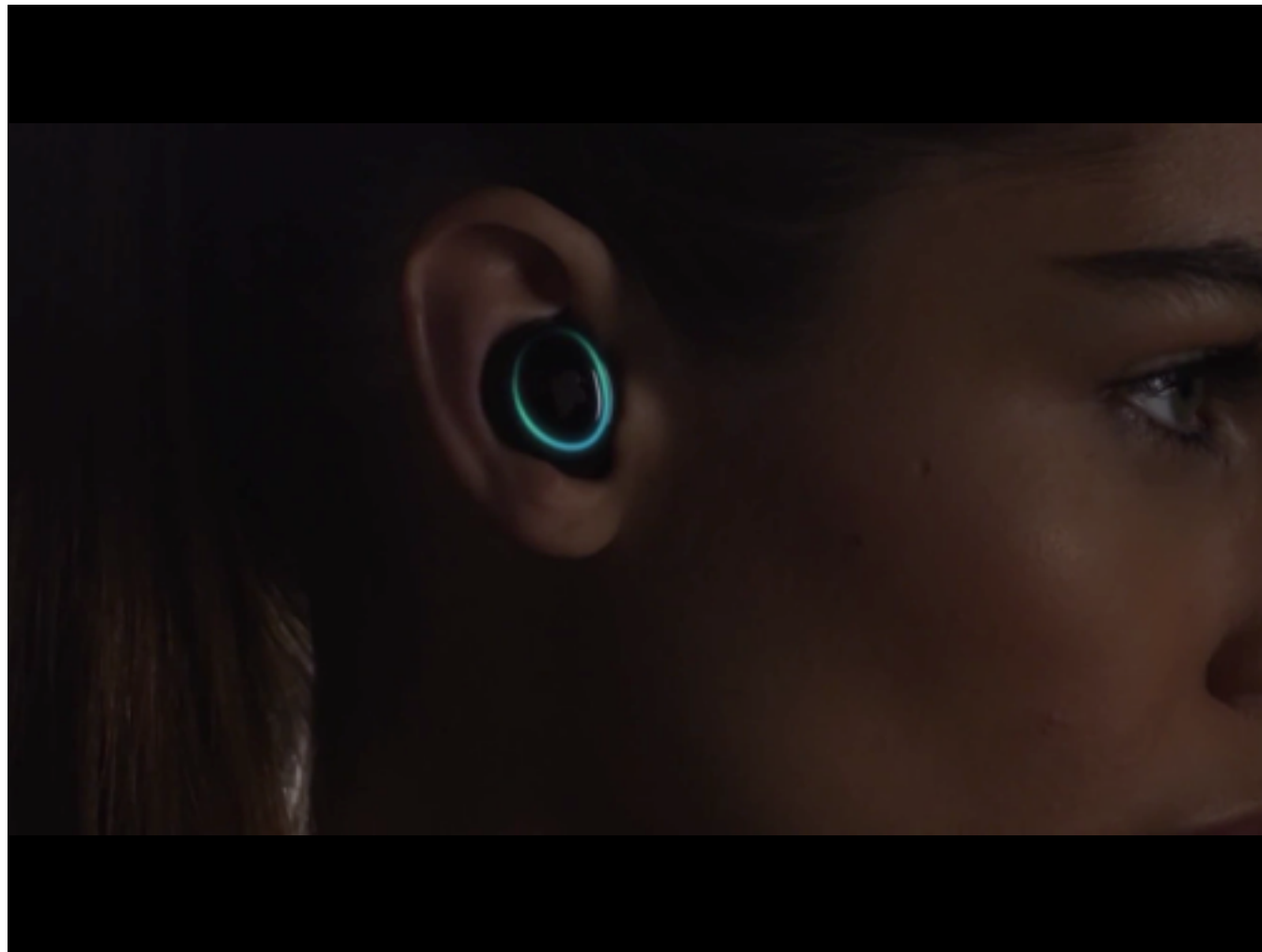
RFID implants could be used as an identification resource. <http://www.forbes.com/sites/andygreenberg/2012/08/13/want-an-rfid-chip-implanted-into-your-hand-heres-what-the-diy-surgery-looks-like-video/>

<http://amal.net/>

Hearing



- Ear based devices are common, especially after years of bluetooth headphones.
- Ears provide same benefits of eye-based location.
- Biometric information, such as body temp, pulse are available
- hands-free, display-free interactions
- Japanese researchers and ear based computer <http://phys.org/news/2014-03-japan-tiny-ear.html>



The Dash is a Kickstarter funded project to create an ear-based device that provides hands-free/display-free support, biometrics, and audio enhancement.

This is just an example of ear-based exploration. <http://www.bragi.com/>

Hearing based devices are display independent, a paradigm shift for designers.

Biometrics



Dialog is just one example of using biometric sensors for health monitoring. This watch and patch detect seizures, user feedback, and emergency alerting. <http://www.artefactgroup.com/content/work/dialog/>

Biometric tracking has become a key feature of most wearables, watch for Apple's expected announcement of a health monitoring package.

iOS8 Health - Google Fit



Apple, Google, and even Microsoft are creating platforms that allow the user to synchronize their various health monitoring devices, diet tracking, and medical health records

<https://www.apple.com/ios/whats-new/health/>

<https://developers.google.com/fit/overview>

<http://apps.microsoft.com/windows/en-us/app/healthvault/728f1c88-7e2f-4b40-95c1-74fc09983689>



clothing can be embedded with threading that transmits electronic signals. A connected shirt can track movement, bio metrics, and potentially gestures.

This is great for health monitoring. <http://www.omsignal.com/>

Clothing can also be combined with sensory output, such as vibrations, to give the wearer feedback.

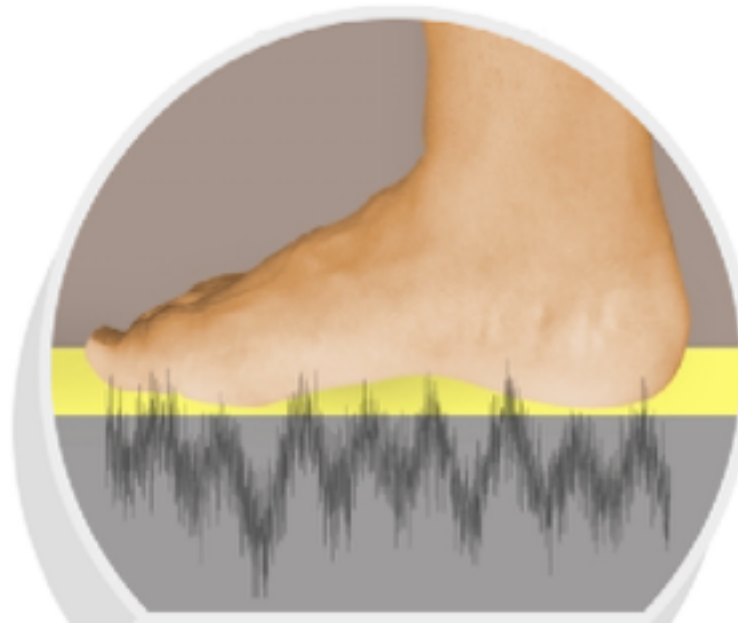
Navigate Jacket



This jacket gives vibrational feedback to let the user know if they should turn left or right while walking.

<http://wearableexperiments.com/navigate/>

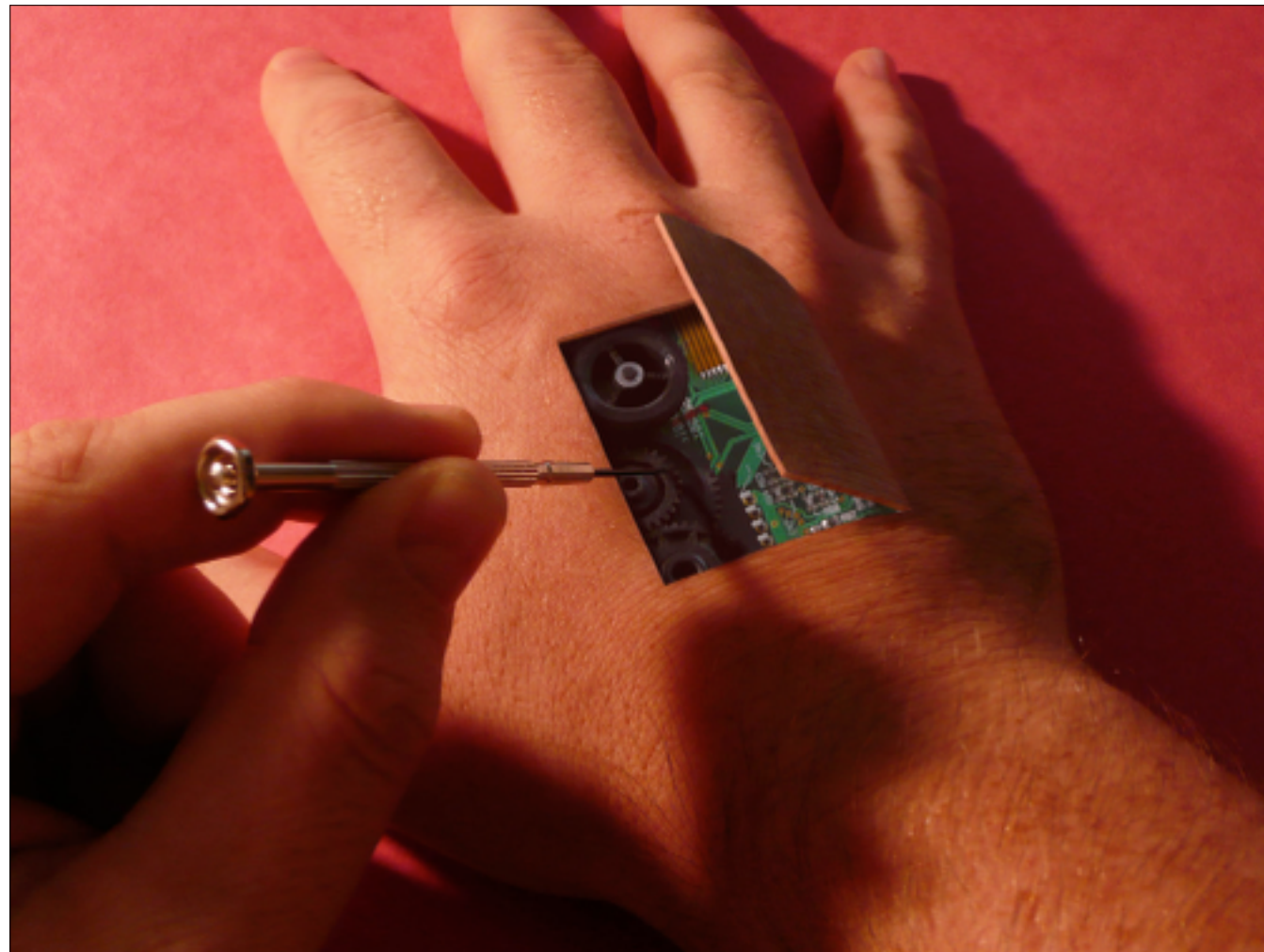
Vibrating Shoes



Applying vibrations to the feet can provide enough stimulation to trigger a threshold within individuals with limited sense of touch. This could prevent falling.

<http://spectrum.ieee.org/tech-talk/biomedical/devices/vibrating-shoes-restore-balance-for-seniors>

<http://spectrum.ieee.org/ns/pdfs/0405balaf1.pdf>



Prosthetics are no longer static extensions of the body. They contain multiple sensors, processors, and controllers. DARPA has been encouraging prosthetic and exoskeleton designs. <http://science.howstuffworks.com/prosthetic-limb4.htm>

the DEKA arm is a good example http://www.dekaresearch.com/deka_arm.shtml

photo: Prosthetic Hand by Vern Hart <https://www.flickr.com/photos/vernhart/1501901190/>

Motion



Detecting the person's motion for gesture recognition, detecting their tasks, understanding the difference between a sit up and a push up, hands-free
Lars Asplund, Professor Emeritus in Robotics at MDH, is working on this hand-based device <http://phys.org/news/2014-05-virtual-keyboard-reality-video.html#nRlv>

Memory



smart watches could help those with memory loss via geolocation/geofencing, reminders, providing information to rescue

http://www.alzheimers.org.uk/site/scripts/documents_info.php?documentID=109

photo: No, I'm sorry, I don't know who you are by Neil Moralee <https://www.flickr.com/photos/neilmoralee/8268874659/>

Short Term Memory Loss



People with short term memory loss require reminders. The watch is a natural location for reminders. Motion and biometric sensors could also detect when an activity has been accomplished. This avoids reminding user to do an already completed task and encourages independence.

shown watch: <http://www.appsapk.com/calendar-reminder-smart-extras/>



Emotion Recognition

Sension is working on facial and gesture recognition with Google Glass <http://www.sension.co/case>

Text and Object Detection



WearScript from Open Shades uses Mechanical Turk and VizWiz to allow blind users to identify text and objects. <http://www.openshades.com/>

Text translation has also been integrated by Word Lens. <http://questvisual.com/us/>

Apple Pay



Apple Pay allows user to make payments with minimal movements

Remote microphone for voice dictation, actions

Great potential for physical disabilities

<https://www.apple.com/apple-pay/>

Instant Captioning



Captioning on Glass allows a person with a hearing impairment to see what another person is saying. This Georgia Tech project is available as open source. <http://borg.cc.gatech.edu/ccg/?q=projects/cog>

Google also has a patent on speech to text transcription <http://goo.gl/p9IElq>

<http://substance-en.etsmtl.ca/google-glass-instant-captioning-for-hearing-impaired/>

Reading



The finger reader project from MIT uses a finger based device to track the sentence a user is reading and convert to speech. It also guides the person to move up/down if they go off the line. <http://fluid.media.mit.edu/projects/fingerreader>

This should be possible with an eye-based device.

OrCam Reader

Eye glass mounted camera and bone conducting headphone.

Uses your finger as the guiding gesture.



An intuitive portable device with a smart camera mounted on the frames of your eyeglasses, OrCam harnesses the power of Artificial Vision to assist the visually impaired. OrCam recognizes text and products, and speaks to you through a bone-conduction earpiece. <http://www.orcham.com/>

Force-Sensing Switches



- Replace joysticks and buttons with wearable switches that detect pressure change
- Embed within shoes and gloves



http://technologylicensing.research.ufl.edu/technologies/13041_wearable-force-sensing-orthotic-device-enabling-disabled-persons-to-control-electronics

<http://apps.research.ufl.edu/otl/pdf/marketing/13041.pdf>

The intellect of the wise is
like glass; it admits the
light of heaven and reflects
it.

-Augustus Hare

<http://www.brainyquote.com/quotes/keywords/glass.html#MkmtKupHAEV7W3f.99>

The opportunity exists for us to build devices that express our hidden selves, explore the world with new senses, and combine reactors and reactions.
What could you solve with wearable computing?

Resources

- **Ted Drake**

- Twitter: [@ted_drake](https://twitter.com/ted_drake)
- Web: Last-Child.com
- [SlideShare.net/7mary4](https://slideshare.net/7mary4)

- **WearAbility**

- Twitter: [@wearabilityorg](https://twitter.com/wearabilityorg)
- Web: WearAbilty.org

http://twitter.com/ted_drake

<http://last-child.com>

<http://slideshare.net/7mary4>

<http://twitter.com/wearabilityorg>

<http://wearability.org>