Estonian Information Technology College

A different kind of IT

Kaido Kikkas

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What if...

- ...we couldn't see, so the display is useless?
- ...we had only one hand – or none?
- ...our fingers couldn't flex?
- ...we had so poor control of movement that even hitting the keyboard unit was difficult, more so for a specific key?
- … we lacked the muscle power to press keys?
- ACTUALLY, PEOPLE DO USE COMPUTERS DESPITE ALL THAT

Regular vs special

- A quite difficult choice:
  - A specialized device (e.g. a keyboard or a pointing device) could fit the person better
  - A regular device allows mobility and independence of the specific model. Also, it allows sharing the computer with regular users
- It helps to send descriptions of special use cases to producers of peripheral hardware

Visual impairment

- Solutions can be sophisticated and expensive compared to some other groups of disabilities
- Three main categories – screen magnification, sound and tactile output (most commonly, Braille)
- Language specific
- Depends on operating system, hardware and stardards compliance of software

Screen reader

- Software that attempts to recognize screen output
- The results go (most commonly) to speech synth or Braille monitor/printer
- Mostly proprietary (JAWS is perhaps the most common), some open-source projects like Orca, Emacspeak and NVDA exist. Windows XP and newer have Narrator, OS X has VoiceOver, Android has Google Text-to-Speech
- Up to recently, expensive (in Estonia, the person has to pay 110€, old DOS version and new test version are free of charge)
- Support for Estonian is still poor

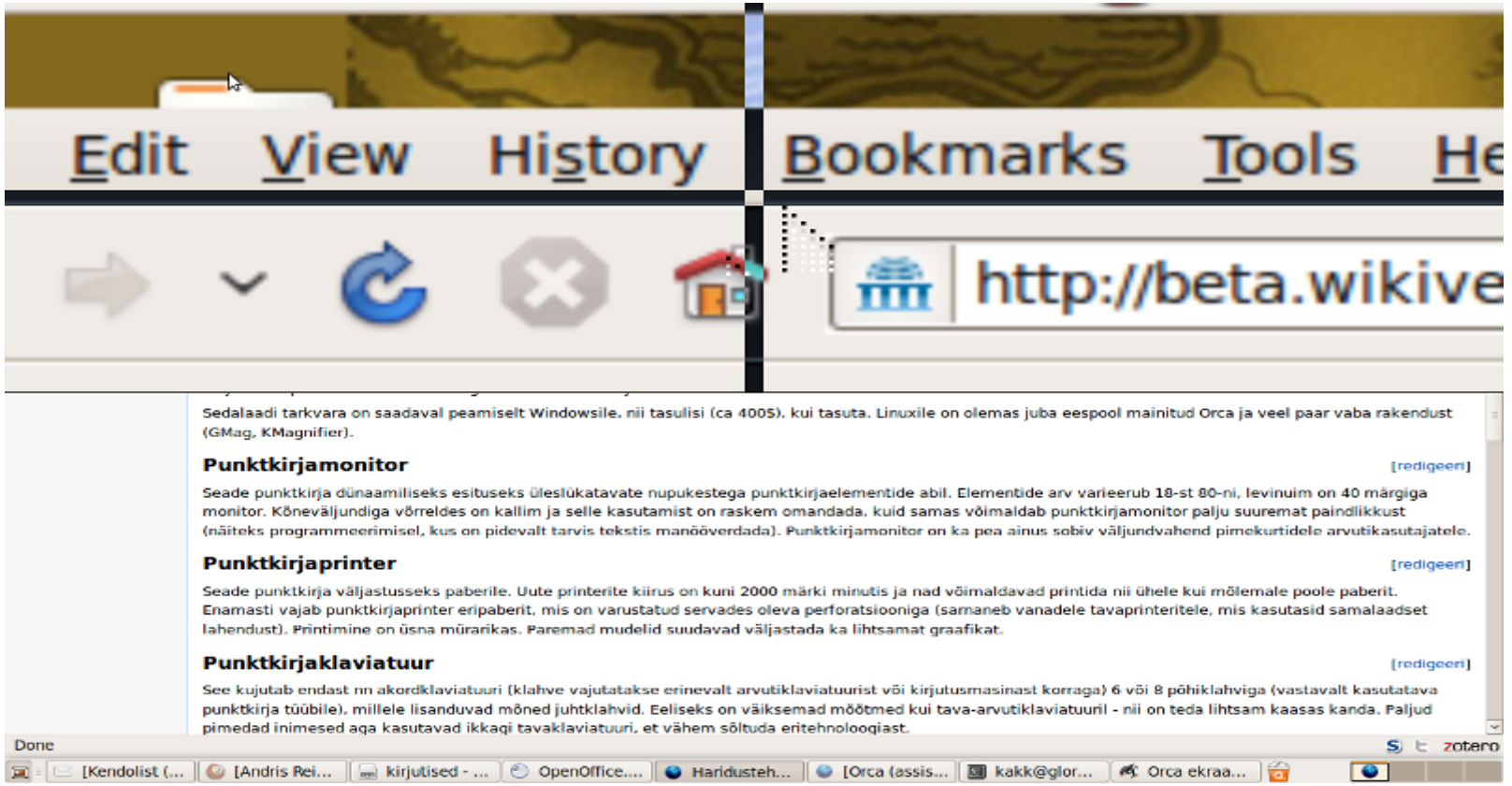
Speech synth

- Software that turns text to speech (commonly paired with screen reader. There are some separate hardware devices as well (expansion cards or standalone units)
- Besides visual impairments, used by people with speech impairments (e.g. spastic throat muscles)
- Experimental solutions for Estonian language can be found at http://www.phon.ioc.ee and http://heli.eki.ee/vaegnagijale/.
- A promising FLOSS project: eSpeak (multi-platform, multi-language)

Screen magnifier

- Software that emulates a magnifying glass on screen, enlarging the screen portion below for 2 to 16 times.
- Problems:
    - Controlling the 'glass'
    - Dependent on graphic drivers
    - Software must comply with standards
- Mostly Windows - commercial (e.g MAGic Pro – in Estonia, available for the payment of 70€) and some free of charge. Some promising solutions for Linux

GNOME screen magnifier on Ubuntu



Braille display

- Device for dynamic presentation of Braille, using Braille elements with protruding knobs; the line can have 18-80 cells (characters)
- More expensive than voice output (in Estonia, the payment range from a couple of hundred to over 1000€), but is also more flexible (e.g. for programming)
- The main assistive solution for people with both visual and hearing impairment

A Braille display

http://upload.wikimedia.org/wikipedia/commons/0/06/Refreshable_Braille_display.jpg

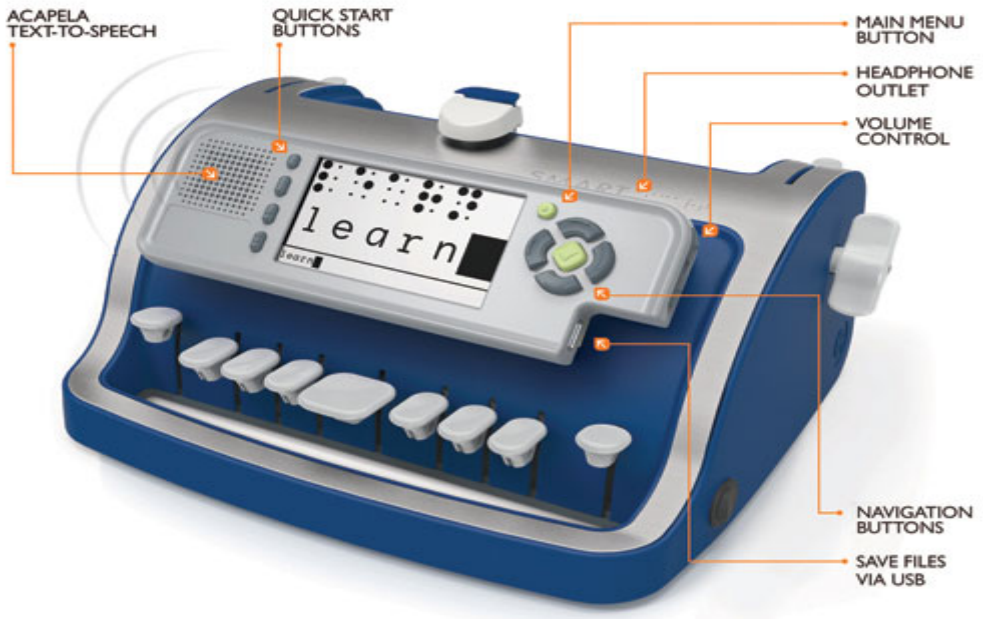
Braille embosser (printer)

- Device for Braille output
- Speed can reach 2000 characters per minute
- One- or two-sided
- Usually needs special paper (or plastic)
- Quite noisy
- Advanced models can also output simpler graphics (e.g. diagrams)
- See http://www.viewplus.com/

Braille keyboard

- Chorded keyboard with 6-8 main keys (depending on the type of Braille used), plus some control keys
- Smaller than regular keyboard – quite mobile
- Many blind users stick with regular keyboards (sometimes, tactile stickers or voice feedback is used)

Perkins SMART Brailler



http://upload.wikimedia.org/wikipedia/commons/d/d9/Perkins_SMART_brailler.jpg

BrailleIn

Photo: Marcin Wichary, http://www.flickr.com/photos/mwichary/2251355897/

Tactile mouse

- Similar to regular mouse, but additionally gived tactile feedback via elements on the back of the mouse
- Still just prototypes (VirTouch VTPlayer was discontinued in 2009). Mostly Windows, but VTPlayer had a Linux driver available (from a volunteer at Sourceforge)

VirTouch VTPlayer

http://vtplayer.sourceforge.net/

PDAs for blind people

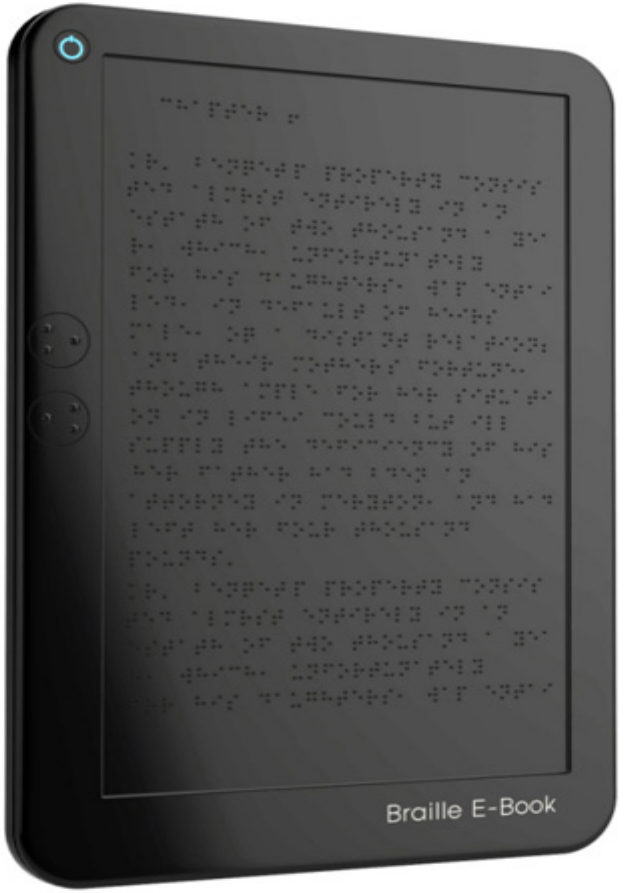
- Similar to netbooks or tablets
- Output via a hardware synth and/or Braille display, input via a regular or Braille keyboard
- Can be connected to regular computers
- Some are compatible with mobile devices as well

RefreshaBraille 18 with an iPhone

Photo: daveynin, http://www.flickr.com/photos/daveynin/6932301000/

Coming soon: e-books

- E-books in Braille
- Electroactive polymers (change physical shape when receiving electric signals)
- A prototype by Yanko Design



http://upload.wikimedia.org/wikipedia/en/thumb/8/80/Braille_e-book.jpg/220px-Braille_e-book.jpg

A special notion: the Web

- All the smart stuff above requires one thing: standards-compliance
- „It works with Explorer“ is NOT a valid argument!
- The first step – W3C validator: http://validator.w3.org
- See also: http://www.w3.org/WAI/
- Useful: http://wave.webaim.org/toolbar
- NB! There are significantly more blind people on the Web than usually assumed!

Mobility and control impairments: main challenges

- Hyperkinesis (spasticity) or hypokinesis (weakness)
- Impaired coordination of movements
- Dysfunctional or missing limbs
- Problems with grasp
- ...
- Mostly everything demanding fine motor control: inserting USB sticks or DVD-s, using mouse or keyboard etc etc

Some common problems

- Mouse - try with your non-dominant hand
- Key combos
- Badly designed software

Solution

- Hardware is often primary
- Software, while secondary, can still be vital
- A very wide choice of measures
- THE MAIN RULE: If a person retains control over just a single function, it can also be used to control the computer!
- THAT MEANS: there is <u>no impairment</u> that prevents using computers!

Regular devices

- Special devices can cost tens of times more
- Simple techniques, e.g. a pen in a fist
- Put the keyboard where it works (e.g. at a foot)
- Mounts – special and regular
- Sticks for input
- Mouse vs trackball vs joystick
- Scanner with OCR
- Webcam + sign language

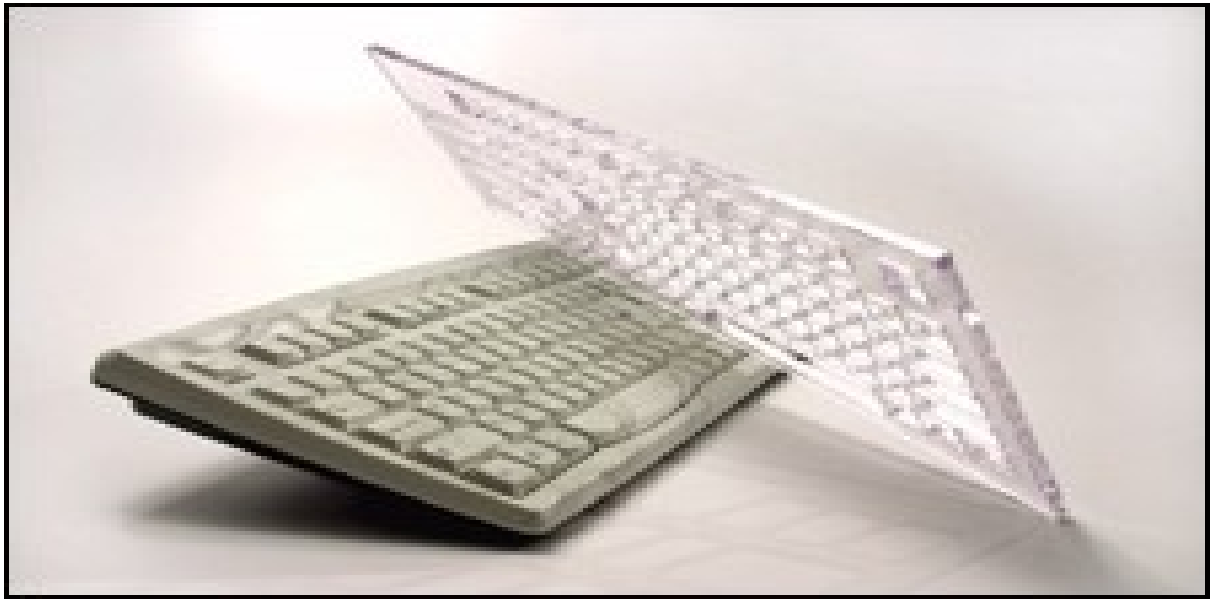
Mouthstick

Photo: David Wallace, http://www.flickr.com/photos/dnwallace/2635909272/

OS access

- First as a DOS complement (AccessDOS), later integrated into all common OS's
- StickyKeys
- RepeatKeys
- SlowKeys
- MouseKeys
- Onscreen keyboards
- Keyguard

Keyguard



http://johannamsspc313.wikispaces.com/file/view/keyguard.jpg/328351870/217x150/keyguard.jpg

Special input devices

- Membrane keyboard
- Mini- and maxikeyboards
- Chorded keyboards
- Other special keyboards
- Concept keyboards
- Touch display
- Foot mouse and other special pointing devices
- Speech input

Some examples

Photo: OregonDOT, http://www.flickr.com/photos/oregondot/6235420475/

Switches

- Not just for lamps...
- Simple hardware, needs software components for providing access
- Slow!
- Any controlled function can be used
- Can substitute both keyboard and mouse!
- Onscreen keyboard
- Mouse switches

Examples

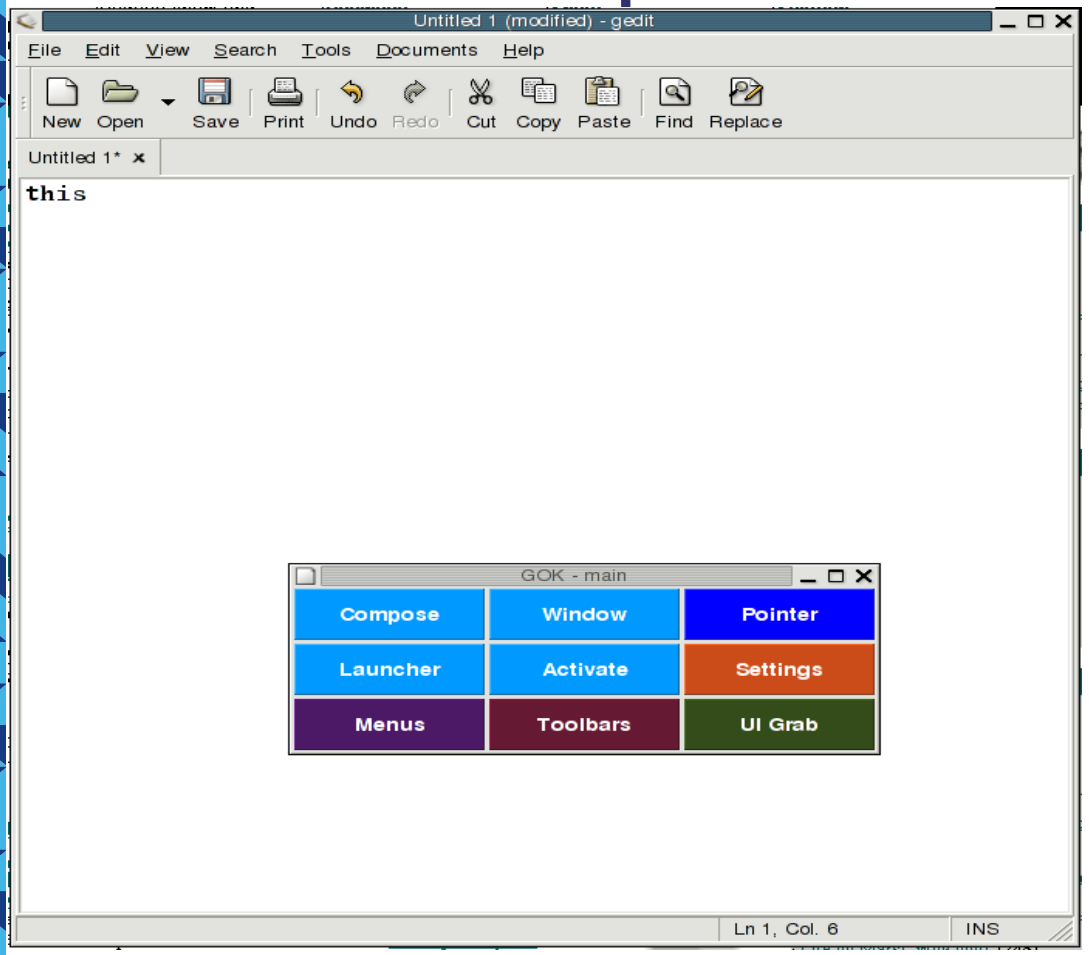
See also: http://en.wikipedia.org/wiki/Switch_access, http://en.wikipedia.org/wiki/Assistive_technology

Sip-and-puff switch

- Input via breathing
- Single or double action
- Works well with simple signals
- The main use – Morse input

Photo: http://en.wikipedia.org/wiki/File:Sip-and-puff_device.jpg

Some more examples



See also:
http://en.wikipedia.org/wiki/Sip-and-puff

Conclusion

- A huge field of challenges – and solutions
- Both special and regular (mix them)
- Hardware and software
- Highly individual
- An excellent way to become MacGyver :-)

For further study

- MS: http://www.microsoft.com/enable/guides/default.aspx
- Apple. http://www.apple.com/education/special-education/
- Ubuntu: https://help.ubuntu.com/community/Accessibility
- Android: https://developer.android.com/guide/topics/ui/accessibility/index.html
- ...

Go invent!