Technology and the Deaf and Hard of Hearing Community

Anna Cavender

11/17/2008
Outline

• Technology and DHH Audiences

• Research projects here at UW
  – MobileASL
  – ClassInFocus
  – ASL-STEM Forum

• Other research on technology for DHH
TTY

- Developed 1964 by Robert Weitbrecht, deaf physicist
- Specific Etiquette:

<table>
<thead>
<tr>
<th>Code</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>BRB</td>
<td>Be Right Back</td>
</tr>
<tr>
<td>CU</td>
<td>See You (be seeing you)</td>
</tr>
<tr>
<td>GA</td>
<td>Go Ahead</td>
</tr>
<tr>
<td>SK</td>
<td>Stop Keying</td>
</tr>
<tr>
<td>SKSK</td>
<td>Now hanging up</td>
</tr>
<tr>
<td>Q, QQ, QM</td>
<td>Question Mark (?)</td>
</tr>
<tr>
<td>PLS</td>
<td>Please</td>
</tr>
<tr>
<td>OIC</td>
<td>Oh, I See</td>
</tr>
<tr>
<td>TMW</td>
<td>Tomorrow</td>
</tr>
<tr>
<td>THX</td>
<td>Thanks</td>
</tr>
<tr>
<td>WRU</td>
<td>Who are You? (or Where are You)</td>
</tr>
</tbody>
</table>

Pros:
- Access to phone network

Cons:
- Communication in English, not ASL
Picturephone

"Picturephone" demonstrated by AT&T at the 1964 World’s Fair

Pros:

– Communication in ASL

Cons:

– Required too much bandwidth for phone system

– Deaf Community excited, then disappointed
Text Messaging

Blackberry, Treo, iPhone, etc.

**Pros:**
- Access to cell phone network
- Cheap and low-tech

**Cons:**
- Communication in English, not ASL
Today’s Video Phone

Many video chat and video conferencing services.

Pros:

– Communicate in ASL or English.
– No dedicated device

Cons:

– Requires high bandwidth for intelligible sign language
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MobileASL

• Deaf people in the U.S. could use video cell phones to communicate in American Sign Language (ASL)

• Problems: low network bandwidths, small cell phone processors

• Solution: video compression specific to sign language
DHH Cyber Community

**GOAL:** Better include deaf and hard of hearing students in mainstream universities

**ClassInFocus:**
Better access in the classroom through technology

**ASL-STEM Forum:**
Growing ASL for Science, Technology, Engineering, Math
DHH Cyber-Community

• **ClassInFocus: Enabling access to STEM* education**
  – High bandwidth connections between universities
  – Networked classrooms allow students to control learning environment

• **ASL-STEM Forum: Enabling ASL to grow in STEM***
  – Online video forum (vlog) to facilitate discussion about signing for STEM

* STEM = Science, Technology, Engineering, Math
Public Law 94-142 (for K-12)

- Individuals with Disabilities Education ACT (IDEA)
  “All children with disabilities are assured a free appropriate public education”

- Shift from centralized residential schools to programs within mainstream schools
  – 85% of d/hh students at mainstream schools

- Trickle through to post-secondary enrollment

Post-secondary Demographics

• 25,000 deaf and hard of hearing students enrolled in ~4,000 post-secondary institutes in U.S.

• 95% of colleges/universities serve 1 or more deaf or hard of hearing student
  – Students are dispersed thinly

• Increased enrollment at mainstream universities

National Center for Education Statistics (NCES) 1999.
Classroom layout

Typical Classroom

Deaf Classroom
Classroom layout

Typical Classroom

Deaf Classroom
Current Accommodations

- Interpreters
- Real-time captionists
- Hearing aids
  - FM systems
- Note takers
Problems:

Deaf and hard of hearing students in mainstream classrooms are often:

– Overloaded with visual information*
– Excluded from content*
– Isolated from peers*

Proposed Solutions:

Modify existing technology to best suit the student by:

– Reducing visual dispersion
– Enhancing classroom collaboration
– Preserving missed content for later retrieval

ClassInFocus

Instructor Presentation

Remote Interpreter

Student Webcam

Sensorimotor substage 6: Object Permanence

- Understanding that objects
  - Have substance
  - Maintain their identity when they change location
  - Continue to exist (ordinarily) when out of sight—otherwise, "out of sight is out of mind"

Participants

Chat

Space for Notes
Reduce Visual Dispersion

On-the-fly video modifications

– Cut, size, zoom, transparency, arrangement
– Student control of interface and layout
Enable Student Flexibility
  – Personalized view of learning environment
  – Independent choice of feeds:
    • slides, video, accommodation, etc.

Enhance Class Interaction
  – Increase channels of communication
  – Better support group work
    • Small group chat, whiteboard, project

Preserve Missed Content
  – Help students find missed information
  – Student-driven video segmentation
ASL-STEM Forum

Problem:

– Lack of scientific terminology in ASL
– Deaf STEM students widely dispersed
– Invented signs are lost

Solutions:

– Sign language dictionaries
– Use video-enabled social networking
Online Dictionaries

- **Shodor Deaf-STEM**
- **RIT Comets**
- **Vcom3D Signing Dictionary**

**Problems:**
- Not scalable
- Limited coverage
- Static
- Avatars not as good as video
Parent topic: Programming Languages
Definition: a machine that manipulates data and executes lists of instructions known as programs.

Example: Example sentence for context: "It will be useful to review some basic concepts about computers."

Other suggested signs for "Computers" (more...)
DHH Cyber Community

- Richard Ladner
- Anna Cavender
- Jeff Bigham
- Jessica DeWitt
- Daniel Otero
- Bill Clymer (RIT/NTID)
- James DeCaro (RIT/NTID)
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Signing Avatars

• “Translate” English to ASL
  – (limited vocabulary, human designer still needed).

• Used to augment webpages and/or educational materials

• One-way communication

• Example

• Not an interpreter

Tessa, VisiCast

- **TESSA** = Text and Sign Support Assistant
- Converts Post Office clerk's voice to BSL avatar
  - pre-trained voice recognition software
  - constrained set of words in post office context

Cox et. al. *Tessa, a system to aid communication with deaf people.* ASSETS 2002
Thad Starner

• ~20 word lexicon
• 96% correct when unconstrained
• 98% with added 5-word sentence constraint

Copy Cat, ASL Game

• *CopyCat*
  – helps deaf children acquire language skills while playing the game
  – collects gesture data for ASL recognition system

HandTalk

• Detects system-specific gestures
  – Not related to ASL
• Detects finger-spelling alphabet
Automatic Voice Transcription

• Instructor trains the system on own voice prior

• Still research (high error rates)

• Not a captionist

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Live Transcription: CSC 8400 Computer Organization

So maybe this is the point you're making. Let's see if we can do something clever.

We just do something called register renaming.

And if you look there are no longer any of those dependencies.

We eliminated the name dependencies just by making use of more of the registers.

So it's an idea that's been around for a long time and compilers now try to do this it turns out.

Has anybody studied algorithms at some point in your past. There's a class of problems classic out under the category of problems called NP complete and these are problems that have exponential complexity.
Facetop Tablet

- Digital Ink and Video
- Reduces Visual Dispersion
- Increases participation (note-taking)

Facetop Tablet: Miller et al. ASSETS 2006.
SignLink Studio

• ASL is visual and dependent on time.
• Videos are unlike text – can’t easily link
• Example Webpage completely in ASL
  – ASLPah

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www.cs.washington.edu/homes/cavender

MobileASL: mobileasl.cs.washington.edu

DHH Cyber Community: dhhcybercommunity.cs.washington.edu