Accessible Education through Crowd-Powered Systems

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Dual Goals

1. Advocate for Accessibility

2. Accessibility w/ Crowd-Powered Systems
Disability in Education

- 15% of the world’s population is disabled (about 1 billion people)
- 9% of the school-age population have disabilities

- 13% of undergraduate IT majors have disabilities.
  - 5% of graduate IT majors have disabilities.
  - 0.8% of IT doctorates have disabilities (53 between 1999 and 2004)

- 40% of students with disabilities complete a bachelor's degree
  - Compared with 60% of everyone else
Apple Tablet Guides

By Jeff on January 6, 2010 1:08 PM

A lot of people have been talking about the iPhone's new open screen, multi-touch device. The iPad is one of those devices, and one that can be used to help screen readers, as opposed to the fancy digital paper.

Apple designs great products and gives them away for free. Because the iPhone is a product for blind people, it has a built-in text-to-speech function, which is compatible with many screen readers, as opposed to the fancy digital paper.

We in the accessibility field are really interested in seeing if it works. It's a great product and one that is accessible to people with disabilities.

Department of Justice
Office of Public Affairs

FOR IMMEDIATE RELEASE

Justice Department Reaches Three Settlements Under the Americans with Disabilities Act Regarding the Use of Electronic Book Readers

WASHINGTON — The Justice Department today announced separate agreements under the Americans with Disabilities Act (ADA) with Case Western Reserve University in Cleveland, Pace University in New York City and Reed College in Portland, Ore., regarding the use in a classroom setting of the electronic book reader, the Kindle DX, a hand-held technological device that simulates the experience of reading a book.

Under the agreements reached today, the universities generally will not purchase, recommend or promote use of the Kindle DX, or any other dedicated electronic book reader, unless the devices are fully accessible to students who are blind and have low vision. The universities agree that if they use dedicated electronic book readers, they will ensure that students with vision disabilities are able to access and acquire the same materials and information, engage in the same interactions, and enjoy the same services as sighted students with substantially equivalent ease of use. The agreements that the Justice Department reached with these universities extend beyond the Kindle DX to any dedicated electronic reading device.

These agreements follow the Jan. 11, 2010 agreement between the Justice Department, Arizona State University, the National Federation of the Blind and the American Council of the Blind concerning the use of electronic book readers.
Accommodation is Expensive and Slow

$150 / hour for real-time captioning

- hours to convert book to digital text
  - days to convert its figures

Adapting assignments
Crowd Education

• Prepared Resources
  – fix a problem once, reach many students

• More (distributed) Interaction
  – as students support students, less accommodation?

• Student Crowds
  – students have the expertise to help
An Accessible Online Library
for people with print disabilities

Free memberships for qualified U.S. students and schools!

Sign Up!

Learn more about Bookshare

This project is supported by the U.S. Department of Education, Office of Special Education Programs (Cooperative Agreement #H327K070001). Opinions expressed herein are those of the authors and do not necessarily represent the position of the U.S. Department of Education.

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SUMMARY
Figure 1.1, The Hydrologic Cycle, shows the processes involved in the water cycle, including evaporation, formation of clouds, precipitation, condensation, infiltration and the paths taken by the water when it has been returned to the ground.

LONG DESCRIPTION
The diagram shows the processes of evaporation, condensation, evapotranspiration, water storage in ice and snow, and precipitation. A large body of water (an ocean), sky, earth surface and cross section of the earth structure are shown to illustrate the processes. The diagram also shows what happens to the water which has returned to the earth as precipitation, including surface runoff, infiltration of the water into the ground surface, percolation, ground water flow, and the movement of water flowing into an ocean. The water table and ground water flow are also shown.

ANNOTATION ADDED BY TEACHER
In the winter if it is below the freezing point, precipitation may take the form of snow rather than rain.
VizWiz

Real-Time Answers to Visual Questions
Releasing VizWiz

• Released on May 31, 2011
  – 5000 users asked more than 50,000 questions
  – average time to first answer < a minute
Legion:Scribe

Real-Time Captions by Groups of Non-Experts
# Real-Time Captioning

<table>
<thead>
<tr>
<th>Stenographers</th>
<th>ASR</th>
</tr>
</thead>
<tbody>
<tr>
<td>expensive</td>
<td>cheap</td>
</tr>
<tr>
<td>difficult to schedule</td>
<td>available on demand</td>
</tr>
<tr>
<td>lack domain expertise</td>
<td>trained for new vocab</td>
</tr>
</tbody>
</table>

pretty accurate

Can I help?

**NO,**
you are worse than ASR.
Real-Time Captioning

Scribe
System Overview

Flash Media Server

Speech Source
we have a crystal that has a two-fold axis ...

Speech

Caption Stream

Output
we have a crystal that has a two-fold axis

Merging Server

Merged Captions

Scribe Algorithm

Multiple Sequence Alignment

1: learning is such a suitcase word though right so has a lot of there is a lot
2: o learning is such a suitcase word though right so has a lot
3: learning ss such a suitcase word though learning has is a lot
4: learning is su h right so learning a lot
5: so learning is such a suitcase though learning has a lot
6: learning is such a suitcase word though right this in a lot
F: so learning is such a suitcase word though right so learning has a lot of there is a lot

Online Version

<table>
<thead>
<tr>
<th>Graph</th>
<th>Stage 1</th>
<th>Stage 2</th>
<th>Stage 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Time</td>
<td>open</td>
<td>the</td>
<td>file</td>
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<tr>
<td>open</td>
<td>.java</td>
<td>java</td>
<td>file</td>
</tr>
<tr>
<td>Worker 1</td>
<td>open</td>
<td>the</td>
<td>now</td>
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<td>open</td>
<td>java</td>
<td>file</td>
</tr>
<tr>
<td>Worker 3</td>
<td>open the java</td>
<td>file</td>
<td>up</td>
</tr>
<tr>
<td>Baseline</td>
<td>open the java</td>
<td>file</td>
<td>up</td>
</tr>
</tbody>
</table>

Scribe Interface

Encourages:
- real-time input
- global coverage
- short sequences

Co-evolution of Interface and Algorithm
Tradeoff

Failures:
“n-factorial” → “in pectoral”
Interesting Qualities

• Captionists can be experts
  – not at captioning but in the subject

• Low cost
  – $30/hour on Mturk (did not optimize)
  – or free (impossible before)

• Recruited on demand
  – for only as long as needed
Summary

• To be open to all, content must be accessible

• Scale Helps
  – Produced once, can be reused by many (usually)
  – Many students ~= many experts

• Making interactive content accessible
  – leveraging the student crowd
Thanks!

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