Personalized Adaptive Accessibility

Krzysztof Z. Gajos
- Health condition?
- Impairment?
- Disability
- Handicap?
• Can a wheelchair user enter MIT?

• What are the social consequences of the current MIT “UI” for wheelchair users?
Redesign
<table>
<thead>
<tr>
<th>Font Style</th>
<th>Size</th>
<th>Underline Style</th>
<th>Effects</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Double solid</td>
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</tr>
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<tr>
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</tr>
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<tr>
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<td></td>
<td></td>
</tr>
<tr>
<td>Latha</td>
<td>17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lucida Console</td>
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<tr>
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<tr>
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<tr>
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</tr>
<tr>
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<tr>
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Preview: Times New Roman
### Font Formatting

**Font**

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<td>Small Fonts</td>
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<tr>
<td>Symbol</td>
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</tr>
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</table>

**Underline style**

- (none)
- Single solid
- Double solid
- Dotted
- Dashed
- Wavy

**Character Spacing**

<table>
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<tr>
<th>Scale</th>
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<tbody>
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<td>100%</td>
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<tr>
<td>80%</td>
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</table>

**Spacing**

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<th>Normal</th>
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<tbody>
<tr>
<td>3</td>
</tr>
</tbody>
</table>

**Position**

<table>
<thead>
<tr>
<th>Normal</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
</tr>
</tbody>
</table>

**Text Effects**

- Animations
  - (none)
- Blinking Background
- Las Vegas Lights
- Marching Black Ants
- Marching Red Ants
- Shimmer
- Sparkle Text

**Effects**

- Strikethrough
- Double Strikethrough
- Superscript
- Subscript
- Shadow
- Outline
- Small Caps
- Emboss
- All Caps
- Engrave
- Hidden

**Preview**

```
Times New Roman
```
Impaired dexterity
Low strength
Average Time to Complete a set of tasks

Motor-impaired with default interfaces

Able-bodied with default interfaces

Performance Gap
Average Time to Complete a set of tasks

Motor-impaired with default interfaces

Motor-impaired with SUPPLE

Able-bodied with default interfaces

Performance Gap
A Vision for a World Without Handicaps

- Interfaces share the burden of adaptation
- Accessibility solutions are **personalized**
- Accessibility solutions are **adaptive**
- Solutions can **scale** to millions of individuals
Interfaces share the burden of adaptation
Solutions can scale to millions of individuals.
DESIGN
Design by Genius

Specification

1955 -- 2011
Design by Exploration

Elaboration
(opportunity-seeking: from singular to multiples)

Design Process

Reduction
(decision-making: from broad to specific)

starting point

focal point

[Buxton, Sketching User Experiences]
Adaptation to Devices
Details

Senders: khai@cc.gatech.edu
Date: Mon Feb 21 12:07:11 PST 2005
Recipients: announcements@ubicomp.org
Subject: [Announcements] PERVASIVE 2005: Extended Workshop Deadlines, Ad...

Content

<TEXT/PLAIN; charset=us-ascii>

**********ADVANCE PROGRAM / REGISTRATION**********

The advance program of PERVASIVE 2005 is now online
http://www.pervasive ifi.lmu.de/program.html

The early registration deadline is March, 14th 2005
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Some Pervasive 2005 workshops have extended their
deadlines for another week. Please take advantage of the
opportunity to present your research results in one of the
following workshops:

W2: International Workshop on Software Techniques for Embedded
and Pervasive Systems (STEPS), 2005
(deadline extended to March 1st)
http://www.pervasive ifi.lmu.de/workshop.html#W2
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W3: PerGames 2005: Second International Workshop on Pervasive
    Gaming Applications
Map Demo
Pick a location
The Map

Info

Photo

Name: Dan
Office: 588

Location: (824.0, 240.0)
Accessibility solutions are personalized
Evaluating Success

\[ \text{cost( )} = 4 \]

\[ \text{cost( )} = 12 \]
Concerns in UI Design

- Perceptual effort
- Cognitive effort
- Motor effort
- Aesthetics
Concerns in UI Design

- Perceptual effort
- Cognitive effort
- Motor effort
- Aesthetics
Adapting to Motor Abilities

cost(...) = time
Collect Motor Performance Data

- Pointing
- Dragging
- List Selection

Select 21
Accessibility solutions are adaptive
What we get in the wild

What we want

In Situ Observations

\[ \text{Index of Difficulty} \]

\[ \text{Movement Time} \]

\[ \begin{array}{cc}
0 & 10000 \\
1000 & 9000 \\
2000 & 8000 \\
3000 & 7000 \\
4000 & 6000 \\
5000 & 5000 \\
6000 & 4000 \\
7000 & 3000 \\
8000 & 2000 \\
9000 & 1000 \\
10000 & 0
\end{array} \]

In Lab Observations

\[ \text{Index of Difficulty} \]

\[ \text{Movement Time} \]

\[ \begin{array}{cc}
0 & 10000 \\
1000 & 9000 \\
2000 & 8000 \\
3000 & 7000 \\
4000 & 6000 \\
5000 & 5000 \\
6000 & 4000 \\
7000 & 3000 \\
8000 & 2000 \\
9000 & 1000 \\
10000 & 0
\end{array} \]

Deliberate, targeted movements
Deliberate, targeted movement?
A Data-Driven Approach
Data from a formal experiment

Data from in situ observations

Mix of unlabeled +ve and -ve examples

[Elkan & Noto, KDD’08]
Results

In Situ Observations

Filter

Filtered

In Lab Observations

≈
A Vision for a World Without Handicaps

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A Vision for a World Without Handicaps

- Interfaces share the burden of adaptation
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A Vision for a World Without Handicaps

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A Vision for a World Without Handicaps

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- Accessibility solutions are **adaptive**
How Else Can We Make The Design Process Scale?