Modelling of users’ capabilities

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Modelling of Users’ Capabilities

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Department of Computer Science
Loughborough University

13th January 2008
Outline

Motivations and Goals

Modelling of Users’ Capabilities
  Basic Concepts

Architecture
  Modelling Components
  Adaptation and Interaction Components
  Architecture

Proof-of-Concept
  Tests
  Results

Final Thoughts
  Conclusions
  Further Work
  Acknowledgements

References
Motivations I

▶ No such thing as "the average user" [Keates and Clarkson, 2003]
▶ Information overload [Ho and Tang, 2001, Mulder et al., 2006]
▶ Learning style
▶ Capabilities and impairments
▶ Device capabilities and limitations
▶ User preference
No such thing as “the average user” [Keates and Clarkson, 2003]
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Access Technology (AT)
Motivations II

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- Retrofitted [Barnicle, 2000, Mazrui, 2005]

Motivations and Goals
Motivations II

- Access Technology (AT)
- Retrofitted [Barnicle, 2000, Mazrui, 2005]
- Disparate [Jefferson and Harvey, 2007, Gajos et al., 2007]
Goals

A user modelling and content adaptation system that...
- decides on adaptations
- (at least) semi-automatically applies them
- monitors for feedback (acceptance/rejection)
- allows simulation
- allows integration of existing solutions
- is a generic process that can be applied in many domains
A user modelling and content adaptation system that...
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Goals

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Modelling of Users’ Capabilities

Low(est!?) level; “Intelligence”

This user + this device

Problem-centred
Modelling of Users’ Capabilities

- Low(est!?) level; “Intelligence”
Modelling of Users’ Capabilities

- Low(est!?) level; “Intelligence”
- *This* user + *this* device
Modelling of Users’ Capabilities

- Low(est!?) level; “Intelligence”
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- Problem-centred
Basic Concepts

- Channels
Basic Concepts

- Channels
- Capability Maps
▶ Modelling Components
Modelling Components
Adaptation and Interaction Components
Modelling Components
Adaptation and Interaction Components
(Meta-)Architecture
Modelling Components

- User (and device and data) profiles
- Channels, Properties and Maps
- Data analysis
- Links to Adaptations
- Constraint Satisfaction (and other reasoning)
User (and device and data) profiles
Modelling Components

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- Channels, Properties and Maps
- Data analysis
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- Constraint Satisfaction (and other reasoning)
Calibration
Adaptation and Interaction Components

- Calibration
- Renderers
Adaptation and Interaction Components

- Calibration
- Renderers
- Feedback Loop
Tests
Proof-of-Concept

- Tests
- Results
Proof-of-concept
Tests

- Proof-of-concept
- Adaptations to documents
Tests

- Proof-of-concept
- Adaptations to documents
- Simulated impairments
The AGRIP project was founded in May 2003 to see if it was possible for a mainstream game to be made accessible for blind and vision-impaired players. The game chosen was Quake, by id Software.

By July 2004, beta version 0.2.0 of AccessibleQuake (formerly known as just AGRIP) was released and was demonstrated at Sight Village that year. Since then, we have begun work on making not just a game accessible, but gaining access for blind people to the entire community of an online game.
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Tests

- Two groups
Tests

- Two groups
- Three documents (in different order)
Tests

- Two groups
- Three documents (in different order)
- Calibration
Tests

- Two groups
- Three documents (in different order)
- Calibration
- Time to read
Tests

- Two groups
- Three documents (in different order)
- Calibration
- Time to read
- Errors
Tests

- Two groups
- Three documents (in different order)
- Calibration
- Time to read
- Errors
- Figure
Tests

- Two groups
- Three documents (in different order)
- Calibration
- Time to read
- Errors
- Figure
- Ranking
Results

▶ Range of capabilities
Results

- Range of capabilities
- Times and errors
Results

- Range of capabilities
- Times and errors
- Rankings
## Results

<table>
<thead>
<tr>
<th>Condition</th>
<th>Lowest</th>
<th>Highest</th>
<th>Mean</th>
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<tbody>
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<td>0.6</td>
<td>0.4</td>
</tr>
<tr>
<td>M</td>
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<td>0.4</td>
<td>0.3</td>
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## Results

### Standard Documents (STD)

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<th>Con</th>
<th>Possible</th>
<th>Time (s)</th>
<th>Error (%)</th>
<th>ErrTime</th>
<th>Fig?</th>
<th>Useful?</th>
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<tbody>
<tr>
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<td>74</td>
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### Low-Adaptation Documents (STD)

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<tr>
<th>Con</th>
<th>Possible</th>
<th>Time (s)</th>
<th>Error (%)</th>
<th>ErrTime</th>
<th>Fig?</th>
<th>Useful?</th>
</tr>
</thead>
<tbody>
<tr>
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<td>48.7</td>
<td>80</td>
<td>1</td>
<td>6</td>
<td>5</td>
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<tr>
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<td>36</td>
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### High-Adaptation Documents (HGH)

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<th>Possible</th>
<th>Time (s)</th>
<th>Error (%)</th>
<th>ErrTime</th>
<th>Fig?</th>
<th>Useful?</th>
</tr>
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<td>2</td>
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## Results

<table>
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<th>Condition</th>
<th>Worst</th>
<th>Medium</th>
<th>Best</th>
<th>Participants</th>
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<tr>
<td>O</td>
<td>STD</td>
<td>LOW</td>
<td>HGH</td>
<td>5</td>
</tr>
<tr>
<td>O</td>
<td>STD</td>
<td>LOW, HGH</td>
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<tr>
<td>M</td>
<td>STD</td>
<td>LOW</td>
<td>HGH</td>
<td>5</td>
</tr>
<tr>
<td>M</td>
<td>STD</td>
<td>HGH</td>
<td>LOW</td>
<td>1</td>
</tr>
</tbody>
</table>
Final Thoughts

Conclusions
Final Thoughts

- Conclusions
- Further Work
Final Thoughts

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The adaptations made were helpful.
Further properties (colour; contrast) would be useful.
Some adaptations expected to be useful only to group M were of use to group O.
Considerable variation of capabilities (particularly in group O).
... suggesting this technique could be useful for many more than just those with disabilities when further developed.
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Further Work

Temporal considerations
▶ Use abilities model for sub-channel capabilities, in similar way to existing work [Fleishman et al., 1984, Balasubramanian and Venkatasubramanian, 2003]

Multi-channel tests
▶ Integration with information filtering techniques [Atkinson et al., 2006]

Application in different problem domains [Atkinson and Machin, 2007]
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Thanks for listening!
Any Questions?


