Modelling of users’ capabilities

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Modelling of Users’ Capabilities

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Research School of Informatics
Department of Computer Science
Loughborough University

13th January 2008
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
Motivations I

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Access Technology (AT)
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Retrofitted [Barnicle, 2000, Mazrui, 2005]
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
▶ is a generic process that can be applied in many domains
▶ allows integration of existing solutions
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Modelling of Users’ Capabilities

▶ Lowest level; "Intelligence"
▶ This user + this device
▶ Problem-centred
Low(est!?) level; “Intelligence”
Modelling of Users’ Capabilities

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Modelling of Users’ Capabilities

- Low(est!??) level; “Intelligence”
- **This** user + **this** device
- Problem-centred
Channels
Basic Concepts

- Channels
- Capability Maps
Basic Concepts
Basic Concepts
Modelling Components
Modelling Components

Adaptation and Interaction Components
Modelling Components
Adaptation and Interaction Components
(Meta-)Architecture
Modelling Components

- User (and device and data) profiles
Modelling Components

- User (and device and data) profiles
- Channels, Properties and Maps
Modelling Components

- User (and device and data) profiles
- Channels, Properties and Maps
- Data analysis
Modelling Components

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

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

- Calibration
- Renderers
Adaptation and Interaction Components

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

Tests
Proof-of-Concept

 uomo

Tests

Results
Tests

- 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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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
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>
<tr>
<td>O</td>
<td>0.2</td>
<td>0.6</td>
<td>0.4</td>
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<tr>
<td>M</td>
<td>0.0</td>
<td>0.4</td>
<td>0.3</td>
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## Results

### Standard 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>
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<tbody>
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<td>29</td>
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<td>74</td>
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### Low-Adaptation Documents (STD)

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<thead>
<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>
<td>O</td>
<td>6</td>
<td>48.7</td>
<td>80</td>
<td>1</td>
<td>6</td>
<td>5</td>
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<tr>
<td>M</td>
<td>5</td>
<td>57.6</td>
<td>38</td>
<td>36</td>
<td>6</td>
<td>1</td>
</tr>
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</table>

### High-Adaptation Documents (HGH)

<table>
<thead>
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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>
</tr>
</thead>
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<td>0</td>
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<td>6</td>
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<td>2</td>
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## Results

<table>
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<tr>
<th>Condition</th>
<th>Worst</th>
<th>Medium</th>
<th>Best</th>
<th>Participants</th>
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</thead>
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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>
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Final Thoughts

- Conclusions
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- Further Work
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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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Further Work

Daylight
Artificial
Tiredness
Visual Capability
Weighted Visual Capability

Final Thoughts
Acknowledgements

- ESRI [http://esri.lboro.ac.uk/](http://esri.lboro.ac.uk/)
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- The Grundy Educational Trust
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▶ ESRI http://esri.lboro.ac.uk/
▶ The Grundy Educational Trust
▶ Loughborough-based NDA network http://nda.lboro.ac.uk/
Thanks for listening!
Any Questions?


