Automated UI Evaluation based on a Cognitive Architecture and UsiXML

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2 Motivation

Target UIs
3 Motivation

- Main Cause for Aircraft Accidents is HUMAN ERROR

- Increasing Automation
  - Pilots “forget” to Fly
  - Over-reliance on Automation and non-understanding of Automation e.g. Air-France Accident
  - Automation Surprises

- Taking Human Factors into account during System Design is major Challenge
  → HUMAN Project
4 The HUMAN Project

Overview

**Objective:** to develop a methodology with techniques and prototypical tools supporting the prediction of human errors in ways that are usable and practical for human centred design

**Results:**

- a **cognitive crew model (PF/PNF)** ⇒ to reduce the effort of flight simulator tests by model-based simulation
- **software tools** supporting model application by human factor experts or system designers
- a **methodology** to evaluate cockpit system designs based on the cognitive model
5 The HUMAN Project
Virtual Testers - CASCaS

► Cognitive Architecture CASCaS used as virtual Testers
► CASCaS = Cognitive Architecture for Safety Critical Task Simulation
► Implements psychological and physiological sound models of human behaviour, e.g. for
  ► Calculation of eye-movements
  ► Memory retrieval and forgetting
  ► Knowledge Processing
► Error Prediction:
  ► Routine Learning
  ► Cognitive Lockup
6 The HUMAN Results

Overall Fitness Value

<table>
<thead>
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<th>Characteristic</th>
<th>Evaluation</th>
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</thead>
<tbody>
<tr>
<td>Task Execution Time (AHMI Task) CRU</td>
<td>✓</td>
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<tr>
<td>Task Execution Time (AHMI Task) APR</td>
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<td>Gaze Distribution (all) CRU</td>
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</tbody>
</table>

14 Characteristics

11 positive

3 negative

Overall Fitness Value

Model Fitness = 0.78

CASCas
22.06.2011
7 Automated UI Evaluation

Proposed Method

- Standard in Industrial System Development:
  - Model based System Design (e.g. Matlab, UML, State-Charts)
  - Testing and Formal Verification
  - Simulation

- HUMAN: Model Based Evaluation of System Design

- UsiXML: Model Based Design of User Interfaces

- IDEA: Integrate this in an Model Based Automated UI Evaluation Process
8 Automated UI Evaluation
Proposed Method
9 Rendering Engine
10 Automated UI Evaluation

Rendering Engine
11 Open Issues / Next Steps

Open Issues:
- How to integrate System Model and UsiXML Model?

Next Steps:
- Adding a “Rendering Library”
- Connection to CASCaS
- Online Transformation of Current Status for evaluation
- Connection to Online Evaluation / UsabilityAdviser
The End

- Thanks for your attention!
- Questions?
Outline

- Motivation
  - System Development in Industry
  - Target UIs
- The HUMAN Project
  - HUMAN Method
  - Virtual Testers
  - HUMAN Results
- Proposed Method Extension
- Current Status and Next Steps
14 HUMAN Results - Example

Task Execution Time