Flexible User Interfaces For Mobile Devices

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User interfaces are one of the most important parts
Difficult to develop because of the wide range of devices
Flexible user interfaces cope with different capabilities and circumstances
Are developed for many years
Different possibilities for output of information (Output)
- Audible, Displays

Different possibilities for input of information (Input)
- Keyboards, pointing devices, speech, specific devices

Internal conditions (calculating power, battery lifetime, ...)
- Possibility to show a web interface instead of running application (Web)

Context-awareness (Context)
- Adaptation of display to changing circumstances

Short statement about actual situation
Different requests to interface

- HMD has other requests than other “usual” displays
  - wGUI for a HMD (Head Mounted Display)
One user interface for all devices inappropriate
  - Tiny on desktop monitor or scrolling on mobile display

Adaptation to according display: Tasks
  - Adapt to many different devices and circumstances
  - Never confuse the user (should look like the used one)
    - Decide what is important

Model-based and rule-based toolkits
  - Model-based: abstract models
  - Rule-based: strict rules how interface should look
SUPPLE

- **Model-based**
  - Functional interface specification
  - Device-model describes capabilities
  - User-model (typical activities)
- **Special algorithm to calculate user effort**
  - Cost for every possible interface
  - Branch and bound
  - Chooses the best possible interface
- **Adapts itself to user actions at runtime**
The same application rendered on different devices
- Calculation very elaborate for processor
- Remote rendering possible
  - Automatic usage of “solver server”
  - Remote rendering service accelerates process
  - Network connection essential
- No support for context events
- Enhancement: Factor in the cost to learn new interface
  - Same application with new device
SUPPLE makes trade-off between optimization and similarity
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- Model-based tool
- Different abstraction layers
  - Top-down method
- XML-Based
  - Possibility to import/export definitions
- Only flexible at generation, not at runtime
- One task-model yields many interfaces
The „one model, many interfaces approach“
The Ubiquitous Interactor

- Creates device-independent user interfaces
- Gives the ability to control presentation of interface
  - Important for branding purposes
- Presentation information separated from user-service information
- Uses mappings and media resources
  - Media resources: pictures or sounds
  - Mappings: link interactions to templates
- Interface generation by server: Network connection required
Personal Universal Controller

- Rule-based interface generator
  - Specific knowledge about target-device is required
- Developed to access functions of appliances
- Architecture has four parts
  - Appliance adaptor
  - Specification language
  - Communication protocol
  - Interface generator
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Short statement about actual situation
- Users familiar with WIMP (Windows, Icons, Menus and Pointer)
  - Mostly not possible for mobile devices

- Two popular input methods
  - Four-way cursor
  - Touch screen

- Translations / adaptations
  - Soft keyboard
  - Input Adaptor Tool

- Completely new methods
Two problems to solve:
- User must be able to select any interactor
- User must be able to control the selected interactor

IAT adapts the running software to given input method

Manipulates the GUI
- Has to have control over the GUI

Very general and applicable to all devices
**Four input methods**
- Pointer (no keyboard)
  - Suitable for most navigation
- Switch
- Speech
  - Cursor moves with regulation of voice pitch
  - Spatial: speak out grid regions
  - Jumping or scanning
- Keyboard (no pointer)
  - Tab-stop or direct mapping (jumping)
<table>
<thead>
<tr>
<th><strong>Input Adapter Tool</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Introduction</strong></td>
</tr>
<tr>
<td><strong>Output</strong></td>
</tr>
<tr>
<td><strong>Input</strong></td>
</tr>
<tr>
<td><strong>Web</strong></td>
</tr>
<tr>
<td><strong>Context</strong></td>
</tr>
<tr>
<td><strong>Statement</strong></td>
</tr>
</tbody>
</table>

- **Automatic addition of shortcuts**
- **Replacement of combo-boxes with text fields**

![Comparison of input forms before and after adaptation using the Input Adapter Tool](image-url)
Refine of touch screen pointing device (stylus)

Supports the recognition of wrist pressure
  - Sensor under the bottom right screen of a PDA

User lays down the hand for editing

User lifts hand for navigation

Very specific – not for use with other methods / devices
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<table>
<thead>
<tr>
<th>Introduction</th>
<th>Output</th>
<th>Input</th>
<th>Web</th>
<th>Context</th>
<th>Statement</th>
</tr>
</thead>
</table>

- **Different possibilities for output of information (Output)**
  - Audible, Displays
- **Different possibilities for input of information (Input)**
  - Keyboards, pointing devices, speech, specific devices
- **Internal conditions (calculation power, battery lifetime,...)**
  - Possibility to show a web interface instead of running application (Web)
- **Context-awareness (Context)**
  - Adaptation of display to changing circumstances
- **Short statement about actual situation**
Displaying web pages on mobile devices
  ▶ No need to install additional software

Common languages are used (Java, XML,…)
  ▶ Many people can handle toolkits

Adaptive User Interface Toolkit (AUIT)
  ▶ Includes Java Swing based design tool
  ▶ Combination of XML and Java Server Pages (JSP)
    – Other languages are possible (prototype)
  ▶ Specifications stored in XML format

Drawback: Server connection essential
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Short statement about actual situation
User interface which adapts the whole interface

E.g. Sulawesi is able to adapt input and output

- Detects movement:
  - switches from pointing device to speech input and from display to audio output

- Adapts on commands:
  - “tell me the time” or “show me the time”
User interface which only adapts its display
Developed for Symbian mobile phones
Adapts operating system GUI to different devices
Location-based context-awareness (not yet implemented)
  - Locate device (Cell ID or GPS)
  - Adapting interface to the users task
    - work / home
  - Copes with local context (shop / cinema poster)
    - Active / passive
Display-adaptation already implemented
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Short statement about actual situation
Server-based systems only applicable for concerns with intranet
  ▶ Online-services too expensive and unstable
Some features already implemented
Separated projects, prototypes and researches
“Designing flexible and dynamically configurable user interfaces (UIs) is difficult and it is unlikely that the developer will come up with a solution of all problems for all users."  
(Bogdan Dorohonceanu, Boi Sletterink, Ivan Marsic: A Novel User Interface for Group Collaboration)
Questions ?