Cross-Device Consistency in Automatically Generated User Interfaces

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Problem Statement

How to automatically generate user interfaces for \textit{the same application} or appliance for \textit{different devices}
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How to automatically generate user interfaces for the same application or appliance for different devices

Motivation: to make new interfaces for old applications easier to learn when switching devices
SUPPLE Architecture

- Interface Model
- Application or Appliance
- Device Model
- Target Device
- SUPPLE
- User Model
- User's Info Space

Diagram showing the SUPPLE Architecture with connections between the Interface Model, Application or Appliance, Device Model, Target Device, SUPPLE, User Model, and User's Info Space.
Automatically Rendered Interfaces for a Classroom Controller
Automatically Rendered Interfaces for a Classroom Controller
Automatically Rendered Interfaces for a Classroom Controller
28.06 11:24 PM  Isabel Raikar <raikar@unterreuth.de>  AW:
28.06 11:24 PM  Isabel Raikar <raikar@unterreuth.de>  AW:
25.06 08:18 AM  supple@web.de  Hey!
[ 25.06 01:02 AM  supple@web.de  Re: TEST]
18.06 07:51 PM  MailDeliverySubsystem <MAILER-DAEMON>

Sorry for replying late, we may be starting a call center in a month so I am bit busy, but we have worked on your modifications and are sending the templates, please suggest us some colours if you don’t like what we are using.

I will be available tomorrow evening our time by around 4–5.

Have a Great Weekend
Best Regards
Prasad
Subject: AW: modified Templates

Dear Isabel, 

I am bit busy, but we have worked on your modifications and are sending them. Please suggest us some colours if you don't like what we are using.

I will be available tomorrow evening our time by around 4–5.

Have a Great Weekend,
Best Regards,
Prasad

Date: 28.06 11:24 PM
Recipients: supple@web.de Raphi <Raphael.hoffmann@unterreuth.de>
Configuration

Rendering

Accounts

Web.de IMAP
UW IMAP
Web.de POP3
SoftHome
.Mac (kgajos)

Details

Account Name: Web.de IMAP
Reply Address: supple@web.de
Incoming Server
Protocol: imap
Server: imap.web.de
User: supple
Password: supple123
Authentication
Outgoing Server
Server: smtp.washington.edu
User: raphaelh
Password: xxx

Save

Buttons:
Add Account
Remove Account
Switch to Account
UI Rendering As Optimization

cost = cost of manipulating individual widgets + cost of navigating through the interface
UI Rendering As Optimization

cost = cost of manipulating individual widgets + cost of navigating through the interface

For a multimodal approach, see “UI on the fly” by Reitter, Panttaja & Cummins
Manipulation-Navigation Tradeoff Example
Manipulation-Navigation Tradeoff Example
Manipulation-Navigation Tradeoff Example

easier navigation
easier manipulation
Manipulation-Navigation Tradeoff Example

cost = $\alpha_m \times$ cost of manipulating individual widgets

+ $\alpha_n \times$ cost of navigating through the interface
UI Rendering As Optimization

cost = \alpha_m \times \text{cost of manipulating individual widgets} \\
+ \alpha_n \times \text{cost of navigating through the interface} \\
+ \alpha_s \times \text{dissimilarity to the previously used interfaces}
The reference UI for a classroom controller rendered on a touch panel.
The reference UI for a classroom controller rendered on a touch panel.

The “optimal” UI for the classroom controller for a keyboard and pointer device rendered in the absence of similarity information.
The reference UI for a classroom controller rendered on a touch panel.

The “optimal” UI for the classroom controller for a keyboard and pointer device rendered in the absence of similarity information.

The “optimal” UI for the classroom controller for a keyboard and pointer device rendered taking into account the similarity information.
Open Questions

• What aspects of surface presentation make user interfaces appear “similar”
• Does surface presentation similarity matter?
Features
Features

• Language (toggle, text, position, icon, color)
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• Domain visibility (full, partial, current value)
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- Language (toggle, text, position, icon, color)
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- Orientation of data presentation
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- Continuous Vs. discrete
- Variable domain
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• Language (toggle, text, position, icon, color)
• Domain visibility (full, partial, current value)
• Orientation of data presentation
• Continuous Vs. discrete
• Variable domain
• Primary manipulation method (point, type, drag)
Features

- Language (toggle, text, position, icon, color)
- Domain visibility (full, partial, current value)
- Orientation of data presentation
- Continuous Vs. discrete
- Variable domain
- Primary manipulation method (point, type, drag)
- Widget geometry
seen "Shopping Bag" on clothing and cosmetic sites.

Solution
Desktop:

Cell phone:
Summary
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• Using optimization for user interface generation enables use of different quality metrics
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• **But:**
  • What features are most salient for determining if two interfaces are similar?
  • Does surface similarity matter?
Summary

• Using optimization for user interface generation enables use of different quality metrics
• If we know the right features, we can find the right numbers
• **But:**
  • What features are most salient for determining if two interfaces are similar?
  • Does surface similarity matter?
• **We are designing a user study to answer these questions (with Roxane Neal)**
More Info

- **SUPPLE:**
  http://www.cs.washington.edu/ai/supple/

- **Krzysztof Gajos:**
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  http://www.cs.washington.edu/homes/kgajos/