User Modeling Meets Usability Goals

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When my fancy novel techniques finally work well enough to be used in real systems . . . will anyone want to use these systems?

This Is Not All New ... 

Usability threats and principles

- Ben Shneiderman, since mid-1990s
- Pattie Maes and coworkers, late 1990s
- Eric Horvitz, 1999
- Kristina Höök, 2000
- ...

Evaluation of user-adaptive systems

- David Chin
- Stephan Weibelzahl
- Alexandros Paramythis
- Judith Masthoff
- ...
What Are the Messages of This Talk?

**The wrong messages**

1. User-adaptivity is fundamentally a great way to increase the usability of interactive systems
2. Just apply general guidelines like "Put the user in control"
3. User modeling is an alternative paradigm to mainstream human–computer interaction paradigms

**The real messages**

1. User-adaptivity requires careful analysis of typical usability threats
2. Because of tradeoffs, no single solution is right for all of the users all of the time
3. By *expanding the design space*, you can find ways to satisfy more of the users more of the time

Goals and Typical Threats

Controllability

The user may not have enough control over the system
**Comprehensibility**

The user may not understand adequately how the system works – or be able to predict what it will do.

**Unobtrusiveness**

The system may distract the user with too many (or poorly timed) messages and requests for input.
11 Goals and Typical Threats

System Competence

The system may perform actions that are so poorly adapted to actual facts about the user that the user is distracted and/or impeded.

Privacy

The system may create situations in which information that the user would prefer to keep private are made available to others.
**Breadth of Experience**

The system may restrict the user’s attention excessively

---

**Controllability vs. Obtrusiveness**

Intelligent Office System

(Cheverst et al., UMUAI special issue on User Modeling in Ubiquitous Computing)
Early Version of Confirmation Prompt

On user's main workstation window:

Prompt on the Touch Screen

-The word "OFF" changes color repeatedly while the prompt is being shown.
## Control Panel

![Control Panel Image]

### Causes and Strategies

<table>
<thead>
<tr>
<th>Preventive Measures</th>
<th>Typical Causes</th>
<th>Usability Threats</th>
<th>Remedial Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allow user to do some of the work</td>
<td>Taking over by system of work of user</td>
<td></td>
<td>Allow user to set system parameters</td>
</tr>
<tr>
<td>Craft image of system carefully</td>
<td>Anthropomorphic appearance</td>
<td></td>
<td>Submit system actions to user for approval</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Shift control to system gradually</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Design messages carefully (form, timing)</td>
</tr>
</tbody>
</table>
Expanding the Design Space

Autonomous action
Autonomous action in specified situations
Nonpreemptory recommendation to press button
Announcement of action within N seconds unless canceled
Preemptory query

Breadth of Experience vs. System Competence
A Decision–Theoretic Shopping Guide

The shopping guide and user study shown in the slides in this and the following section are presented in Bohnenberger, T., Jacobs, O., Jameson, A., & Aslan, I. (2005). Decision-theoretic planning meets user requirements: A decision-theoretic shopping guide. In H. Gellersen, R. Want, & A. Schmidt (Eds.), Pervasive computing: Third international conference (pp. 279–296). Berlin: Springer.
A Decision–Theoretic Shopping Guide

The decision–theoretic shopping guide

- The shopper specifies at the beginning her interests in particular (types of) products
  - "A loaf of pumpkin seed bread"
  - "A novel for my teen–aged daughter"
  - ...
- The system computes a policy:
  - At each point in time, it directs the shopper to a promising store, taking into account:
    1. the current location
    2. the products found so far
    3. the amount of time remaining
Direction to Walk In

left

Overview Map
Study in Shopping Mall: Method

- The localization infrastructure was simulated by the experimenter (Wizard of Oz)

- 21 subjects from different social groups

- Each shopped for 20 minutes with 25 Euros after specifying what they wanted to buy in six categories:
  - Some bread, a book, a gift item, some fruit, a magazine, some stationery
Objective Results

(a) Time needed to buy all 6 items

(b) Time to finish despite not having bought all 6 items

- All 21 subjects got back to the exit on time

Subjective Results

(a) Enjoyment

(b) Willingness to use

(c) Feeling restricted

(d) Difficulties
Breadth of Experience

Critique

- "Shoppers don’t like to be led around on a fixed route
- They want to explore and buy spontaneously and have fun while doing so"

Response

- Not all shoppers are the same all of the time
- Our subjects expressed interest in using the system when ...
  - ... they are unfamiliar with the shopping mall
  - ... they want to buy a particular set of products
  - ... their time is limited

Causes and Strategies

Preventive Measures
- Allow user to do some of the work
- Acquire a lot of relevant information

Typical Causes
- Taking over by system of work of user
- Incompleteness of system’s information

Usability Threats

Remedial Measures
- Intentionally introduce diversity
- Explain the system’s actions
Control and Comprehension vs. Obtrusiveness

Control and Comprehension

- Why do users sometimes want more control and understanding?
  - So that they can override the system’s recommendations
    - They have information that the system lacks
    - They see that the system’s model is too limited
- What do they need?
  - Robust response by the system when they deviate from a recommendation
    ⇒ Given by the basic algorithm
  - Ability to second-guess the system in an informed way
    ⇒ Requires explanations by the system
### Causes and Strategies

#### Preventive Measures
- Use simple modeling techniques
- Acquire a lot of relevant information
- Allow user to do some of the work

#### Typical Causes
- Complex processing
- Incompleteness of system’s information
- Taking over by system of work of user

#### Usability Threats

#### Remedial Measures
- Allow inspection of the user model
- Explain the system’s actions
- Shift control to system gradually
- Submit system actions to user for approval
- Allow user to set system parameters

### Explanations: Implementation

#### Expected Length of Time

**Stores Along the Way**

**Option**

- bread
- gift
- stationary
- book
- fruit
- journal
Explanations: When Presented

Difference between best and second–best options:

- Small Exploitation
  - Left
  - Bread, gift, stationary
  - Book, fruit, journal

- Medium Explanation
  - Right
  - Consider looking at the explanations!
  - Bread, gift, stationery
  - Book, fruit, journal

- Large Explanation
  - Expected Length of Time
  - 12 min, 13.7 min, 14 min
  - Store Along the Way
  - Kohl, Mast, Wish
  - Option
  - Bread, gift, stationery
  - Book, fruit, journal

Explanations: Results

Results
- Five subjects used the system with explanations
- They generally approved of the basic idea
- But most said that they had too little time to look at the explanations and preferred to follow the recommendations blindly

Prediction
- With more experience, each user would learn in what situations it is worthwhile to check the explanation
  - E.g., when they are tempted to second–guess the system
Expanding the Design Space

Pre- or postshopping critique (cf. SPECTER)

Comprehensibility vs. Obtrusiveness
An Adaptive Hotlist for Conference Events

Session 1: Acquiring User Models from Multi-Modal User Input (Sun July 15, 9:30 – 11:00 AM)

Harnessing Models of Users’ Goals to Mediate Clarification Dialog in Spoken Language Systems (Add to Hotlist)

Authors: Eric Horvitz, Tim Rake

Time: Sun July 15, 9:30 – 10:00 AM

Hotlist Recommender Concepts (with your estimated interest level): [3] Natural language dialog (-)

Decision-theoretic methods (+)

Abstract: Speaker-independent speech recognition systems are being used with increasing frequency for command
Overview of Studies

- Experiment with original version (see previous slide)
  - 18 student subjects
    Made to act like UM researchers
    (How? ⇒ Discussion)
    Comparison between controlled and automatic updating

- Experiment with improved (current) version
  - Same as above, but:
    28 student subjects
    12 without the ++s and −−s

Causes and Strategies

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</tr>
<tr>
<td>Acquire a lot of relevant information</td>
<td>Incompleteness of system’s information</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inform user about information acquisition</td>
<td>Implicit information acquisition by system</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>![Allow inspection of the user model]</td>
<td></td>
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</table>
Comprehensibility of the Hotlist

- Theory: The explanations can help the user to understand ...
  - Why this particular recommendation was made
  - What the system’s basic procedure for making recommendations is
  - How accurate the system’s user model is at the present time
- The user should then be better able to predict
  - Whether this particular event will turn out to be interesting to the user
  - What sorts of recommendations the system will make in the future
  - How valuable these recommendations will be

Impact of Explanations

- Those with explanations did a bit better (p < .05) on a "comprehension test":
  "Does the system take into account ..."
  ... 1. what talks you have added to the hotlist? [correct: 'Yes']
  ... 2. what pages you have looked at? ['Yes']
  ... 3. how long you looked at each page? ['No']"
- Most found them "somewhat useful" or "useful to a small extent"
Expanding the Design Space

Controllability vs. System Competence
Causes and Strategies
Some Results (Study 1)

Advantages of Two Updating Styles

Controlled updating:

1. The user’s feeling of control over the interaction with the system is enhanced
2. The user can follow up on more than one recommendation in a given set
3. System response times can be faster because of less frequent updating
4. The user can restrict updates to situations in which the system’s model of her interests is assumed to have useful accuracy
5. A smaller amount of irrelevant text appears in the hotlist.
Advantages of Two Updating Styles (2)

**Automatic updating:**

1. The user cannot overlook the availability of the recommendation feature

2. The user is regularly reminded that new recommendations are available

3. The user is spared the effort of clicking on a button to obtain new recommendations

4. The recommendations displayed always reflect the system’s most complete model of the user’s interests

**Improved Interface**

<table>
<thead>
<tr>
<th>Hotlist (reader-friendly version) [3]</th>
<th>Update recommendations</th>
<th>Execute changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set 14:00-18:00 Tutorial Mark Maybury</td>
<td>View session</td>
<td>✚ Accept ✚ Reject</td>
</tr>
<tr>
<td>Set 14:00-18:00 Tutorial Anthony Janerson</td>
<td>View session</td>
<td>☑ Remove</td>
</tr>
<tr>
<td>Sun 08:30-09:30 Invited Talk Alfred Kobsa</td>
<td>View session</td>
<td>✚ Accept ✚ Reject</td>
</tr>
<tr>
<td>Mon 09:00-10:00 Invited Talk Joseph A. Konstan</td>
<td>View session</td>
<td>☑ Remove</td>
</tr>
</tbody>
</table>

Alfred Kobsa: "Tailoring privacy to the user’s needs"
*(Recommendation to include in Hotlist: Accept or Reject)*

You can now download the slides from this talk.

**Time:** Sun 15 July, 8:30 - 9:30 AM

**Hotlist Recommender Concepts** *(with your estimated interest levels)*: Information retrieval (++) E-commerce (+++)

**Abstract:** This article discusses how the deployment of personalized systems is affected by users’ privacy concerns.
Some Results (Study 2)

- Some drawbacks of automatic updating were eliminated through the interface improvements
- Preferences generally shifted toward automatic updating
- But there were still large differences in preferences concerning almost all aspects of the interaction

Expanding the Design Space
Concluding Remarks
The Messages Again

1. User-adaptivity requires careful analysis of typical usability threats

2. Because of tradeoffs, no single solution is right for all of the users all of the time

3. By expanding the design space, you can find ways to satisfy more of the users more of the time

What Does the Title Mean?

User Modeling Meets Usability Goals

Gets to Know

Confronts

Achieves