

# Ensuring the Usability of Systems That Adapt to Their Users

Proposal for a CHI 2007 Course

## Description

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### 1 TIMING

This course requires one 90-minute block. Although a more thorough treatment of the topic, with more active participation by the participants, could be given in two 90-minute blocks, the instructor's experience shows that participants can learn a great deal within 90 minutes. This shorter duration was chosen so as to make participation feasible for a larger number of CHI 2007 attendees.

### 2 LEARNING OBJECTIVES

The course concerns ways of dealing with the usability issues that typically arise in the design of systems that adapt to their users, which may range from adaptive user interfaces to recommender systems in e-commerce. Although some of these usability issues have been discussed in the literature since the 1980s, the most widespread approach to dealing with them is the application of general principles like "put the user in control". Such principles are of limited use to designers who need to make specific design decisions; their uncritical application can have side effects that outweigh the benefits of adaptation.

After completing the course, participants will be better equipped to make informed design decisions concerning the usability issues associated with adaptivity. They will:

- be familiar with a variety of concrete examples of the forms that the usability issues can take and ways in which they have been dealt with successfully;
- be aware of general design strategies that have been applied in dealing with these issues;
- have some experience in dealing with the tradeoffs that typically arise when these strategies are applied.

### 3 MATERIAL THAT WILL BE COVERED

With reference to a briefly presented concrete example, the characteristic of adaptivity will be defined, so that participants understand why superficially different systems raise similar usability issues: A system is said to be *user-adaptive*

if it adapts its behavior to individual users on the basis of processes of user model acquisition and application that involve some form of learning, inference, or decision making.

An brief overview of the typical usability issues will then be given. In the terms used in the instructor's chapter in the *Human-Computer Interaction Handbook* (?), adaptivity can threaten the general usability goals of *predictability and comprehensibility, controllability, unobtrusiveness, privacy, and breadth of experience*. As an advance organizer, a preview of the recommended conceptual framework for thinking about these issues will then be presented: Usability challenges are understood in terms of typical properties of adaptive systems that can threaten the usability goals. *Remedial measures* aim to limit the negative consequences of these properties, while *preventive measures* aim to limit the extent of these properties in the first place.

A sequence of three case studies will then be presented, whose overall goal is to build up a sophisticated understanding of ways of dealing with these usability issues. Each case study will include:

- a demonstration or other concrete presentation of a system that shows participants what specific form the usability issues take and how they have been dealt with in the system's design;
- a discussion of the preventive or remedial measures that were—or could have been—applied in the design of the system;
- a discussion of tradeoffs involved in the application of these measures;
- a brief summary of the results of any relevant studies involving systems like the one used in the case study.

As the participants become more familiar with the concepts introduced, the discussion of the case studies will focus increasingly on the ways in which the best solution to tradeoffs can vary over users and situations and on ways of enabling users to choose the solution that best fits their preferences and situation.

The case studies will include two systems that most participants will be familiar with:

- The recommendation functions of amazon.com raise all of the usability issues to some degree.
- The SMARTMENUS of Microsoft Office and Windows raise the typical issues concerning adaptive interfaces. A number of empirical studies have focused on this type of adaptive menu.

The third case study, which has proved useful in previous tutorials and courses, is the instructor's adaptive web-based system for planning conference attendance (?).

#### 4 ASSUMED BACKGROUND AND EXPECTED SKILLS OF ATTENDEES

The course is directed at practitioners and researchers who are currently involved—or who may in the future get involved—in the design of systems that involve some sort of adaptation to the user (even if the adaptation is a relatively minor aspect of the overall system). No previous experience with the issues involved is presupposed, though participants with relevant experience will be better able to participate actively in discussions. The instructor's experience indicates that even designers and researchers who have been dealing with adaptive systems for a long time can benefit from the conceptual framework and concrete examples presented in the course.

#### 5 JUSTIFICATION FOR A CHI AUDIENCE

Only a minority of the systems dealt with by members of the CHI community exhibit any form of adaptation to the user, and in fact many members of the community are skeptical about such systems because of the usability challenges that they raise. On the other hand, as successful examples have shown, there are contexts in which some form of adaptation to the user can yield tangible benefits, provided that the usability challenges are dealt with appropriately. The ability to deal constructively and realistically with these issues is therefore a potentially valuable addition to the skill sets of many designers and researchers.

The instructor's previous tutorials that covered adaptive systems more broadly have typically attracted several dozen attendees at various conference venues, including CHI (cf. Section 10). Focusing on the usability issues seems appropriate for a CHI course, since it will allow this topic to be treated in appropriate depth within a short course that will not make CHI attendees miss many other CHI events.

#### 6 HOW THE TUTORIAL WILL BE CONDUCTED

As is indicated in Section 3, during most of the 90 minutes the instructor will be showing concrete examples, eliciting ideas from participants, and summarizing the points raised with reference to general concepts and principles. Although the brief duration will not allow time for group work or discussions, the style will be concrete and interactive, ensuring that participants think actively about the systems and issues

presented.

#### 7 SCHEDULE

5 minutes: Greeting, brief motivation, and preview of the course.

10 minutes: Presentation of basic concepts with reference to a demonstrated example system (e.g., amazon.com recommendations).

About 20 minutes each: Presentation and discussion of the three case studies.

15 minutes: Discussion of questions and examples provided by participants from their own experience.

#### 8 TUTORIAL NOTES

The tutorial notes will include the following materials:

- Organizational material (e.g., schedule, table of contents)
- Printed copies of the tutorial slides
  - In addition to the slides actually shown in the course, these slides will include (a) screen shots of the systems demonstrated live and (b) some textual slides summarizing what the instructor said while demonstrating systems or presenting graphical material.
- Worksheets (cf. Figure ?? in the Appendix) that participants can use for guidance in their own work
  - These worksheets list specific questions that can be asked about particular usability issues along with possible answers to the questions. They will help the participants apply ideas from the course even long after the course.
- Reprint of handbook chapter
  - The latest version of the instructor's chapter *Adaptive Interfaces and Agents* for the *Human-Computer Interaction Handbook* (?) includes one section on the topic of this course and also gives an overview of the broader topic of systems that adapt to their users. The chapter includes about 100 references to (mostly recent) literature.

#### 9 AUDIENCE LIMITATIONS AND EXPECTATIONS

On the basis of previous experience at CHI and similar conferences, I would expect the number of participants to be something like 80-90% of the average number for a course: The topic is of interest only to a subset of CHI attendees, but those who are interested in it find the material of the course important and interesting. The concentrated presentation should make attendance feasible even for participants for whom the topic is not of top priority.

The way the course is conducted does not presuppose any minimum number of participants. The interactive style of presentation works best with up to about 60 participants; should the number be much greater, the course could be given twice.

#### 10 HISTORY AND MODIFICATIONS FOR CHI 2007

The instructor has given full- and half-day tutorials on the broader topic of systems that adapt to their users at CHI

2001, CHI 2002, IUI 2001, UM 1999, UM 2003, and AH 2006. (Together with John Riedl and Joseph Konstan, he has also given tutorials on recommender systems at AAAI 2002, AAAI 2004, and IJCAI 2003.)

This course is an expansion of one section of the earlier tutorial, which CHI participants indicated in their comments to be especially interesting and relevant to them.

The CHI 2001 tutorial was revised in a number of respects for CHI 2002 on the basis of the participants' comments. In the evaluation results for CHI 2002, no major changes were suggested; so the main change for this course is the narrowing of the focus and the reduction in length.

## **11 REFERENCES**

## **12 APPENDIX: SAMPLE SLIDES**

The following pages show examples of slides from a recent keynote address and a recent tutorial of the instructor's on the topic of this course. The slides are not designed to be self-explanatory, since their presentation is accompanied by comments by the instructor.

## Goals and Typical Threats Controllability

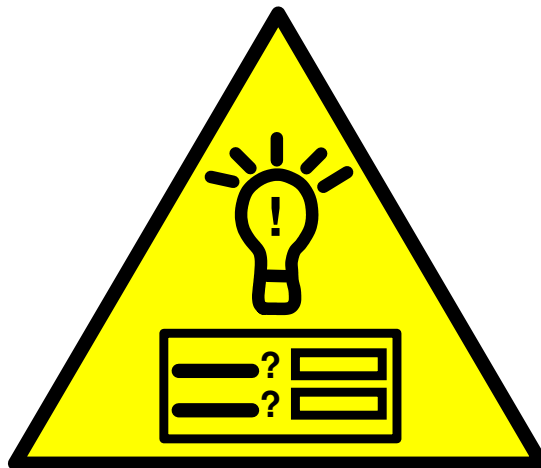
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The user may not have enough control over the system

## Unobtrusiveness

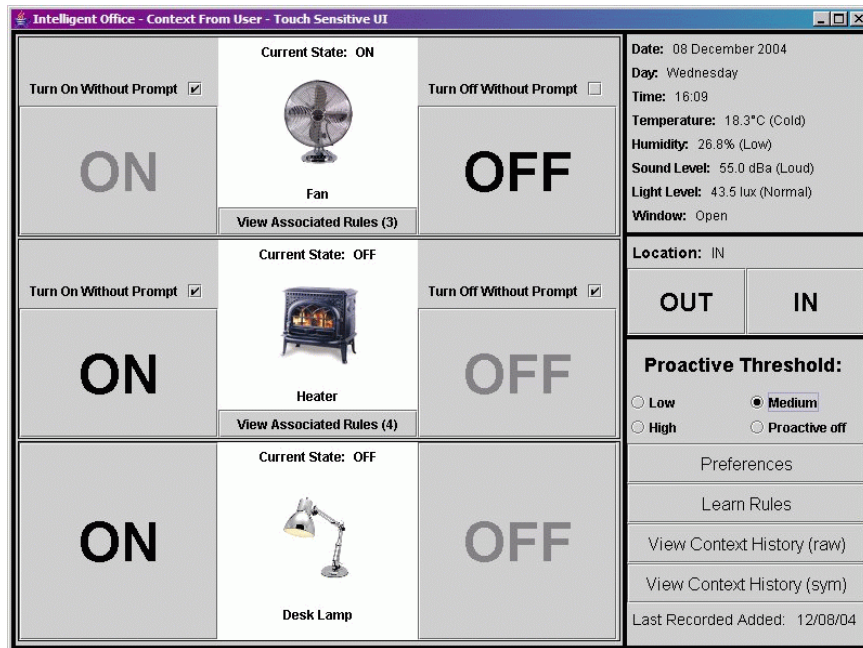
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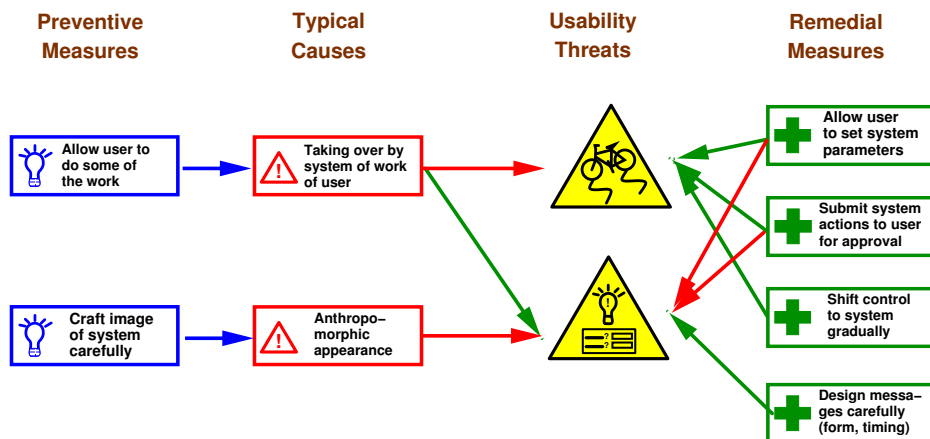
The system may distract the user with too many (or poorly timed) messages and requests for input

**Figure 1.** These and the following 3 example slides are taken from the instructor's keynote address at the Tenth International Conference on User Modeling (the complete slides are available via <http://dfki.de/jameson/abs/Jameson05UM.html>)..

## Controllability vs. Obtrusiveness Intelligent Office System



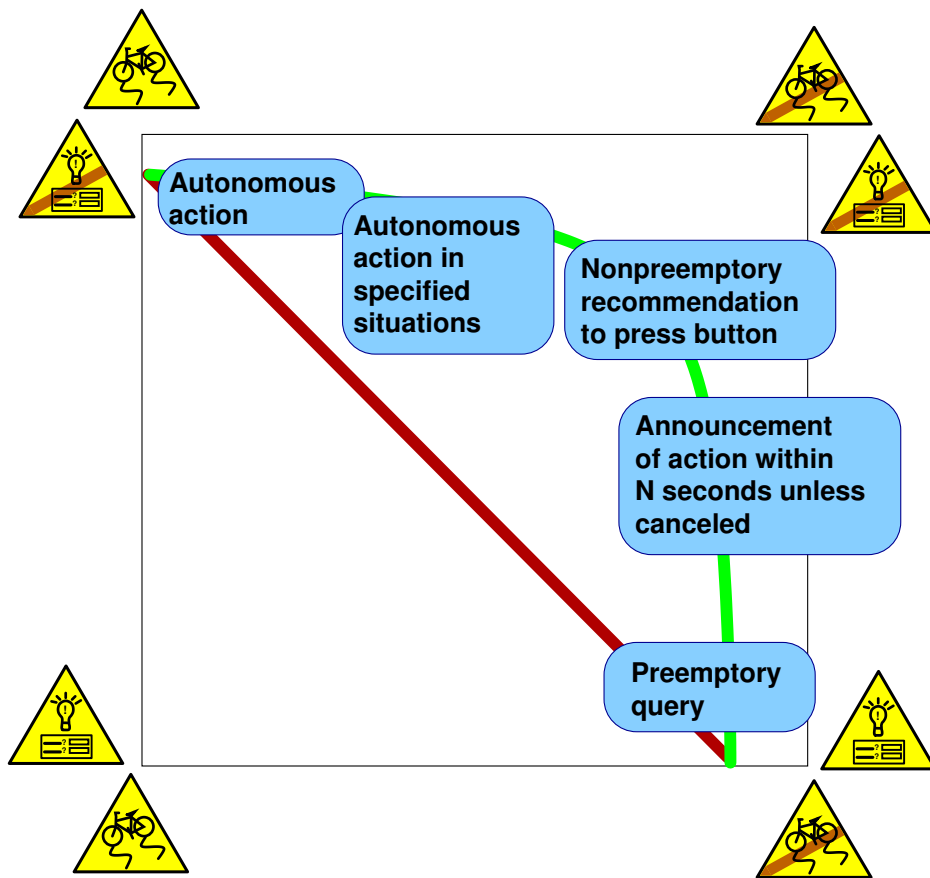
## Causes and Strategies



**Figure 2.** The first slide shows a screen from a simple example system, while the second slide summarizes some common strategies for dealing with problems of controllability and obtrusiveness.

## Expanding the Design Space

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**Figure 3.** This graphic illustrates how different solutions to tradeoffs between two usability goals can be compared.

## **Worksheets: Controllability**

### **Questions: Specific Behaviors (1)**

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*Other answers / Comments*

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1. Are there specific adaptive system actions that the user might want to control individually?
  - a. Actions that may disrupt the user's interaction with the system
    - Presentation of information or advice by the system in a way that attracts the user's attention
    - Changes to the interface that require changes in behavior by the user
  - b. Actions that have potentially serious consequences, apart from the interaction
    - Deletion or movement of documents
    - Communications sent to other persons
  - c. ⇒

### **Questions: Specific Behaviors (2)**

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*Other answers / Comments*

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2. How could the user be given control over these actions?
  - a. The system requests explicit confirmation for each action
  - b. The system collects larger sets of actions and allows the user to approve the entire set, or some subset
  - c. With sufficiently low confidence, the system should omit the action without consultation
  - d. With sufficiently high confidence, the system should execute the action without consultation
  - e. ⇒

**Figure 4.** This page (included in the course notes but not shown during the course itself) shows a worksheet (cf. Section 8) for the subsection *Controllability* from the tutorial held at the 2006 conference on Adaptive Hypermedia and Adaptive Web-Based Systems.