Syllabus

HF760: INTELLIGENT USER INTERFACES

Roland Hübscher
Human Factors in Information Design, Bentley University

JANUARY 20, 2014

1 Navigation

<table>
<thead>
<tr>
<th>Instructor</th>
<th>Roland Hübscher</th>
</tr>
</thead>
<tbody>
<tr>
<td>Email</td>
<td><a href="mailto:rhubscher@bentley.edu">rhubscher@bentley.edu</a></td>
</tr>
<tr>
<td></td>
<td>Add HF760 to the subject line when sending me an email</td>
</tr>
<tr>
<td>Office hours</td>
<td>By appointment, also before and after class</td>
</tr>
<tr>
<td>Office location</td>
<td>Adamian Academic Center (AAC) 259</td>
</tr>
<tr>
<td>Home page</td>
<td><a href="http://rolandhubscher.org">http://rolandhubscher.org</a></td>
</tr>
<tr>
<td>Course page</td>
<td><a href="http://rolandhubscher.org/courses/hf760">http://rolandhubscher.org/courses/hf760</a> and <a href="http://blackboard.bentley.edu">http://blackboard.bentley.edu</a></td>
</tr>
<tr>
<td>Wiki articles</td>
<td><a href="http://rolandhubscher.org/courses/wiki">http://rolandhubscher.org/courses/wiki</a></td>
</tr>
</tbody>
</table>

2 About

2.1 Course Organization

This course is a combination of interactive lectures and group project. We will talk quite a bit about methods coming from artificial intelligence (AI) and how that can be used to transform the way we interact with all kinds of devices and interfaces.

To get more involved in the relevant questions and issues that are inherent to intelligent interfaces, you will work on a semester-long project that connects you to ongoing research at MIT’s Media Lab.

You will also write an article on some IUI related topic that allows you to go deeper in some area and, at the same time, provide interesting additional content to your fellow students.

2.2 Learning Goals

At the end of this course you should be able to:

• Understand when intelligent user interfaces (IUI) are useful (and when not) and formulate why an approach with an IUI is needed;

• Understand the underlying technologies and methods, especially from AI, well enough to know its possibilities and limits;

• Design an IUI and a rudimentary system architecture; and

• Discuss all IUI design issues intelligently with all the members of the design team including developers.
3 Important Dates

These are the official dates of deadlines and other important events in the course. Changes will be announced in class. I will discuss in class what you are supposed to do for each deadline.

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Misc.</th>
<th>Group Project</th>
<th>Wiki Article</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1/22</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1/29</td>
<td>Groups assigned</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>2/5</td>
<td>Focus approved</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>2/12</td>
<td>Analysis, criteria, scenarios</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>2/19</td>
<td></td>
<td></td>
<td>Focus approved</td>
</tr>
<tr>
<td>6</td>
<td>2/26</td>
<td>First prototype</td>
<td></td>
<td>Abstract posted</td>
</tr>
<tr>
<td>7</td>
<td>3/5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>3/12</td>
<td>Spring break</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>3/19</td>
<td>1st quiz</td>
<td></td>
<td>First draft posted</td>
</tr>
<tr>
<td>10</td>
<td>3/26</td>
<td></td>
<td></td>
<td>Comment on at least six drafts</td>
</tr>
<tr>
<td>11</td>
<td>4/2</td>
<td>Second prototype</td>
<td></td>
<td>Second draft posted</td>
</tr>
<tr>
<td>12</td>
<td>4/9</td>
<td></td>
<td></td>
<td>Comment on at least six drafts</td>
</tr>
<tr>
<td>13</td>
<td>4/16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>4/23</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>4/30</td>
<td>2nd quiz</td>
<td></td>
<td>Final version posted</td>
</tr>
<tr>
<td>16</td>
<td>5/7</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4 Text

*The Essence of Artificial Intelligence* by Alison Cawsey, Prentice Hall, 1998. I expect you to read and understand pretty much the whole book.

Additional readings from the web are in general available from [http://rolandhubscher.org/courses/hf760](http://rolandhubscher.org/courses/hf760).

If you are interested in more details about AI, I strongly recommend *Artificial Intelligence: A Modern Approach* by Stuart Russell and Peter Norvig, Prentice Hall, 3rd edition, 2009. However, this book is much harder to read than Cawsey's.

5 Centra: Online Course Information

Please visit the Blackboard site for this course regularly for announcements, course information, class documents, and more. You can log in to Blackboard from any location, at any time at [http://blackboard.bentley.edu](http://blackboard.bentley.edu).

You are required to have a functioning microphone while online. When attending a class online, log in five minutes prior to class to test your microphone. For Centra login information, system requirements, and help, go to [http://atc.bentley.edu/hybrid.html](http://atc.bentley.edu/hybrid.html).

Note that in-state students are expected to attend classes in person and not via Centra.

6 When You Read a Paper or a Book Chapter

Keep in mind that the papers you read do not exist in isolation. If you run into problems understanding an article or book chapter, resolve the problems with additional literature, discussion with colleagues (of this class), talking to me, and discussing issues that are still unclear in class. When you come to class, be prepared to answer questions from the paper and ask good questions about it. I will not just present it to you.

Whenever you read a paper or a book chapter for this class, you will have to document this for your own records. I want to see proof of you doing this sometime toward the end of the semester. For each paper and chapter, write the following:
Exact bibliographic entry  This will enable you to reference and find the article later.

Summary in your own words  Summarize the paper/chapter in one paragraph. This can be viewed as an abstract biased toward your interests when you read the paper. Do not just copy the abstract. Remember, a good abstract describes what problem is tackled, why the problem is important, how it is approached and what the main results are.

Good parts  List at least two (at most six) good points (from your perspective and given your interests) you found in this article. One sentence per point.

Bad parts  List at least one (at most six) bad elements you found in this article/chapter. Again, one sentence per point.

7  Individual Wiki Article

You will write a carefully researched Wiki article for this class. There are several reasons for this. First, communicating a complicated topic clearly is one of the most important tasks as a professional and also one of the most difficult ones. Second, we don’t have the time in this course to look at lots of different systems with IUIs. You have the opportunity to look at one in quite some depth, and you can read your colleagues take on other interesting systems. Finally, by commenting on other article drafts in a critical yet constructive way, you further hone your communication and review skills.

Topic  Pick an interesting topic related to IUI. It can be an existing product that has an IUI, it can be some system from a research lab, it can be an issue that’s especially relevant like privacy, etc. Pick a rather narrowly focused topic, not some boring survey. If you don’t pick a specific system/interface and you have a more survey-type topic in mind, it must be focused on some narrow issue.

I’m happy to help you find a topic that is interesting for you and me. A good source for topics is the in-class discussions that sometimes cannot go deep enough into each and every interesting issue that comes up. Also, you might want to get feedback from me on the focus and organization of your paper relatively early on.

Obviously, plagiarism of any kind is not allowed. See the right column at [http://rolandhubscher.org/teaching.html](http://rolandhubscher.org/teaching.html) for a few useful resources regarding paper writing.

The paper will be graded using the following criteria:

Proper focus  Focus on IUI issues. Make clear why your focus is relevant for IUI. (Points: 10)

Technical errors  Simply said, don’t say things that are incorrect. Of course, if you avoid any interesting issue where you could go wrong, you will suffer for this in other categories (e.g., focus, completeness, and how well it is written). (Points: 15)

Unique insights  Are there any deep thoughts, comments, etc. of your own in there or is it just a rehash of stuff found in the sources? Rehash is bad, unique insights are indeed good. But don’t just make up stuff or provide your opinion. What you say must be backed up by literature, your own research (probably not applicable for most of you) and clear reasoning. (Points: 25)

Well written  The paper needs to be written clearly, using concise explanations, having a good organization, etc. Crippled sentences and typos are no-nos. So are repetitiveness, meaningless collections of big words, etc. (Points: 20)

Complete  Do not ignore relevant issues related to your topic. If you can’t deal with them all, make sure that the reader knows what you are focusing on and what you are omitting in this paper. How long should the paper be? Well, it needs to be complete so I expect at least 3,000 words without the bibliography. An article of length less than 2,000 words is useless and results in a zero for the whole paper.) (Points: 10)
Comments on other articles  Provide constructive feedback to your colleagues’ articles (see table in section “Important Dates”). Such feedback can be about clarity (you may not understand what the person is saying), correctness, omission, simply having questions not answered by paper, etc. No need to point out trivial typos, etc. (Points: 20)

8 Group Project

Each team is made up of about four to five students to make sure we have enough tie to discuss each project in class a few times during the semester. Therefore, please contact me for group meetings with me if you need some more feedback.

The goal of the group project is to design, in detail, a prototype of an intelligent user interface. The goal of the prototype (and the final presentation) is to convince a technically knowledgeable investor to give you the necessary funding to build a real version of your system.

8.1 Groups

The groups will be formed by the second week based on the online questionnaire you will fill out. The questionnaire is available on BB as a text document to be filled out and sent to me by email by Friday. If you have preferences (positive or negative) regarding the members of your team, let me know by email no later than Friday of the first week. However, these are only preferences, i.e., soft but not hard constraints. The groups will be announced in the second lecture.

8.2 Topic

In the group project of this semester’s Intelligent User Interface design course, we combine the strengths of Bentley’s MSHFID program with those of MIT’s Media Lab. Whereas Media Lab scientists are famous for their innovative solutions to difficult problems, MSHFID graduates are excellent at designing effective interfaces and experiences for end users. We start with Christopher Fry’s Justify, an intelligent computer system developed at the Media Lab supporting the collaborative construction of complex arguments. Check out Fry’s home page (section “Decision Support”) for more information about it. To explore the many different ways such a system can be effectively used by end users, the MSHFID students will use the Justify argumentation engine to design intelligent interfaces supporting domain-specific argumentation. The tool may support activities such as

- the review of journal articles where authors and reviewers build an argument in favor or against the article’s publication,
- the argument of an experiment including development of hypothesis, design of experiment, and analysis and interpretation of results,
- the argument for what the best move in a certain chess position is,
- or the argument for which major to study in,
- or an argumentation tool,
- or…

The students can decide on what kind of domain-specific tool they want to design in the semester-long project. They will present their evolving prototypes multiple times during the iterative design process and will receive guidance and a heavy dose of constructive feedback from Hübscher, Fry, and their fellow classmates.

Fry (see http://web.media.mit.edu/~cfry/) is a member of MIT’s Media Lab’s Software Agents Group (see http://agents.media.mit.edu/).
8.3 What to submit

At the end of the project, you will submit the following:

**User interface prototype**  Provide a set of wire frames that good enough to understand the user experience of the intelligent system.

**Architecture of intelligent system**  The architectures of the intelligent system. Show the final version only and discuss the main parts including representations used, input and output of the modules. Justify is obviously part of this picture.

**Report**  Describe the final version, not the intermediate steps.

- **Conceptualization**  As is, the idea of the interface is somewhat messy. It needs some conceptualization that adds coherence to it. Do this for the whole functionality, not just the one you focus on.
- **Analysis**  User, task, and context analysis.
- **Scenarios**  One or more scenario for the part of the system you focus on; feel free to use personas as well.
- **Criteria**  Usability and other criteria that drive the design and are used to evaluate it.
- **UI prototype**  This includes the user interface (see above) as well as the design decisions including those decisions that were made without incl. those decisions that were based on informed guesses.
- **Architecture**  This includes the architecture (parts and information flow) with the necessary explanations.
- **Discussion**  Reflect on the design. What are the advantages and disadvantages of the intelligent approach. Is it worth going that route?

8.4 Grades

Group projects are graded as shown below. The progress report is based on the presentations and the analysis. You will also be required to grade each other’s (within your own group) performance which then will be used to adjust your individual group grade.

<table>
<thead>
<tr>
<th><strong>GROUP PROJECT</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Progress reports (first &amp; second)</td>
<td>20%</td>
</tr>
<tr>
<td>Final report</td>
<td>40%</td>
</tr>
<tr>
<td>Prototype (actual solution)</td>
<td>20%</td>
</tr>
<tr>
<td>Presentation</td>
<td>20%</td>
</tr>
</tbody>
</table>

9 Quizzes

There will be two announced quizzes of 60 minutes each focusing on the readings and the in-class discussions. They are closed-book but two pages of cheat sheets are allowed.

10 Active Participation

You are expected to participate in class with interesting and thoughtful questions, answers and comments. This obviously excludes you browsing the web, answering email, playing games, etc. during class.

11 Grades

You are not allowed to skip parts of the requirements for this course, i.e., all the reports, paper and quizzes need to be done. For each missing part, I will have to deduct a full grade (10 points on the 100-point scale) from the final class grade.

---

That is one sheet, front and back; or two sheets, front each; or …
12 Topics

The dates (and topics) are quite approximate. Sometimes, we might spend more time than planned and sometimes less. This depends on what happens during class and what the students’ interests are. If something is not going to be covered, but you are interested in it, please let me know as soon as possible. I’m quite flexible with what we cover and when.

Weeks 1, 2 (1/23 – 1/30) — Introduction to intelligent user interfaces

What are intelligent user interfaces? Why do we need them and what can they do for us? We also talk about ubiquitous, pervasive and affective computing, some example problems and applications.

Reading
Chapter 1 of Cawsey and Chapter 1 of Computers as Assistants by Peter Hoschka available as hoschka.pdf. Also read (Lieberman, 2006).

We will discuss Justify so that everybody has a good enough idea. Do the readings and movies available from Fry’s home page.

Collect examples of what you think are examples of intelligent user interfaces (IUIs) and bring them with you so you can briefly describe them and why do you think they are indeed an IUI and not “just” an UI.

Weeks 3, 4 (2/6 – 2/13) — User interface design

We review the methods necessary to design novel user interfaces. The focus will be on knowing one good method instead of surveying all of them. Of course, we will concentrate on intelligent user interfaces and what it means to view a computer as an assistant to the user.

Weeks 5, 7 (2/20 – 3/5) — Knowledge representation

Artificial intelligence (AI) will be the topic for a while starting with how and why to represent knowledge. We will look at several representations including logic, rules and frames. We will focus on frames since they also allow us to understand some interesting cognitive issues. We also will talk about knowledge acquisition.

Reading
Chapters 2 and 3 of Cawsey and the very important (Minsky, 1975) available from http://web.media.mit.edu/~minsky/papers/frames/frames.html.

Week 6 (2/27) — Prototypes

You will present your prototypes and we all will discuss them. Focus is on interface and much less internal architecture.

Weeks 8, 9 (3/19 – 3/26) — Problem solving

We will talk about problem solving and reasoning. This includes heuristic search, expert systems, case-based reasoning and planning.

Reading
Chapter 4 of Cawsey. Read (Studer, Benjamins, & Fensel, 1998) available as studer98knowledge.pdf and...
The extended version (Clancey, 1985) of Clancey’s paper is a great resource. Read the first 12 pages; the rest of the paper is optional reading and available as Clancey-HeuristicClassification-CS-TR-85-1066.pdf.

Week 10 (4/2) — Machine learning
Computers can do more than what they are programmed to do. We will talk about the learning capabilities of computers, including neural networks.

Reading
Chapter 7 of Cawsey.

Week 11 (4/9) — Recommender Systems
Recommender systems are used quite widely and can be very useful. However, they also have some serious drawbacks. We will discuss the technology and that usability (incl. privacy, etc.) issues.

Reading
(Frankowski et al., 2007) available as p47-frankowski.pdf and (Svensson, Höök, & Cöster, 2005) available as p374-svensson.pdf.

Week 12 (4/16) — NLP and Vision
Since multimodal interaction is important, we will talk about natural language processing and vision.

Reading
Chapters 5 and 6 of Cawsey.

Week 13 (4/23) — Intelligent agents
We will discuss autonomous intelligent agents and multiagent systems.

Reading
Chapter 8 of Cawsey.
Read about applications of intelligent agents by N. R. Jennings and M. Wooldridge available as ia-applications.pdf, look at the projects at http://agents.media.mit.edu/ and read (Fischer, Nakakoji, Ostwald, Stahl, & Sumner, 1998) available as fischerg9embedding.pdf.

Week 14 (4/30) — IUI examples
Read the paper that we will determine later in the semester based on the students’ interests. The papers will be announced a few weeks before this lecture and provided as PDFs. I will lead the discussion of the papers we all have read carefully before class.

Week 15 (5/7) — Presentations
Your final group presentations.

References


