

The 5th Wave

By Rich Tennant



...AND TO ACCESS THE PROGRAMS 'HOT KEY', YOU JUST DEPRESS THESE ELEVEN KEYS SIMULTANEOUSLY. HERB OVER THERE HAS A KNACK FOR DOING THIS THAT I THINK YOU'LL ENJOY - HERB! GOT A MINUTE?

Human-Computer Interaction

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Overview of lecture

- Introduction to human-computer interaction (HCI)
 - What it is
 - Brief history
- Fundamental (design) principles in HCI
- New challenges when designing and building intelligent products based on *ubiquitous computing*

- Two common reasons when a project fails are the lack of:
 - user input during the design and development process
 - requirements that the final product/system should meet in the end
- A successful (intelligent) product is more than the development of and the knowledge about the latest technology

Technology-driven vs user-centred design

- You can have different starting points:
 - The technology runs the design of the interface which give the user the functionality of the system
 - Users put demands on the functionality of the interface which runs the design of the technology

Human-Computer Interaction

“Human-computer interaction is a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them.”

(ACM SIGCHI, 1992, p. 6)

Disciplines contributing to and benefiting from HCI

- Computer science
- Cognitive psychology
- Social and organizational psychology
- Ergonomics or human factors
- Interaction design
- Linguistics
- Artificial intelligence
- Philosophy, sociology and anthropology
- Engineering
- Design

HCI History

- 1970s: user interface, Man-machine Interface (MMI)
- mid-1980s: HCI (definition)
- From the PC explosion with the design of menu names etc and of hardware (terminal, keyboard) to a wider context, ex social (integration of technology in workplaces), and development of theories and methods of design
- From "good intentions" to a rich challenge

HCI

- The fundamental goals of HCI: “to develop or improve the **safety**, **utility**, **effectiveness**, **efficiency**, and **usability** of systems that include computers” (Interacting with Computers, 1989, p. 3)

Safety (design of safety-critical systems), utility (the functionality of a system), **usability** (making systems easy to learn and easy to use)

Usability

- Key concept in HCI
- Can be broken down into the following **goals**:
 - Effective to use (effectiveness)
 - Efficient to use (efficiency)
 - Safe to use (safety)
 - Have good utility (utility, functionality)
 - Easy to learn (learnability)
 - Easy to remember how to use (memorability)

Interaction design

- “Designing interactive products to support people in their everyday and working lives”
- Creating user experiences that enhance and extend the way people work, communicate and interact
- Entertainment, education, home, public areas etc
- Same fundamentals as HCI in terms of usability goals and design methodology, but is also concerned with other goals

User experience

- Interaction design is also concerned with creating systems that are:
 - Satisfying
 - Enjoyable
 - Fun
 - Entertaining
 - Helpful
 - Motivating
 - Aesthetically pleasing
 - Supportive of creativity
 - Rewarding
 - Emotionally fulfilling

Why is HCI important?

- In order to achieve efficient, effective and safe products/systems:
 - **Productivity** (introducing technology that does not support the work may cause reduced productivity)
 - **Safety** (crashed air planes and nuclear power plant disasters have led to an understanding why HCI is important!)

Computers should be designed for the needs and capabilities of the people for whom they are intended!

More reasons

- The interface is not a “later problem”
- Products and systems cannot be developed and designed using the developers/designers themselves as the norm
- Users might not have a great interest in technology
- Users rarely read manuals and instructions

“Human-computer interaction is the kind of discipline which is neither the study of humans, nor the study of technology, but rather the bridging between those two. So you always have to have one eye open to the question: what can the technology do? How can you build it? What are the possibilities? And one eye open to the question: what are people doing and how would this fit in? What would they do with it? If you lose sight of either of those, you fail to design well.”

(Terry Winograd, Professor of computing, Stanford University)

Design principles

- Know your user
- Reduce cognitive load
- Engineer for errors
- Maintain consistency and clarity

Know your user

- Cognitive and perception psychology
 - General knowledge about humans
 - Sara will give an introduction today
- User analysis
 - Specific knowledge about a group
- Reasons:
 - Minimize cognitive load
 - Use resources efficiently (system and user)

Reduce cognitive load

- Make functions, objects and information visible
 - The human brain is limited in its capacity: memory, attention...
 - PC-specific example: UNIX (cat, grep, mv, lpr) vs GUI (icons); which ones are easiest to recognize/remember?

Reduce cognitive load

Mental model:

“The model people have of themselves, others, the environment, and the things with which they interact. People form mental models through experience, training and instruction.”

- Provide clear conceptual models
 - Help the user getting a clear mental model of the system!
 - Metaphors (e.g. the desktop metaphor)

Engineer for errors

- Make it difficult for the user to make errors
 - E.g. menus give the user the possible alternatives (prevents errors but not mistakes), sound can indicate right/wrong
- Provide good error messages
 - Less user frustration

Engineer for errors

- Reversible actions
 - Allow users to correct their own errors
- Provide feedback
 - The user need to know the state of the system



Maintain consistency and clarity

- Standard operations and representations
- Appropriate metaphors help building and maintaining a user's mental model
- Easier for users to learn, recognize and to foresee what is going to happen

Designing ubicomp systems

- The fundamental HCI principles also apply to the design of ubicomp systems, but...
- Ubicomp means new design challenges!
- Smaller, tangible and “invisible”
- E.g. a user interface in a ubicomp system might not even have a display...
 - How to inform the user if he/she has done something wrong?
 - How to give the user feedback?

PC (GUI based) vs ubiacomp systems

- **PC**: familiar mechanisms such as cursors, windows, icons, menus, drag&drop and cut&paste
- **Ubiacomp**: wide range of input (and output) such as sound, speech, haptics, gestures, camera, sensor input/output (activity, light, accelerometer...)
- E.g. How provide users with an *undo function* in ubiacomp systems? Not like ctrl + Z. Many questions and not as many answers yet.

Still...

- Know who the users are
 - How do humans function?
 - What do humans do (work, home, mobile...)?
- Know what your system or product should support to match the users' needs and requirements
 - E.g. context-aware computing where you model user activity and features of the environment. E.g. what sensors do you need?

Further reading

- Bellotti et al. 2002. "Making Sense of Sensing Systems: Five Questions for Designers and Researchers"
- Tolmie et al. 2002. "Unremarkable Computing"
- Will be available from the course website soon, but temporarily here:

www.viktoria.se/~mariah/isd/

Reading assignment

Thursday 27 Oct

- Similar to Furby
- Read article on ActiMates Barney!
- www.viktoria.se/~mariah/isd/barnev.pdf



Further reading

- Human-Computer Interaction by Jenny Preece, Addison-Wesley, 1994
- Interaction Design Beyond Human-Computer Interaction by Preece, Rogers and Sharp, John Wiley & Sons, Inc., 2002
- The Design of Everyday Things by Donald Norman