Intelligent User Interfaces Design and Implementation

http://www.dfki.de/~sonntag/courses/WS15/IUI.html

Specific Objectives of the Course

Upon completion of the IUI course, students are expected to have:

- Interdisciplinary knowledge and understanding of IUI topics
- Skills to engage as active participants in critical reflection and debate
- The intellectual capabilities inherent in reading and interpretation, written argument, qualitative/ quantitative critique, and creative thinking required for further IUI scholarship
- ... which means:

Upon completion of the IUI course, students are expected to have:

- Understanding of:
  - importance of IUI design and implementation issues
  - limitations of presented algorithmic solutions (and in general undecidable/untractable)
- Ability to:
  - participate in large-scale IUI programming/implementation projects.
  - communicate effectively in a professional environment & work in IUI group projects
  - review and evaluate IUIs (to a certain extend)
  - recognise the need to keep up to date with developments in IUI
  - participate professionally in industrial research and development (after taking related information science courses).

Grading

- Credit points: 4 ECTS-CP (2C+1R)
- Grading will be based on the assignments, the recitations (required prerequisite for final examination), and the oral or written examination.
  - Readings Critiques (**4** assignments); Readings critiques must be submitted in hardcopy at due date, don’t worry: Critiques will be graded as "check", "check minus", or "check plus" (extra credit).
  - Recitations (up to three students, but: 50% of points required prerequisite for final examination)
  - Software project
  - 100% the written examination
- Regular class attendance (and active participation) is expected.

Recitations

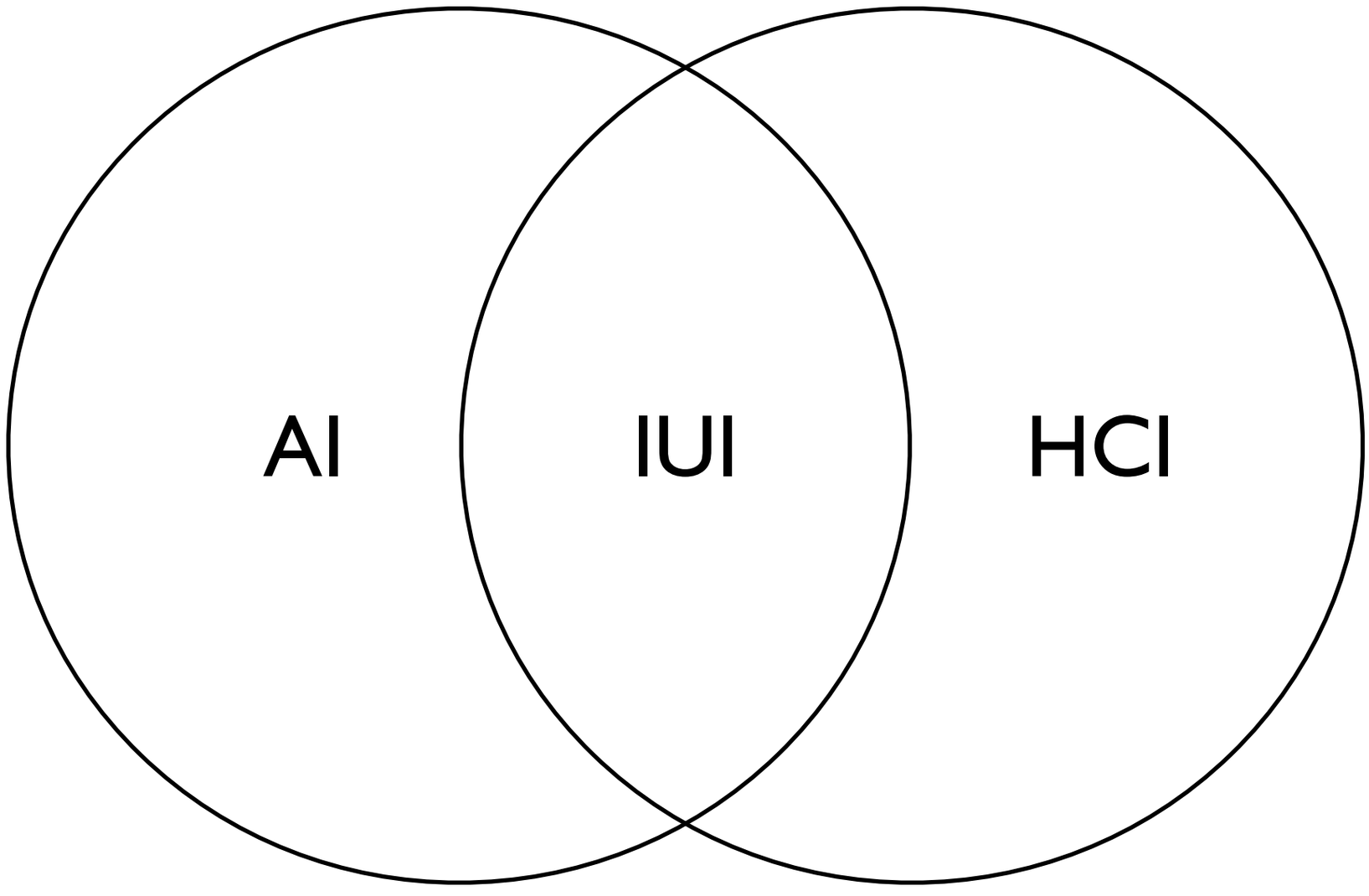
- exercise sheets / Übungsblätter
- you will like it: it includes **video** projects:
  for each HCI video, explain what the IUI aspect is, and if there is none, describe how the HCI application presented in the video "product" could have been designed to include IUI.

IUI

Design and Implementation
Lecture 1: Overview and Design

Daniel Sonntag, DFKI
WWW: http://www.dfki.de/~sonntag

Interdisciplinary Field and Transcommunity



Some IUI Objectives

- Increase productivity
- Decrease expenditures
- Improve efficiency, effectiveness, and naturalness of interaction
- How?
  – for example, use knowledge representation, reasoning, ML, adaptation, adaptivity
- Example Email Filter / Email Response System / Dialogue System

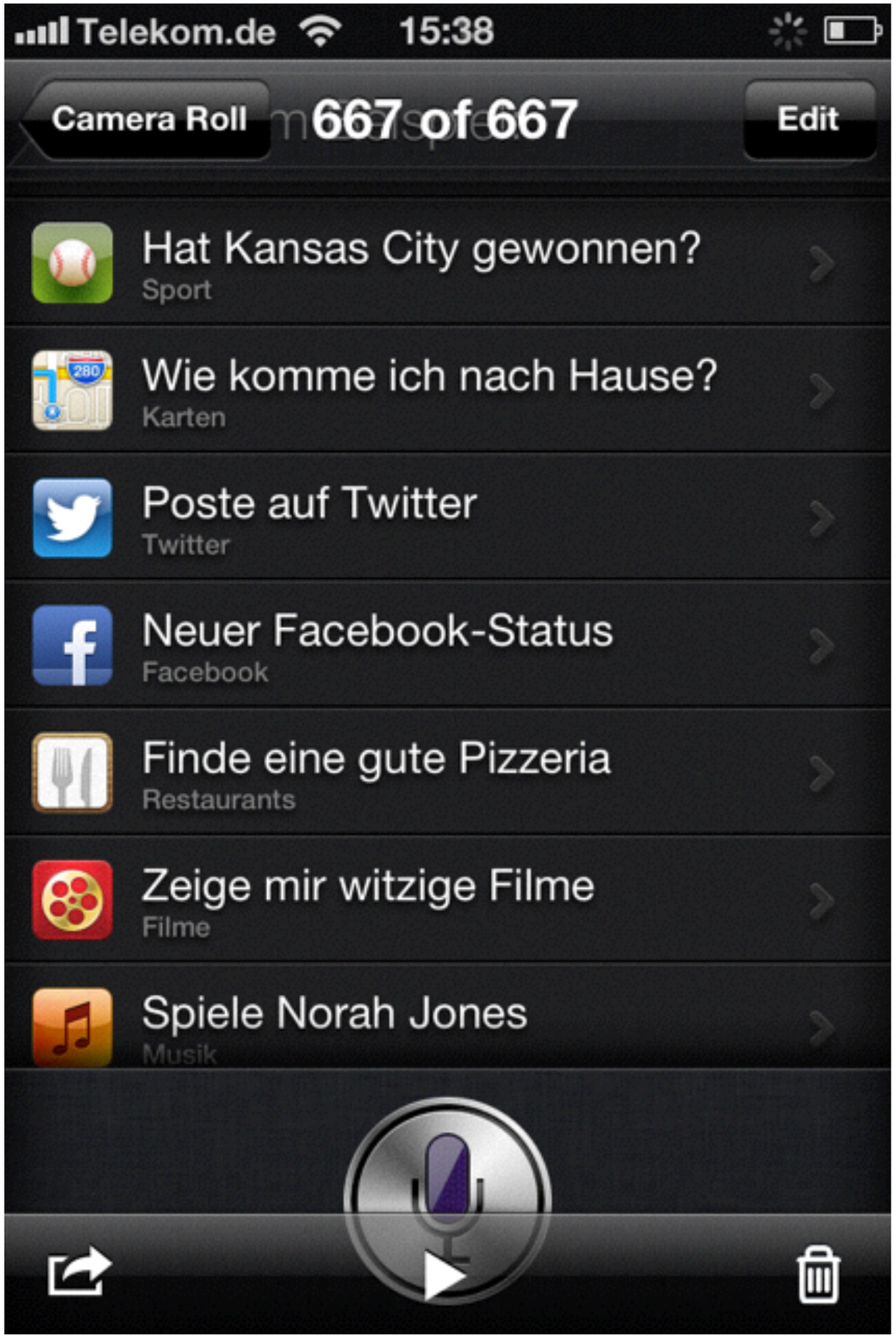
Smartweb and Siri

Who was world champion in 1990 ?

Anno 2007

Question Answering Functionality

2006 WM Demonstrator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Camera Roll
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Edit
Hat Kansas City gewonnen?
Sport
Wie komme ich nach Hause?
Karten
Poste auf Twitter
Twitter
Neuer Facebook-Status
Facebook
Finde eine gute Pizzeria
Restaurants
Zeige mir witzige Filme
Filme
Spiele Norah Jones
Musik


OK, I found four theaters not far from Anchorage:
CENTURY 16 ANCHORAGE
REGAL DIMOND CENTER 9 CIN...
REGAL TOTEM 8 THEATRES
REGAL TIKAHTNU STADIUM 16 &...
I found quite a number of movies:
25 MOVIES
THE ODD LIFE OF TIMOTHY...
Released August 15
BRAVE
Released June 22
JOHN CARTER
Released March 9
THE MUPPETS
Released November 23, 2011
WINNIE THE POOH
Released July 15, 2011
'2001: A Space Odyssey' was directed by Stanley Kubrick.
2001: A SPACE ODYSSEY
DIRECTOR
Stanley Kubrick
STARRING
Keir Dullea
Gary Lockwood
William Sylvester
Runtime: 2h 19m
'The Big Lebowski' stars Jeff Bridges, John Goodman and Julianne Moore.
THE BIG LEBOWSKI
DIRECTOR
Joel Coen
STARRING
Jeff Bridges
John Goodman
Julianne Moore
Runtime: 1h 57m
Here's 'The King's Speech' which won the Oscar for Best Picture in 2011:
THE KING'S SPEECH
DIRECTOR
Tom Hooper
STARRING
Colin Firth
Geoffrey Rush
Helena Bonham Carter
Runtime: 1h 58m
I found a few movies coming out last Monday to Sunday:
13 MOVIES
WON'T BACK DOWN
LOOPER
HOTEL TRANSYLVANIA
THE PERKS OF BEING A...
Coming September 28
THAANDAVAM
Coming September 28

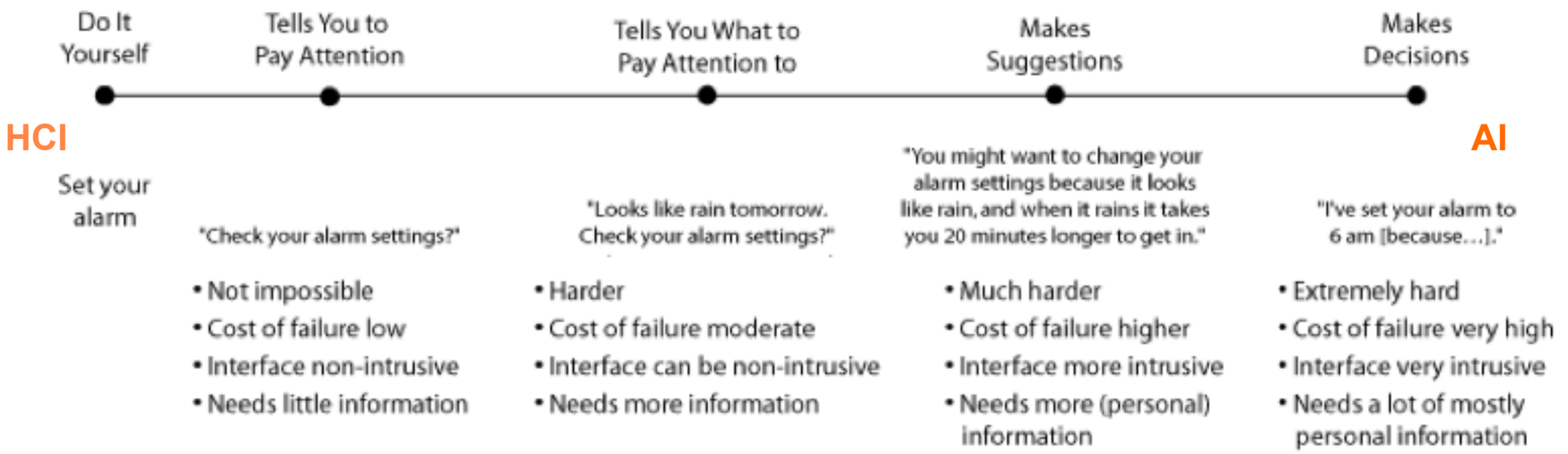
Augmented and mixed reality examples

http://www.dfki.de/~sonntag/siemens-talk.pdf

Introducing aspects of IUIs

Classification Example: IP Continuum for Adaptive Interface Design

- Interface-proactivity (IP) continuum between the user and the system (Isbell and Pierce) from HCI perspective (2005)
- Vocabulary for discussing and comparing adaptive interfaces



http://www.cc.gatech.edu/~isbell/papers/IPContinuum-IsbellPierce.pdf

IUI Design Opportunities

- Risks (examples):
  - Don’t do what the user wants
  - Sometimes this is okay
  - Interrupt the user at a bad time
  - Frustrate user
  - Loose user trust
- How should the system decide?
  - Design opportunities: needs and technique driven

IUI Design Opportunities

- What are some specific UI components that you/others interact with?
  - Desktop/Web apps
  - Ubiquitous and pervasive apps
  - Mobile apps
  - Very large displays

OLD SCHOOL

- In the future?
  - Speech based multimodal dialogue systems
  - Cyber-physical Systems, e.g., MedicalCPS
  - Towards **user-environment interaction and collaboration**

Towards automation and mixed initiative

- Roughly, input processing requires system to "understand" input
- Likewise, output display requires system to "generate" output
  - Historically, canned output is used (parse tree not required)
  - **Reaction on the fly**
  - Generation on the fly
  - Requires common representation of knowledge
  - Towards model−based solutions

ELIZA's Canned Text

- Psychotherapist who repeats your thoughts
  - "Yes, tell me more about _____ "
  - "Do you think it is _____ to _____ "
  - "I understand. I am listening."
- Simple "parsing" and substitution of key words into canned phrases.
- Try it out at: http://nlp-addiction.com/eliza/

Some Major IUI Challenges

- Mixed-initiative dialogue (will be discussed)
- Modeling what users want
- Eliciting what users want
- Not knowing the “true” world state (partial observability) and acting
- Planning and reasoning ahead
- Continually learning model parameters or whole models (never ending learning)
- Speech understanding and activity recognition

Medium and Modality

- Medium
  - Material object used for presenting, saving, or handling information, e.g., paper, CD, microphone, mouse
- Modality
  - Human senses used to process information, e.g., vision, audition, olfaction, touch, taste
  - Also called mode

Intelligent Help Agent

- “What do you want to do?”
- “Copy a videotape to a DVD”
- “First, insert a blank DVD in the recorder”
- “OK, what next?”
- “Push the button marked IN/REC on the DVD recorder.”

Some Examples of IUIs

- Radspeech (Video)
- ERmed (later ...)
- DigitalPen (Demo)
- Smartweb Design (later ...)

Student Projects

- The tutors will meet with each project team individually a couple times during the semester to provide advice, answer questions, etc.

Student Projects

- Count as 3 recitation!

- Phase 1: Topic Selection & Task Analysis
  Identify a type of technology to investigate and begin thinking about tasks and (possibly hypothetical) set of users that you will support with your intelligent user interface. Determine what is difficult (and easy) about the current task and how it can be supported.

- Phase 2: Initial Design and Implementation
  Specify system design goals and create an initial conceptual design and implement it together.

- Phase 3: Final Report and Presentation
  Write a report describing the users, their tasks, your technological solution to supporting them (including design and prototype implementation), and how the system is expected to be used. Also include an empirical or observational study of how you would evaluate your system's success in meeting its goals of supporting users.

Student Projects

- What you turn in: 6 page final report
  - Two to three page description of the task being supported, how users currently perform this task, and the type of technology.
  - This should include some indication of how the new system might augment current work practices -- remember to respect current tradition while looking for ways to transcend current practice.
  - Description of the system goals and conceptual design. This should include diagrams/drawings of the interface or interactions between system components and users in order to provide a sense of what the system might look like.
  - **This year, we will focus on 3D (video) sensor data + Myo + annotating daily life activities in the IOT (internet of things) paradigm.**

IUI moves on ...

IUI Group Endorsement

- the design, realisation, and evaluation of interactive systems that exhibit some form of intelligence
- create a transcommunity
- bring to mind the "binocular view" of interaction and intelligence that is central to IUI

The term intelligent UI

- techniques used to realize intelligent systems have their origins in AI—though in many cases a subfield has formed around a given type of technique (no longer primarily associated with AI)
- The canonical intelligent system includes a wide variety of capabilities, including sensing and perception, knowledge representation and reasoning, learning, creativity, planning, autonomous motion and manipulation, natural language processing, and social interaction.

Relationships between the intelligence in a system and the user interaction

- The intelligent processing is found in the user interface(s) of the system, and its purpose is to enable an effective, natural, or otherwise appropriate interaction of users with the system. For example, the system may support human-like communication methods such as speech or gesture; or it may adapt its style of interaction to individual users.

Relationships between the intelligence in a system and the user interaction

- The intelligent processing is found in the "backend" of the system, and its primary purpose is to serve some beneficial function such as performing actions partly autonomously on behalf of the users. The relevance of the system's intelligence to interaction with users.

Relationships between the intelligence in a system and the user interaction

- The intelligent processing is used not directly in the system itself but in the process of designing, implementing, and/or testing the system. Hence, the system that the users interact with may not itself be an intelligent system.

Systems where the intelligence lies mainly in the user interfaces

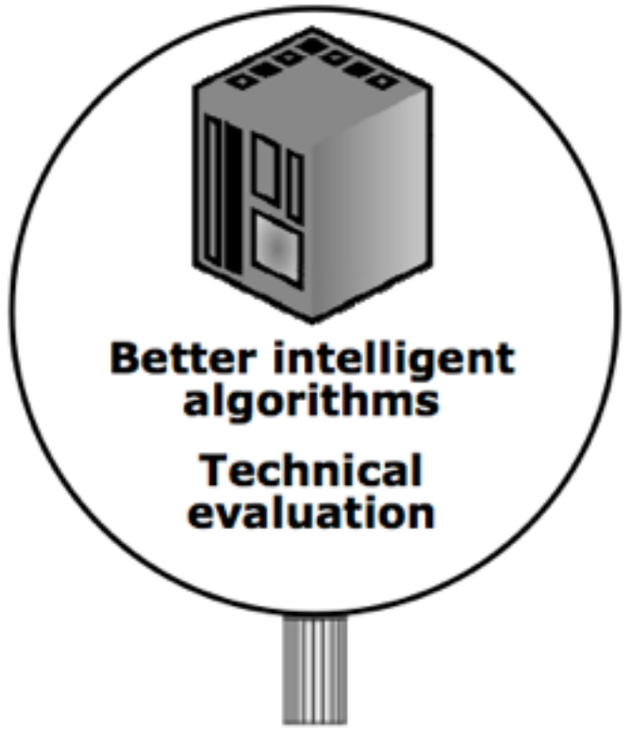
- Systems with adaptive user interfaces that are automatically adapted to the inferred capabilities or needs of the user.
- Multimodal systems that aim to enable more natural, human-like forms of input and output.
- Systems with human-like virtual characters that enable the user to interact with a system in a way that is partly similar to human-human interaction.
- Smart environments in which embedded objects interact intelligently with their users.
- Personalised websites, in which the displayed content is adapted to the inferred interests of the user.

Systems where the intelligence lies mainly behind the user interfaces

- Recommender systems, which present products, documents, or other items that are expected to be of interest to the current user.
- Systems that employ intelligent technology to support information retrieval.
- Learning environments that offer learning assistance on the basis of assessments of each learner's capabilities and needs.
- Interface agents that perform complex or repetitive tasks with some guidance from the user.
- Situated assistance systems that monitor and support a user's daily activities.
- Systems for capturing knowledge from domain experts who are not knowledge engineers.
- Games that make use of AI technology to create the opponents against which the human players play.

Different perspectives on IUIs

Focus on Intelligent Technology



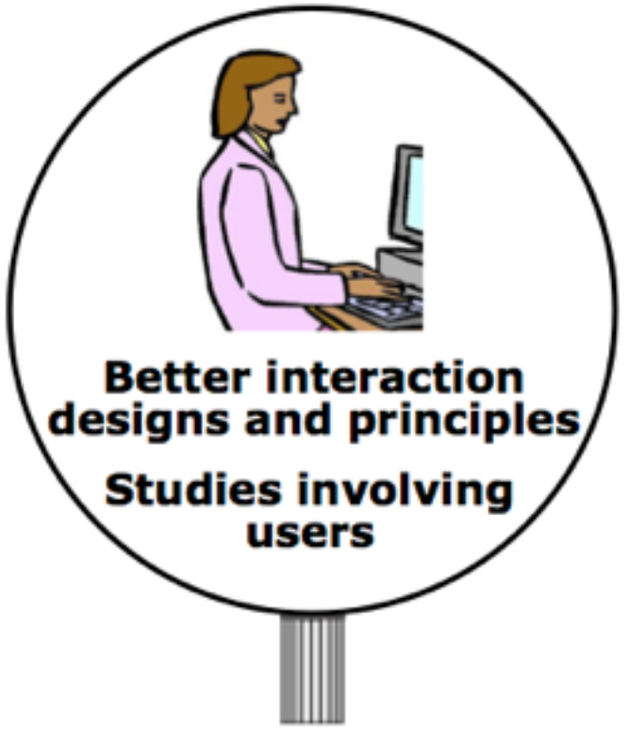
Existing interaction designs

Knowledge and assumptions about users and interaction

Focus on User Interaction

Existing intelligent systems

Knowledge and assumptions about possible system intelligence



Binocular View

Design of combinations of intelligent algorithms and interaction

Studies examining algorithm performance and users' behavior

Relevant Research Areas

- In some research areas, such as recommender systems, information retrieval, or intelligent learning environments, the system's intelligence typically consists in learning, reasoning, or decision making which supports the system's primary function (e.g., suggesting appropriate products or documents; monitoring and supporting a learner's progress).

Relevant Research Areas

- In some other areas, the main contribution of the intelligence is to enhance communication between the system and users, in a way which **may or may not** be closely related to the system's main function. This is the contribution most commonly found in the areas of multimodal interaction, natural language processing, embodied conversational agents, computer graphics, and accessible computing.

In what ways can artificial and human intelligence work together effectively

- Where does intelligent processing yield the greatest benefits for interaction, relative to other forms of computation?
- What patterns of division of processing between the human and the intelligent system tend to be successful, and which less so?

Challenges to usability and acceptance the incorporation of intelligence raises

- The performance of an intelligent component may be fallible, leading to inappropriate interpretations or actions.
- Intelligent processing is often—though not inevitably—relatively difficult for users to pre- dict, understand, and control.
- If they rely on relatively extensive information about the users, intelligent systems may raise certain types of privacy and security risks.
- An increased ability of a system to take over tasks that normally require thought and judgment can limit the breadth of experience and the responsibility of users.

Methodology for research, design and evaluation of IUIs

- How can we understand users' requirements for intelligent support in a particular context when the potential users have little idea of what sort of intelligent support is currently feasible?
- How can we design an evaluation of a system that comprises measures of the performance of the intelligent algorithms, observations of users' behavior, and the interpretation of users' subjective reactions.

Notes on IUI evaluation

- With a focus on technology, it is often possible to demonstrate a small but statistically reliable improvement to an algorithm, especially when benchmark datasets are used.
    - Benchmark datasets are often not available.
- By contrast, improvements and differences with regard to interaction design usually have to be more substantial to be measurable, and the effort required to achieve and document them (e.g., with user studies) is often greater.
    - User studies are often biased.