Social Robotics

PDEEC PhD course on Social Robotics

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Social robotics environments

- "... laboratories are not real environments, especially for service robots ...", [Kanda, Ishiguro, 2013]
- The design of robot behaviors requires deep knowledge of the environment (including relations between entities)
- This knowledge can often be acquired through
  - Autonomous experiments of controlled complexity
  - Wizard-of-Oz experiments

Takayuki Kanda and Hiroshi Ishiguro
"Human Robot Interaction in Social Robotics"
CR Press, 2013.

Wizard-of-Oz vs. Human-in-Loop

Wizard-of-Oz The experimenter can manipulate (in a manipulative meaning) some/all dof; the experimenter is not part of the environment

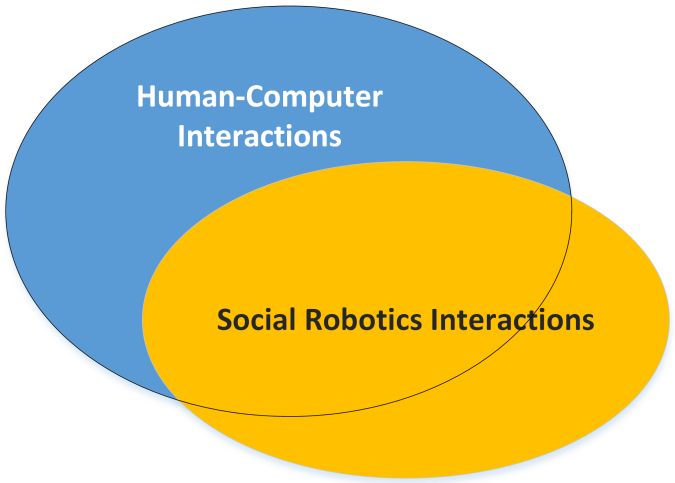
Examples: A social robot is controlled by a hidden-from-sight experimenter

Human-in-Loop The experimenter uses (without manipulative intent) some/all dof; the experimenter is part of the environment

Examples: The experimenter interacts with a robot; the experimenter flies an aircraft simulator

Interfacing and Interaction

- **Interaction:** The information exchanged through some media
- **Interface:** The media (the tools) for interaction



Human-Computer Interaction

- The human, the computer, and the interaction – the key trilogy in HCI – How do humans work? How do computers work? What are good models of interaction (maybe the ones that minimize errors)?
- Which paradigms for HCI? What are the effective strategies?
- What are the design rules for quality HCI? Go for maximum usability
- How to assess HCI? Usability?

The execution-evaluation cycle when interacting via an interface

1. Establishing the goal.
2. Forming the intention.
3. Specifying the action sequence.
4. Executing the action.
5. Perceiving the system state.
6. Interpreting the system state.
7. Evaluating the system state with respect to the goals and intentions.

HCI and social robotics

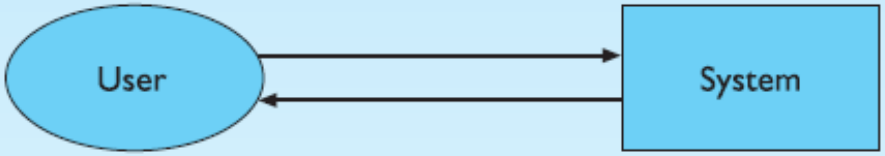


Figure 3.5 Office system – direct manipulation

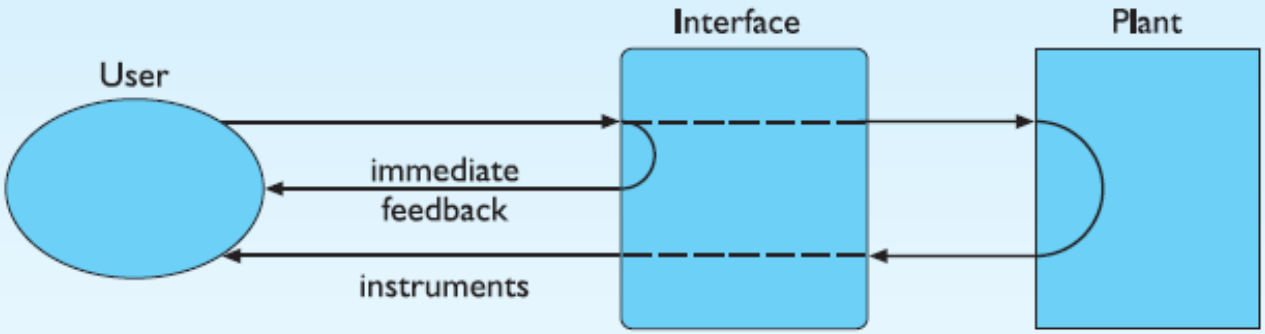


Figure 3.6 Indirect manipulation – two kinds of feedback

- Interfacing architectures can be useful to design interactions with social robots

Human-Computer Interaction – the “Waterfall” model

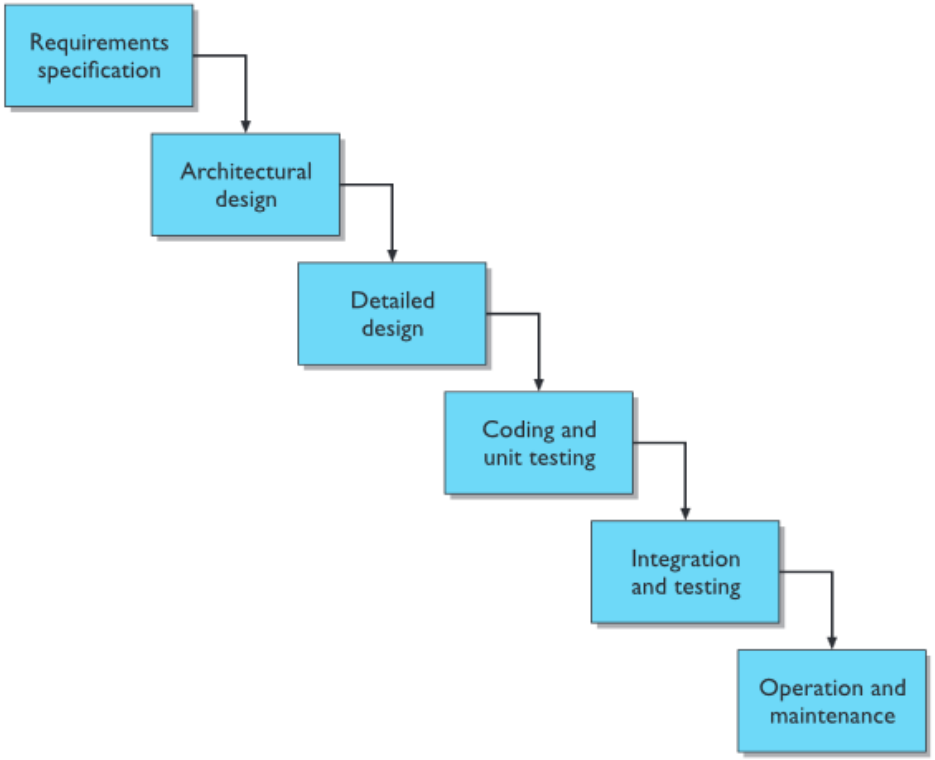


Figure 6.1 The activities in the waterfall model of the software life cycle

Source: [**?**]

- Activities common in software development cycle – Akin to interface development

Human-Computer Interaction basic “truths” I

A product (e.g., an interface) is successful if, [**?**]

- It is useful – accomplishes what is required
- It is usable – do it easily and naturally, without danger of error
- It is used – make people want to use it, be attractive, engaging, etc

$\Downarrow$

Is this applicable to social robotics ?

Human-Computer Interaction basic “truths” II

Design focus, [**?**]

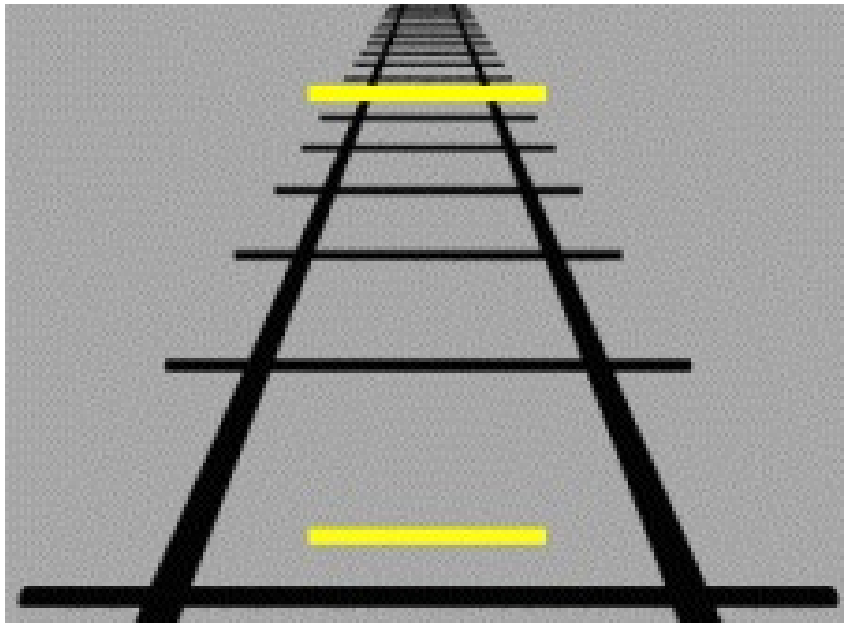
- Think user, remember that someone will use the interface
- Try it out, have someone beta-test the interface
- Involve the users, in the design process
- Iterate, the 1st version will hardly be the final one

Assessing an HCI may be a delicate operation – Much as planning a Social Robotics experiment

Human-Computer Interaction “tricks”

Know how people’s perception works

- Optical illusions show the difference between what the eyes see and what the brain perceives



- People recognize words in a text by shape (there’s no serial character reading); eyes move back and forth during the process (akin to speed-reading techniques)

Human model from HCI

Acquisition of information

$\Downarrow$

Information storage

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Information processed and applied

- Human factors, e.g., emotions may disturb the interaction skills, [**?**]

A model of human memory I

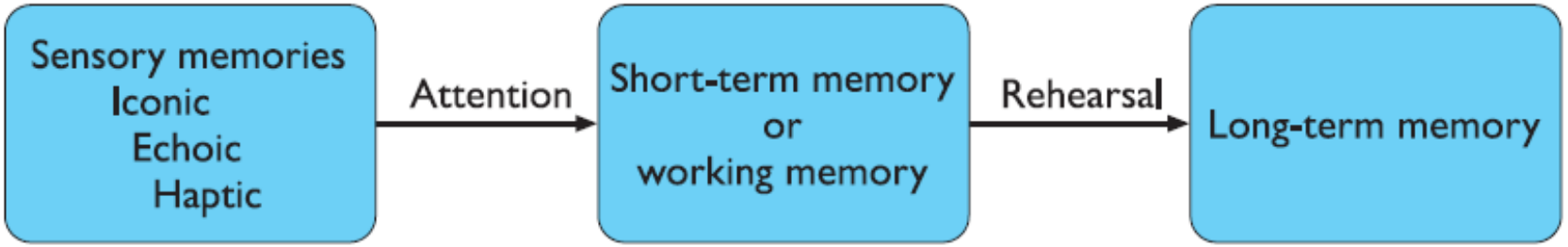

Figure 1.9 A model of the structure of memory

Source: [**?**]

- Sensory memories: Buffers for iconic (visual) stimuli, echoic (aurali) stimuli, haptic (touch) stimuli received from senses

  Each of these sensory memories has a dynamics and a lifetime

- Short term memory (working memory) lifetime can be as low as 200 ms

  Short term storage capacity is limited to 7 ± 2 chunks of information (rule of thumb)

A model of human memory II

- Long-term memory has little decay

  Episodic memory – Events and experiences in serial form

  Semantic memory – Structured memory; a network of concepts

  The 2 main processes manipulating the long-term memory are *information retrieval* and *information forgetting*

  Repeated exposure to a stimulus transfer it to the long time memory

  Information is forgotten through interference (new information overlaps old information) and/or decay

A model of human memory III

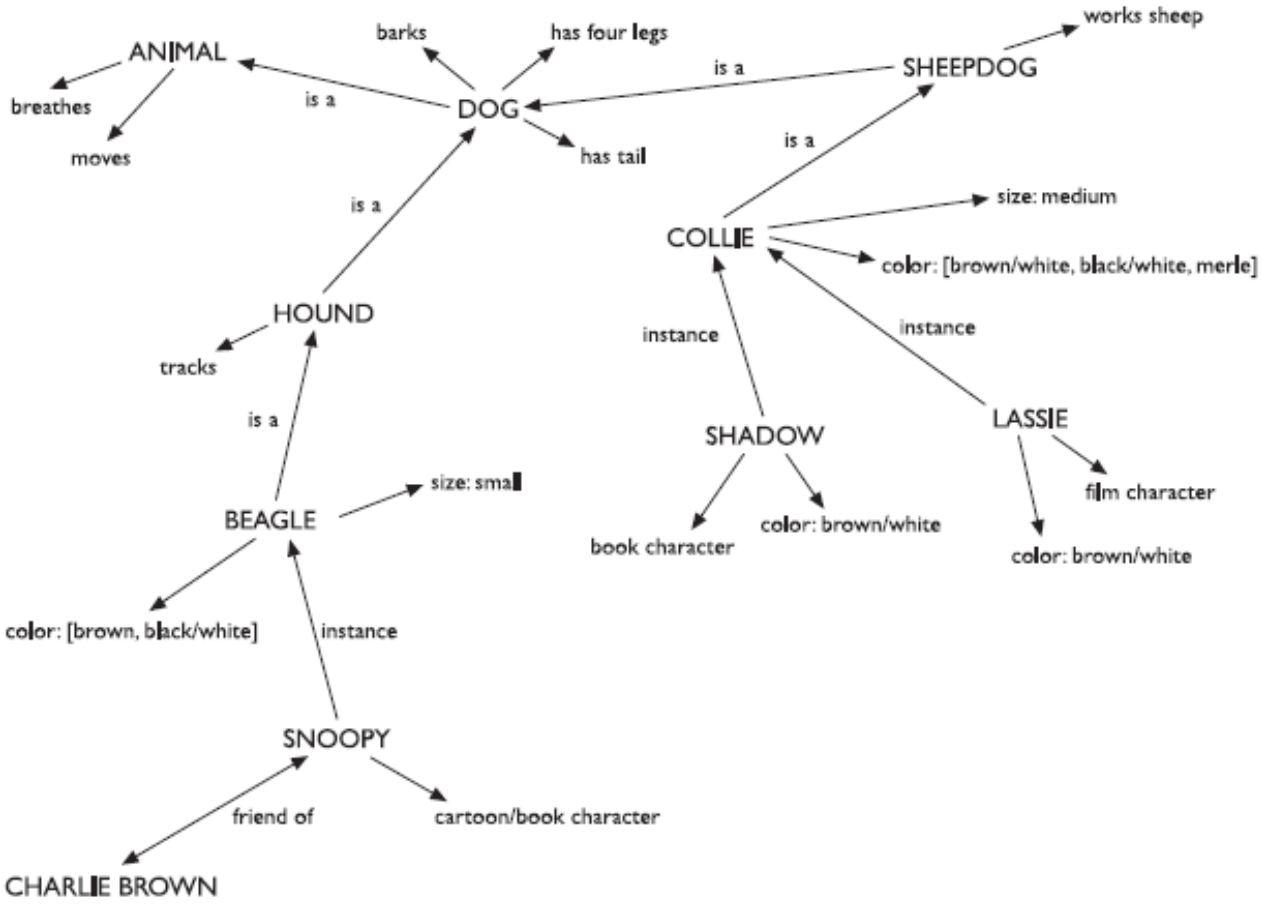

Figure 1.11 Long-term memory may store information in a semantic network

Source: [**?**]

A semantic network is a database with a structure allowing fast access to related concepts

The Mehrabian model – Human memory with direct social impact

A typical audience retains, [Mehrabian, 1981]

- Verbal content – 7%
- Vocal tone – 38%
- Non-verbal/Facial expression – 55%

Albert Mehrabian
"Silent Messages: Implicit Communication of Emotions and Attitudes"
(2nd ed), Belmont CA; Wadsworth, 1981

Alan Dix and Janet Finlay and Gregory D. Abowd and Russel Beale
"Human-Computer Interaction"
Third edition, Pearson, Prentice-Hal, 2004.