NUR: Intelligent UI, CSCW
Intelligent system

- Reasoning
- Learning
- Adaptability
Intelligent system - reasoning

- Derivation of a new knowledge
  - not previously contained in the system

- New knowledge is based on the existing knowledge
Reasoning Example

ROI definition: \((\text{object}_1, \text{semantic\_relation}, \text{object}_2)\)

ROI: \((\text{r2}, \text{connected}, *)\)

Legend

- \(\text{connected}\)
- \(\text{contains}\)
Reasoning Example

ROI: (r2, connected, *)

connected: \( R(X,Y) \leftrightarrow \text{door}(A), R(X,A), R(Y,A). \)

connected: contains(r1,r4)?
Reasoning Example

ROI: (r3, safeconn, r7)

rule template:

\[
\text{saferoom}(X) \iff \text{room}(X), \text{safe}(X).
\]

\[
\text{safe}(X) \iff \text{contains}(X,g).
\]

\[
\text{safe}(X) \iff \neg\text{dangerous}(X).
\]

\[
\text{dangerous}(X) \iff \text{contains}(X,t).
\]

\[
\text{safeconn}(X,Y) \iff \text{saferoom}(X), \text{saferoom}(Y), \text{connected: contains}(X,Y).
\]

query:

\[
\text{safepath:safeconn(r3,r7)}?
\]

\[
\text{safepath:safeconn(r3,r7,P)}?
\]
Intelligent Interactive System

- Systems that provide interactive support based on embedded AI mechanisms
- Provides interface to AI functionality and knowledge representations

Examples
- Cooperative problem-solving systems
- Operation center of autonomous system
Intelligent User Interfaces (IUI)

- A bridge between user and intelligent interactive system
Reasons for introduction of IUI

- Make the communication more natural
  - natural language conversation
  - talking head

- Lower cognitive load
  - personalization of UI and the content to user needs
  - efficient UI control and content presentation

- Accessibility
  - adaptation of UI and content to user capabilities

- Increase the flexibility
  - automatic UI generation based on the context (tasks, environment, user model)

- Allow autonomous work
Intelligent versus Intuitive Interfaces

- **Intuitive** - having immediate mental perception or understanding (natural, no training)

- **Intelligent** - capable of communicating and reasoning (user, task, dialogue, information, media)

- **Interface** - a device that bridges different systems, people, ideas, etc. (interpretation and generation)
Models used in IUI design

- Environment model
- Conversation model
- Domain model
- User model
- Behavior model
- Physical model
Example: Conversation system

- Conversation context
  - Conversation state
  - Conversation history
  - Forgetting

- User context
  - Physical location
  - End-device capabilities
  - Network status
  - User preferences

- Ontology
  - Tasks
  - Domain
  - Environment
  - Application knowledge
  - Environment

- Forgetting
Example: Conversation system

- User context:
  - Physical location
  - End-device capabilities
  - Network status
  - User preferences

- Conversation context:
  - Conversation state

- Conversation history

- Ontology:
  - Linguistic ontology
  - NL annotation
  - Domain
  - Application knowledge
Example: Conversation system
Example: Domain model enriched by NL

Natural language attributes of a property type
How to discover Intelligence in an interactive system
Turing test

- Test whether we discover that our partner is a computer
- Behavioral view of intelligence
  - A behavior capable of fooling a human interrogator
- Acting humanly is sufficient to pass the test
  - Is it necessary the AI system also thinks humanly?
Agents and intelligence in user interfaces
Agent definition

- Agent is a theoretical concept from AI
- There is no single universal definition of an agent
- Agent in Webster's New World Dictionary: A person or thing that acts or is capable of acting or is empowered to act, for another.
What is an intelligent agent?

- Intelligent agent is a computer system located in certain environment and is capable to react in a flexible way on events in its environment.
Intelligent Agent Types

- Human agents (Travel agent)
- Software agents
- Hardware agents (robots)
  - Information agents
  - Cooperation agents
  - Transaction agents
Characteristics of SW agents

Source: W. Brenner, et al, Intelligent Software Agents
Software Agents

- One view:

  Software processes that have non-trivial tasks delegated to them which require independent action and a report on the results.
SW Agents: Autonomy

- Agent’s activities are autonomous (no statements from the user)
- Properties of an agent: autonomy, mobility, ability to communicate, ability to learn, …
SW Agents: Intelligence (necessary attributes)

- Reasoning: agent monitors environment and takes decisions (based on changes in the environment)
- Learning: agent’s behavior is improving (based on previous experience)
- Adaptability: agent is able of adaptation to changes in its environment (robustness)
SW Agents: Mobility

- Agent mobility = “traveling” from one computer to another one
SW Agents: Cooperation with other agents

- Cooperation between agents makes possible to solve the problems much faster (usually the solution is better)

- Language for cooperation description

- This is **NOT** an essential attribute of SW Agent
SW Agents: Emotions

- It may be desirable to humanize the agents

- Problem with so called “uncanny valley” effect

![Diagram showing the uncanny valley effect with axes for Similarity and Familiarity, illustrating the transitions from 'Toy robot' to 'Human' and 'Moving corps' with the 'Uncanny Valley' in between.](image-url)
Issues for Software Agents

Personification
- Should agents be represented as a living or animated character?
- Does it improve adoption of software?
- Does it create inflated expectations?
- Is it just too annoying?
Talking Head: Real-time generation
Talking Head: Interpolation between expressions

Surprised

Sad

Worried

Actual

Actual

Interpolated
Issues for Software Agents

- **Trust and Competence**
  - How does user develop an informed level of trust?
  - Can agent give self-assessment on likely outcome of task?

- **Delegation**
  - How can user delegate tasks?
  - How can user check on status of delegated tasks?
Issues for Software Agents

- Control
  - How does user set limits on the agent’s activity?
  - When does the agent get to interrupt the user (mixed-initiative dialog)?

- Dealing with multiple agents
  - How can the user manage many agents?
  - How can interactions between agents be predicted?
Issues for Software Agents: Multiple agents
Automation and human control

- Users can avoid:
  - Routine, tedious, and error prone tasks

- Users can concentrate on:
  - Making critical decisions, coping with unexpected situations, and planning future actions
Agents in user interfaces

- **Agents learn**
  - monitoring user’s behavior (and they use behavioral patterns)
  - feedback from the user
  - question to other agents

- **Example**
  - e-mail filter
  - purchase of a ticket
Computer Supported Cooperative Work (CSCW)
What is CSCW?

- *Work* is a social activity
  - People and their activities are integral to design of technology

- Workers may have social proximity despite physical/temporal distance
CSCW as a ‘Science of the Artificial’

“CSCW is at once an **engineering discipline** attempting to construct suitable systems for groups, organizations, and other collectivities, and ad the same time, CSCW is a **social science** attempting to understand the basis for that construction in the social world.”

*Ackerman*
CSCW focuses on people working with others
Face to Face communication

- Personal space
- Eye contact and gaze
  - can convey interest, confusion, boredom
- Gestures and body language
- Back channels, confirmation, interruption
  - Back channels = nods, shrugs, small noises
- Turn taking/yielding
  - Ums, ahs, pauses

- What happens when these channels are unavailable?
Face to Face vs CMI

Face to Face vs CMI

Communication

Coordination

Information

Communication

Coordination

Information

Computer mediated interaction
### Dimensions of Cooperation

<table>
<thead>
<tr>
<th>Location</th>
<th>Same Place</th>
<th>Different Place</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Same Time</strong></td>
<td>Synchronous Local</td>
<td>Synchronous Remote</td>
</tr>
<tr>
<td><strong>Different Time</strong></td>
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</table>

What are some examples of applications in these areas?
## Dimensions of Cooperation

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</tr>
<tr>
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</tr>
<tr>
<td></td>
<td>conversation</td>
</tr>
<tr>
<td>Different Time</td>
<td>Post-it note</td>
</tr>
</tbody>
</table>
Groupware systems

- Email
- Videoconferencing
- Interactive Information Boards
- Instant messaging
- Google Documents
- Slack, Trello, ...
## Email

- **Where does it fit?**

<table>
<thead>
<tr>
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<tr>
<td>Same Time</td>
<td>Same Place - Synchronous Local</td>
</tr>
<tr>
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</tr>
</tbody>
</table>

- **Why is it successful? Where has it failed?**
Video conferencing

- **Where does it fit?**

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- **Why isn’t it more popular?**
## Instant messaging

- **Where does it fit?**

<table>
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- **Why is it successful? Where has it failed?**
Smart tables/walls

- Where does it fit?

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- Is it successful? Where has it failed?
Select Findings in CSCW (Ackerman)

- Exceptions tend to be the norm in work processes
- People prefer to know who else is present in a shared space, and how they are performing
- Visibility of communication and information exchange can enable learning, but also works against efficiency under some circumstances.
- Norms emerge for CSCW systems, and these norms tend to be constantly re-negotiated.
- Critical Mass problems
- Importance of Incentives (tied to many other issues above)
Thank you for attention