Wisdom is not the product of schooling
but the lifelong attempt to acquire it.
- Albert Einstein

From “Anywhere, Anytime, Anyone”
to
“The **Right Information** at the **Right Time**, in the **Right Place**, in the **Right Way** to the **Right Person**”

Gerhard Fischer
Department of Computer Science and Institute of Cognitive Science
University of Colorado, Boulder

Presentation, “International Workshop Series on RFID — Information Sharing and Privacy, Tokyo, November 2004
Overview

- The Center for Lifelong Learning and Design (L3D)

- Basic Message

- Examples:
  - Privacy (Movie Clip from ABC)
  - L3D’s CLever Project (multimedia presentation)

- Conceptual Frameworks
  - Information Access and Information Delivery
  - Gift-Wrapping and Techno-Determinism
  - Meta-Design

- Example: Envisionment and Discovery Collaboratory

- Conclusions
L³D’s Research Focus and Intellectual Identity

- Artificial Intelligence (AI) ♦ Intelligence Augmentation (IA)
  - replacement ◊ empowerment
  - emulate ◊ complement (exploit unique properties of new media)

- instructionist learning ♦ constructionist learning
  - learning about ◊ learning to be
  - when the answer is known ◊ when the answer is not known (collaborative knowledge construction)

- individual ♦ social (distributed cognition, social creativity)
  - knowledge in the head ◊ knowledge in the world
  - access ◊ informed participation

- generic ♦ specific (“universe of one”)
  - design ◊ meta-design (adaptive, adaptable, situated)
  - general ◊ customization, personalization

- desktop ♦ ubiquitous computing (going small, large, everywhere)

- “gift-wrapping” and “techno-determinism” with new media ♦ co-evolution of new media, new theories about working, learning, and collaborating
Thanks

♣ Shin’ichi Konomi

♣ all members of L3D

♣ our sponsors:
  - National Science Foundation
  - Coleman Institute for Cognitive Disabilities
  - Software Research Associates (SRA), Tokyo, Japan
The Basic Message

RFID technologies offer opportunities and risks

- **risks:**
  - privacy
  - information overload: anywhere, anytime, anyone, push technologies, information delivery, …

- **opportunities:**
  - new levels of distributed intelligence
  - “the right information at the right time, in the right place, in the right way to the right person”
The Challenge — RFID Research: Beyond Technology

สถานีsocial context(127,303),(247,348)

(127,348),(222,393) ethical issues (privacy)

(127,394),(242,439) high impact

(127,440),(343,485) new divisions of labor

(127,486),(343,531) redefinition of the unique human role in socio-technical environments

(127,532),(492,577) questions: magnitude of a change
  - oral ◊ literal society
  - printing press
  - digital media
  - World Wide Web (WWW)
  - RFID????
The **Right Information** at the **Right Time**, in the **Right Place**, in the **Right Way** to the **Right Person**

- **right information**: relevant to the task at hand ◇ task modeling

- **right time**: intrusiveness (pull versus push)

- **right place**: location-aware cell phone (noisy environment versus movie theatre), smart tour guides

- **right way**: multimodal presentation (textual, visual, auditory, tactile)

- **right person**: taking background knowledge and interests of specific users into account ◇ user modeling, “who do I ask and who do I tell”
Finding the Limiting Resource in Design

Herbert Simon (Nobel Prize Winner) in “Sciences of the Artificial”

♣ claims
- a design representation suitable to a world in which the scarce factor is information may be exactly the wrong one for a world in which the scarce factor is attention
- the critical component in information sharing is not information per se, but human attention
- “What information consumes is rather obvious: it consumes the attention of its recipients. Hence a wealth of information creates a poverty of attention, and a need to allocate efficiently among the overabundance of information sources that might consume it.”

element:
- some crisis in the world ◇ many messages to the State Department
- printing capacity was identified at the limiting factor ◇ buy high speed printers
- the real bottleneck: time and attention of the human decision makers who had to use the incoming information ◇ the real challenge: filters, intelligent summarizing, …
Trade-Offs between Risks and Opportunities
(provided by new technologies such as RFID, GPS, ..)

Opportunities

- Food traceability
- Supply chain
- Keys & Access
- Tickets & Payments
- Distributed intelligence approaches controlled by users
- Manufacturing
- Tracking medical wastes
- Timekeeping in sports
- Gift-wrapping

Risks

- Privacy
- Techno-determinism
- Smart assistive technologies
- Libraries
- Tracking children
- Future store
- RFID injection
Opportunities
(provided by new technologies such as RFID, GPS, ..)

**Business benefits**
- Reduced costs
- Increased profits

**Consumer benefits**
- Security and piece of mind
- Convenience and efficiency

**Social benefits**
- Environmental conservation
- Universal usability
Risks
(provided by new technologies such as RFID, GPS, ..)

**Business risks**
- Failure of RFID systems
- More lawsuits and product return

**Consumer risks**
- Privacy violation
- Health risks (stress; RF signals can affect pacemakers etc.)

**Social risks**
- “Big Brother”
- Job loss
Example-1: Privacy Issues (ABC Movie Clip)

*example:* newspaper story “Man accused of using GPS to track ex-lover”
- cellular phone with GPS and motion sensor
- man faces up to six years in prison if convicted

*Personal Privacy Assistants (see contribution by Shin'ichi Konomi)*
- boundary control rather than isolation
- Personal Privacy Assistants provide users with feedback and control
Example-2: The CLever Project — Enriching the Life of People with Disabilities

“CLever: Cognitive Levers — Helping People Help Themselves”

* supported by the Coleman Institute, August 2000 – July 2005
Cognitive **Levers (CLever)** — Helping People Help Themselves

 flexDirection: distributed intelligence  empower humans with cognitive disabilities with media and technology

"Give me a lever long enough and I can move the world"
MAPS: Memory Aiding Prompting System
Lifeline: monitor and support clients with wireless prompting systems
Mobile architecture

- Mobile users
- Transportation systems
- Wireless networks
- Data servers
- Internet backbone
- Internet
- Mobility agents
- Support communities
The Story Shown on the Videotape

♣ specific: a woman with cognitive disabilities (memory problems, no capacity for planning and remembering) and her mother

♣ general: the scenario shows socio-technical environments to help people with
  - cognitive disabilities
  - elderly people (e.g., with Alzheimer)
  - out-of-town visitors
  - foreigners
  - everyone

♣ many people **can not use** current public transportation systems

♣ innovative technologies to **“simplify”** their use
  - personal device such as personal digital assistants (PDAs),
  - mobile phones,
  - global positioning systems (GPS),
  - web-based collaboration tools
Selected CLever Projects

- **Web2gether: Online Community Environment** — supporting the members of a community (not only information management)

- **TEA: The Evaluation Assistant** — matching the needs of individuals to specific technologies

- **MAPS: Memory Aiding Prompting Systems** — creating new “knowledge” (scripts) by end-users who have no interest or technical knowledge

- **Mobility-for-All: Human Centered Public Transportation Systems** — from “anywhere, anytime, anyone” ⇒ right information, right person, right time, right way (exploiting the power of ubiquitous, wireless technologies)

- **Lifeline: Remote Monitoring** — reuse of the technological infrastructure for a different purpose
Conceptual Frameworks

❖ shift from purely computational worlds inside the computer (such as domain-oriented design environments) ◇ augmented reality, pervasive computing (a partial mapping / representation of the external world needs to be created inside a computational environment)

❖ Information Access and Information Delivery

❖ Gift-Wrapping and Techno-Determinism

❖ Meta-Design
## Information Sharing:
Access ("Pull") and / or Delivery ("Push")

<table>
<thead>
<tr>
<th></th>
<th>access (&quot;pull&quot;)</th>
<th>delivery (&quot;push&quot;)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>examples</strong></td>
<td>browsing, search engines, bookmarks, passive help systems</td>
<td>Microsoft’s “Tip of the Day”, broadcast systems, critiquing, active help systems</td>
</tr>
<tr>
<td><strong>strengths</strong></td>
<td>non-intrusive, user controlled</td>
<td>serendipity, creating awareness for relevant information, rule-enforcement</td>
</tr>
<tr>
<td><strong>weaknesses</strong></td>
<td>task relevant knowledge may remain hidden because users can not specify it in a</td>
<td>intrusiveness, too much decontextualized information</td>
</tr>
<tr>
<td></td>
<td>query</td>
<td></td>
</tr>
<tr>
<td><strong>major system design</strong></td>
<td>supporting users in expressing queries, better indexing and searching</td>
<td>context awareness (intent recognition, task models, user models, relevance to the task-at-hand)</td>
</tr>
<tr>
<td></td>
<td>algorithms</td>
<td></td>
</tr>
</tbody>
</table>


Decontextualized Information Delivery:
Example: Tip of the Day (“Did You Know”)

・the **Assistant of Microsoft Office** provides tips on how to use features or keyboard shortcuts more effectively
  - When a yellow light bulb appears next to the Assistant, click the light bulb to see a tip
  - user can turn on or off showing the Tip of the Day

・idea behind it: to incrementally learn **High-Functionality Applications**
Contextualized Information Delivery — Example: Codebroker

Yunwen Ye (more info at: http://www.cs.colorado.edu/~yunwen)

- **thousands of components**, no programmer knows all of them, constantly evolving

- information access does **not support programmers** who do not actively search for reusable components

- **delivers personalized components** based on task and user modeling techniques

- programmers are **consumers and contributors**
Information Delivery in Large Software Reuse Repositories

(L4 – L3): Unanticipated Information

Task-relevant information

L4: Entire Information Space

L1: Well Known
L2: Vaguely Known
L3: Belief
**Gift-Wrapping: Adding Technology to Existing Practice**

“There is nothing so useless as doing efficiently that which should not be done at all.” — Peter Drucker

Current practice (e.g., education) wrapped in technology
Techno-Determinism
Learning and Media: Rethinking, Reinventing, and Redesign
Theory and Practice

current practice  computer-supported and computer–mediated practice of the future
Examples of Gift-Wrapping

- using the World Wide Web for “new” approaches in education: posting slides on a website rather than handing them out as paper copies
  - this is worthwhile and has advantages (e.g., ease of updates)
  - but: it leaves the underlying processes unchanged

- in RFID: using tags in smart stores to eliminate the scanning process at check-out
Meta-Design

- meta-design = how to create new media at design time ("world-as-imagined") that allow users to act as designers and be creative at use time ("world-as-experienced")

- why meta-design?
  - deal with a changing world
  - address and overcome problems of closed systems
  - transcend "consumer mindsets"

- impact of meta-design
  - "if you give a fish to a human, you will feed him for a day — if you give someone a fishing rod, you will feed him for life" (Chinese Proverb)
  - can be extended to: "if we can provide someone with the knowledge, the know-how, and the tools for making a fishing rod, we can feed the whole community"
Design Time and Use Time

world-as-imagined
prediction
planning

world-as-experienced
reality
situated action
Computational Media
—
Extending Design Opportunities at Use Time

打印媒体:
- 一个固定上下文在使用时间被决定在设计时间
- 所有解释都需要由人类完成

计算媒体:
- 使用时的展示可以利用仅在使用时已知的上下文因素（关于任务、用户、社会系统等），
- 示例：规格单和使用数据，支持动态形式，动态网站，用户和任务特定的地图和交通时间表等...

演进现有系统：用户（作为设计师）可以在使用时间超越在设计时间开发的系统的边界
The Envisionment and Discovery Collaboratory

http://www.cs.colorado.edu/~l3d/systems/EDC (including demo)

- creating shared understanding in the context of collaborative design

- integration of physical and computational environments

- specific major application: urban planning build an end-user modifiable version of Simcity (meta-design approach)
Non-Computational Collaborative Environments
Collaboration with many Stakeholders on the Desktop

YOUR NEIGHBORHOOD ACTIVIST GROUP WANTS TO CREATE A FOCUS FOR THE NEIGHBORHOOD. WHAT DO YOU THINK?

A. No Action
   - This choice would result in a stalemate.

B. Hire a local developer to build a mall as the focus
   - This would create a new environment for the neighborhood.
   - Would be a large shopping store and

Choose Something

4. choose one:
   - a. No Action
   - b. Develop a strip mall

OK Cancel
Smartboards: Computation and Collaboration Beyond the Desktop
PiTaBoard: Parallel Interaction and Computational Objects
PiTaBoard: Parallel Interaction and Computational Objects
Realities based on Assessment Studies

⦁ **RFID**: new technology is necessary, but not sufficient ♦ change of work practices, mindsets and reward structures is necessary

⦁ motivation for a group is different than for an individual
  - “who is the beneficiary and who has to do the work?”
  - utility = value / effort ♦ can the EDC or RFID technologies change this equation?

⦁ **EDC**: engage skilled professionals in realistic work situations
  - requires useful and usable systems (not just demo systems)
  - prerequisite for evolutionary growth
Utility = Value / Effort

- increase in value: motivation and rewards for a “design culture”
  - feeling in control (i.e., independent from “high-tech scribes”)
  - being able to solve or contribute to the solution of a problem
  - mastering a tool in greater depth
  - making an ego-satisfying contribution to a group
  - enjoying the feeling of good citizenship to a community (“social capital”)

- decrease in effort:
  - exploit data provided computational mechanisms
  - extending meta-design to design for design communities
Future Directions

★ technical:
- more resources (e.g., weather information in CLever/Mobility-for-All environment)
- more integration: e.g., use personal devices in the context of the EDC
- use objects and interaction histories as indices into large information spaces

★ theoretical:
- integrate individual and social creativity
- integrate planning and situated action ♦ meta-design
- extend distributed intelligence framework
- design with human attention as the fundamental limiting resource

★ social:
- privacy and security
Innovating Innovation

[file]

looking 10 years in the future

1994 ↓---------------------------------------------------------------◊ 2004 ↓---------------------------------------------------------------◊ 2014
WWW becomes Business, Education, Collaboration
available have been fundamentally changed

RFID technologies become widely available

innovating innovation (John Seely Brown)
- our ideas of innovation have gone stale ◊ be innovative in the area of innovation itself
- will RFID technologies be a “disruptive innovation” (= something that actually changes social practices: the way we live, work and learn ◊ beyond “gift-wrapping”)

challenges associated with disruptive innovation:
- it is not technology per se that matters, but technology-in-use
- shift the discourse: from a concern about who has access to new information technologies ◊ who will have the knowledge to design, create, invent, and use the technologies enhancing human lives
Summary — The Basic Message Again

- the biggest problem in the field of RFID is an imagination crisis of exciting things to do, of balancing the trade-offs between risks and opportunities, ....

- it is not a technology crisis
More Information

http://l3d.cs.colorado.edu/~gerhard/papers.html

context awareness in augmented reality environments


meta-design:


More Information

❖ gift-wrapping

❖ Clever Project and Mobility-for-All

❖ Envisionment and Discovery Collaboratory

❖ information overload (push and pull technologies):