

Just-in-Time Information

Prof. Pattie Maes

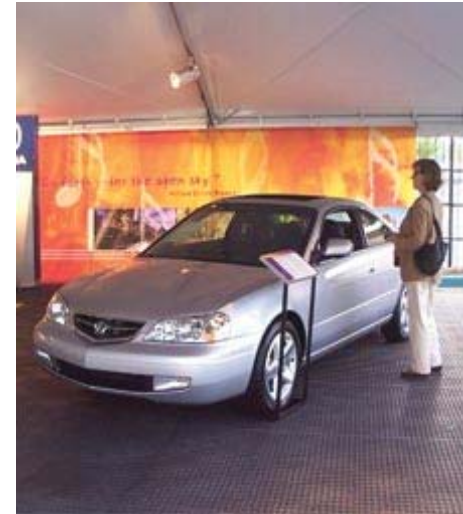
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What is “Just-in-time Information”?

Proactively offering a user information that is highly relevant to what s/he is currently focused on



Why offer Just-in-time Information?

To promote:

- Insight
- Inspiration
- Interpersonal connections

...without interrupting the user's activities

How offer Just-in-time Information?

1. Model user interests/preferences
2. Sense current context of user
3. Compute information relevant to the context and user profile (recommendation algorithm)
4. Present information in subtle, non-intrusive way

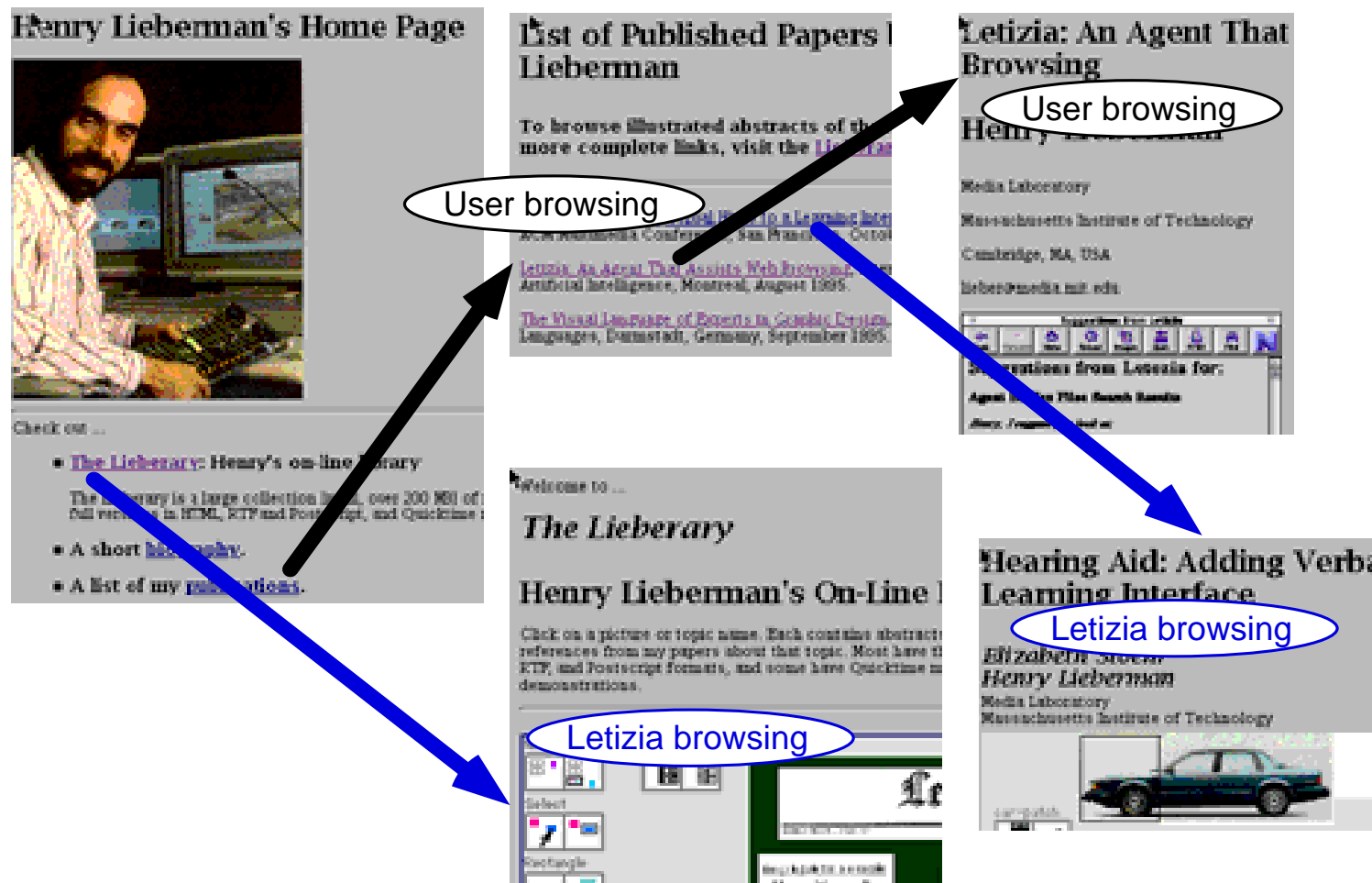
Just-in-time Information for the Desktop User

Examples:

- Recommender systems
 - Based on patterns identified in user's behavior
 - Based on patterns identified among users
- Remembrance systems
- Mentoring systems
- Matchmaking systems
- ...

Letizia: A Recommender System for Webpages

- Henry Lieberman 1998



***“Collaborative Filtering”* recommenders**

- Upendra Shardanand, Max Metral 2004

File Edit View Go Bookmarks Options Directory Help

Netscape: HOMR - Get Recommendation

Location: <http://rg.media.mit.edu/scripts/ringo-bin/getrecmd.pl?username=pattie@media.mit.edu&password=50T52KagtKmCA&recalc=1>

What's New? What's Cool? Handbook Net Search Net Directory Newsgroups

HOMR

The program formerly known as RINGO

HOMR Recommendation

In making your recommendations, I consulted 200 other users. I considered 1223 artists.

You may like to check out:

Artist	Predicted Rating	Confidence	# Ratings
Indigo Girls	6.0594	Medium	36
Thompson, Richard	6.0186	Medium	14
Lovett, Lyle	5.9379	Medium	16
Bach, JS	5.9188	Medium	11
Shocked, Michelle	5.8358	Medium	11

...And you might want to avoid:

Cinderella	1.0000	Low	13
Poison	1.0861	Low	12
Vanilla Ice	1.1316	Medium	52
The 2 Live Crew	1.2320	Low	13
Marky Mark And The Funky Bunch	1.2890	Medium	24

To rate these artists, click [here](#).

Firefly (Barnes&Noble, Launch, etc, 94)

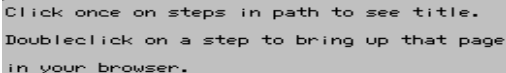
The screenshot shows the Firefly web application interface. On the left is a purple sidebar with navigation links: **bignote**, **music ratings**, **venue**, and **shop**. The main content area has a dark blue background with a faint constellation pattern. At the top right of the main area are links for **firefly** and **message**. The text reads: "Pattie, here are some more recommended albums." followed by "How recommendations work . . .". Below this is a table of recommended albums:

rate it!	artist - album	options
<input type="text"/>	Essential Louis Armstrong, The by: Louis Armstrong	S
<input type="text"/>	Best Of Aretha Franklin by: Aretha Franklin	🔊 ⚙️ ≡ S
<input type="text"/>	Highway 61 by: Bob Dylan	🔊 ⚙️ ≡ S
<input type="text"/>	Harvest Moon by: Neil Young	🔊 ⚙️ ≡ S
<input type="text"/>	Blonde on Blonde by: Bob Dylan	🔊 ⚙️ ≡ S

At the bottom of the main area are links: **show recommended albums**, **show recommended artists**, and **submit and send more**. Below these is a row of icons: RealAudio, Link, Reviews, and Similarities. The footer features the **webmonkey.com** logo and tagline "A hands-on how-to guide for Web junkies." along with a cartoon character. The browser status bar at the very bottom shows "99% of 1K".

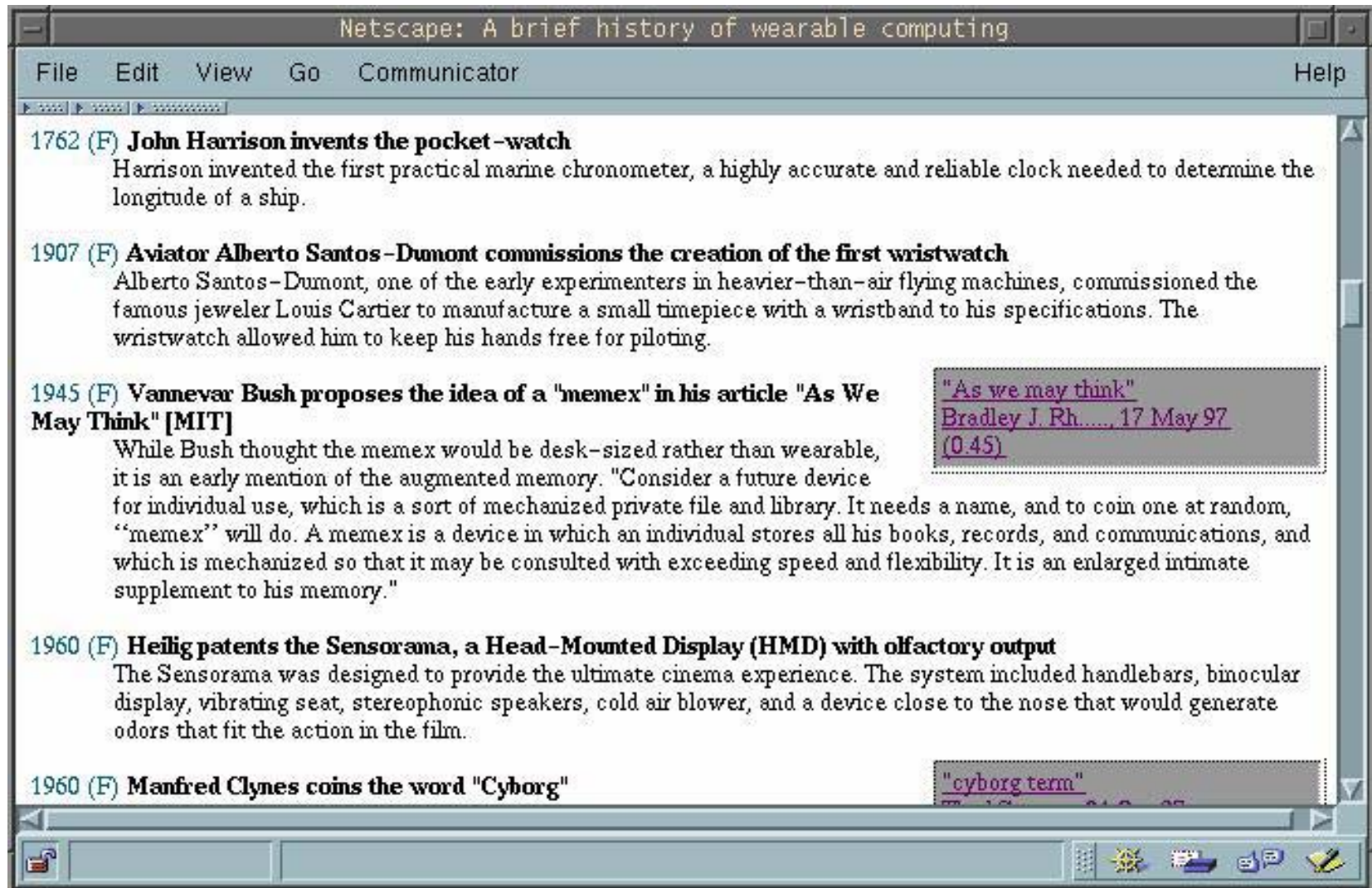
- Alan Wexelblat 1999

- Alan Wexelblat 1999



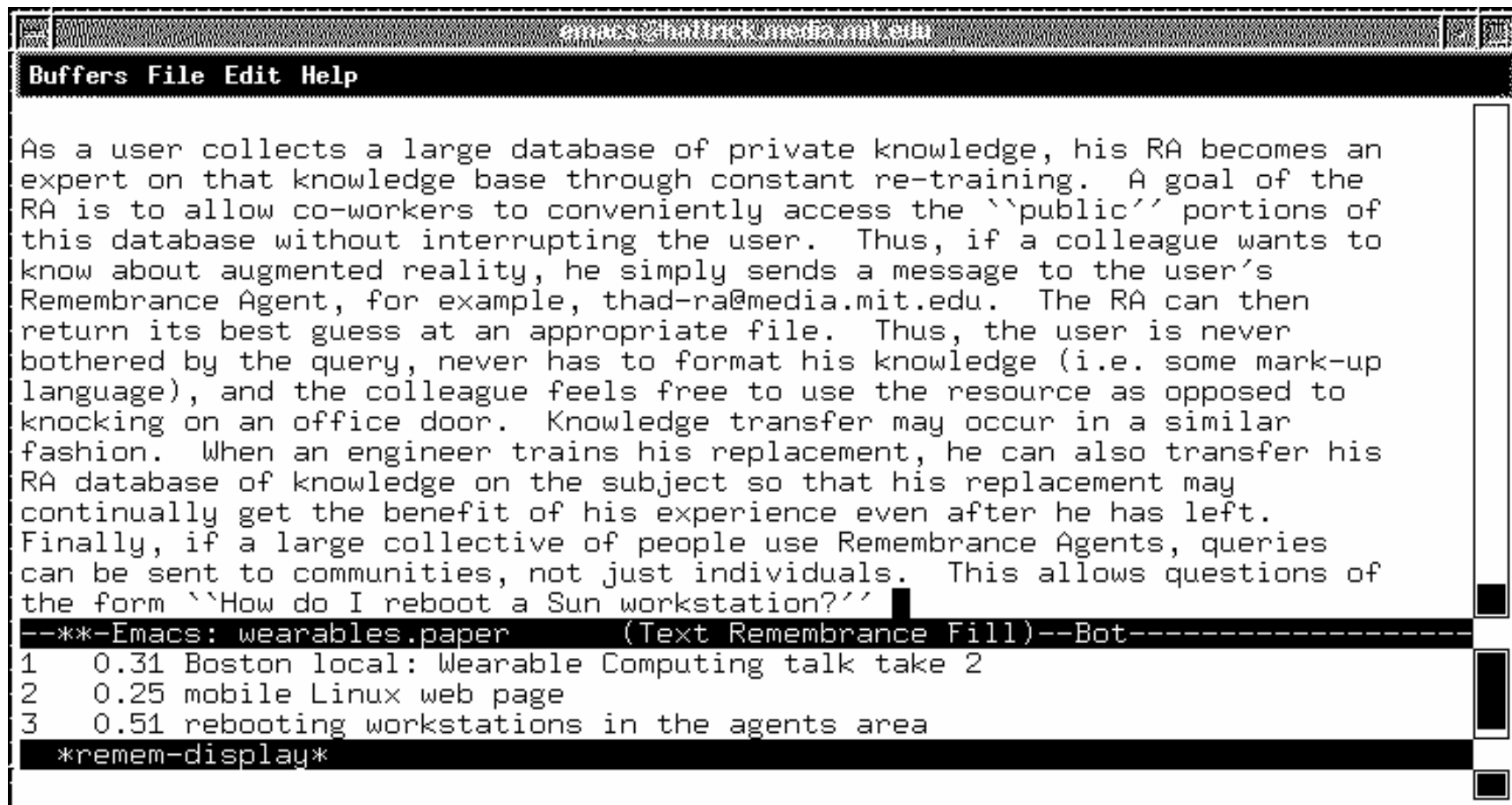
Remembrance Agent (Web version)

- Bradley Rhodes 1996



Remembrance Agent (Emacs version)

– Bradley Rhodes 1996



```
emacs - hatrick media.mit.edu
Buffers File Edit Help

As a user collects a large database of private knowledge, his RA becomes an
expert on that knowledge base through constant re-training.  A goal of the
RA is to allow co-workers to conveniently access the ``public`` portions of
this database without interrupting the user.  Thus, if a colleague wants to
know about augmented reality, he simply sends a message to the user's
Remembrance Agent, for example, thad-ra@media.mit.edu.  The RA can then
return its best guess at an appropriate file.  Thus, the user is never
bothered by the query, never has to format his knowledge (i.e. some mark-up
language), and the colleague feels free to use the resource as opposed to
knocking on an office door.  Knowledge transfer may occur in a similar
fashion.  When an engineer trains his replacement, he can also transfer his
RA database of knowledge on the subject so that his replacement may
continually get the benefit of his experience even after he has left.
Finally, if a large collective of people use Remembrance Agents, queries
can be sent to communities, not just individuals.  This allows questions of
the form ``How do I reboot a Sun workstation?''

--*-Emacs: wearables.paper      (Text Remembrance Fill)--Bot-----
1   0.31 Boston local: Wearable Computing talk take 2
2   0.25 mobile Linux web page
3   0.51 rebooting workstations in the agents area
*remem-display*
```

“What would they think?” Virtual Mentors

- Hugo Liu 2004

MIT Media Lab: Research at the MIT Media Lab - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Home Search Favorites Media Mail Print Address Book Links

Address <http://www.media.mit.edu/research/ResearchPubWeb.pl?ID=53> Go

Google mit media lab Search Web PageRank 348 blocked mit media lab

human interlocutor.

7% what would they think? ::hugo@media::

file edit options help

fodder:: the ability to have them.

and John McBean

project is to research and test existing of actuation that are viable for robot to develop new actuators that will rmance of robots intended to interact s for performance include power and ollability, smoothness of motion, ease cost, and shape. Current explorations f long-travel voice coils as drop-in C motors or pneumatic cylinders, and e hydraulic actuators to combine the of hydraulics with the high power density of electromagnetic actuators.

Robotic Computer

Cynthia Breazeal, Roz W. Picard, Karen Liu, Jesse Gray, Ashish Kapoor and Cory D. Kidd

A Robotic Computer that moves its monitor "head" and "neck" but has no explicit face, is being designed to interact with users in a natural way for applications such as learning, rapport-building, interactive teaching, and posture improvement. In all these applications, the robot will need to move in subtle ways that express its state, and that promote appropriate movements in the user, but that don't distract or annoy. Toward this goal, we are giving the system the ability to recognize subtle expressions as well as the ability to have them.

Robotic Flowers

Cynthia Breazeal, Jeff Lieberman and the Cooper-Hewitt, National Design Museum

We are designing and developing an array of robotic

Uses NLP and “attitude processing” to show what some mentors have to say about the topic the user is focused on

Yenta Matchmaking System

- Leonard Foner 1999



Current cluster memberships

Cluster number	Top words	Number of documents	Visibility			Status
			ignore	careful	carefree	
2	agent, paper, conference, author	11	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	Searching (tried for 4 hours)
3	one-time-pad, shipping, contract	24	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	Found and joined: (37 known, ~400 estimated members)

Submit Preferences

Just-in-time Information While on the Go

State of the art in mobile computing:

- Too many clicks
- Not enough screen space



Wearable *Remembrance Agent*

– Bradley Rhodes 1998

User receives
context-specific reminders
of relevant information
(based on location,
day of week, time of day,
other people present,
conversation topics)



Impulse: Automated Information Exchange with Entities in the Physical Vicinity

- Joan Morris & Jim Youll 2000

The Coop Bookstore
out of stock

Harvard Univ. Bookstore
lowest price \$55

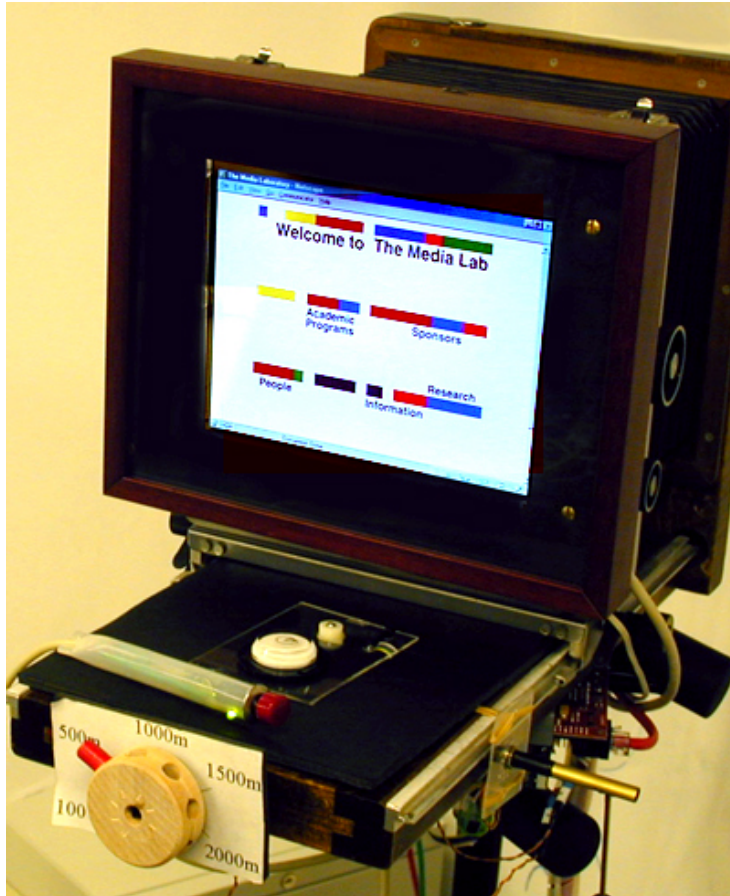
Brad's PDA

Wordsworth Bookstore
lowest price \$45



Periscope: A Browser for the Real World

– Jim Youll 2001



Camera with
compass
and range finder
shows
Web pages about
the location the
user/camera is
currently focused
on

Hanging Messages: ***A platform for Annotating the physical world***

- Emily Chang 2000

The screenshot shows a PDA screen with a window titled 'Hanging Messages: michelle'. Inside, there's a sub-window titled 'emily: add/drop form'. The form has fields for 'To:' (emily), 'Subject:' (add/drop form), and 'Urgent-Personal'. Below these is a 'Delivery Time Period:' section with two rows of time selection: '11 : 00 AM 03 / 08' and 'to 7 : 00 PM 03 / 09'. A 'Location:' field is set to 'media lab'. A text area contains the message: 'can you grab an add/drop form for me before you leave lab? i forgot add date was friday. :('. At the bottom are 'Send' and 'Cancel' buttons.

Hanging Messages: michelle

emily: add/drop form

To: emily Urgent-Personal

Subject: add/drop form

Delivery Time Period:

11 : 00 AM 03 / 08

to 7 : 00 PM 03 / 09

Location: media lab

can you grab an add/drop form for me before you leave lab? i forgot add date was friday. :(

Send Cancel

A PDA device with GPS allows users to leave & receive location-based and thread-based messages from others

Ether Threads:

location-based messaging using a cell phone

- Bradford Lassey 2004

Blue-tooth and GPS data
trigger location-based
messages relevant to
the user and the
threads s/he is
interested in



Photowhere: **Automated annotation of photographs**

- Dan Relihan & Bradford Lassey 2004



- Cell phone communicates with GPS device via bluetooth to record location of picture taken
- Phone interfaces to metacarta.com server to find URLs about that location
- Extracts and offers keywords for the picture taken

ReachMedia: On-the-move Interaction with Augmented Objects

– Assaf Feldman, Sajid Sadi 2005

- Wireless RFID reader wristband reads tags in objects held by user
- Touching an object results in a menu of services and information:
 - Order a copy
 - Read reviews
 - Leave a message
 - Retrieve messages
 - Do a keyword search
 - ...



ReachMedia: On-the-move interaction with Augmented Objects

– Assaf Feldman, Sajid Sadi 2005

- Wireless and mobile
- Natural and seamless, hands-free and eyes-free interaction option:
 - Gesture input (accelerometers on wristband)
 - Audio output
- Keypad & screen-based interaction option



ReachMedia: Video

Peripheral visual interface for ReachMedia Platform

- Enrico Costanza 2005



Wearable peripheral display
(using tiny LEDs)
embedded in a pair of eyeglasses
delivers notification cues
in a private, subtle and
non-obtrusive way

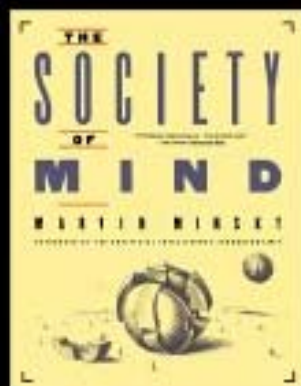
Ambient Semantics: **Personalizing information** **presented on the ReachMedia Platform**

- Hugo Liu 2004

E.g. When user picks up a book with ReachMedia wristband, user's cell phone conveys:

- A prediction of how much user will like the book
- Which passages are relevant to user's interests
- How it relates to other books recently read
- Reviews by respected friends/editors
- Which friends loved/hated it
- ...





I see that you are looking at
SOCIETY OF MIND.

Your friends are crazy about this book!
Barbara Barry and Henry Lieberman say it's
one of their favorites!

People on the web who have read
SOCIETY OF MIND have said some things
about it:

"In this book Minsky tries, as have
many scientists before him, to explain what
seems unexplainable. Even though in present day,
many people believe in science over magic,



Hugo, please meet Dave Merrill!

Dave and you both love some of the same sports, such as snowboarding.

Both of you know Nathan Eagle, Elisabeth Sylvan, Cory Kidd, Cameron Marlow, Joanie Morris DiMicco!



Hugo, you might also be interested that Dave Merrill likes neal stephenson, student, lifelong learners, lifelong learners, outdoor enthusiasts, domestic gods & goddesses, surfing, polo, water polo, cake, eagles, thai, mexican, musicians, san francisco lovers, euophiles, linguists, futurama, the simpsons, run lola

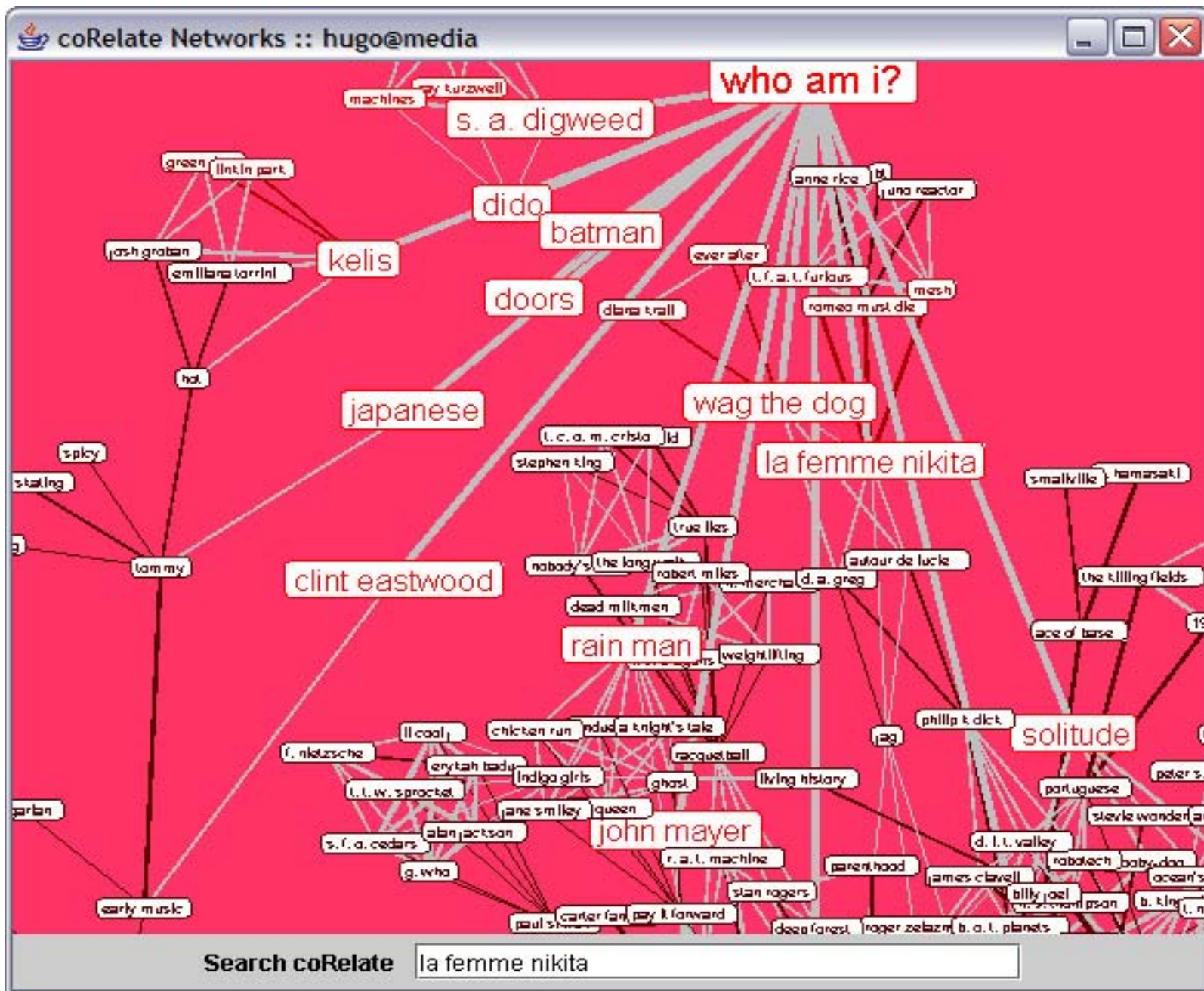
Ambient Semantics:

Personalizing Just-in-time Information

- Hugo Liu 2004

- Uses webmining to build:
 - User profiles (orkut, friendster, linked-in, homepages)
 - Object profiles (amazon, google)
- Uses webmining to build *InterestMap*
 - Map of correlations between interests as mined from tens of thousands of homepages
 - Is used to compute distance/relevance
- Presents information about object/person that ranks high in relevance

InterestMap – Hugo Liu 2004



Invisible Media: Sensing & responding to visual focus of attention

- David Merrill 2005

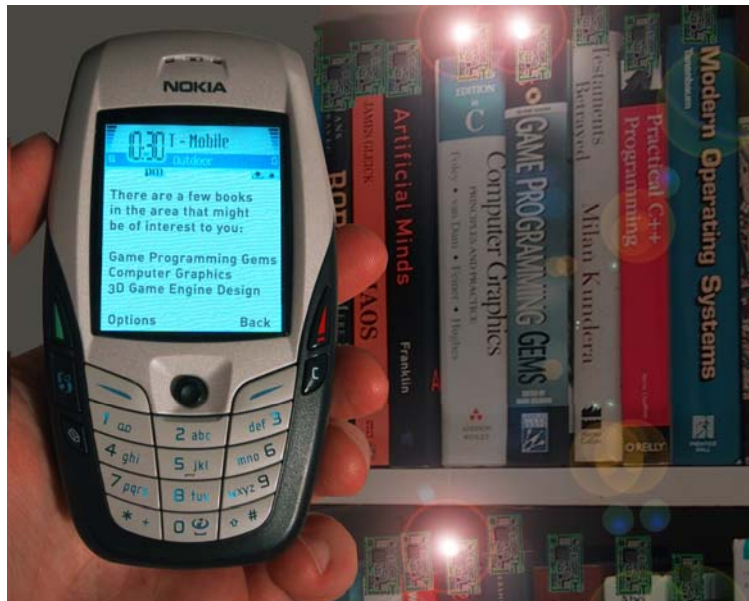


- User wears earbud with IR emitter/receiver
- Augmented objects sense the user's focus of attention
- Relevant information is presented in audio format
- Speech input

Object Awareness: **Drawing the person's attention to objects of interest in the immediate environment**

- David Gatenby 2005

- Bluetooth-enabled cell phone communicates user's interests to augmented objects in user's vicinity
- Relevant objects can draw the user's attention by blinking their LED's



Functions:

- Finding an object
- Keyword search
- Recommendations
- Similarities
- ...

Other Projects: Augmenting Everyday Objects with Specific Functionalities

- Responsive portraits
- Responsive mirrors
- Augmented pillows
- Augmented doors, windows, walls, clocks, ...

CASY: Responsive Portraits

Support Staying in Touch

- Orit Zuckerman 2005

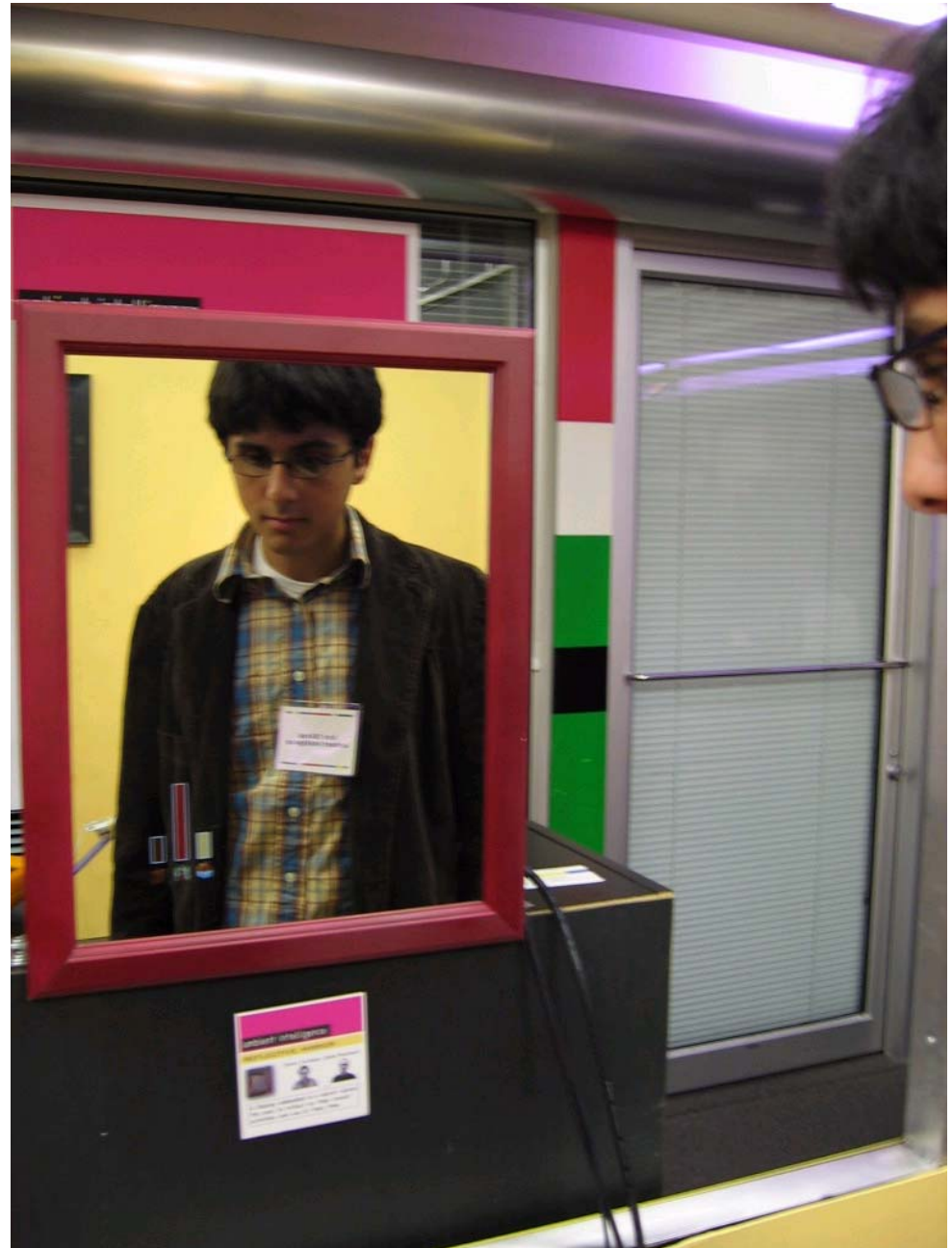
- Context-based delivery of audio/video messages on PDA
- Ex:
 - Grandparent records 'good morning' and 'good night' video snippets
 - Grandchild is shown the snippet in-context of going to sleep or waking up



Reflective Mirror

- David Bouchard,
Enrico Costanza 2005

Bathroom mirror
allows person to
reflect on their
recent behavior.
Uses half-way mirror
& hidden LCD screen
and camera.



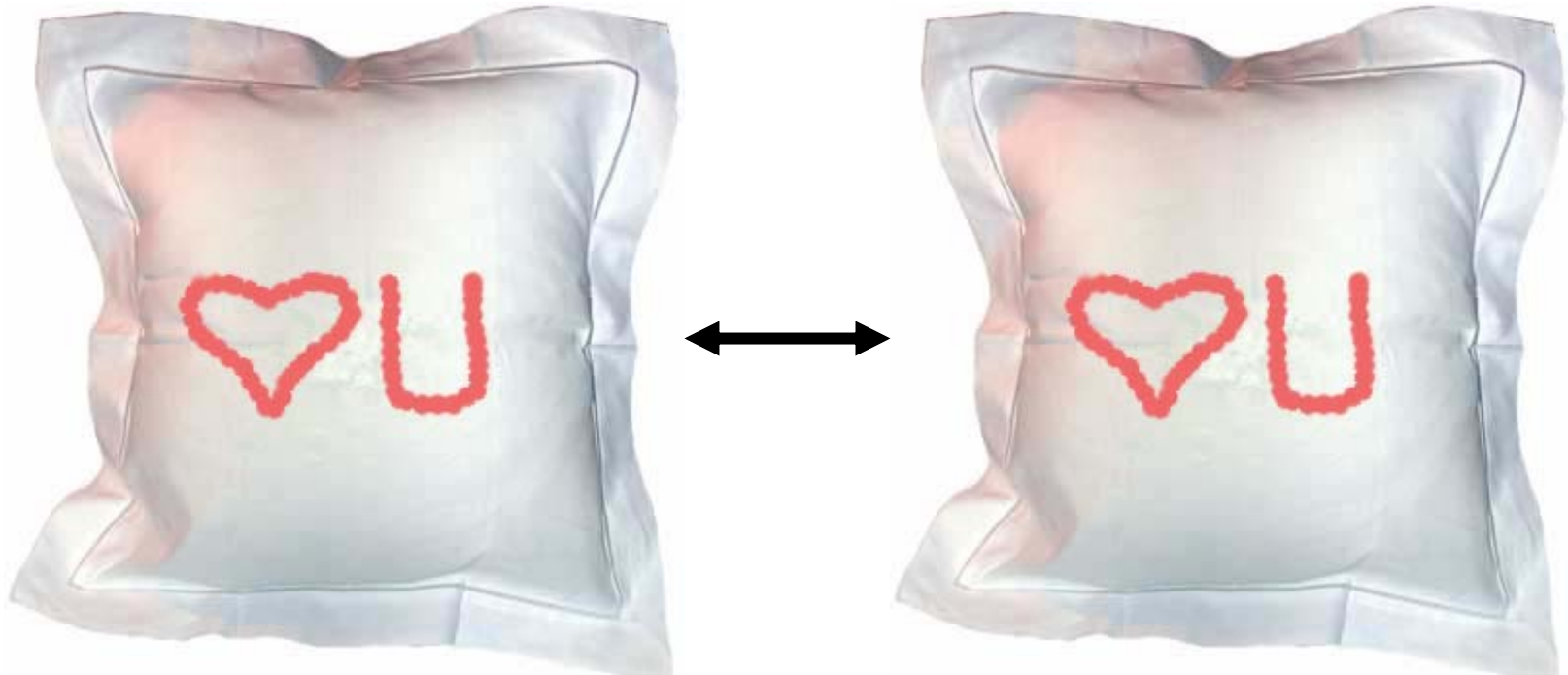
Identity Mirror – Hugo Liu 2005



Abstracted “mirror”
reflects person’s
“identity neighborhood”
as gleaned from user’s
homepage and
public profiles
pages

Pillow Talk

- Amir Bakhtiar, Sajid Sadi & David Merrill 2005



A pair of networked touch-sensitive pillows with crude LED displays support synchronous, low-tech messaging

Just-in-time Information: Technical Challenges

Just-in-time information “works” if it is:

- likely to be relevant to the user
 - Challenges in:
 - » *user profiling*
 - » *detecting context of user*
 - » *recommendation algorithms*
(personalization, contextualization)
- offered unobtrusively
 - Challenges in:
 - » *Subtle interfaces*
- requires minimal user effort to access
 - Challenges in:
 - » *Natural, “on-the-move” interfaces*

Challenge: User Modeling/Profiling

Approaches:

- Entered explicitly by user
 - *Form filling, choosing options in menu*
- Gathered implicitly by system
 - *Data mining of observed user behavior*
 - *Data mining of personal texts*
 - *Eg homepages, profiles on social networking sites, files*
- Combination of approaches

Challenge: Detecting User Context

- Detect who, what, where, when
 - Offer info relevant to current focus of user
- Approaches:
 - On desktop:
 - *Sense user's actions in different applications*
 - Offline:
 - *Sensors in the environment & on user*
- May involve use of background knowledge & inferencing
 - E.g. shaking someone's hand first time
 - *Background info, creating connections, breaking the ice*
 - versus shaking someone's hand nth time
 - *Reminders of previous conversations online/offline*

Challenge: Recommender Systems

Range of approaches based on:

- Cases/prototypes
- Features of the content (patterns in content)
- Collaborative Filtering (patterns among users)
- Other approaches

Challenge: Subtle, Natural Interfaces

– Goals:

- Avoid change of focus/interruption
- Recommendations are proactive but easily ignorable
- Avoid additional gear/devices/windows
- Support “on-the-move” access to details

– Approaches:

1. Either offer suggestions using secondary I/O modalities of user
Eg peripheral vision, audio, gestures, etc
2. Or provide seamless integration of recommendations in existing interface in minimal way

– Offer “ramping” interface

- Present minimal “hints”
- User controls access to more information/detail

Other User Interface Lessons Learned

- Transparency is key
 - => trust
- Avoid dependence/“tunnel vision” problem
- Protect user’s privacy

Summary

Radically rethink user-information interaction by:

- Proactively offering “just-in-time” information
- Highly relevant to a unique user and their current focus of attention
- In non-disruptive, easily accessible way

For More Information

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<http://interact.media.mit.edu/>