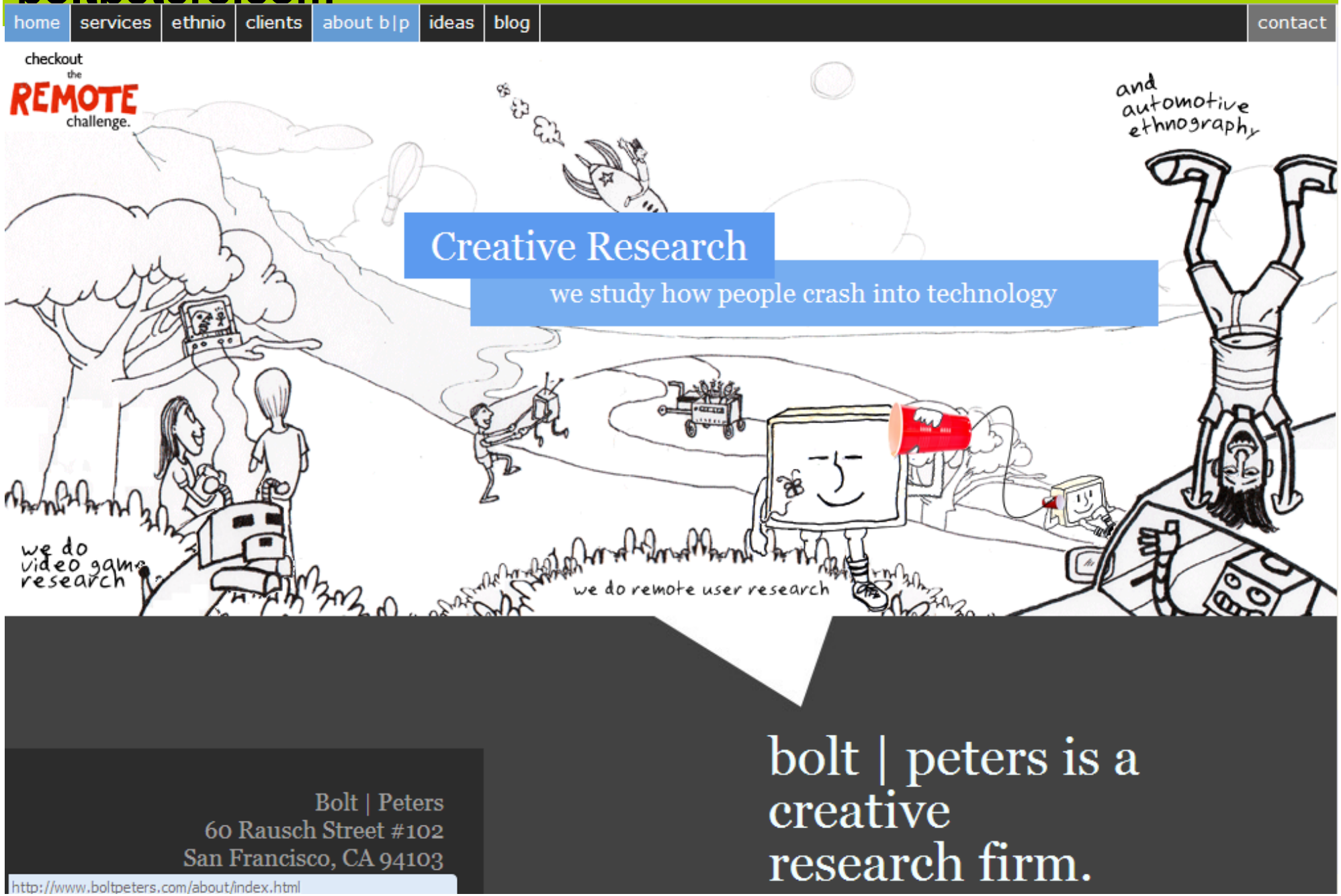
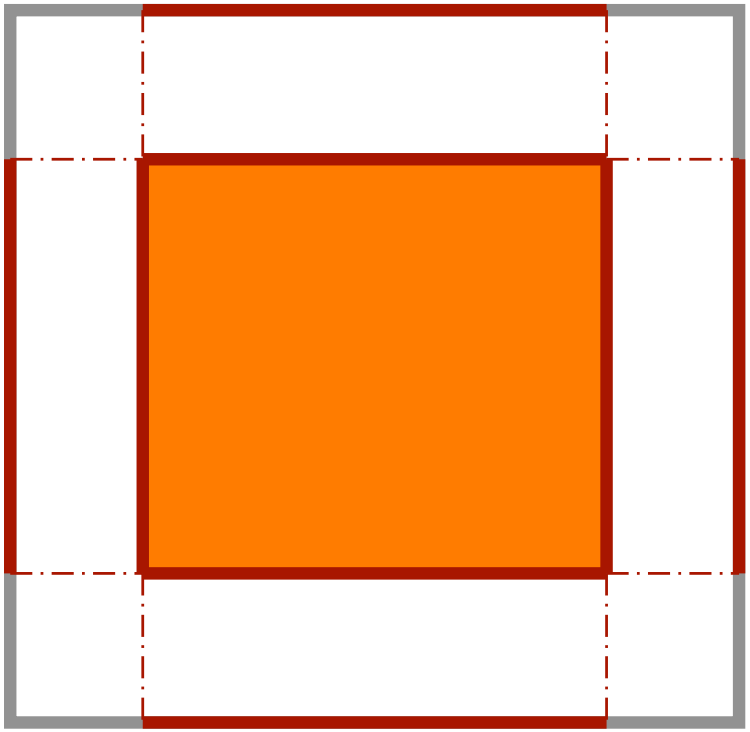
Spore Interface Study Outtakes
boltpeters.com



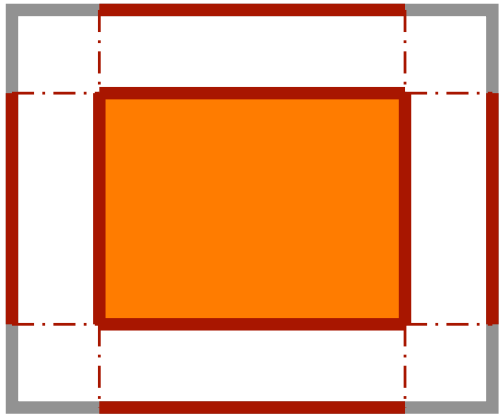
Let's Start With A Question

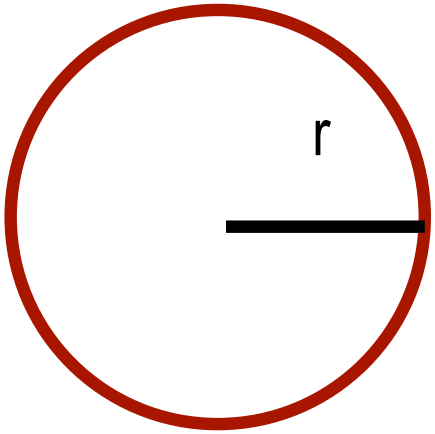
To help us think about representation

String Around The World



String Around The World





$C=2\pi r$

$C=2\ \pi(r+1)$

$C=2\ \pi r + 2\pi$

Why is the answer surprising to many people?

What makes a representation effective?

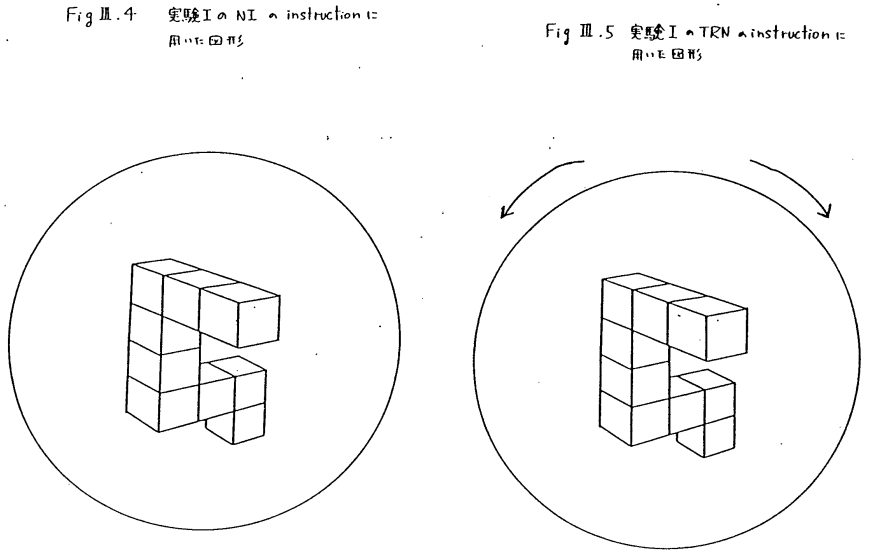
Representations are fundamental

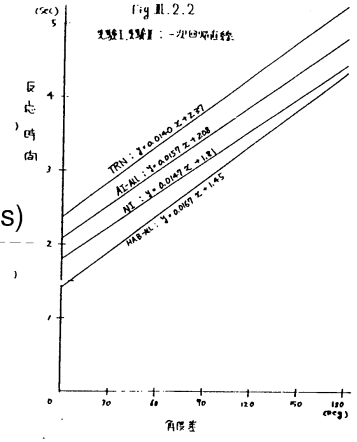
Representations can be amazingly subtle

Representation and Mental Rotation

Shepard &
Metzler
Mental
Rotation
Task

SAYEKI EXAMPLE



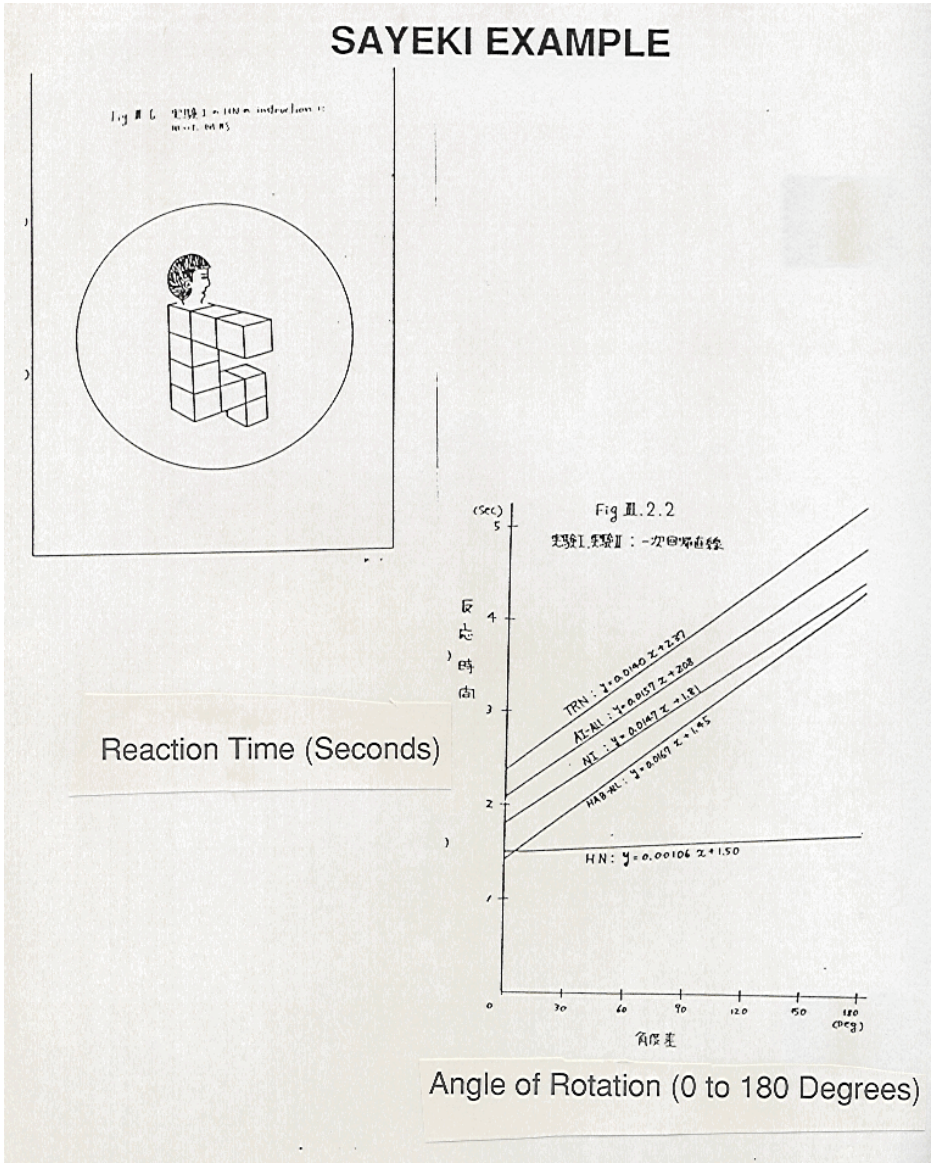


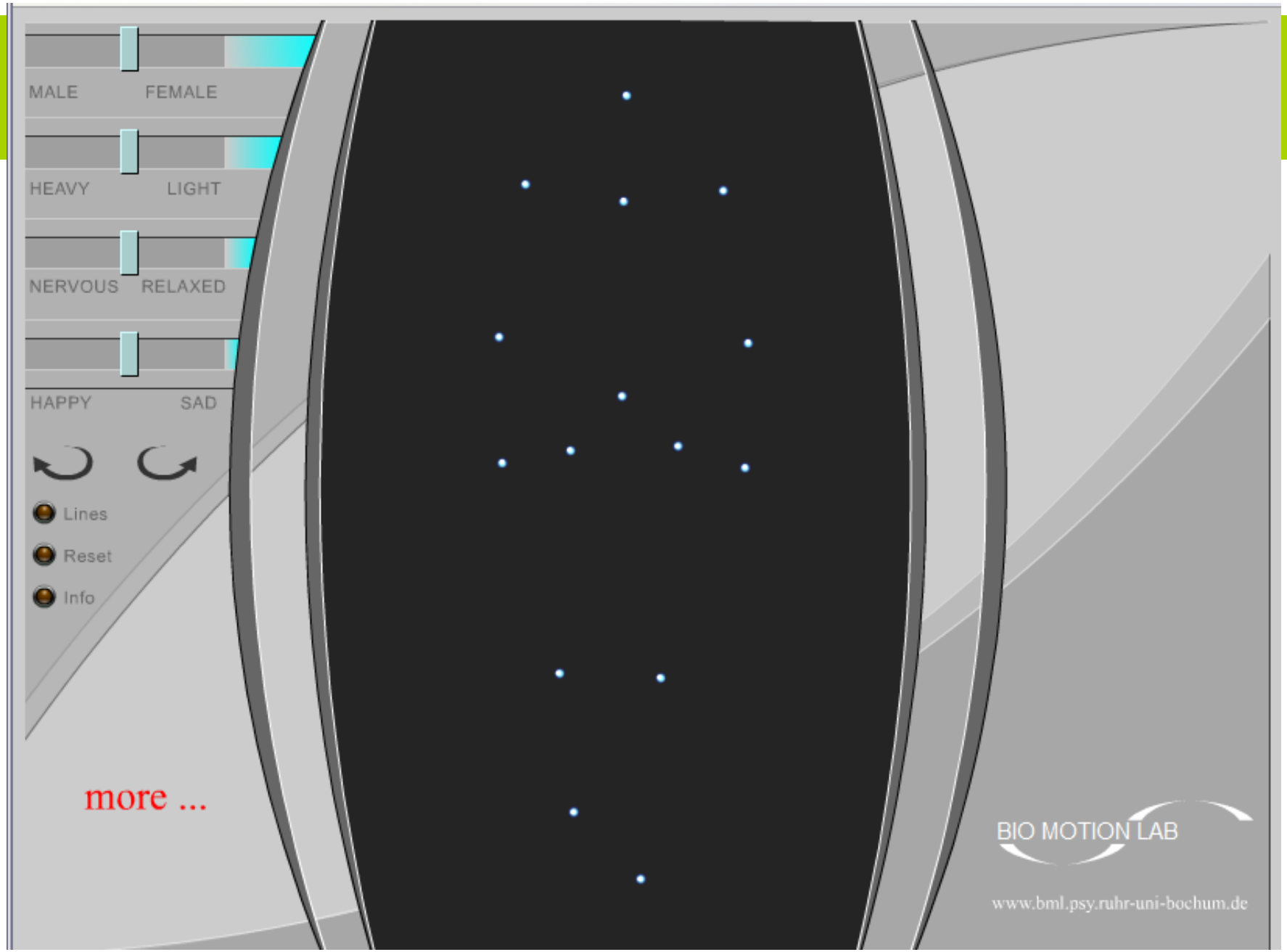
Reaction Time (Seconds)

Angle of Rotation (0 to 180 Degrees)

Representation and Mental Rotation

Sayeki




MALE
FEMALE
HEAVY
LIGHT
NERVOUS
RELAXED
HAPPY
SAD
Lines
Reset
Info
more ...
BIO MOTION LAB
www.bml.psy.ruhr-uni-bochum.de

Distributed Cognition and Digital Cognitive Ethnography

Jim Hollan

Distributed Cognition and Human Computer Interaction Lab

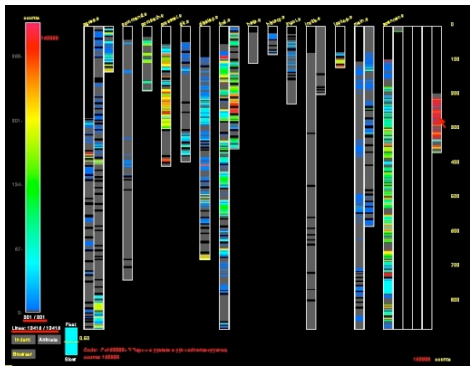
Department of Cognitive Science, University of California, San Diego

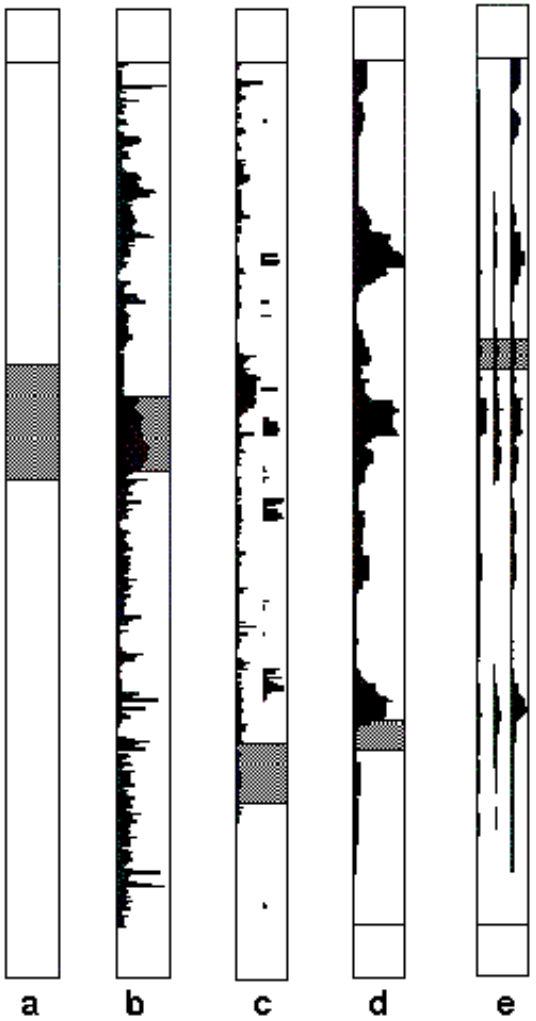
Ensuring design of computationally-based systems respects human needs and effectively augments our abilities is an intellectual challenge of the highest order.

Technology Change Impacts Data, Analysis, and Theory:
Capturing Activity Data

Long Interested in Activity Histories

Activity Histories



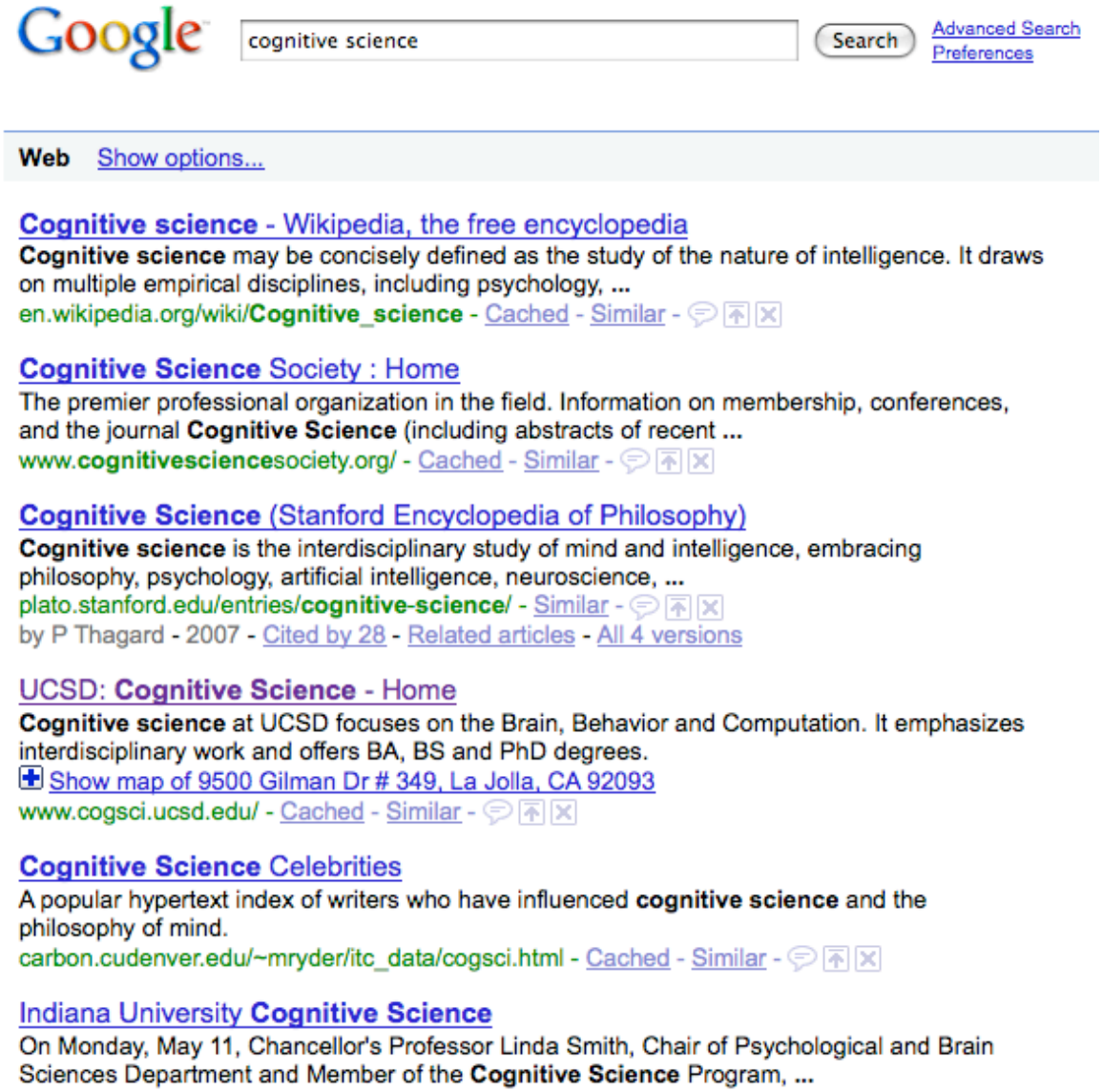


Read-Wear and Edit-Wear/ Read-Wear

- Modify editors to maintain history
- Visualization of history
- Augmented scrollbars
- Buffer histories
- Software copy histories
- Menu-Wear, Vita-Wear, …

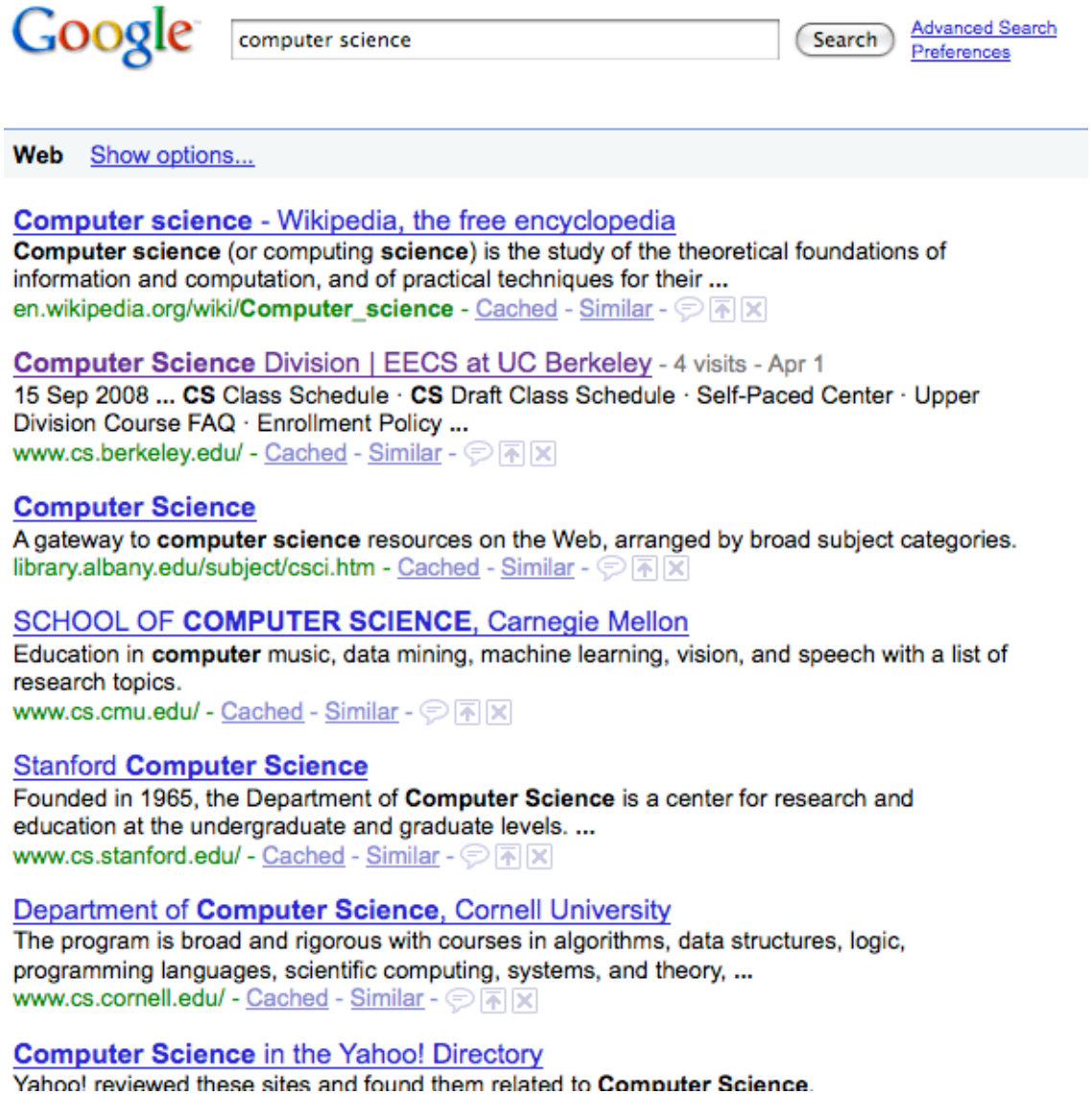
History Enriched Digital Objects

Collaborative Filtering: An Example of Exploiting Activity Histories



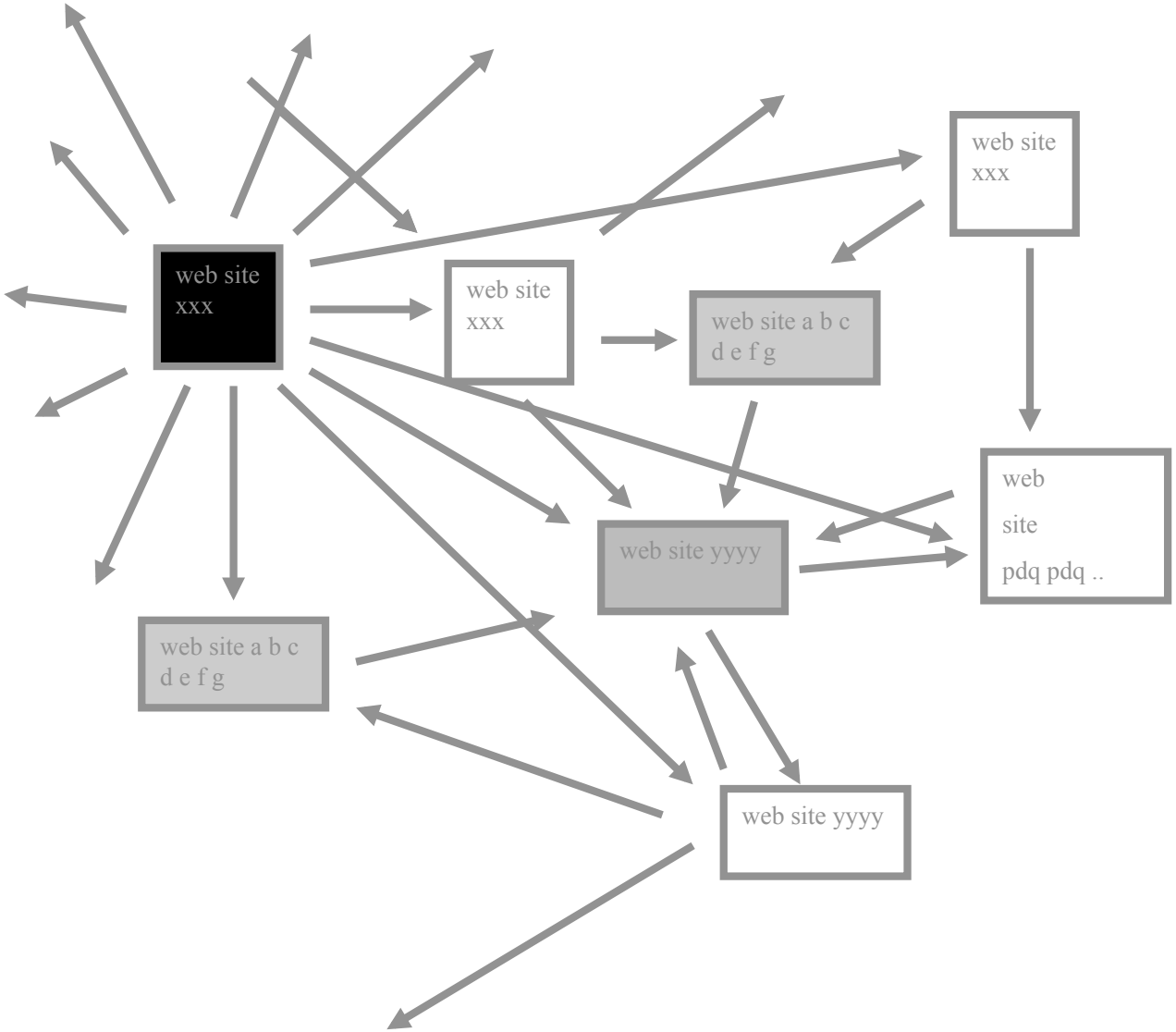
Results **1** - **10** of about **7,790,000** for **cognitive science** [definition]. (**0.19** seconds)

Collaborative Filtering: An Example of Exploiting Activity Histories



Results **1** - **10** of about **158,000,000** for **computer science** [definition]. (**0.31** seconds)

Collaborative Filtering: PageRank



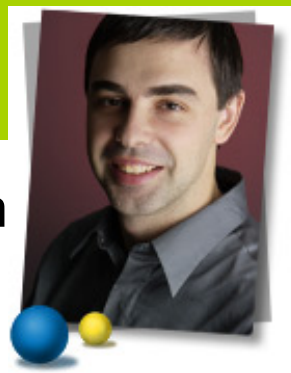
Inlinks are "good" (recommend ations)

Inlinks from a "good" site are better than inlinks from a "bad" site

but inlinks from sites with many outlinks are not as "good"...

"Good" and "bad" are relative.

PageRank



Developed by Larry Page and Sergey Brin

PageRank Explained (from Google)

PageRank relies on the uniquely democratic nature of the web by using its vast link structure as an indicator of an individual page's value. In essence, Google interprets a link from page A to page B as a vote, by page A, for page B. But, Google looks at more than the sheer volume of votes, or links a page receives; it also analyzes the page that casts the vote. Votes cast by pages that are themselves "important" weigh more heavily and help to make other pages "important.“

Important, high-quality sites receive a higher PageRank, which Google remembers each time it conducts a search.

Of course, important pages mean nothing to you if they don't match your query. So, Google combines PageRank with sophisticated text-matching techniques to find pages that are both important and relevant to your search. Google goes far beyond the number of times a term appears on a page and examines all aspects of the page's content (and the content of the pages linking to it) to determine if it's a good match for your query.

Bellcore MovieRecommender

My research group at Bellcore was one of earliest developers of collaborative filtering (actually based on experiences at UCSD in 1979)

Recommending And Evaluating Choices In A Virtual Community Of Use. CHI 1995

> By **virtual community** we mean "a group of people who share characteristics and interact in essence or effect only". In other words, people in a Virtual Community influence each other *as though* they interacted but they *do not interact*.
>
> Thus we ask: "Is it possible to arrange for people to share some of the personalized informational benefits of community involvement without the associated communications costs?"

Bellcore MovieRecommender

Participants sent email to videos@bellcore.com

System replied with a list of 500 movies to rate on a 1-10 scale (250 random, 250 popular)

- Only subset needed to be rated

New participant *P* sends in rated movies via email

System compares ratings for *P* to ratings of other users

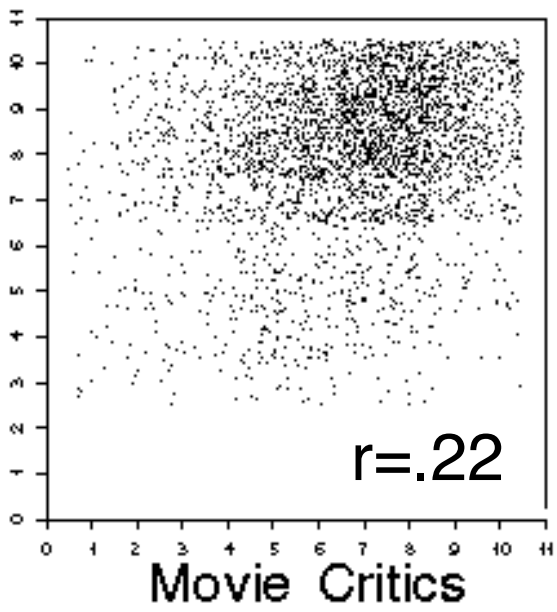
Most *similar users* are used to predict scores for unrated movies (more later)

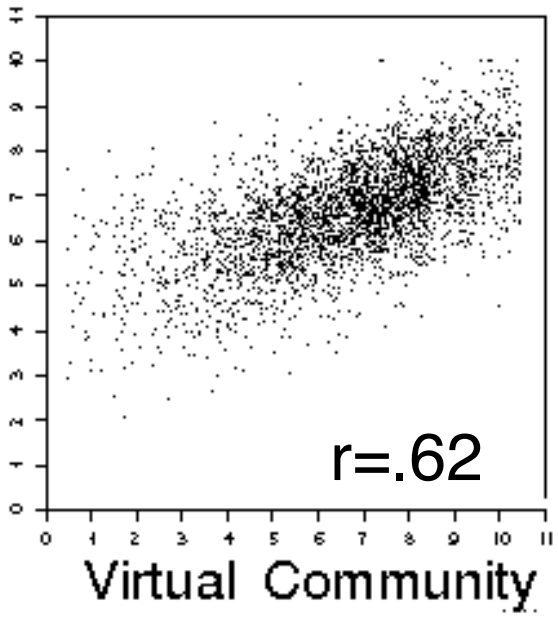
System returns recommendations in an email message.

Bellcore MovieRecommender

Evaluation:

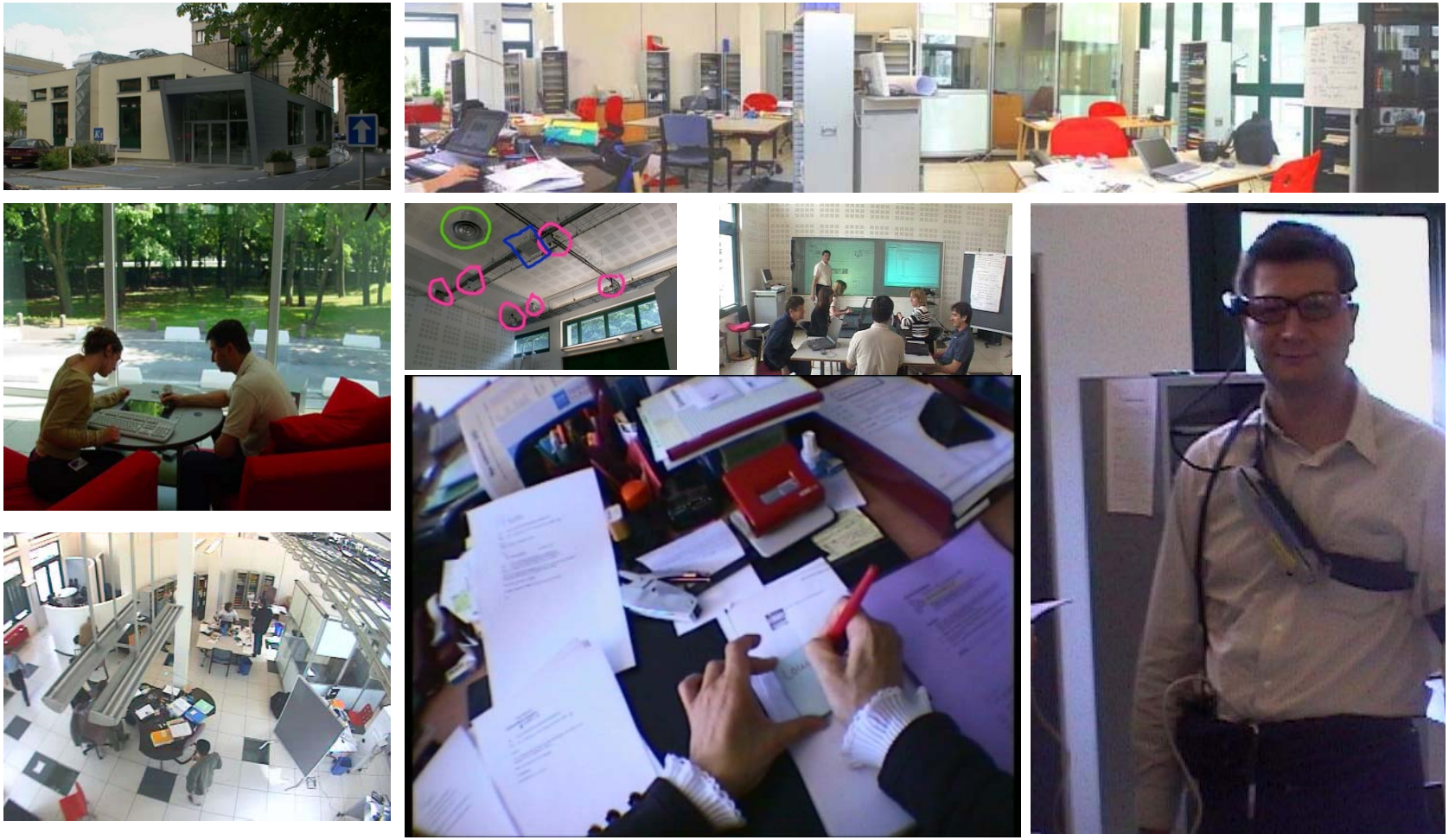
- Withhold 10% of the ratings of each user to use as a test set
- Measure correlation between *predicted* ratings and *actual* ratings for test-set movie/user pairs
- 3,





Video Activity Data: Laboratory of Design for Cognition

Saadi Lahlou, EDF, Paris



An Unprecedented Opportunity and A Critical Moment

In the history of science, changes in technologies for capturing data, for creating and manipulating representations, and for communicating and collaborating have often led to significant advances

- Automatic DNA sequencing in human genome project
- Web (communication, search, scientific publication, …)

Continuing advances in digital technology provide not only ever increasing processing power, decreasing storage cost, and faster and more ubiquitous networks but an unprecedented opportunity for the capture, storage, analysis, and sharing of activity data

For example, many disciplines are taking advantage of inexpensive digital video to assemble extensive data collections of human activity captured in real-world settings

The ability to record and share rich activity data has created a critical moment in the practice and scope of behavioral research

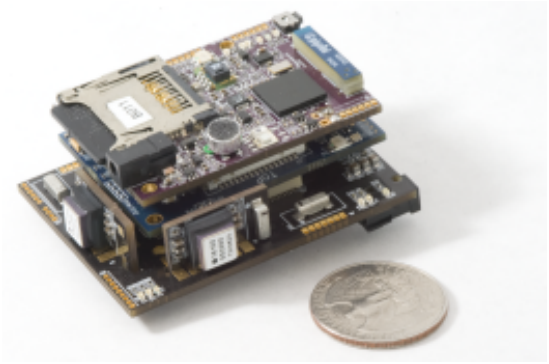
An Unprecedented Opportunity and A Critical Moment

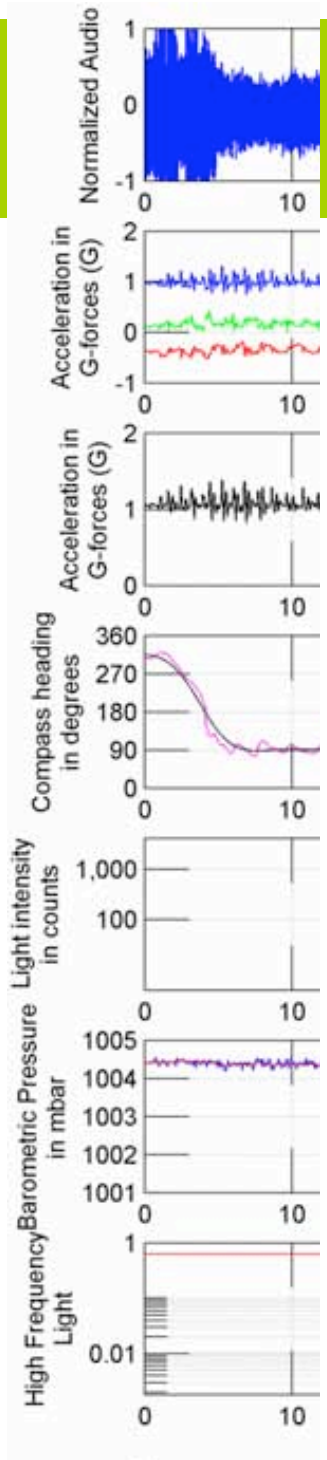
Such ubiquitous capture is important because in order to understand the dynamics of human activity we must understand its full context, and that can only be accomplished by recording and analyzing real-world behavioral data.

Intel and UW

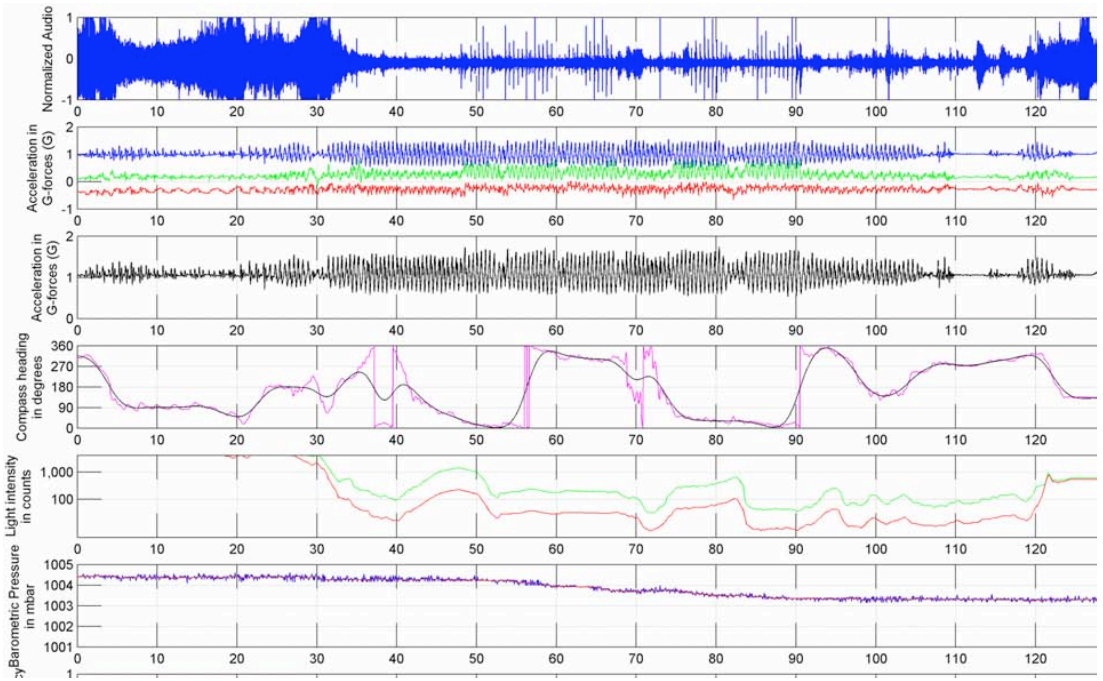
The MSP is a small-form factor mobile computing device that features a 400 MHz Xscale processor, 32 MB of memory and a diverse collection of sensors. It runs Linux and is extensible.

Sensing. Seven sensors are included in the base platform: 3D Accelerometer, Microphone, Barometer, Humidity, Visible light, Infrared light, and Temperature. To support experiments in location and inertial sensing, an optional daughter card provides: 3D magnetometers, 3D gyros, 3D compass, and USB host. This option increases the size of the MSP and its power usage. To support extensions of the MSP with new sensors, there are also extra serial connection and extra GPIO pins.

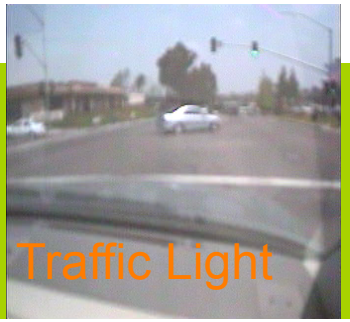



Normalized Audio
Acceleration in G-forces (G)
Acceleration in G-forces (G)
Compass heading in degrees
Light intensity in counts
Barometric Pressure in mbar
High Frequency Light


Time in seconds
Outside
Paul Allen CSE Building
Floor 1
Floor 3
Floor 6
Floor 3
Walking
Up Stairs
Up Elevator
Walking
Down Elevator
Down Stairs


Normalized Audio
Acceleration in G-forces (G)
Acceleration in G-forces (G)
Compass heading in degrees
Light intensity in counts
Barometric Pressure in mbar

UCSD Intelligent Driver Support System Project



CVRR Lab:

Sensors and Recognition Algorithms

Conceptual models of new automation such as Active Cruise Control

Dcog-HCI Lab:

Ethnographic Study

Understanding sense making and the cognitive ecology of driving

Design of future interfaces and negotiated access

Multiscale annotation and timeline navigation of data

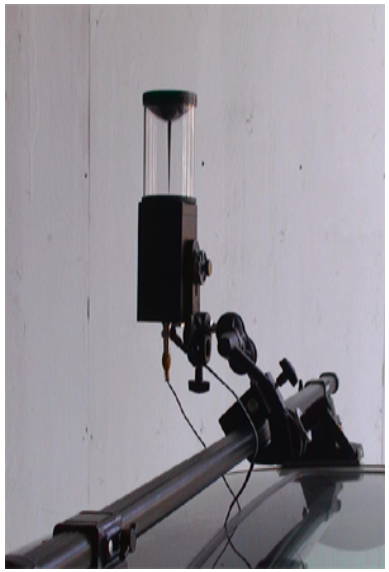
Driver intent and attention

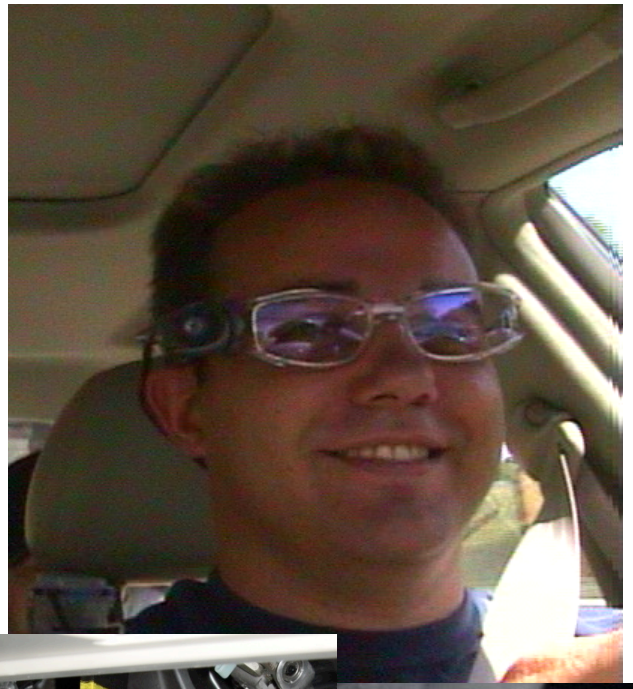
DCOG HCI LAB:
NISSAN IDSS

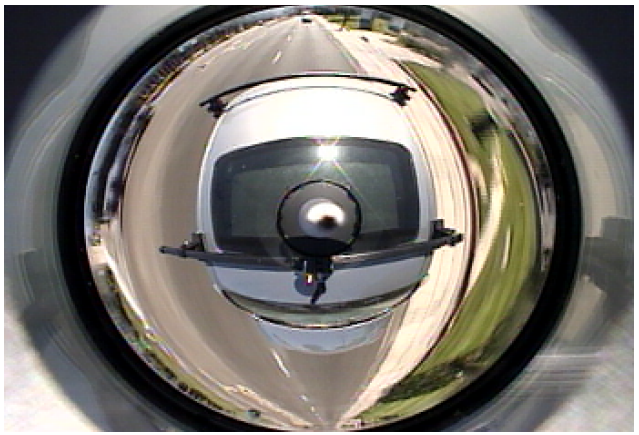
Nissan IDSS: Ethnographic Data Collection
UCSD Dcog-HCI LAB

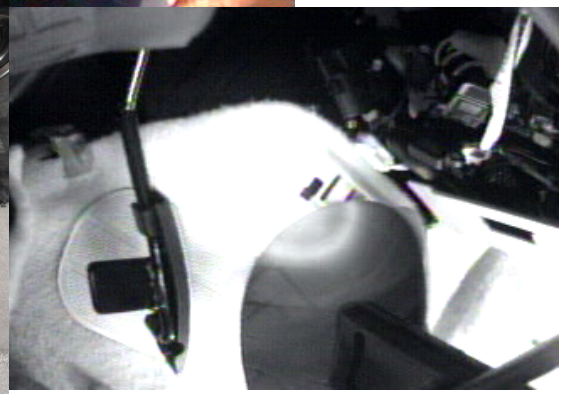
Cameras Everywhere

Cameras: Omni, Front, Rear, Face, Foot, …





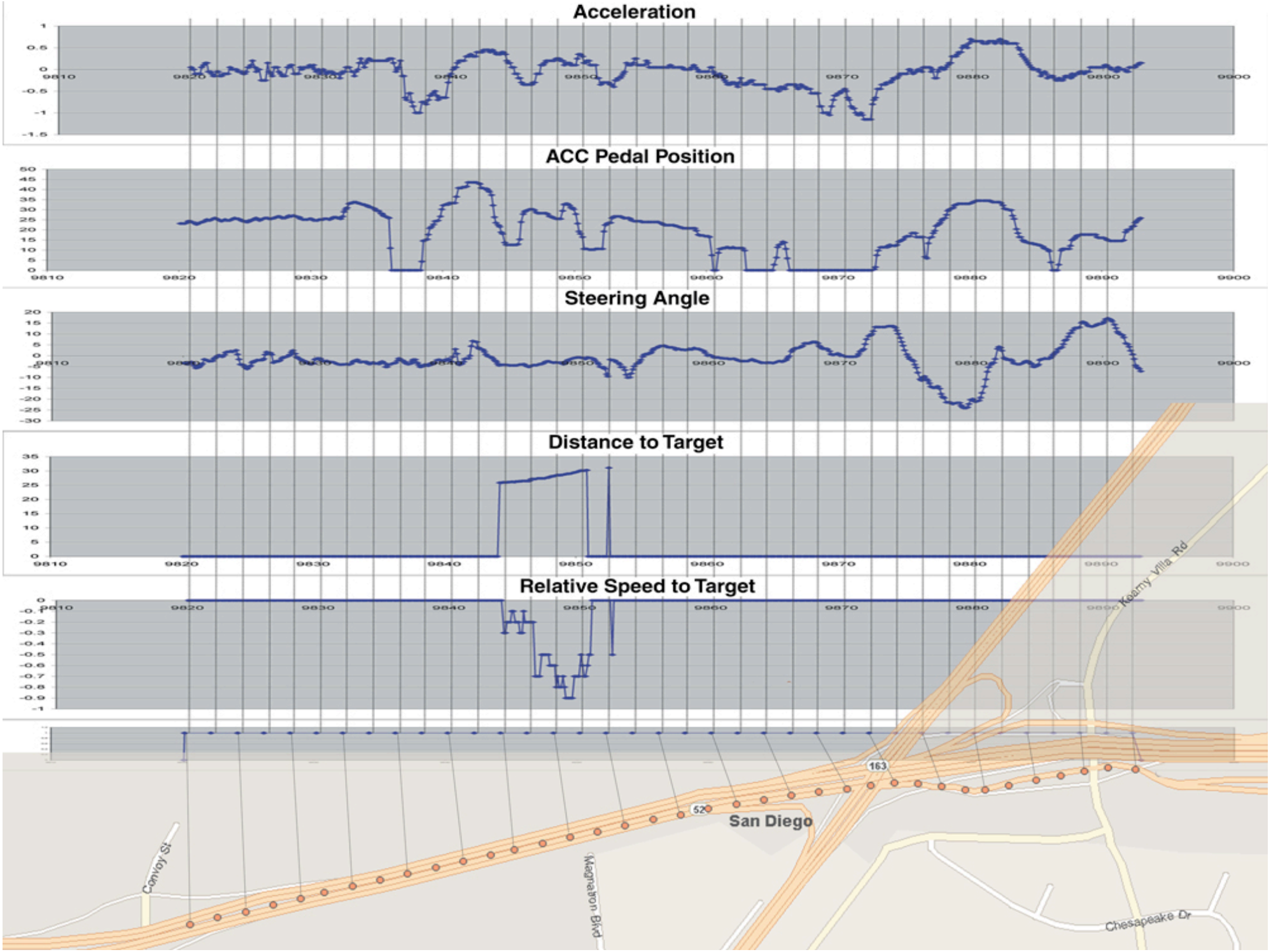




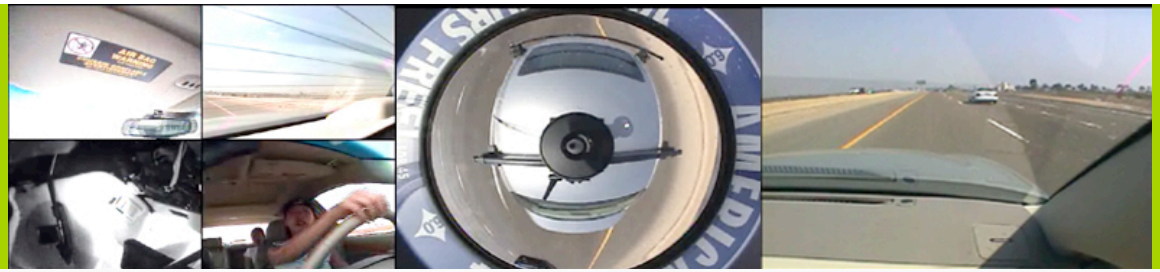
Trunk Full of Computer & Disks

Time and Location Synched Notes During Drive


LEGEND
C1: On campus
S1: Surface
OR1: On-ramp [5S]
F1: Freeway [5S]
F2F1: Freeway to Freeway [5S-52E]
F2F2a: Freeway to Freeway [15N exit]
F2F2b: Freeway to Freeway [15N]
OR2: Off-ramp [Miramar]
S2: Surface
C1
C2
S1
OR1
F1
F2F1
F2F2a
F2F2b
OR2
S2


Acceleration
ACC Pedal Position
Steering Angle
Distance to Target
Relative Speed to Target
San Diego
Convoy St
Magnatron Blvd
Kearny Villa Rd
Chesapeake Dr
163
52

Multiple Video Streams



Understanding the Dynamics of Human Activity

Such ubiquitous capture is important because in order to understand the dynamics of human activity we must understand its full context, and that can only be accomplished by recording and analyzing real-world behavioral data.

Examining the details of behavior [43] reveals that it is highly fragmented. For example, during the course of a typical day information workers spend an average of only 12 minutes on any given task and most uninterrupted “events” average about 3 minutes in duration. The nature of modern work requires people to manage a complex mix of multiple tasks and activities, each frequently requiring different resources and often being interrupted for extended periods by meetings, travel, or the press of other responsibilities. The difficulty and extensive time required to reestablish the mental context associated with interrupted activities is common to all forms of creative work. It is an issue that knows no disciplinary boundary and is as pervasive in the arts and humanities as in science and engineering.

Challenge

- Challenge is how to fully capitalizing on the unprecedented opportunity for the capture, storage, analysis, and sharing of activity data
- Challenges both theory and methodology
  - Understanding how to coordinate analyses focused at different scales so as to profit fully from the theoretical perspectives of multiple discipline
  - The huge time investment required for analysis using current methods
- Our long-term goal is to better understand the dynamics of human activity as a scientific foundation for design
- Our approach
  - Theory: Distributed Cognition
  - Method: Digital Cognitive Ethnography

Distributed Cognition

"We more than any other creature on the planet, deploy non-biological 'wideware' (instruments, media, notations) to complement our basic biological modes of processing, creating extended cognitive systems whose computational and problem-solving profiles are quite different from those of the naked brain."
– Andy Clark

"To take the body and world seriously is to invite an emergentist perspective on many key phenomena – to see adaptive success as inhering as much in the complex interactions among body, world, and brain as in the inner processes bounded by the skin and skull."
– Andy Clark

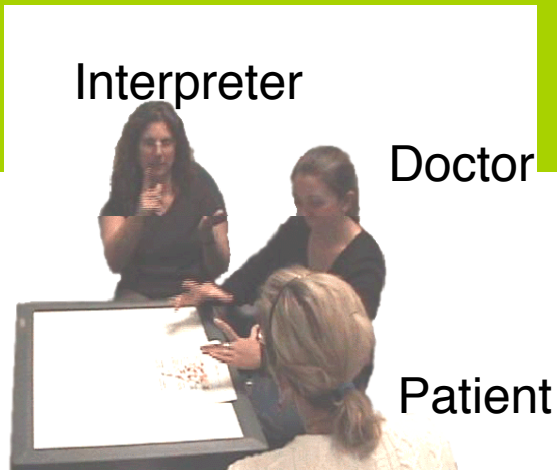
- Cognition is distributed, situated, and embodied
- Focus on functional systems and propagation of representations
- Technology should be conceived broadly to include language, gesture, and other representations
- View technology not as simple amplifier of cognition but as something that can transform cognitive functional systems in ways that permit people to be smart by using the relatively simple processes of pattern matching, manipulating objects in the world, and imaging the dynamics of simple physical worlds
- Fundamental importance of looking at *cognitive ecology*

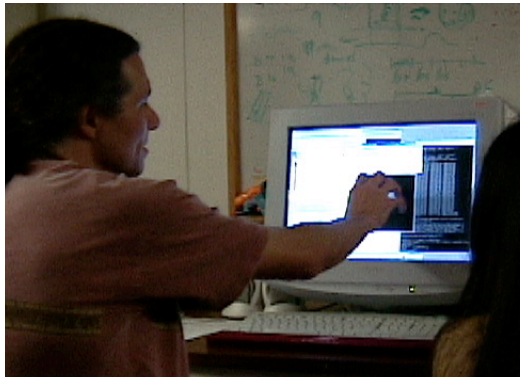
Cognitive Ecology

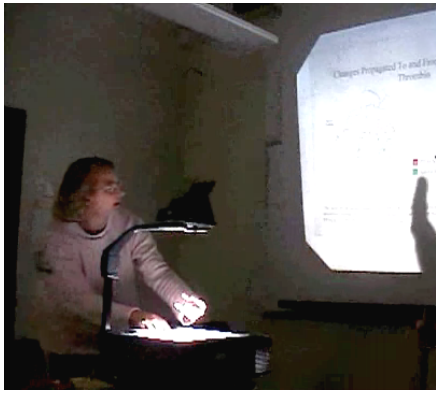
Brains in bodies

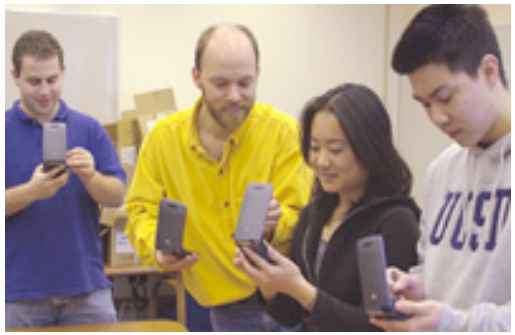
engaged in meaningful activities

in culturally constructed settings









Distributed Cognition

The theory of distributed cognition, like any cognitive theory, seeks to understand the organization of cognitive systems.

Unlike traditional theories, however, it extends the reach of what is considered cognitive beyond the individual to encompass interactions between people and with resources and materials in the environment.

It is important from the outset to understand that distributed cognition refers to a perspective on all of cognition, rather than a particular kind of cognition.

It can be distinguished from other approaches by its commitment to three related theoretical principles.

Unit of Analysis

The first of these principles concerns the boundaries of the unit of analysis for cognition.

In every area of science, the choices made concerning the boundaries of the unit of analysis have important implications.

In traditional views of cognition the boundaries are those of individuals. Sometimes the traditionally assumed boundaries are exactly right. For other phenomena, however, these boundaries either span too much or too little.

Distributed cognition looks for cognitive processes, wherever they may occur, on the basis of the functional relationships of elements that participate together in the process.

A process is not cognitive simply because it happens in a brain, nor is a process non-cognitive simply because it happens in the interactions among many brains.

Range of Mechanisms

The second principle that distinguishes distributed cognition is the range of mechanisms that may be assumed to participate in cognitive processes.

Whereas traditional views look for cognitive events in the manipulation of symbols inside individual actors, distributed cognition looks for a broader class of cognitive events and does not expect all such events to be encompassed by the skin or skull of an individual.

For example , an examination of memory processes in a airline cockpit shows that memory involves a rich interaction between internal processes, manipulation of objects, and the traffic in representations among the pilots.

Functional Relationships

A cognitive process is delimited by the functional relationships among the elements that participate in it, rather than by the spatial co-location of the elements.

When one applies these principles to the observation of human activity “in the wild”, at least three interesting kinds of distribution of cognitive process become apparent:

- Cognitive processes may be distributed across the members of a social group.
- Cognitive processes may involve coordination between internal and external (material or environmental) structure.
- Processes may be distributed through time in such a way that the products of earlier events can transform the nature of later events.

Distributed Cognition: Embodiment and Culture

Cognition is embodied. It is not an incidental matter that we have bodies locking us causally into relations with our immediate environment.

The study of cognition is not separable from the study of culture because agents live in complex cultural environments.

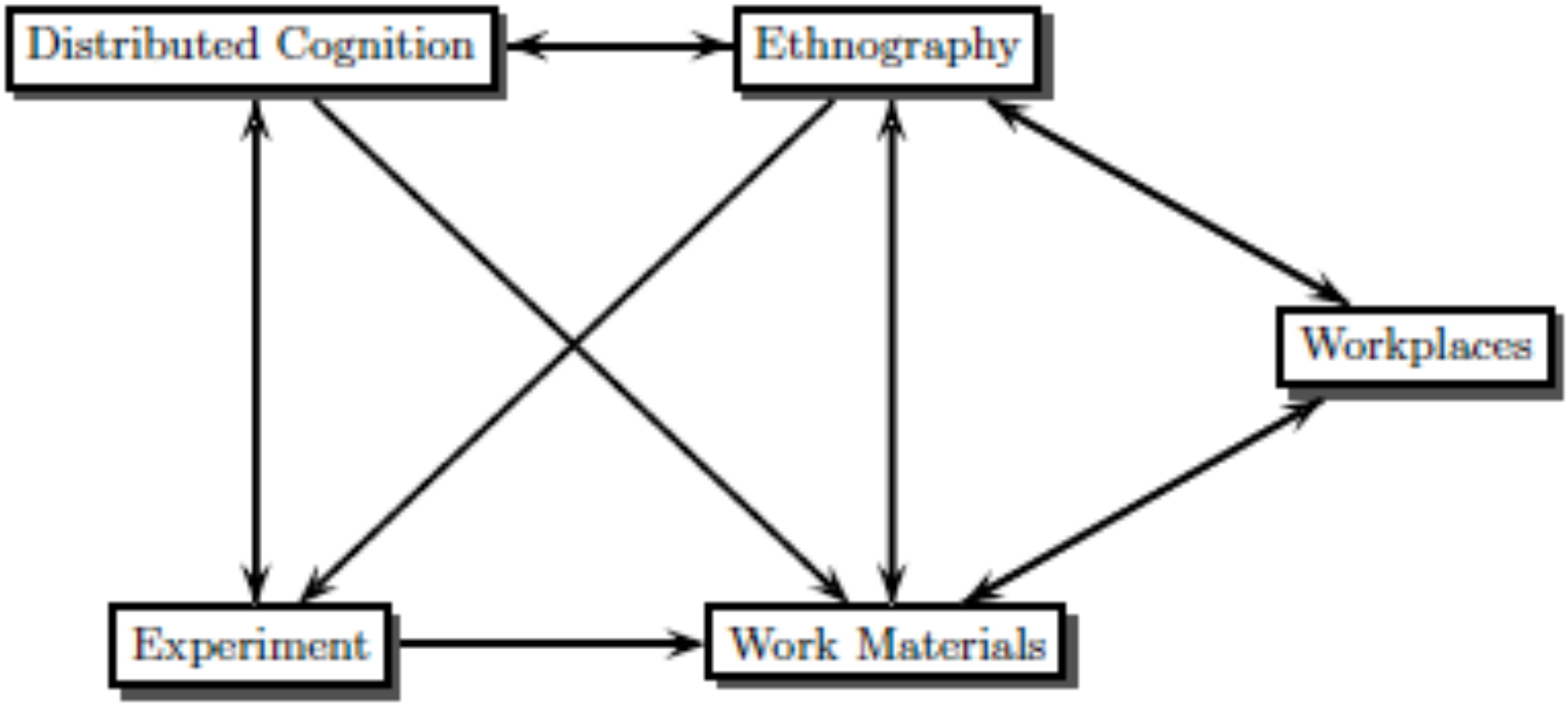
A Cognitive Ethnographic Approach

The theoretical emphasis on distributed cognitive processes is reflected in the methodological focus on events.

Since the cognitive properties of systems that are larger than an individual play out in the activity of the people in them, a cognitive ethnography must be an event-centered ethnography.

We are interested not only in what people know, but in how they go about using what they know to do what they do.

Integrated Research Activities



Challenge: Reducing Analysis Costs

Today the high labor cost of analyzing rich activity data leads to haphazard and incomplete analyses or, all too commonly, to no analysis at all of much of the data. Even dataset navigation is cumbersome.

Data records are chosen for analysis because of recording quality, interesting phenomena, and interaction density—producing a haphazard sampling of the recorded set.

Good researchers have a nose for good data, but with a tendency to focus on small segments of the record that contain “interesting” behavior, analyze them intensively, and then move on to the next project.

Challenge: Reducing Analysis Costs

When analysis is so costly, few analyses can be done—so datasets are severely underutilized—and researchers come to have a large investment in the chosen data segments.

Since each analysis may appear as an isolated case study, it can be difficult to know how common the observed phenomena may be. Larger patterns and contradictory

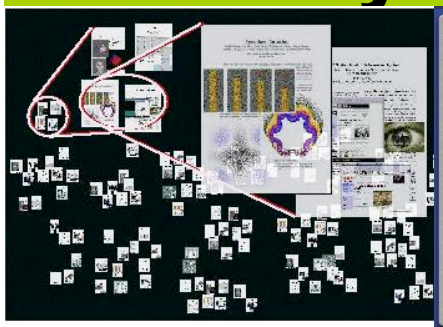
cases can easily go unnoticed.

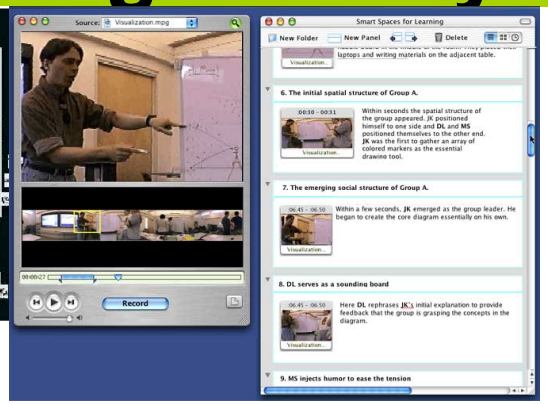
Well-known human confirmation biases can affect the quality of the science when each analysis requires so much effort.

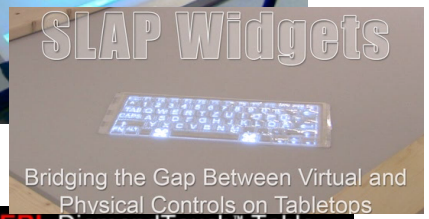
Thus, one focus of our proposed research will be on tools to speed and

improve analysis

Beginning of Infrastructure and Framework for Analyzing Activity



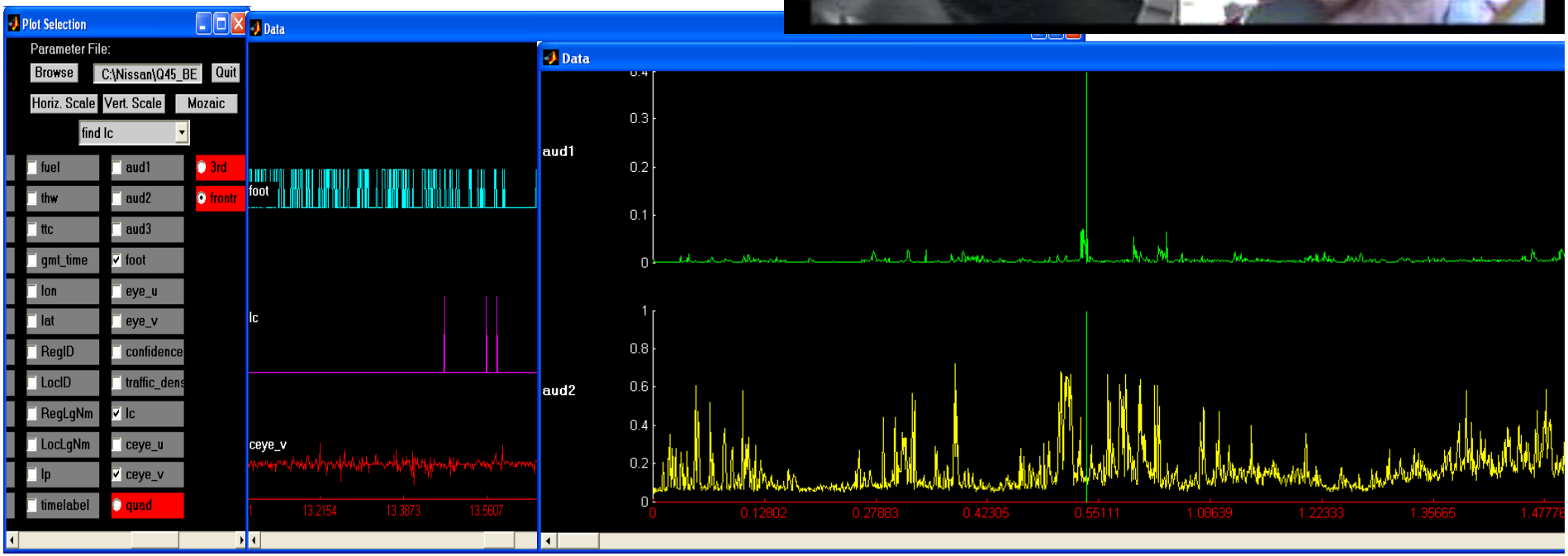




Analysis Tool

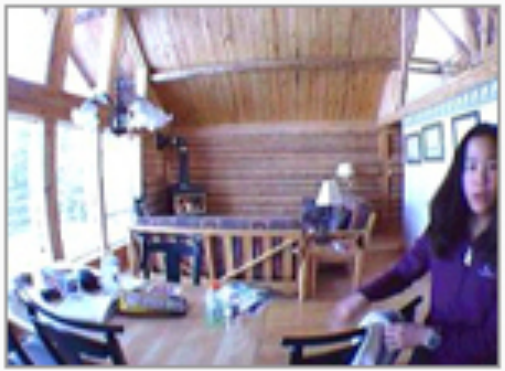
Carrie Joyce, Erwin Boer, Jim Hollan

Video processing: locate lane changes, show foot activity (e.g. shifting between pedals, hovering over pedals) and head activity, classifying head movements according to where drivers are looking (e.g. rearview or side mirror), locate and classify hand movements, etc. Also who is talking, …



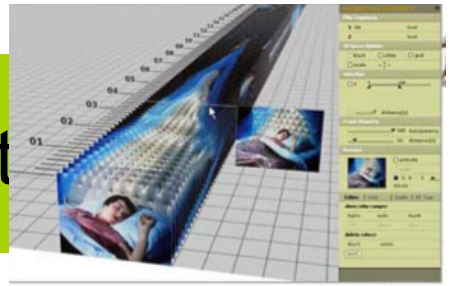
Microsoft Research: SenseCam

The v2.3 SenseCam shown close up and as typically worn by a user. The model pictured here has a clear plastic case that reveals some of the internal components.



Example images captured by SenseCam.

Adam Fouse: Visualizing Workstation Activit



DIVA: Exploratory Data Analysis with Multimedia Streams

Wendy E. Mackay [1,2] Michel Beaudouin-Lafon[2]

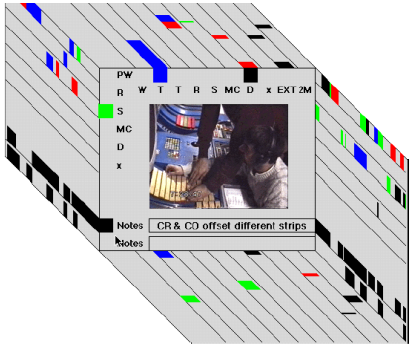
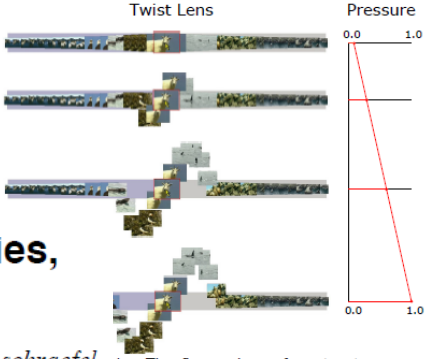


Figure 10 : The spatial view of the stream appears in the center of the display and the temporal views appear on the sides. When the time base is running, the spatial view is constantly updated and the temporal views stream backwards.

Fluid Interaction Techniques for the Control and Annotation of Digital Video

Gonzalo Ramos, Ravin Balakrishnan
Department of Computer Science
University of Toronto

Figure 5: This partial view of the *TLslider* shows how a regular fish-eye approach that keeps a fixed target size may present occlusion problems in the vicinity of the focus.



der. The figure shows from top to amplitude of the lens changes with ure, which is displayed on the right.

Connecting Time-Oriented Data and Information to a Coherent Interactive Visualization

Ragnar Bade and Stefan Schlechtweg
Otto-von-Guericke University of Magdeburg
Department of Simulation and Graphics
Universitätsplatz 2, D-39106 Magdeburg
{rbade|stefans}@isg.cs.uni-magdeburg.de

Silvia Miksch
Vienna University of Technology
Institute of Software Technology and Interactive Systems
Favoritenstrasse 9 - 11 / 188, A-1040 Vienna
silvia@ifs.tuwien.ac.at

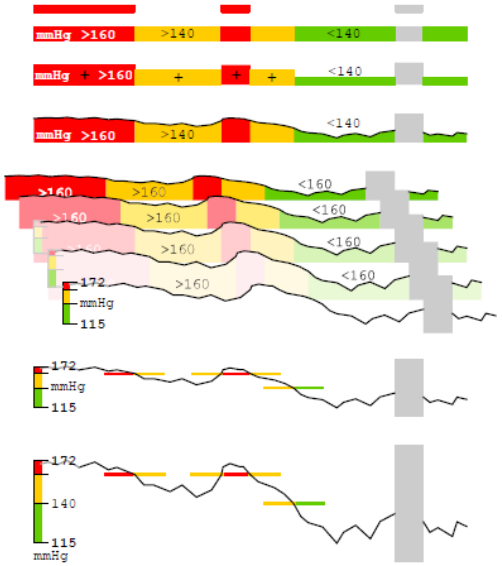


Figure 16. Steps of resizing/zooming the representation of a data stream from a broad overview to the fine structure.

Continuum: designing timelines for hierarchies, relationships and scale

Paul André, Max L. Wilson, Alistair Russell, Daniel A. Smith, Alisdair Owens and m.c. schraefel
School of Electronics and Computer Science
University of Southampton, UK

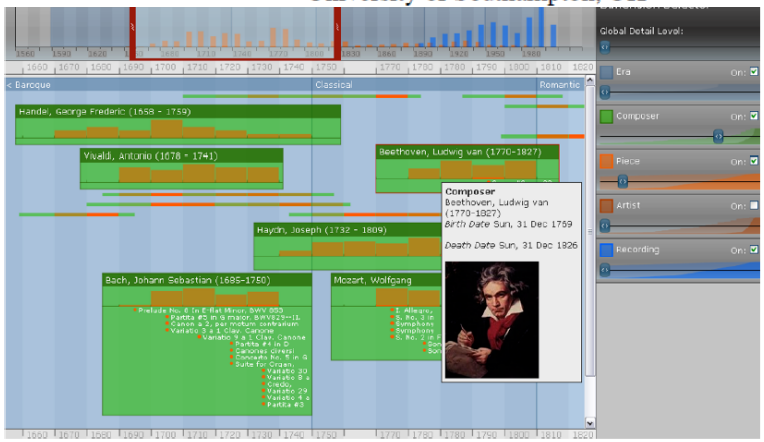
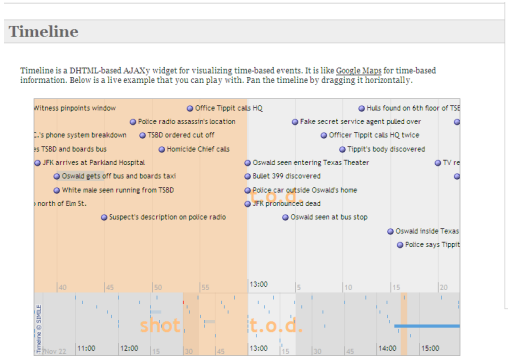
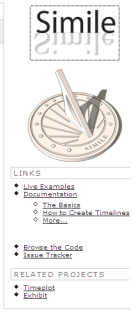
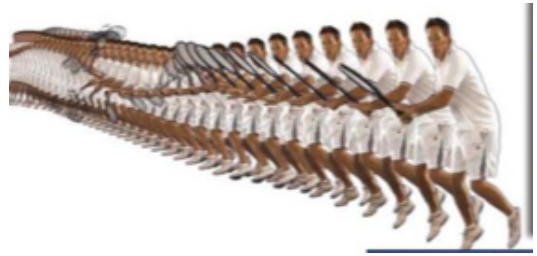


Figure 1: Continuum, a timeline visualisation tool for representing faceted temporal data.

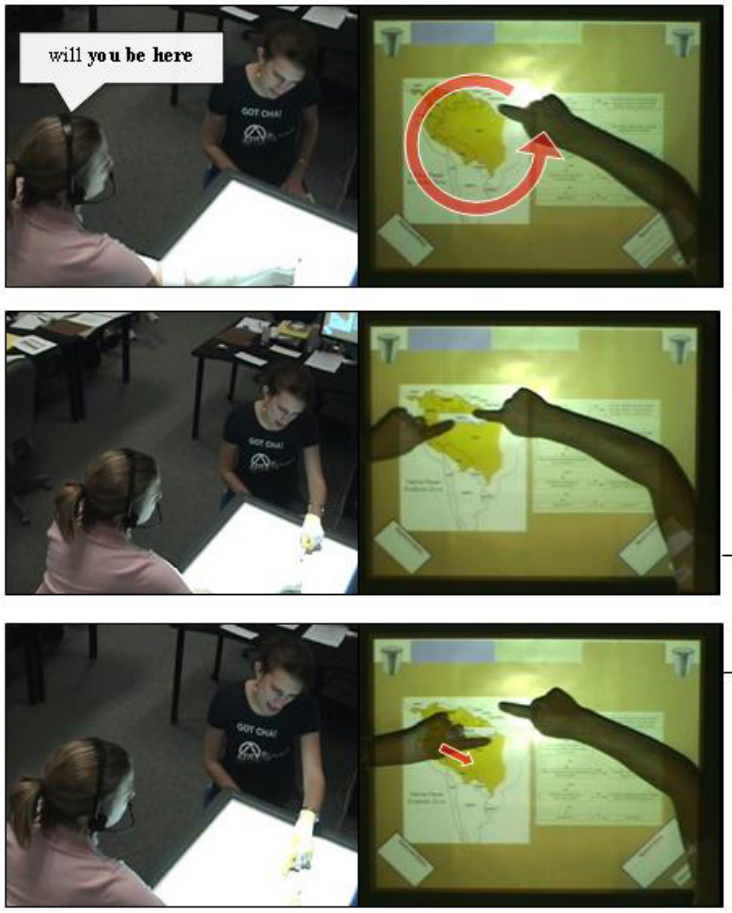






Anne Marie Piper:
Multimodal Interaction on DiamondTouch Table

- Multimodal interaction



Livescribe

livescribe desktop

File Edit View Navigation Help

PADD1

Page Viewer | Sessions | Upload Session | Upload Pages | livescribe online

Library

My Notebooks
- Blue Single Subject-Included
- Tutorial

Blue Single Subject-Included

Testing

Jim: researcher & lab of the week - ~~Mark~~ Martin Wattenberg
- Many eyes project → CHI 08
- Look at video at park

Adam:
Introduction
- Chapters are background
- Threads - historical dev. of graphical forms, graphical excellence
  - guidelines based on history for making good graphics

Data Maps - diff. maps that represent quant. info.
- Ex: John Snow - epidemic in London
- Ex: Tradewinds
- Ex: Routes of trade & goods traded
  → take quant. data in abstract & represent

Graphs - time series
- Ex: New York city weather → get indiv. temps & scale of data
- Ex: Train schedule between Paris & Leon
  - shift in line indicates stop
  - slope of line shows speed of train

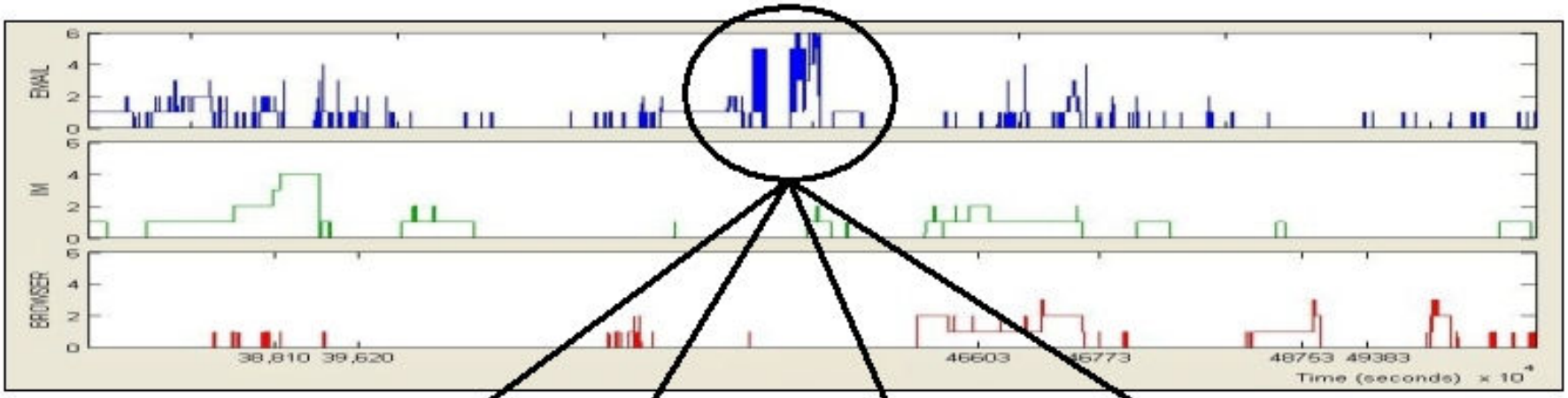
Ex: trade deficit, England, 1786
Note: he acknowledges that there are cases where pure numerical tables are better
Ex: chart showing wages vs. price of wheat
→ key insight: can look at proportionality btwn wages & wheat prices

5 of 200

00:00/00:00 Slow Fast

Gaston Cangiano :
Mining Activity Histories on the Desktop

Digital

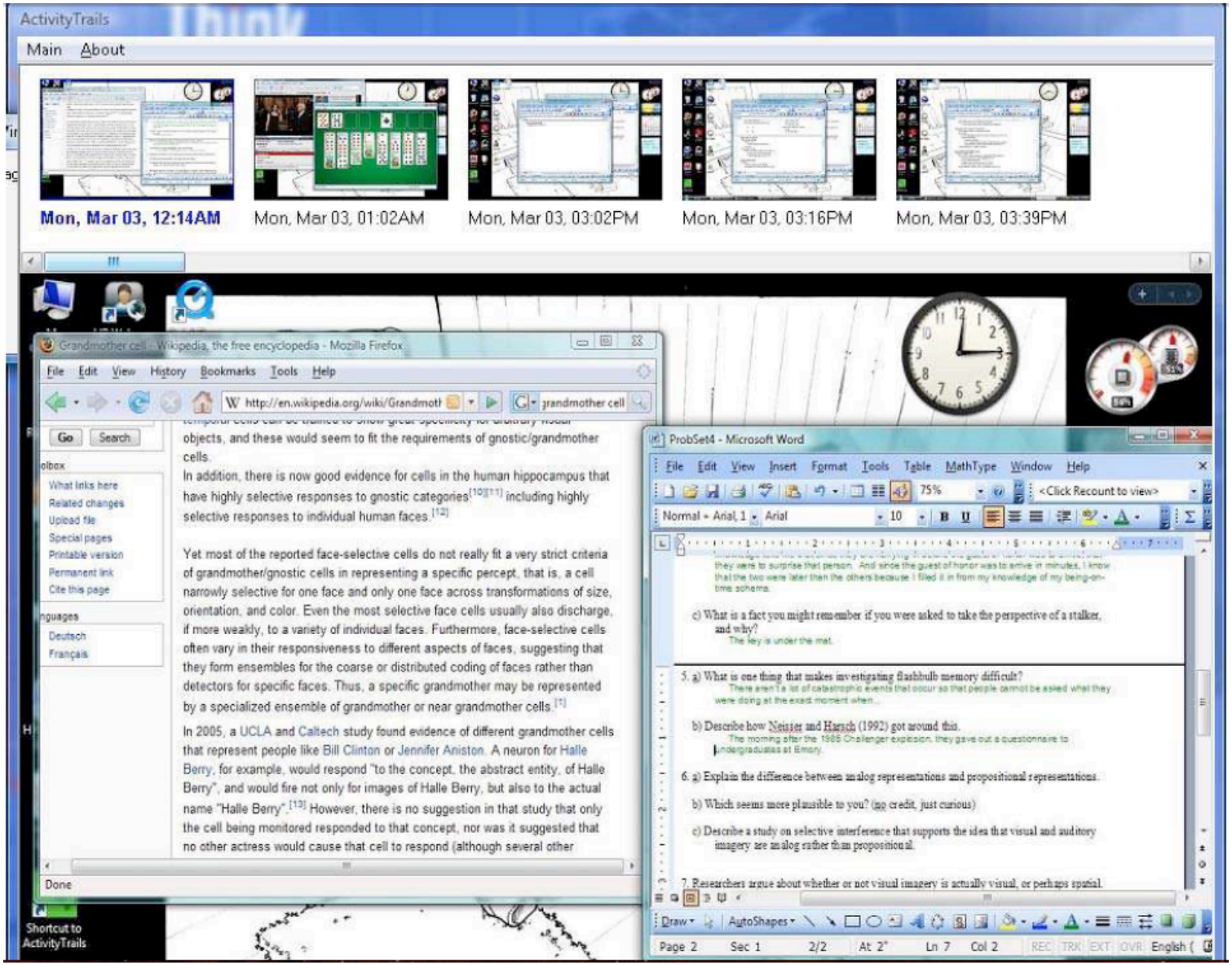


Qualitative

Discourse

28 H: hum:: <and that i do: through:> responses via i-m, responses via email. .h (.5) ahm::: (.2) doing legal research at ti:mes?-I don't think in this <session> i needed to do legal research: .hh=
29 G: =>you did<-you did some of that stuff towards the end (.1)
30 H: °I did?°

Gaston Cangiano: Activity Trails



A Scenario

You have just returned from a week long professional conference and are in the process of resuming your research, teaching, personal and family responsibilities. You have paper and grant deadlines rapidly approaching, a huge backlog of email messages demanding attention, you need to prepare lectures for upcoming classes and grade the exams given while you were away, you should talk with other members of the faculty search committee you chair about meetings you had with prospective candidates at the conference, your graduate students are anxious to meet with you about their research activities while you were away, numerous personal and family issues require your attention, ...

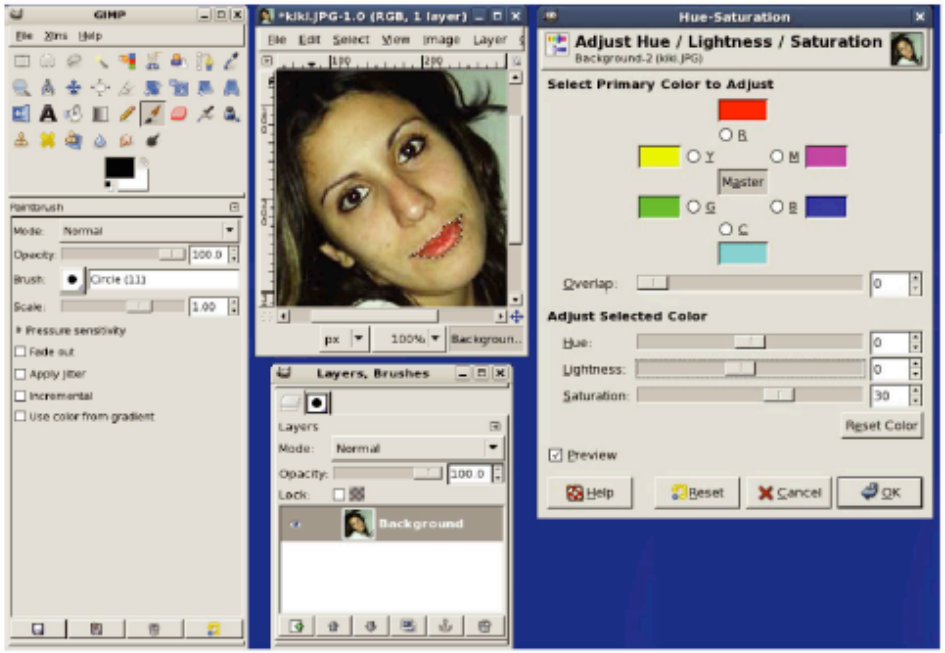
A Conjecture

While it may be the case that interruptions, multitasking, and cognitive overload are brute facts of modern life [33], we see exciting opportunities to aid reestablishing the context associated with complex activities that have been interrupted.

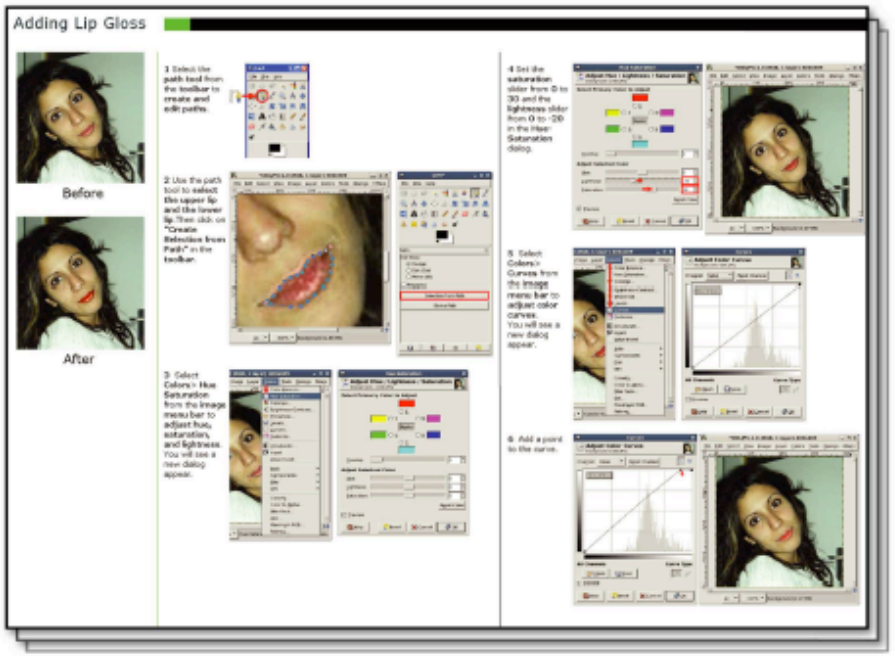
The gist of the idea leading to this proposal is to employ image and video-based summaries of activities to assist reestablishing mental context. Specifically we propose to: (1) develop non-intrusive mechanisms for automatic capture and visual summarization of activity, and (2) explore their effectiveness to help reestablish context and encourage reflection in a variety of domain settings, including programming, image manipulation, writing, collaborations in a law office, health care communication for the elderly, and classes on programming and design.

Another Scenario

Gail leads a computer-vision research group at a major research university. Her group has recently developed a novel stochastic modeling technique and she has been working on an implementation of it. She would like to demo it tomorrow as part of an NSF site visit and finally has some time after dinner with the visit team to work on it. She last worked on the code just before attending a conference the week before last. Looking at the files she can't remember where she left off and because she doesn't even recognize some of the code, wonders if this is the most recent version. Fortunately, she is using Mylyn and can at least see tasks and a filtered list of files. That helps because there are hundreds of files in the her group's system. Still, where did she leave off? She decides to look at a visualization of her activity history. It is easy to move back on the timeline to just before the conference and to see the characteristic images of programming activity. Zooming into one of those activities it is now clear that this is the code she was last working on. Because she still doesn't remember what she was doing, she decides to play a short video of the activity. This is an automatic activity summary created by a new research system she has agreed to use. She decides to demonstrate this new system to her spouse and plays a short clip. The clip has some of the rapid editing feel of an MTV video. He is completely unimpressed and jokes about the clip's need for music. He has no idea what he has just seen even though he is an accomplished programmer. But for her the clip is interpretable and useful. She is also able to interpret some surrounding images as documenting that she went off to a former colleague's web site and was looking at one of his papers. Of course! She now realizes that she was trying to understand the details of a recursive algorithm he recently published that she thought might make her implementation of the stochastic modeling technique finally run in real time. Seeing a mosaic of images of the web site and specific sections of the paper (ones associated with pages she had spent the most time reading) was sufficient to restore the context of her earlier activity from two weeks before. She now turns back to programming and the activity that was interrupted a couple of weeks before. [Stay tuned to see if our heroine completes the code, impresses the site review visitors and gets the grant.]



GIMP Activity Recording



Automatically Generated Tutorial

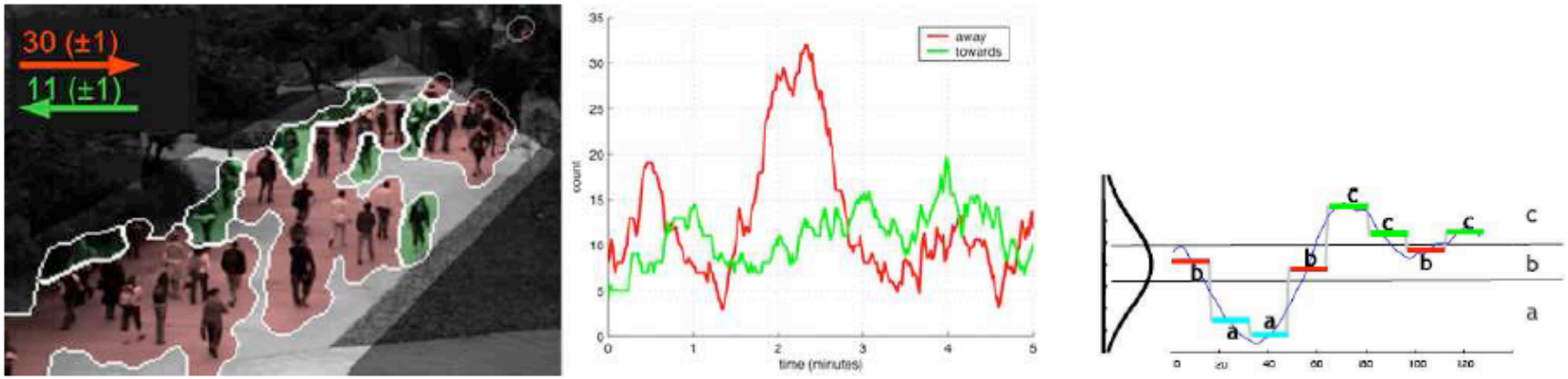


Figure 6: *Left and Center: Crowd counting results. The red and green segments are the "away" and "toward" crowds. The estimated crowd count for each segment is on the center. Right: Stepwise Aggregate Approximation (SAX). SAX can be used to convert a complex time-series into a symbolic representation suitable for discrete data mining algorithms. SAX figure reproduced from [49].*