Research Topics in Human-Computer Interaction

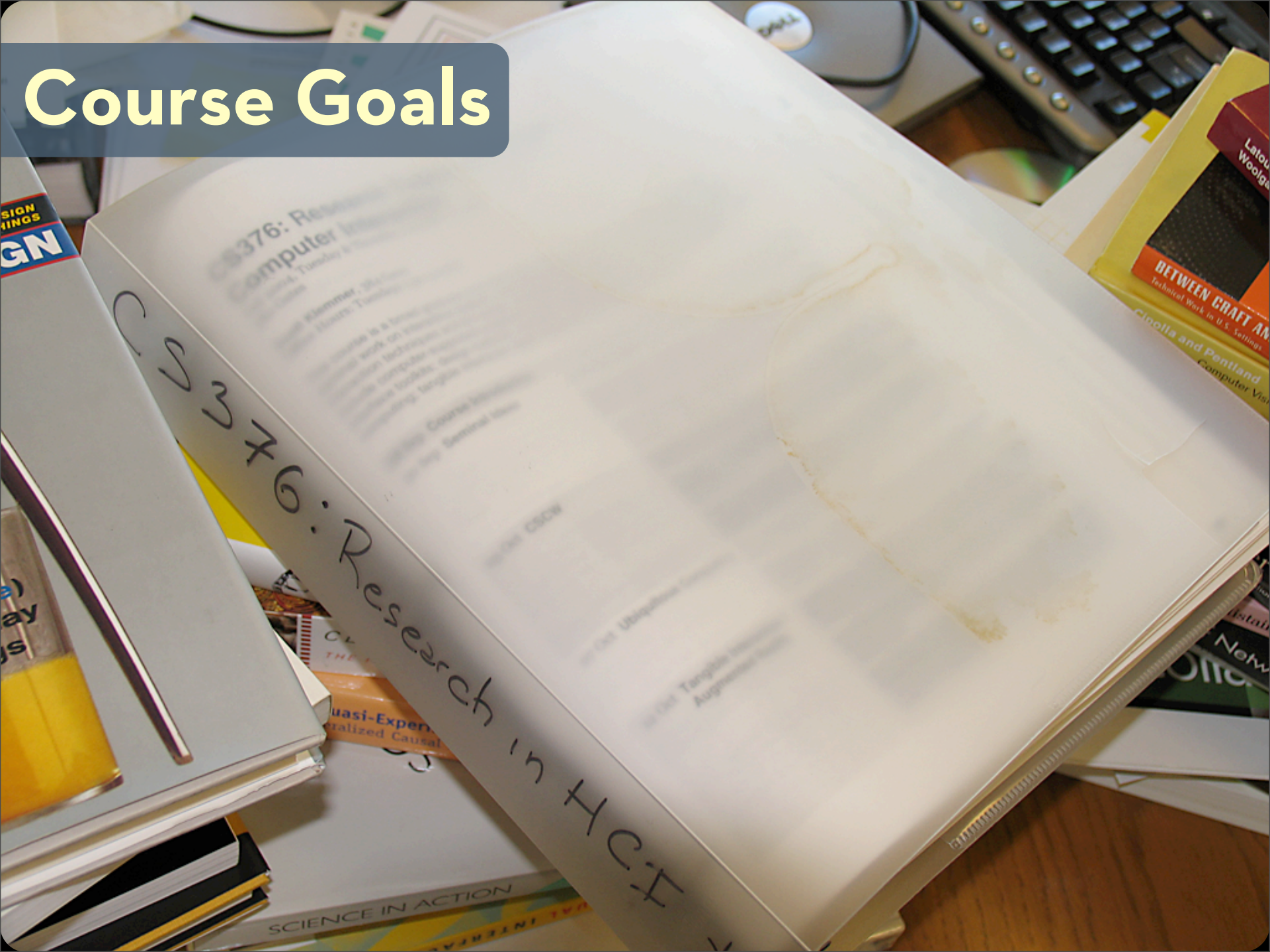
MICHAEL BERNSTEIN

SPRING 2013

cs376.stanford.edu

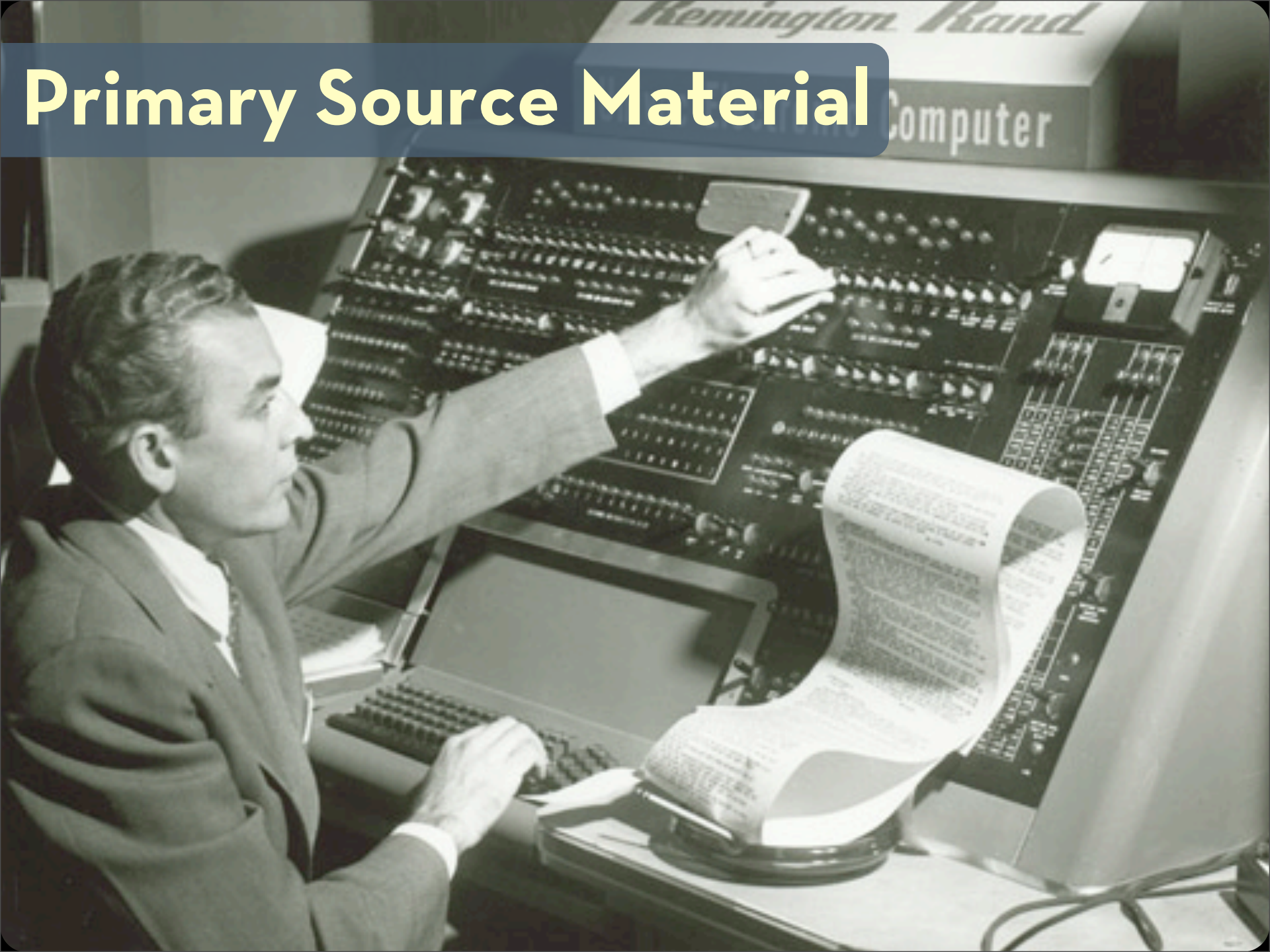
INTRODUCTIONS

Course Goals



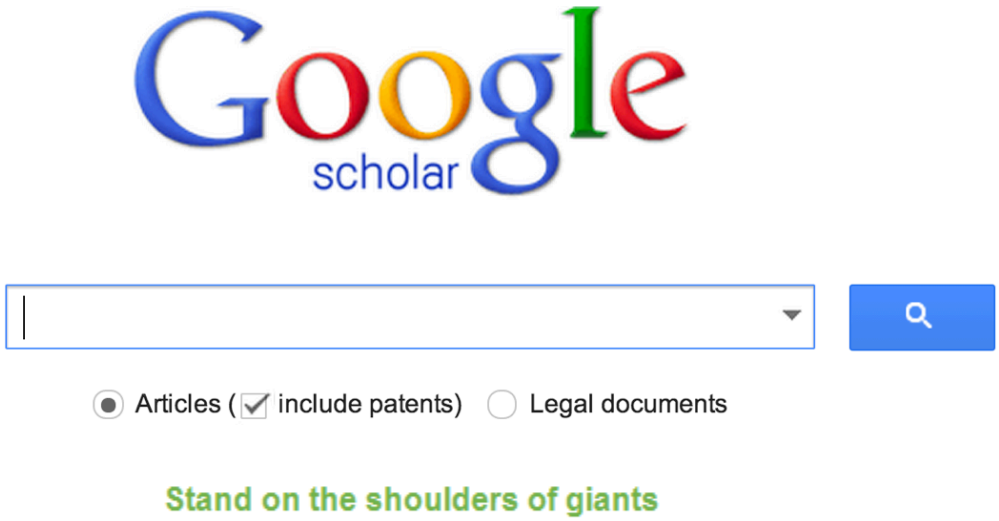
Contributions to HCI

Primary Source Material



Literature Index

Literature Index



Research Methods


reading
doing

Writing
Technical Presentation
Critical Thinking

Expected background

- Most important:
  - Are you prepared to complete a mini-research project of your own choosing?
- Helpful:
  - Depth in at least one of {programming, social science methods, design, STS}
  - Experience in HCI (e.g., cs147, cs247)
- Required:
  - Undergraduates: A- or better in cs147

SYLLABUS

Course Overview

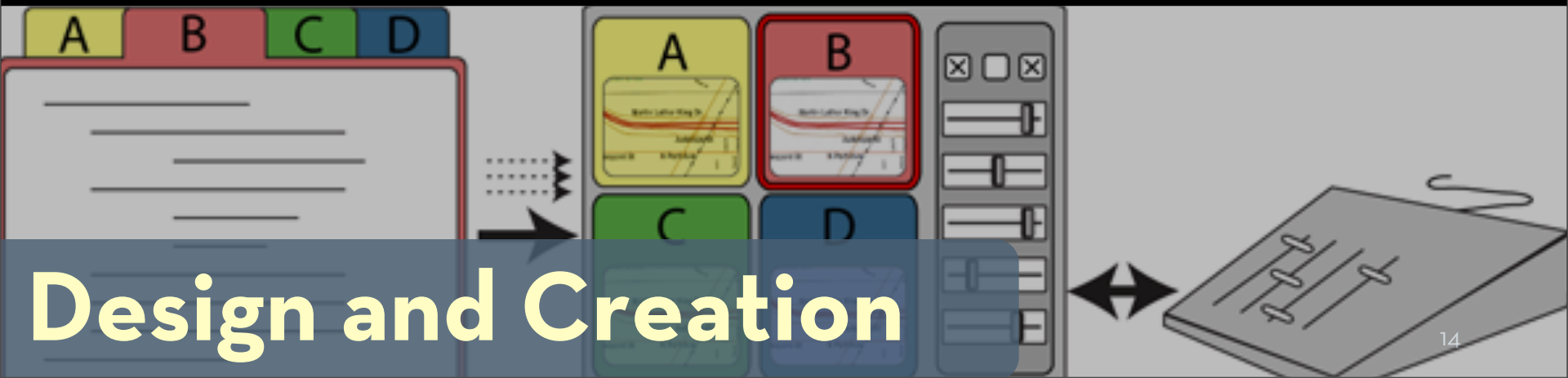
1. **Introduction**
2. **Depth**
3. **Breadth**

HCI research

- Conference papers (CHI, UIST, CSCW)
- Journal articles (TOCHI, HCI, ...)
- ~4 papers/week


Ubiquitous Computing


Social Computing


A
B
C
D
A
B
C
D
Design and Creation

research	methods	global citizenship
models	programming	collaboration
intelligent user interfaces	visualization	attention

Course Overview

1 APR	Seminal Ideas
3-10 APR	Intros: Ubicomp, Social, Design
15-17 APR	Research Theory & Methods
22-24 APR	Ubiquitous Computing
6-8 MAY	Social Computing
13-15 MAY	Design and Creation
20-5 JUN	Breadth

Administrivia

Course Info

Mondays & Wednesdays 1:15-3:05pm, Littlefield 107

4 units

http://cs376.stanford.edu

cs376@cs.stanford.edu

My Info

Office Hours: Fridays 3:50-5:00pm, Gates 308

http://hci.stanford.edu/msb

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Format

1:05-1:35	Instructor-led area overview
1:35-3:05	Student-led reading discussion

Grading

30% Paper Critiques

25% Participation & leading in-class discussion

45% Original research project

READINGS

Reading: Come prepared!

- Typically two readings per class meeting
- I strongly suggest hiding in the library, distraction-free

Critiques

- For selected readings, submit your critique at http://cs376.stanford.edu
- Due: 7:00am, the day of class
- Which readings need critiques? Check the course web site.

Writing Critiques

- Guidelines at http://hci.st/376crit
  - Why the paper does/doesn't seem important
  - Observations of novel methodology or methodology that seems suspect
  - Aspects of the paper that you disagree with or which trigger skepticism
  - Why the paper is/isn't effective at getting its message across
  - How the paper changed your opinion or outlook on a topic

~~"This paper has so many problems."~~

"This inspired me to develop an idea:"

Example Length

- As We May Think
  Rating: 5/5

  This paper was fascinating because it forces us to consider technologies that nowadays we take for granted. In some ways Bush was overly optimistic; for example walnut-sized wearable cameras are uncommon (even though they are possible), likely because optical and physical constraints favor handheld sizes. In other ways he underestimated, such as the explosion of data. For example, some modern cameras can store ten thousand photos rather than a hundred.

  Underestimating the data explosion is also apparent in the disconnect between the initial problem description ("publication has been extended far beyond our present ability to make real use of the record") and the first two-thirds of the paper, which describe technologies that would (and did!) exacerbate the issue by further proliferating data. Yet, he recognizes this issue later in the paper, and then goes on to predict search engines

  It is remarkable how many technologies are predicted in this paper: digital photography, speech recognition, search engines, centralized record-keeping for businesses, hypertext (even Wikipedia?). At the same time, many of the predicted implementations are distorted by technologies and practices common at the time, like "dry photography" or "a roomful of girls armed with simple keyboard punches". While these presumably served to make the hypotheses more accessible to readers of the time, is it even possible to hypothesize technology without such artifacts.

  Aside from predictions, this paper is important for the way Bush frames science in the support of the human race, by augmenting the power of the human mind. It is likely that many of the scientists (and physicists in particular) that were his audience felt guilt and despair from the destruction wrought by advances in nuclear, and even conventional, weaponry in the war. In that social context, seeing science described as a powerful constructive tool for good must have been inspiring.

DISCUSSANTS

Discussants

Each student is required to lead a discussion

Submit slides/notes *instead of* your critique

Lead a ~45 minute in-class discussion

- *Briefly* summarize readings (≤ 10 min)
- Identify points of interest, be prepared to spur and lead in-class discussion

Incorporate critiques submitted by the class

Full description at http://hci.st/376discuss

PROJECTS

Research Projects

- The “doing” part of the course
- Working in pairs is strongly encouraged
- A project related to your research (or another course project) is great
- Project ideas available at http://hci.st/376ideas

Project Timeline

8 APR	Find partners
13 APR	Abstract draft
26 APR	Abstract final (in depth)
6-29 MAY	Meetings
15 MAY	Pilot study exercise
10 JUN	Project paper due
12 JUN	Final project presentations

← Intro classes

Dynamic Speedometer: Dashboard Redesign to Discourage Drivers from Speeding

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ABSTRACT
We apply HCI design principles to redesign the dashboard of the automobile to address the problem of speeding. We prototyped and evaluated a new speedometer designed with the explicit intention of changing drivers' speeding behavior. Our user-tests show that displaying the current speed limit as part of the speedometer visualization (i.e. the dynamic speedometer) results in safer driving behavior. Designing with the intent to achieve a particular behavior can be an effective approach for increasing the safety of mission-critical systems. This is an area in which HCI designers can have a significant impact.

Author Keywords
Dynamic Speedometer, Automobile Interfaces, Automobile Cockpit Design, Persuasive Technology, Captology, Speeding, Designing for Safety, Mission-Critical Systems.

ACM Classification Keywords
H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION
Speeding increases the risk of a crash and the severity of related crashes and drivers' awareness of the speed limit alarming.

Speeding is a problem related to driver behavior. If we hope to save lives, reduce the number of accidents, associated costs, or even just the number of speeding tickets, we need to affect a change in the drivers' behavior by making them more aware of the speed limit and assisting them in realizing when they are speeding. Our goal for this research was to redesign the automobile dashboard to discourage drivers from speeding by appealing to their self-motivation to drive safely.

RELATED WORK
The most common example of a system that encourages drivers to slow down and follow the speed limit is the Speed Monitoring Awareness and Radar Trailer (SMART). The SMART speed trailer shows the driver the posted speed limit and the driver's current speed. If the driver is driving faster than the posted speed limit, the sign flashes in order to attract the driver's attention. The speed trailer causes drivers to slow down, albeit, temporarily [4, 5].

There is active research in the area of Behavior-Based Safety (BBS) sponsored by the Federal Motor Carrier

groupTime: Preference-Based Group Scheduling

Mike Brzozowski[1], Kendra Carattini[2], Scott R. Klemmer[1], Patrick Mihelich[2], Jiang Hu[3], and Andrew Y. Ng[2]
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ABSTRACT
As our business, academic, and personal lives continue to move at an ever-faster pace, finding times for busy people to meet has become an art. One of the most perplexing challenges facing groupware is effective asynchronous group scheduling (GS). This paper presents a lightweight interaction model for GS that can extend its reach beyond users of current group calendaring solutions. By expressing availability in terms of *preferences*, we create a flexible framework for GS that preserves *plausible deniability* while exerting social pressure to encourage honesty among users. We also propose an ontology that enables us to model user preferences with machine learning, predicting user responses to further lower cognitive load. The combination of visualization/direct manipulation with machine learning allows users to easily and efficiently optimize meeting times. We also suggest resulting design implications for this class of intelligent user interfaces.

Author Keywords
Machine learning, supervised learning, intelligent user interfaces, group scheduling, group calendaring

ACM Classification Keywords
H5.3. Information interfaces and presentation (*e.g.*, HCI): Group and Organization Interfaces. K.4.3. Organizational Impacts: Computer-supported collaborative work.

People use calendar artifacts as *memory prostheses* for events and tasks [23, 26]. A calendar serves as a "world-word" [30] mapping, by *describing* a fixed schedule (*e.g.*, "September 5 is Labor Day"), and as a "word-world" mapping, by *prescribing* things that should occur (*e.g.*, "Pay bills"). However, items on a calendar do not always directly translate to actual activity [36].

In the context of group scheduling (GS), calendars serve as communication tools; a form of "distributed cognition" [20]. Finding a time that a group of people can meet together is often aided by some expression of each participant's calendar, whether in spoken dialogue, email or instant messaging text, or in some visual representation.

Current Group Calendaring Systems
Traditional group calendaring systems (GCS) such as Microsoft Outlook and Lotus Notes present an explicit representation of users' schedules (typically whether they are free or busy) [3, 5]. For a group of users, finding a time to meet is simply a matter of choosing a time that all users appear to be free.

Yet, this binary view of availability is often inadequate to describe users' actual *preferences*. Palen's research found that scheduling has come to be viewed as "less an 'optimizing' task and more often a 'satisficing' task" [27]. As a result, suboptimal meeting times are selected. Worse, people

Wizard of Oz for Participatory Design: Inventing a Gestural Interface for 3D Selection of Neural Pathway Estimates

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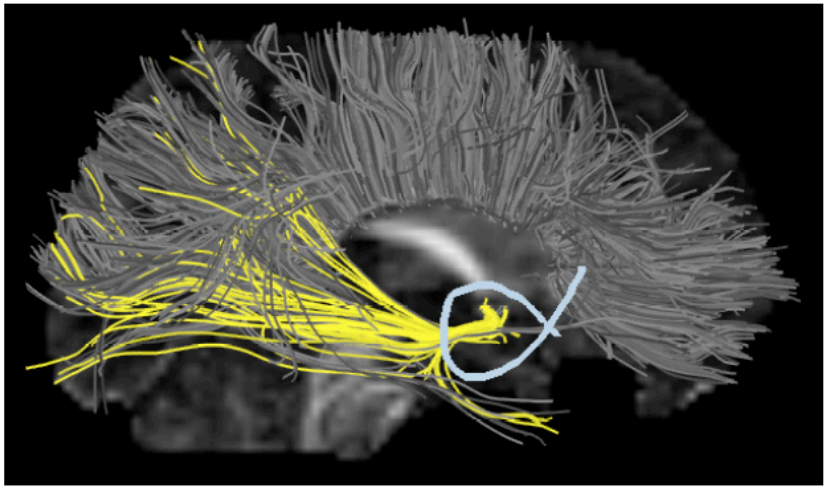

CHI 2006, April 22–27, 2006, Montréal, Québec, Canada.
ACM 1-59593-298-4/06/0004.

Abstract
This paper describes a participatory design process employed to invent an interface for 3D selection of neural pathways estimated from MRI imaging of human brains. Existing pathway selection interfaces are frustratingly difficult to use, since they require the 3D placement of regions-of-interest within the brain data using only a mouse and keyboard. The proposed system addresses these usability problems by providing an interface that is potentially more intuitive and powerful: converting 2D mouse gestures into 3D path selections. The contributions of this work are twofold: 1) we introduce a participatory design process in which users invent and test their own gestural selection interfaces using a Wizard of Oz prototype, and 2) this process has helped to yield the design of an interface for 3D pathway selection, a problem that is known to be difficult. Aspects of both the design process and the interface may generalize to other interface design problems.

Keywords
Participatory design, Wizard of Oz prototyping, 3D selection, gestural interfaces, brain visualization.

Castaway: A Context-Aware Task Management System

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CHI 2006, April 22–27, 2006, Montréal, Québec, Canada.
ACM 1-59593-298-4/06/0004.

Abstract
This paper describes the development of Castaway, a context-aware task management system. Specifically, we describe a three-week field study with thirty-five participants, the results of which illuminate the nature of people's recorded tasks. We further describe in detail iterations made to our task management interface, including a map-based view, and the insights gained that will inform future design and development.

Introduction
The increasing ability to both track people's movements and sense the environment combined with the growing ubiquity of mobile devices has lead to an exciting acceleration of research and development of context-aware computing. One potentially powerful context-aware application is the mobile management and receipt of personal tasks. Our vision of Castaway consists of three parts: 1) support for the fast and convenient input of tasks the instant they are conceived; 2) a lightweight, flexible tool to view and manage these tasks; and 3) a system for reminding users of their tasks at precisely the right place and/or time. Here we describe our progress in developing the second component. Although prior research has explored task management and the delivery of context-relevant information [1, 2, 3], the current work

VACA: A Tool for Qualitative Video Analysis

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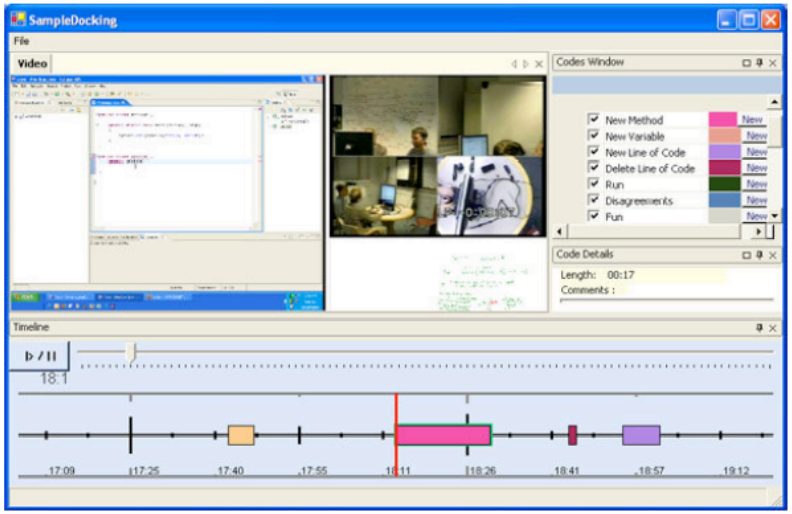


CHI 2006, April 22–27, 2006, Montreal, Canada.
ACM 1-xxxxxxxxxxxxxxxxxx.

Abstract
In experimental research the job of analyzing data is an extremely slow and laborious process. In particular, video and audio data of human behavior are difficult to analyze, as this type of information does not lend itself to automation. Here we present VACA, an open source tool for qualitative video analysis. VACA presents video annotations on a timeline interface and integrates external sensor data to improve the rate at which analysis can be performed. A comparative study is run against commonly used video analysis tools, and results are reported.

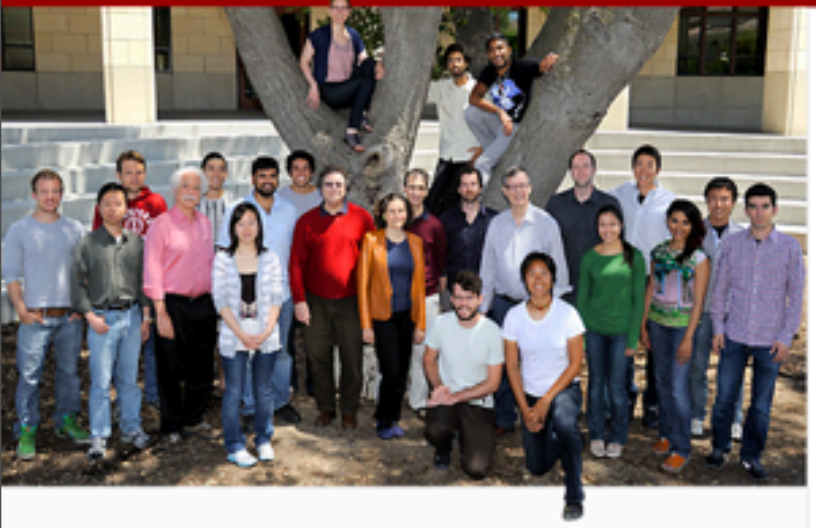
Keywords
Video analysis, annotation, behavioral research.

Introduction
Most disciplines of behavioral study require a significant degree of human observation, either in a lab or in the field. Many of these studies use video as their data medium, as video is perhaps the richest of the recording media. Because the data is very rich, it requires a large amount of time to analyze the qualitative content. Usability and human behavioral researchers analyze video data by watching videos on

Project Inspiration

STANFORD HCI GROUP

COURSES PEOPLE RESEARCH CONNECT DIRECTIONS



PEOPLE

Michael Bernstein · Stu Card · Jeff Heer · Scott Klemmer · Monica Lam · Terry Winograd · Affiliated Faculty · Students · Visitors · Alumni

COURSES

HCI ONLINE (FREE)

cs376 **Research Topics in Human-Computer Interaction**, *Bernstein*

PAPERS

CHI 2013

Quantifying the Invisible Audience in Social Networks, Michael S. Bernstein, Eytan Bakshy, Moira Burke, Brian Karrer *honorable mention*

The Efficacy of Human Post-Editing for Language Translation, Spence Green, Jeffrey Heer, Christopher D. Manning PROJECT *best paper*

Webzeitgeist: Design Mining the Web, Ranjitha Kumar, Arvind Satyanarayan, Cesar Torres, Maxine Lim, Salman Ahmad, Scott R Klemmer, Jerry O Talton PROJECT VIDEO *best paper*

Are MOOCs the Future of Education?, Daniel M. Russell, Scott Klemmer PROJECT VIDEO

CSCW 2013

EmailValet: Managing Email Overload through Private, Accountable Crowdsourcing, Nicolas Kokkalis, Thomas Köhn, Carl Pfefferbaum, Diana Chenyi, Michael S. Bernstein, Scott R. Klemmer TRY

http://hci.st/376ideas

cs547: HCI Seminar

Fridays 12:50-2:05pm, Gates B01

http://hci.st/seminar/

This quarter's guests include leading luminaries in social computing, data science, medicine, data-driven design, and crowdsourcing.

To take cs376 you must apply by Tuesday 11:59pm

http://hci.st/376apply

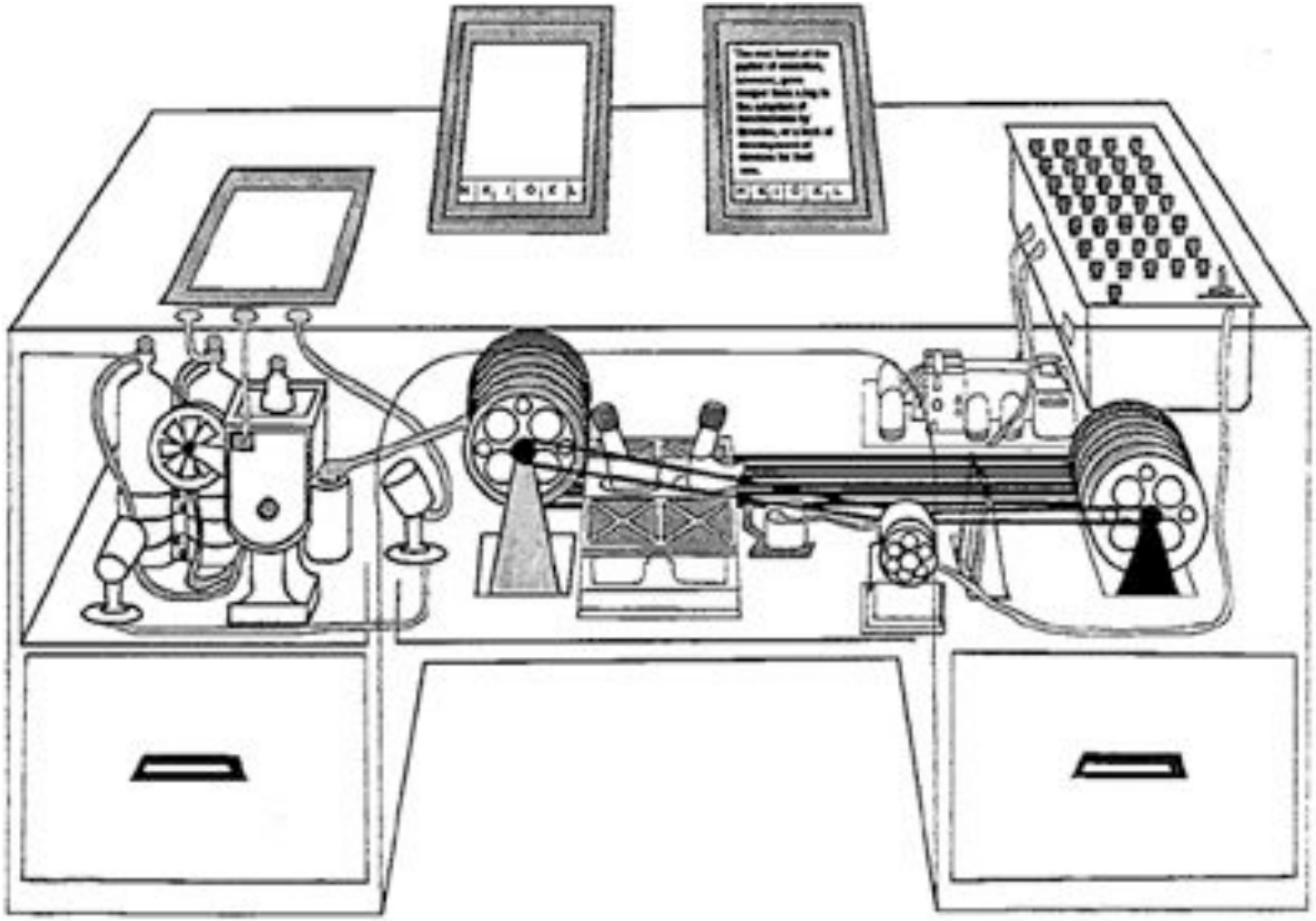
Questions?

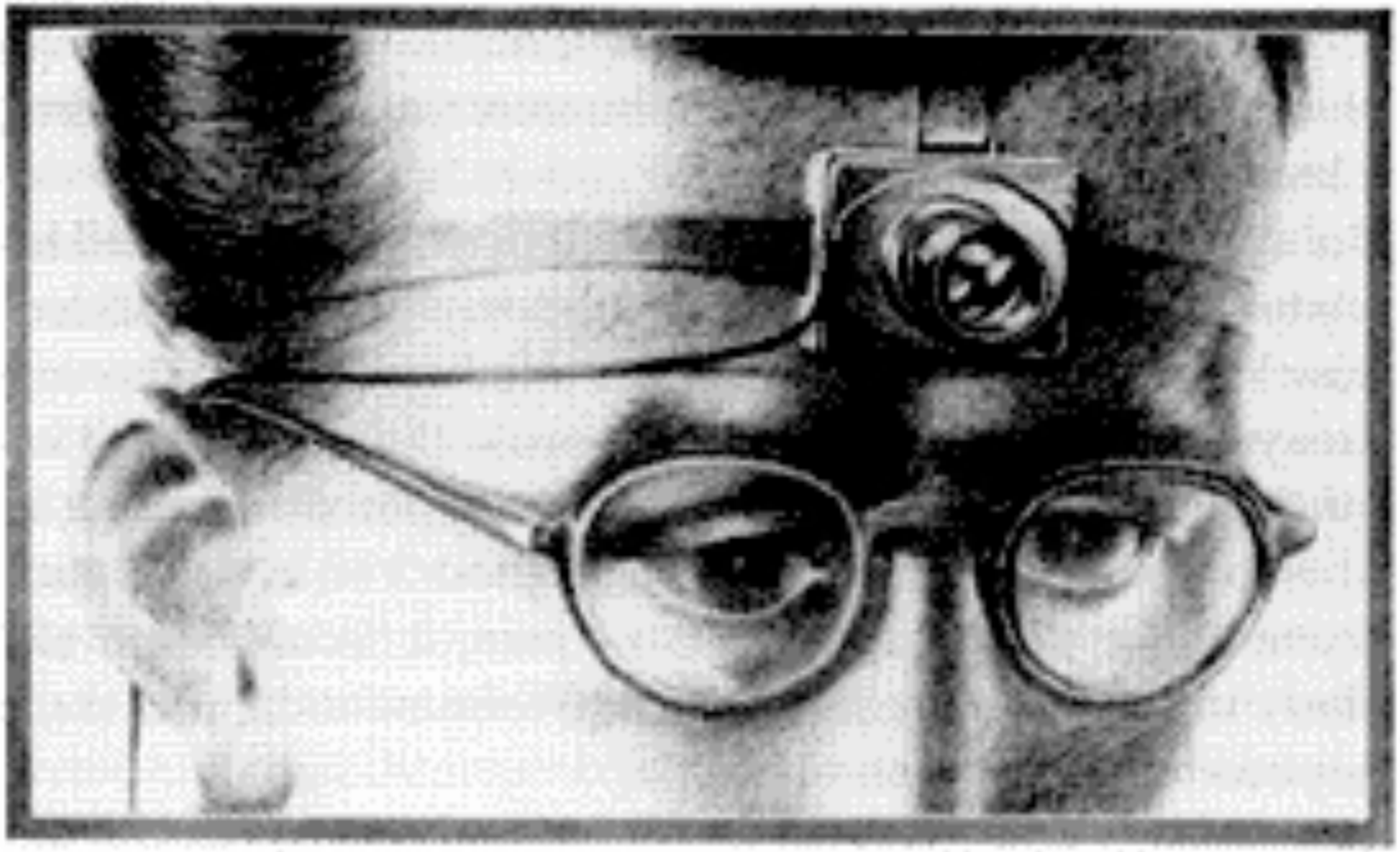
IN-CLASS READING


As We May Think
Vannevar Bush, 1945

5 minutes

1 minute



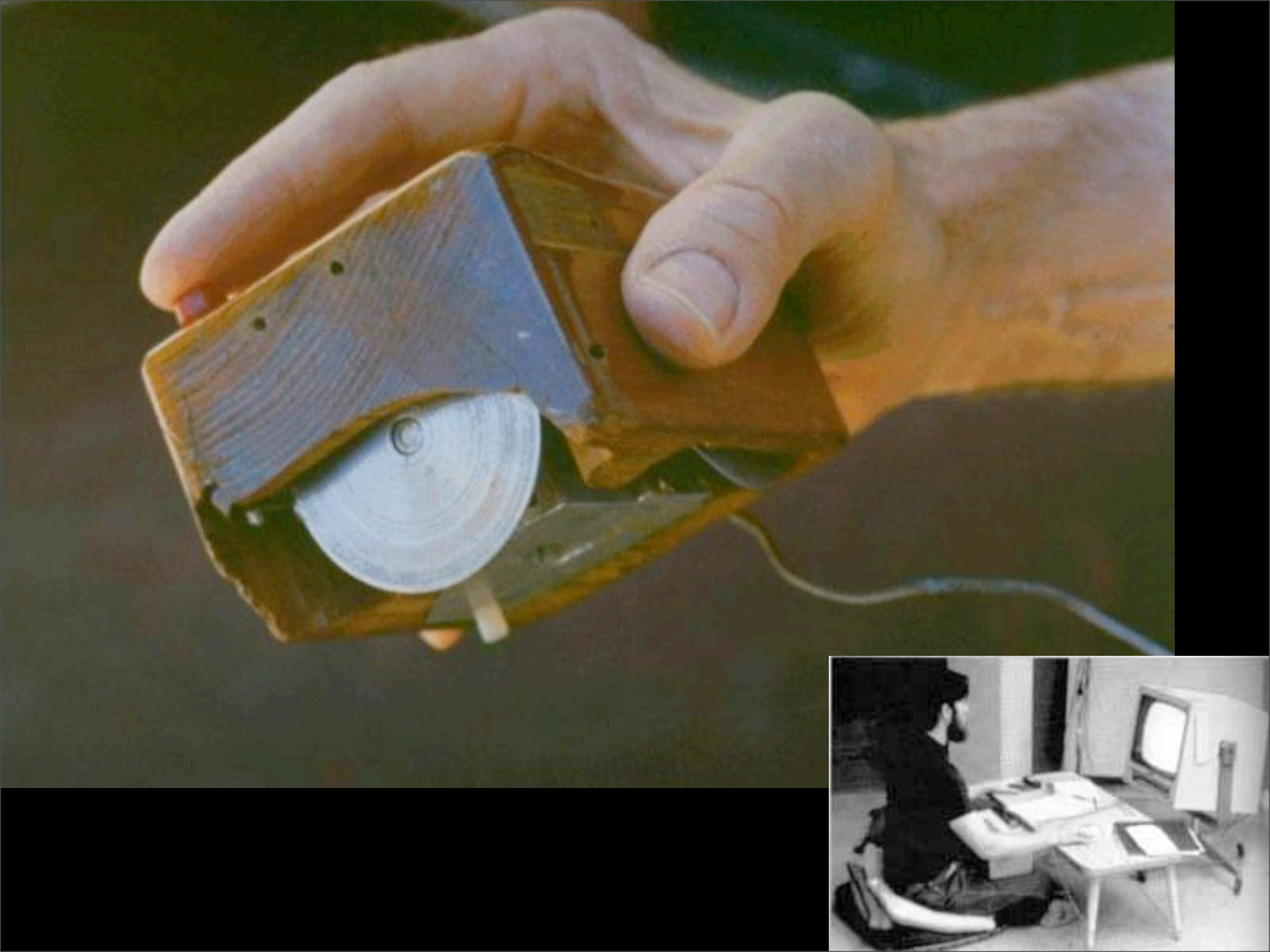


A scientist of the future records experiments with a tiny camera fitted with universal-focus lens. The small square in the eyeglass at the left sights the object (*LIFE 19*(11), p. 112).

Memex Inspires Ivan Sutherland


Video

Memex Inspires Doug Engelbart



ROUTE
MARKET SEE 1
2A PRODUCE
2A1 ORANGES
2A2 APPLES
2A3 BANANAS
2A4 CARROTS
2A5 LETTUCE
2A6 BEANS
2B CANS
2B1 APPLE SAUCE
2B2 BEAN SOUP
2B3 TOMATO SOUP
2C CEREALS
2C1 BREAD
2C2 NOODLES (ELBOW FIN
2C3 FRENCH BREAD
2D COLD LOCKER
2D1 MILK

The NLS Inspires Alan Kay

“The best way to predict the future is to invent it”

Xerox
Note 1
(Correction Copy)

Allen Newell
(retyped 11 Feb 73)

Notes on a Proposal for a Psychological Research Unit

The purpose of these notes, of which this is the first, is to act as a working vehicle to explore the notion of a psychological laboratory within a computer science oriented industrial research laboratory. The specific context is the Xerox Research Laboratory in Palo Alto.

I consider these notes to be working documents -- not the record of prior analysis, but an integral part of an analysis in progress. Hence ideas expressed in them may be exploratory and stipulative, to be contradicted by ideas expressed subsequently. They may also be somewhat discursive.

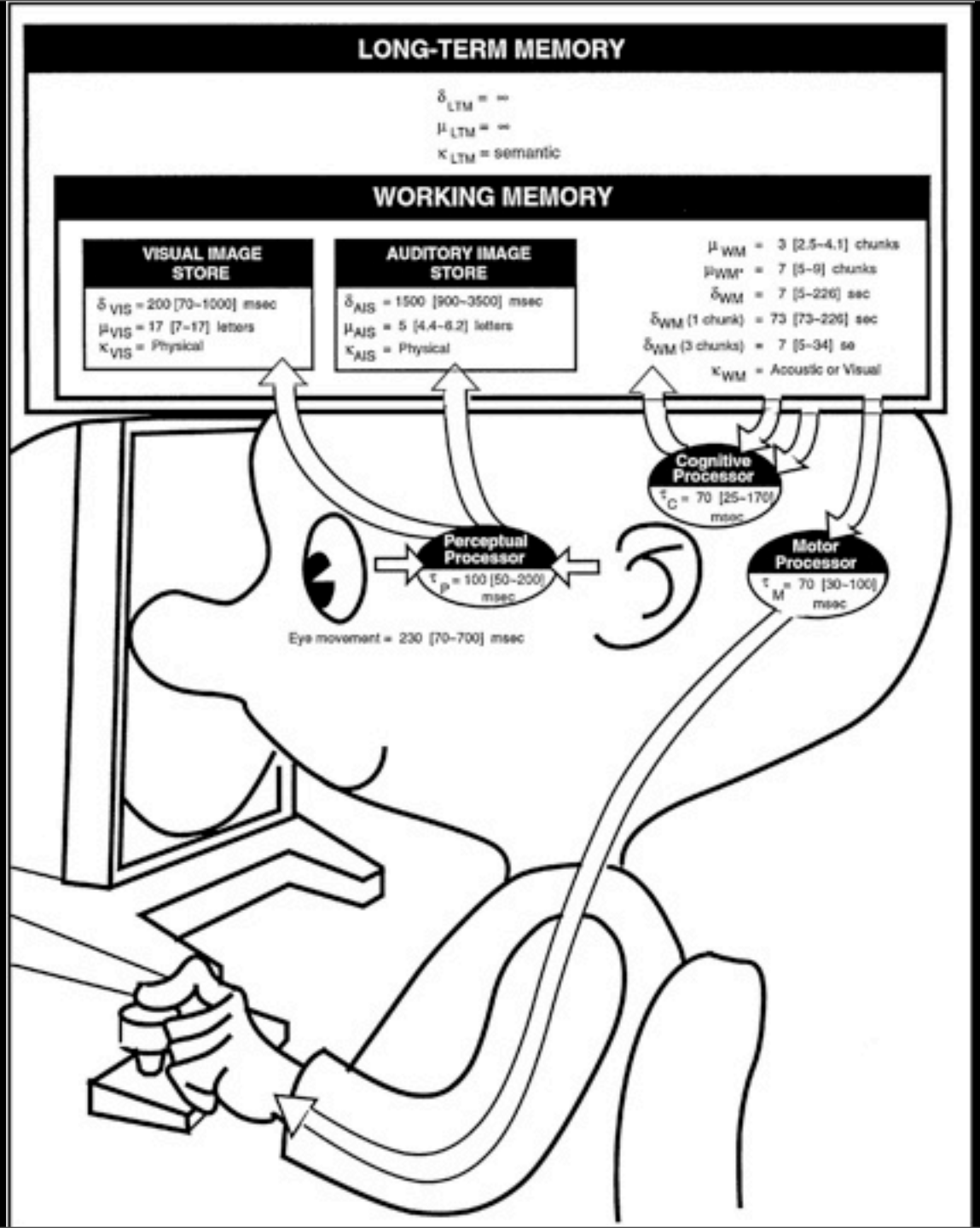
Basic proposition. The central idea that these notes are to explore is contained in a set of somewhat independent propositions:

(1) There is emerging a psychology of cognitive behavior that will permit calculation of behavior in new situations and with new humans (called information processing psychology currently).

(2) Several of the tasks that are central to the activities of computing -- programming, debugging, etc. -- are tasks that appear to be within the early scope of this emerging theory.

(3) Computer science in general is extremely one-sided (for understandable reasons) in the treatment of its phenomena: almost no effort goes into understanding the nature of the human user. This applies to the design of programming languages, debugging systems, operating systems, etc.

(4) There is a substantial payoff (in dollars) to be had by really designing systems with detailed understanding of the way the human must process the information attendant thereto.


LONG-TERM MEMORY
δ LTM = ∞
μ LTM = ∞
κ LTM = semantic
WORKING MEMORY
VISUAL IMAGE STORE
δ VIS = 200 [70–1000] msec
μ VIS = 17 [7–17] letters
κ VIS = Physical
AUDITORY IMAGE STORE
δ AIS = 1500 [900–3500] msec
μ AIS = 5 [4.4–6.2] letters
κ AIS = Physical
μ WM = 3 [2.5–4.1] chunks
μ WM* = 7 [5–9] chunks
δ WM = 7 [5–226] sec
δ WM (1 chunk) = 73 [73–226] sec
δ WM (3 chunks) = 7 [5–34] se
κ WM = Acoustic or Visual
Cognitive Processor
τ C = 70 [25–170] msec
Perceptual Processor
τ P = 100 [50–200] msec
Motor Processor
τ M = 70 [30–100] msec
Eye movement = 230 [70–700] msec

Wednesday: Introduction to Ubiquitous Computing