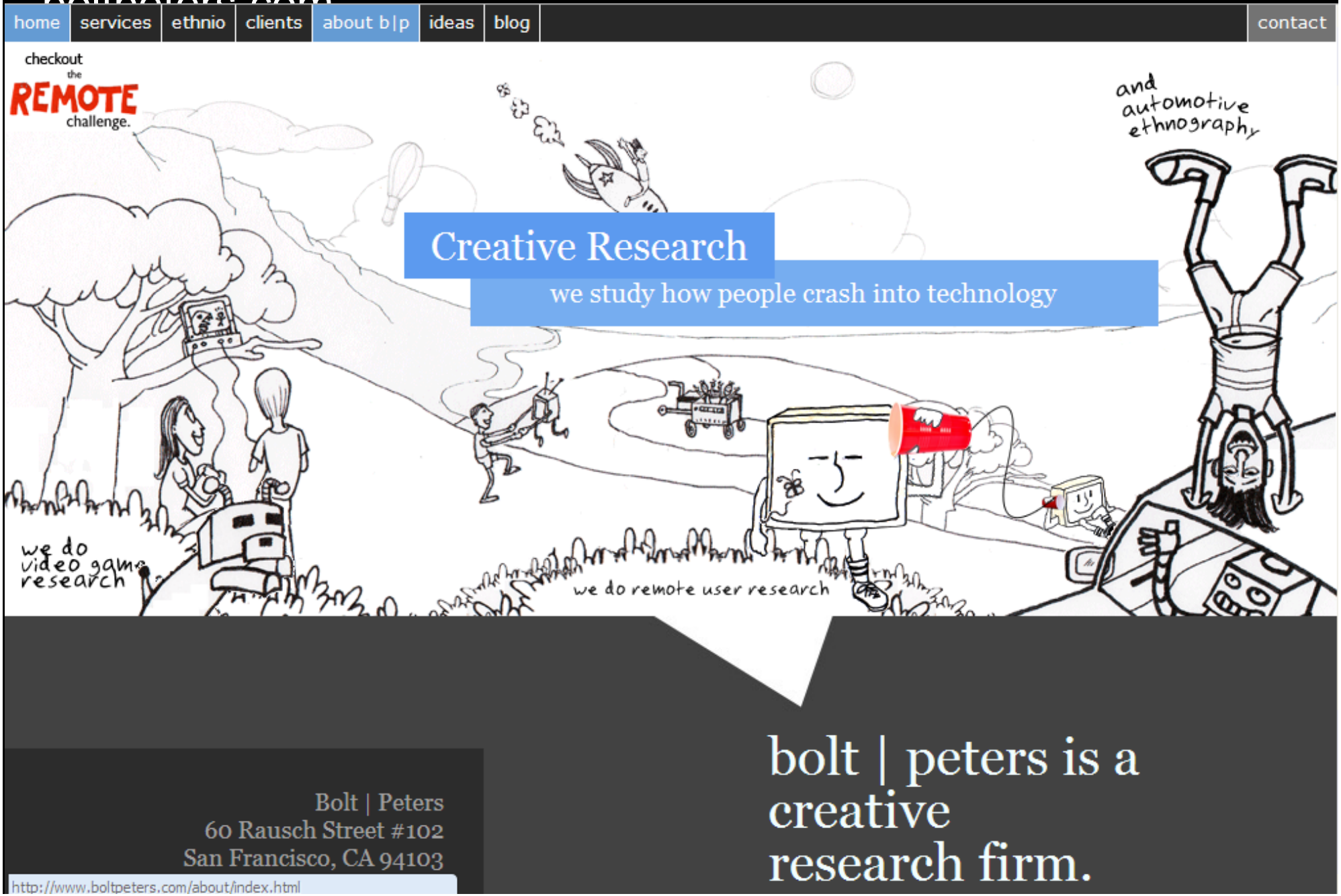
Spore Interface Study Outtakes

boltpeters.com



Cognitive Consequences of Technology and the Technological Consequences of Cognition

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Jim Hollan

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Department of Cognitive Science, University of California, San Diego
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RESEARCH GROUPS and RESEARCH AFFILATIONS:
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OFFICE HOURS: 159 Cognitive Science Building
No office hours while on sabbatical
Photographs

FAQ
Requests to Meet
Undergrads & Research
Undergrad Honors Projects
Letters of Recommendation
Graduate Applicants to UCSD
Advice to Students Slides (PDF)

WEEKLY MEETINGS
DCOG-HCI Lab: Wed 10-11
Department: Wed 12:30-2:00
UCSD Lab: Wed 3:30-5:00

TRAVEL
6 – 8 October 2008
NSF HSD Grantees Conference
Washington, DC

19 – 22 October 2008
UIST 2008
Monterey, CA

8 – 12 November 2008
CSCW 2008
San Diego, CA

3 – 5 December 2008
CHI Committee Meeting
Boston, MA

8 – 10 December 2008
CineGrid International Workshop
La Jolla, CA

15 – 16 January 2009
NSF CreativeIT Workshop
Washington, DC

4 – 8 February 2009

I am currently on sabbatical at the Department of Electrical Engineering and Computer Science, University of California, Berkeley. At Berkeley I am located in 643 Soda Hall. Email is the best may to contact me.

My research explores the cognitive consequences of computationally-based media. It is motivated by a belief that we are at the beginning of a paradigm shift in thinking about representational media, one that is starting to appreciate the importance of representations that are not only dynamic and interactive but that also adapt to the structure of tasks, the context of activities, and even our relationships with others. The goal is to understand the cognitive, computational, and social ecology of dynamic interactive adaptive media.

My interests span across cognitive ethnography, distributed and embodied cognition, human-computer interaction, multiscale information visualization, multimodal interaction, and software tools for visualization and interaction. My current work involves four intertwined activities: developing theory and methods, designing representations, implementing prototypes, and evaluating the effectiveness of systems and understanding the broader design space in which they are situated.

Current research is funded by the National Science Foundation (NSF), Microsoft Research, the UC MICRO Program, and the Chancellor's Interdisciplinary Collaboratories Program. Recently completed research has been funded by California's Digital Media Innovation Program, Darpa, Intel, Microsoft, Nissan, NSF, and Sony. Email is the best way to contact me.
(*NSF Bio – Academic Vitae*)

RECENT RESEARCH PUBLICATIONS (*Publication List*)

Scaffolding Embodied Practices in Professional Education
Amaya Becvar and James D. Hollan. *Mind, Culture, and Activity: An International Journal, in press* (PDF)

Tabletop Displays for Small Group Study: Affordances of Paper versus Digital Materials

CURRENT ACADEMIC YEAR (*Course List*)

FALL 2008
Cognitive Science 120: Human-Computer Interaction (*class wiki*)
Tues & Thurs 2:00PM - 3:20PM · Peterson 104
TA: Anne Marie Piper
IAs: Amanda Lazar and Anna Ostberg

General Advice for Students

Why do so few people make significant contributions?

- What is the difference between those who have impact and those who don't?
  - One factor is expectations
  - If you think you can't almost certainly you won't

Prepare Yourself

- Do what you love and love what you do
- Don't worry about how intrinsically smart you are or anyone else is
- To do significant things you have to neglect other things
- Be careful about your commitments but when you commit really do it
- Experience how it feels to do your absolute best
- Take time to think important thoughts
- Refuse to let the urgent drive out the important
- Be careful about who you spend time with

Advice for Graduate Students: Research Requires Courage

Research Involves Risks

- Social and emotional
- Risks to reputation and pride
- High probability any particular project, especially if challenging, will fail

Transitioning from student to independent researcher

- A difficult transition from being a student to being a research contributor
- Think of yourself not as a graduate student but as a young researcher in your field (wider context is key)
- Reputations start early
- Learn how to balance multiple things and deal with ambiguity
- You have more time and flexibility now than you likely ever will again
- Be smart in using time
- Get to know people in your field (email, conferences, talks, visits, …)

Develop a Research Portfolio

- Your time is the investment currency
- Portfolio should be a mix of differing risk/payoff projects
- Adjusting the mix
- Work on important problems

Research Advice

Goal is to have impact: work on important problems

Feedback is key: seek out and value thoughtful critics

Do real stuff: make sure you are solving problems some one (especially you!) deeply cares about and stay focused on those questions

Become methodologically sophisticated and know the literature

Develop research taste: for selecting problems, how to attack them, and how to communicate results

Your legacy will be not only you papers but your influence of your colleagues, students, and others

Science is a Social Activity

Doing

- Collaborate, collaborate, collaborate

Talking

- Importance of both formal and informal interactions (Hinton, Rumelhart)
- From water cooler chats to lab meetings to classes and seminars to conference talks
- TAing and teaching are important opportunities

Writing

- A constant activity and continual developing skill (Knuth, Norman)
- Set aside time to write
- A new challenge is learning how to write proposals

Overview

Introduction

- Brief research history
- Distributed Cognition and Human-Computer Interaction Lab
- Ubiquitous Computing and Social Dynamics Research Group
- Rapidly changing technological, cognitive, and social ecology

Tuesday Focus:

- Boundaries between physical, digital, and social worlds are increasingly permeable. Example of bridging paper and digital worlds. Brainstorm and develop research programmes. How to link? Is linking and permeability for good or for ill? What are the tradeoffs?

Wednesday Focus:

- Distributed Cognition
- An unprecedented opportunity for capturing real-world activity and the methodological implications and challenges
- Conjectures about context reinstatement and interruptions

Brief Research History

UCSD Institute for Cognitive Science and Xerox Parc:
Graphical User Interfaces, Graphical Editor, Steamer and Moboard, Direct Manipulation, User-Centered System Design

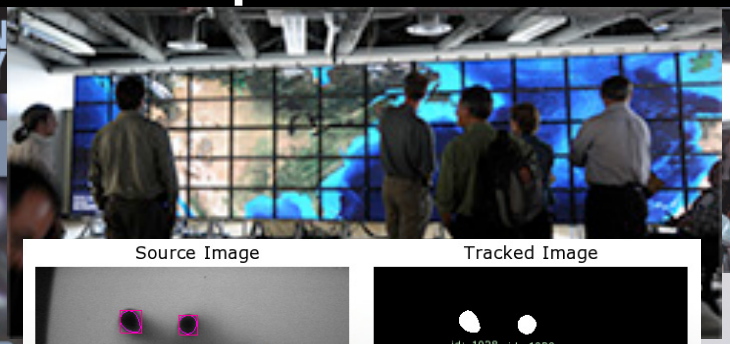
MCC Human Interface Lab:
Human Interface Tool Suite (HITS), Multimodal Interfaces, ReadWear and EditWear, History-Enriched Digital Objects

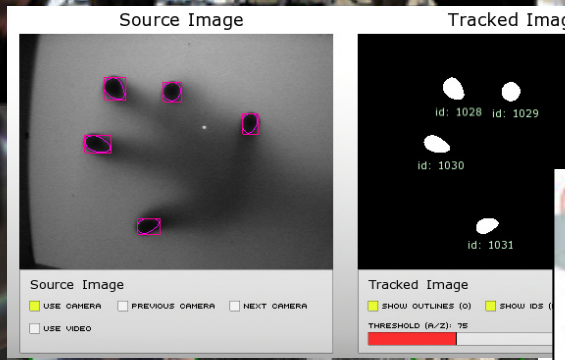
Bellcore Computer Graphics and Interactive Media, UNM Department of Computer Science:
Beyond Being There, Multiscale Information Visualization, AR3T, and Pad++

UCSD Department of Cognitive Science and Department of Computer Science, Dcog-HCI Lab and UCSD@UCSD:
Dynapad, Anoto Pens, Digital Ethnography Workbench, Multitouch Multimodal Surfaces, Activity Histories, Reinstatement of Context

Dcog-HCI Lab: Distributed Cognition and Human-Computer Interaction Lab

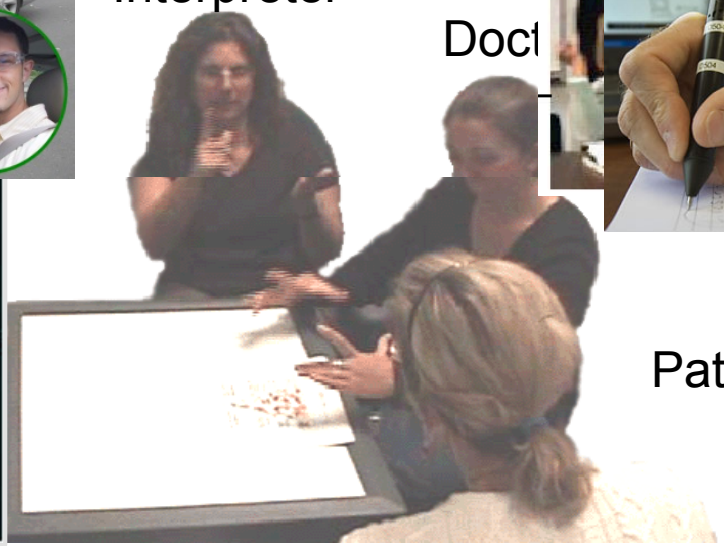
http://hci.ucsd.edu



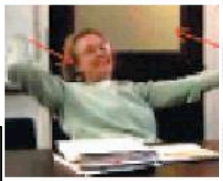


Interpreter

Doct



Patient

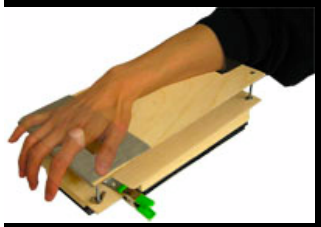


Sponsors

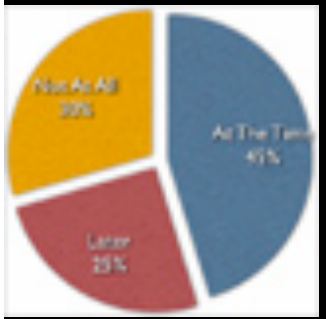
Ubiquitous Computing and Social Dynamics

UCSD@UCSD

We are a multidisciplinary research group exploring the potential for ubiquitous computing technologies to improve daily life. One main focus is the Campus of the Future. The group is led by Bill Griswold (Computer Science & Engineering), Louise Barkhuus (Computer Science & Engineering), Barry Brown (Communication), Jim Hollan (Cognitive Science), and Adriene Jenik (Visual Arts).



Tapping and Rubbing: exploring new dimensions of tactile feedback with voice coil motors. Kevin A. Li, Patrick Baudisch, William G. Griswold, James D. Hollan. *Proceedings of the ACM Symposium on User Interface Software and Technology* (UIST 2008).



A Diary Study of Mobile Information Needs. Timothy Sohn, **Kevin A. Li**, William G. Griswold and James D. Hollan. *Proceedings of the ACM Conference on Human Factors in Computing Systems* (CHI 2008).

Computers Are Special

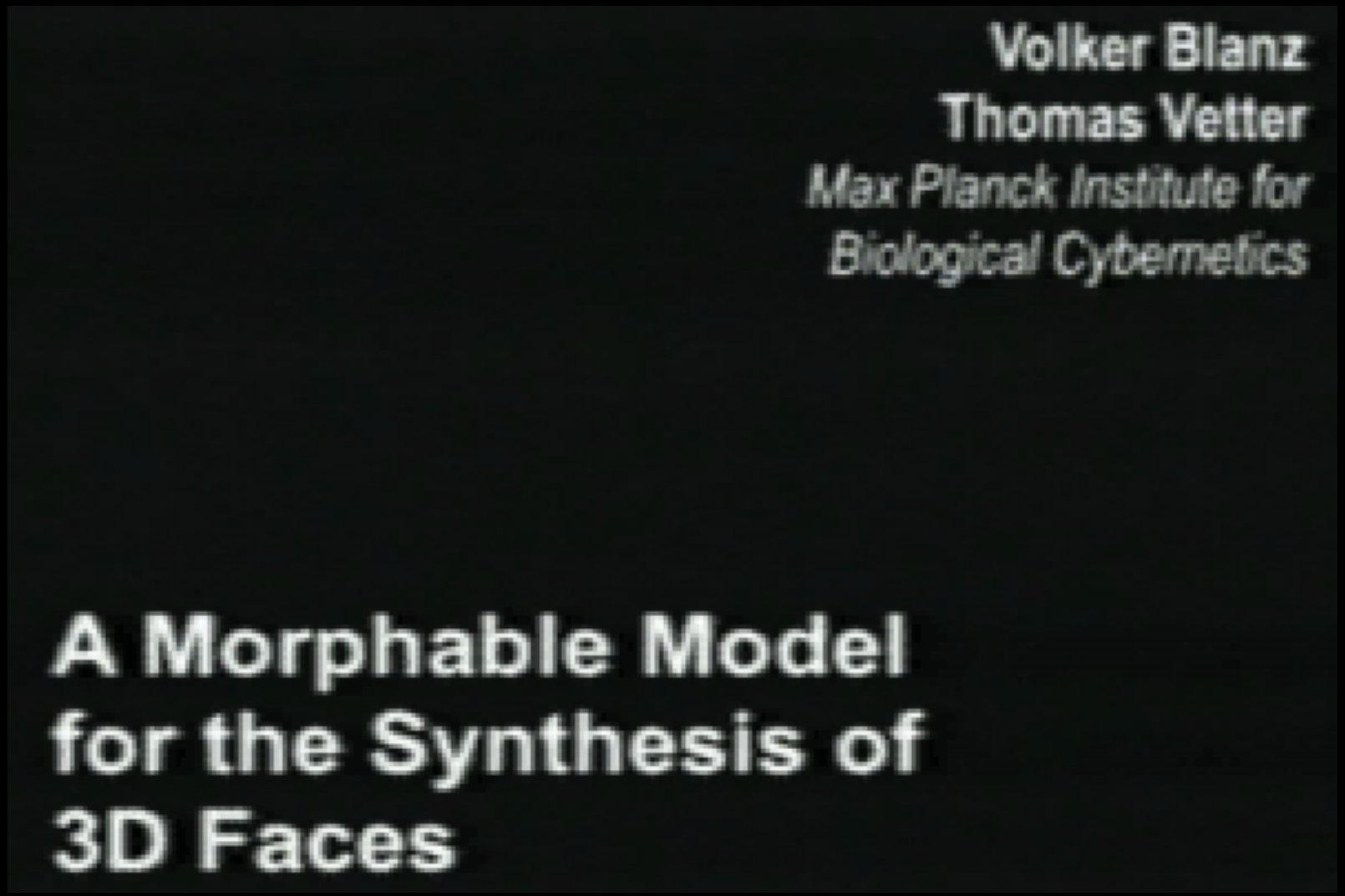
Computers are special in that they provide a new kind of stuff out of which to fashion dynamic interactive systems to assist thought, communication, collaboration, and social interaction

Computation provides the most plastic medium for representation, interaction, and communication we have ever known

- Mimic existing media (e.g., books, newspapers, magazines, photographs, audio recordings, and films)
- Create new media and modify the form of existing media,
- Create models that represent, with ever increasing fidelity, the physical world
- Provide virtual worlds that range from the simple metaphorical desktop of the graphical user interface to the amazing digital effects and virtual characters of current games and films
- Combine the real and the virtual, as with computer-augmented surgery in which images of internal structure are projected onto a patient's body to guide surgery and robotic-assisted controls remove the tremors from the surgeon's hands

"The computer is the first metamedium, and as such it has degrees of freedom for representation and expression never before encountered and as yet barely investigated." -- Alan Kay

Morphable Model



Morphing Ethnicity

Slowly, almost imperceptibly, the face of the artist transforms continuously into his Asian or African counterpart. This counterpart is a synthetic version of his own face with everything changed that is specific to ethnicity, but everything retained that sets him apart from the average white male.

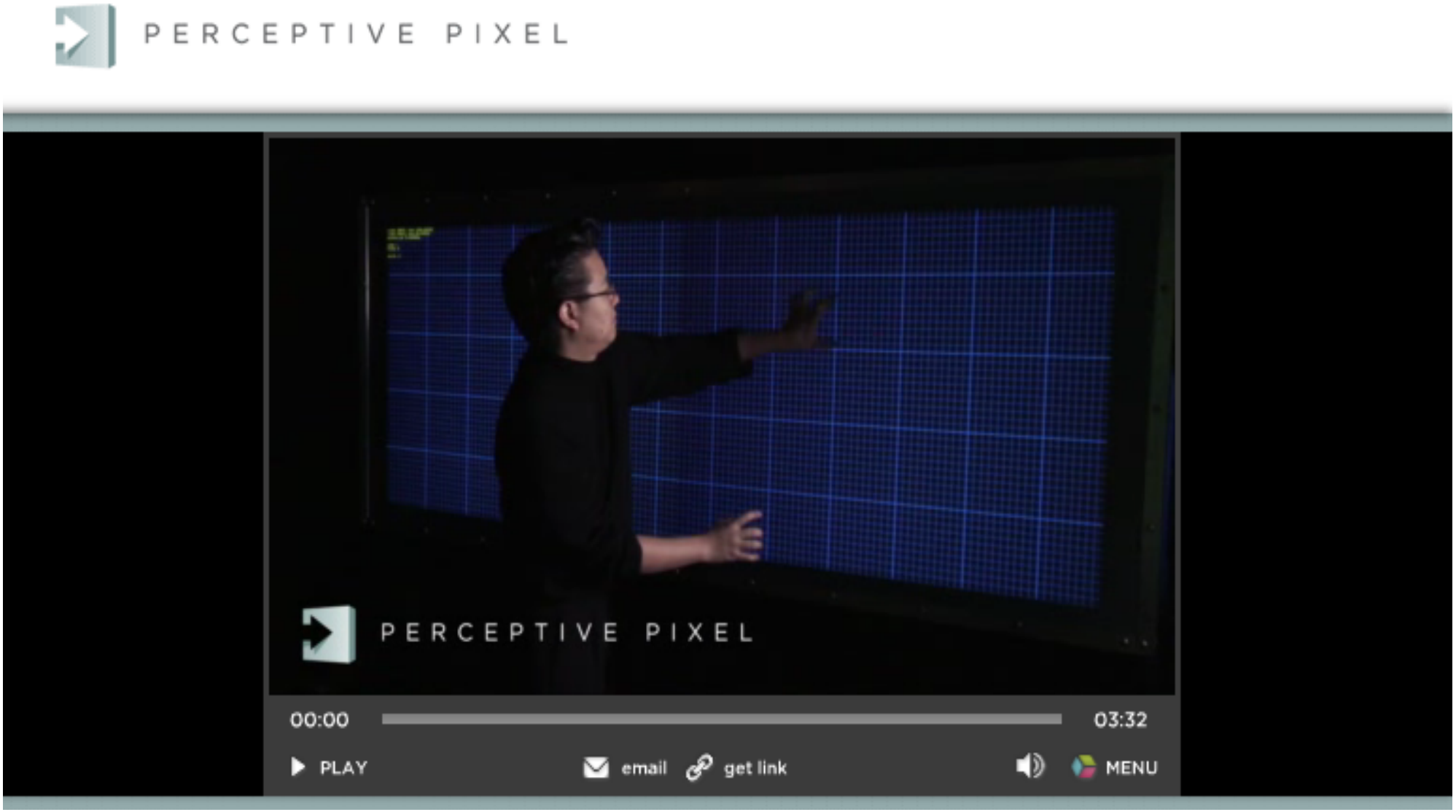
The technology behind this work is an average face generated from 3D scans. The average faces and all original faces can be thought of as points in a high-dimensional *Face Space*.

Differences between ethnic averages describe what is typical to ethnicity. Adding them to a face affects only the perceived ethnicity, yet leaves all unrelated features unchanged.

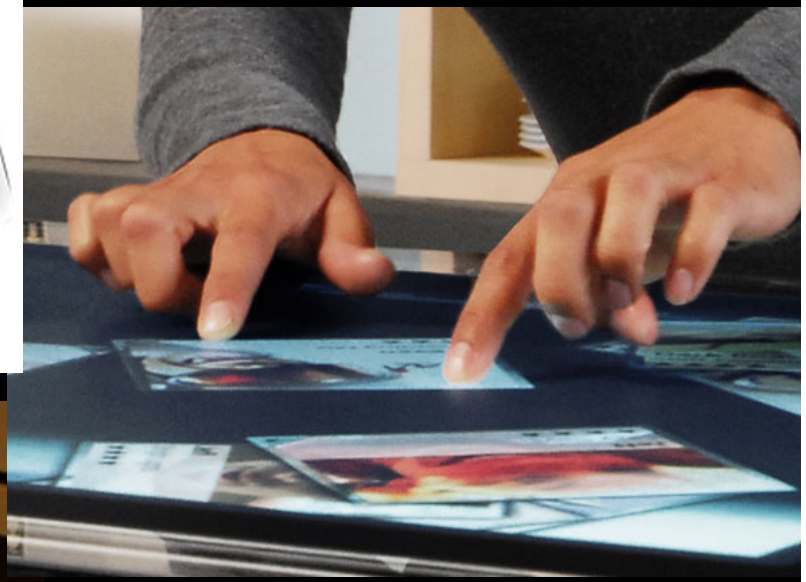
Seam Carving for Context-Aware Im

FTIR: Multitouch

Jeff

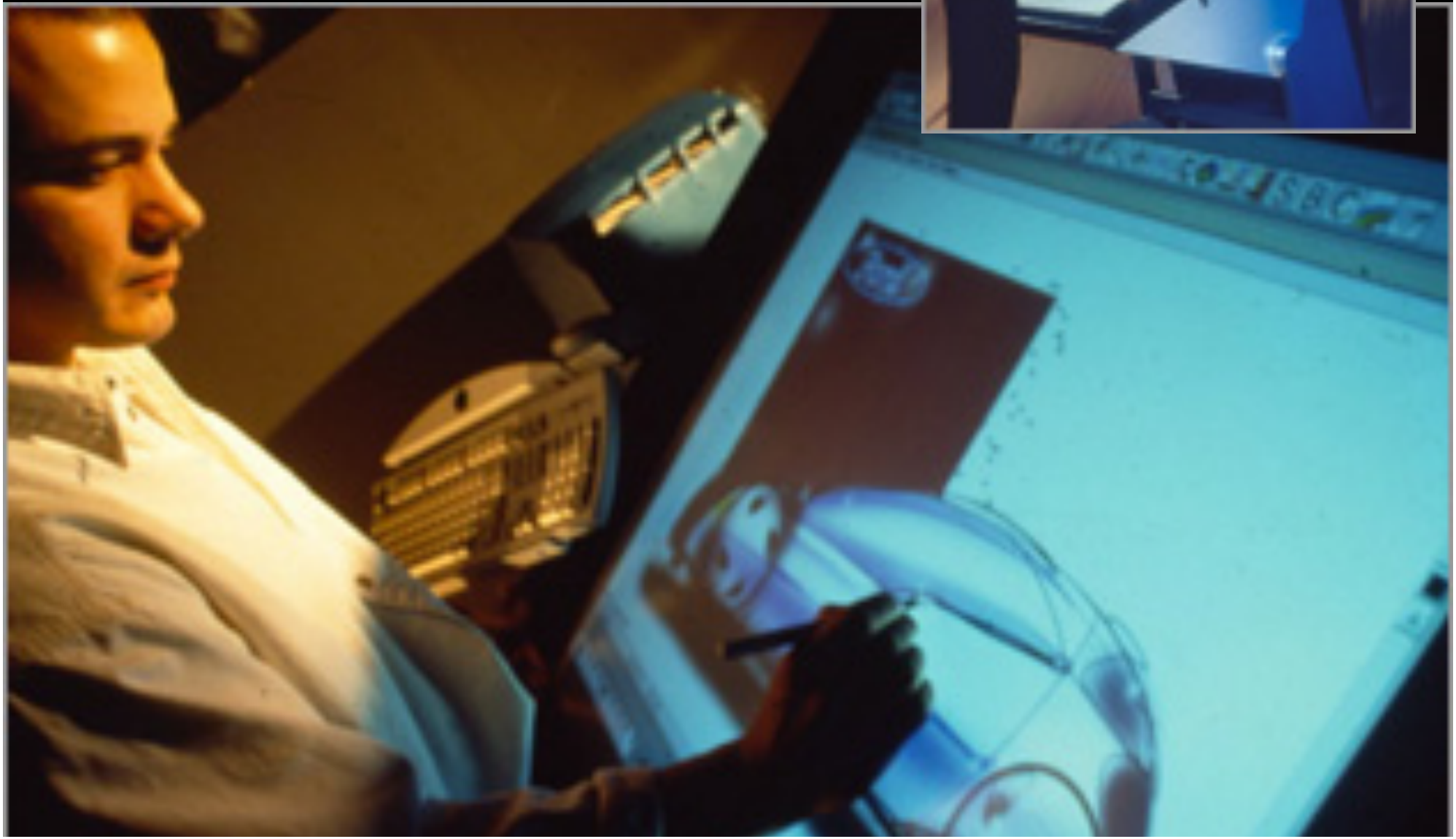


Microsoft Surface



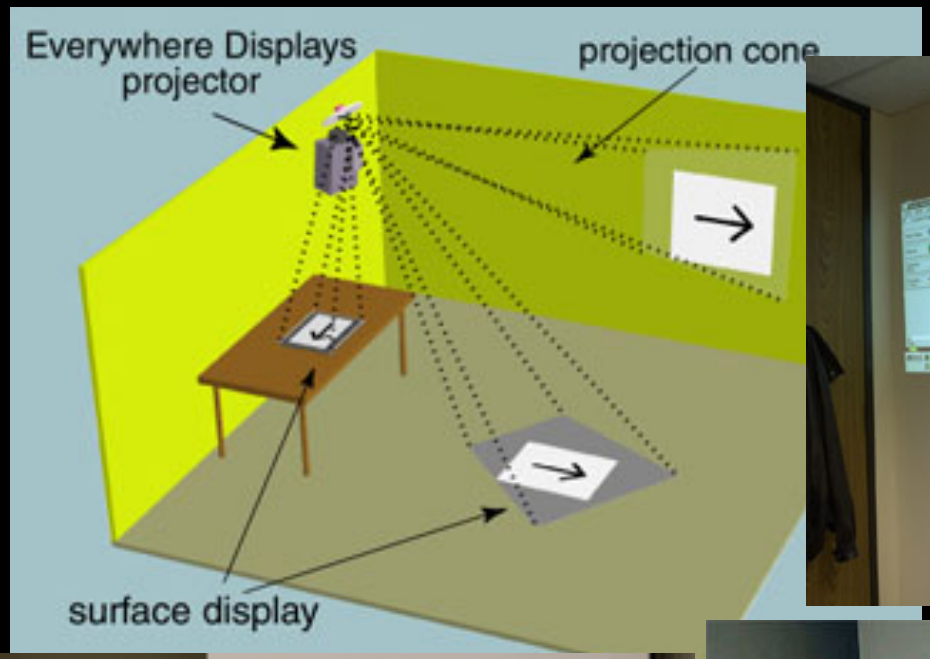
Microsoft Surface

Visionmaker Desk



SLAP: Silicon Illuminated Active Peripherals

IBM: The Everywhere Displays Project



Today's Context

Rapidly changing technological landscape

- Unbundling of the monolithic computer
- Increasing power and ubiquity of computing
- Boundaries between physical, digital, and social worlds are increasingly permeable (for good and for ill)

Tremendous challenges and opportunities

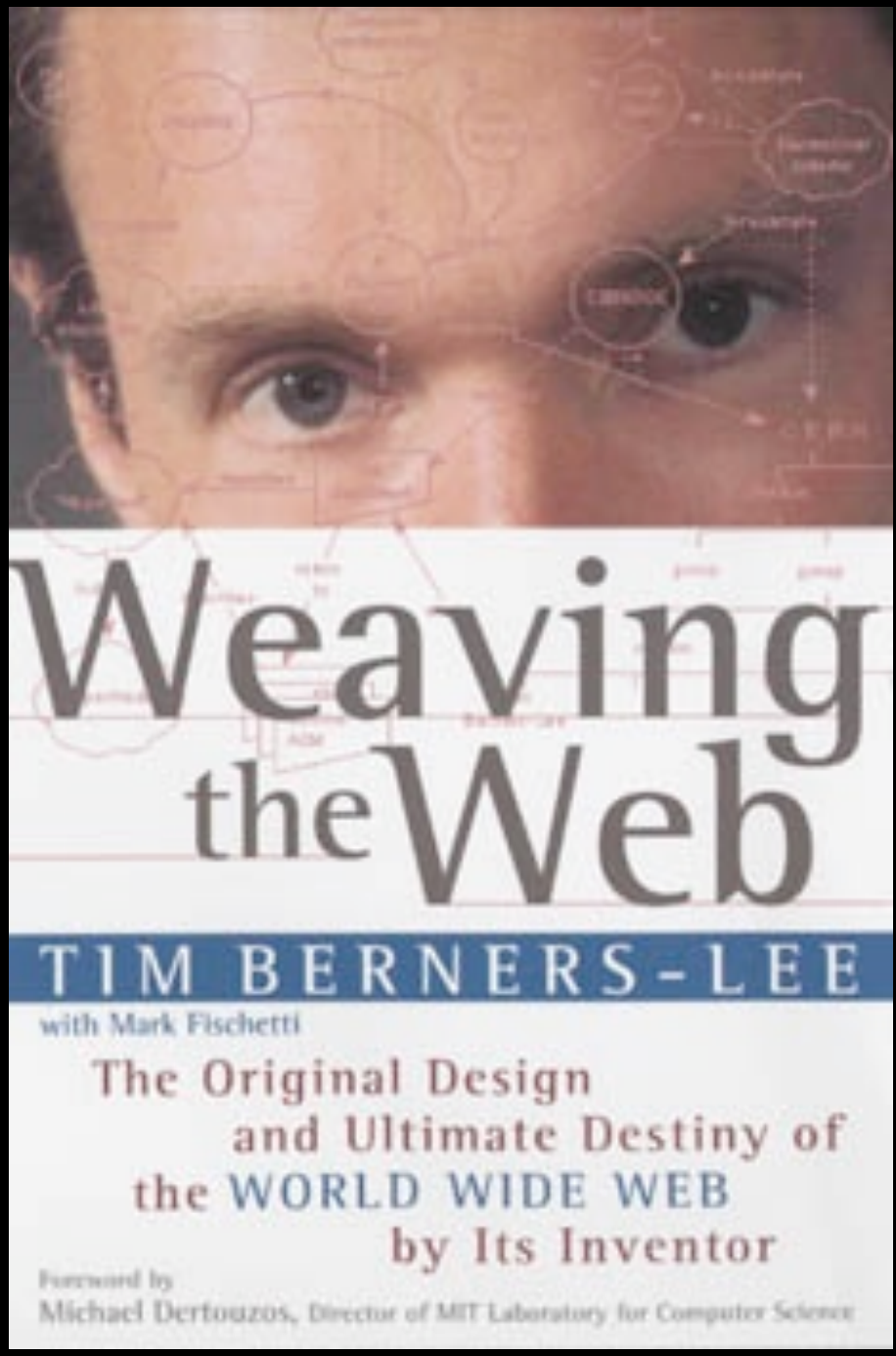
Designing for an ecology of devices

Not just the desktop computer any more

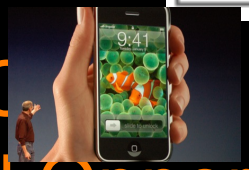
- Increasingly we have multiple and we don't think of many of them as computers
- Connected to computers, sensors, and people all over the world
- For good and for ill, changing our professional, personal, and social lives
- Impact magnified by the web

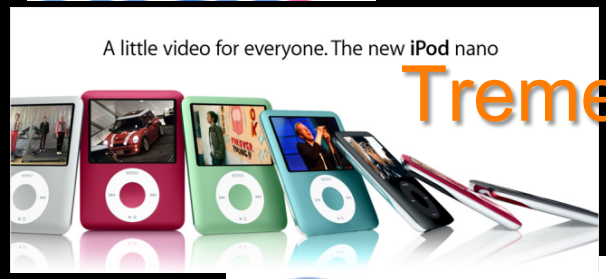
World Wide We

- Web 1990
- (The Door)
- Mosaic browser 1994
- Yahoo! 1994
- eBay 1995
- Google 1998
- Wikipedia 2001
- MySpace 2003
- Second Life 2003
- Web 2.0 2004
- Facebook 2004
- flickr 2004
- World of Warcraft 2004
- YouTube 2005
- …
- Google Wave
- Google OS



Exciting Time for HC
Tremendous Challenges and Opportunitie
for Design and Research





Augmented Surfaces, Rekimoto ‘99

Bridging Physical and Digital

Bridging Paper and Digital Worlds: One important example

A Little History

- Ideas have histories
- Very important to know their histories
- Weiser: Ubicomp and Calm Technology
- Ishii: Tangible Media. Giving physical form to digital information and computation, making bits directly manipulable and perceptible.

Fundamental importance of cognitive science: understanding people and real-world activities

Current Research Systems

- PADD and PapierCraft
- ButterflyNet
- GIGAprints
- Recent PhD System: Nadir Weibel and colleagues

Interesting New Commercial System: Livescribe

BRIDGING PAPER AND DIGITAL WORLDS: Background and Examples

Jim Hollan
Distributed Cognition and HCI Laboratory
Department of Cognitive Science
University of California, San Dieg0

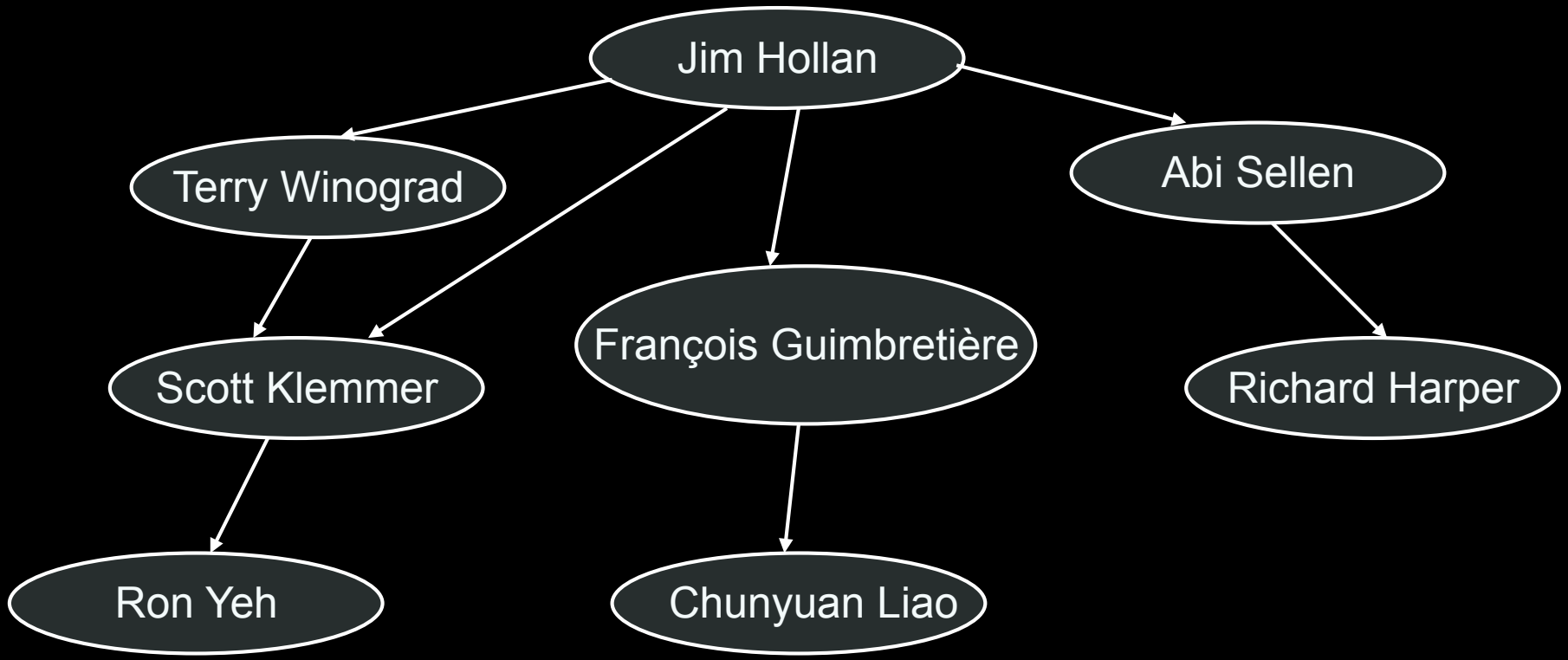
Acknowledgements to:

Richard Harper
Socio-Digital Systems
Microsoft Research
Cambridge

François Guimbretière
Information Science
Department, Cornell
and Chunyuan Liao
FXPal

Scott Klemmer and Ron Yeh
HCI Group
Department of
Computer Science
Stanford University

Social Network



Jim Hollan

Jim Hollan is Professor of Cognitive Science and Professor of Computer Science at the University of California, San Diego. In collaboration with Ed Hutchins, he directs the Distributed Cognition and Human-Computer Interaction Laboratory. In collaboration with Bill Griswold he directs the Ubiquitous Computing and Social Dynamics research group.

After completing a PhD in cognitive psychology at the University of Florida and a postdoctoral fellowship in artificial intelligence at Stanford University, he was on the research faculty at the University of California, San Diego for a decade. In collaboration with Ed Hutchins and Donald Norman, he led the Intelligent Systems Group in the Institute for Cognitive Science at UCSD and the Future Technologies Group at NPRDC. Jim left UCSD to become Director of the MCC Human Interface Laboratory and subsequently established the Computer Graphics and Interactive Media Research Group at Bellcore. In 1993, he moved to the University of New Mexico as Chair of the Computer Science Department. In 1997, he returned to UCSD as Professor of Cognitive Science.

Jim's research explores the cognitive consequences of computationally-based media. The goal is to understand the cognitive and computational characteristics of dynamic interactive representations as a basis for effective design. Current work focuses on cognitive ethnography, computer-mediated communication, distributed cognition, human-computer interaction, multiscale information visualization, and tools for supporting analysis of rich

François Guimbretière

François is Assistant Professor in the Information Science Department at Cornell.

François received his Ph.D. in computer science from Stanford in 2002. His Ph.D. work included the development of the Stanford Interactive Mural, PostBrainstorm system, FlowMenu (a fluid pen-based interaction technique), and ZoomScape (a novel focus+context visualization technique) . He is also known for his work on CrossY and Scriboli, interaction techniques for tablet computers, and for Flipper and TreeJuxtaposer, information visualization and navigation techniques.

François developed PADD (Paper Augmented Digital Documents), a novel approach to bridging the digital and paper worlds. PADD considers printouts as proxies to capture pen annotations on behalf of the digital documents they represent. This provides a new basis for cohabitation between the two media. The PapierCraft system augments PADD to provide a gesture-based command system.

Richard Harper

Richard is a Senior Researcher at Microsoft Research in Cambridge.

Richard has spent twenty years developing tools and techniques for understanding user behaviour in workplaces, mobile settings and the home. He has over 140 papers, patents, and books, which include: New Technology and Practical Police Work (1992), Inside the IMF (1998), Organisational Change and Retail Finance (2000), Wireless World (Ed, 2001),The Myth of the Paperless Office,(2002), Inside the Smart Home (Ed, 2003), and most recently, Inside Text: Social and design perspectives on SMS (Ed, 2005). He is currently completing Fieldwork and Design, with Dave Randall and Mark Rouncefield.

Prior to joining MSR Richard was director of various technology innovation companies, including The Appliance Studio and Social Shaping Research. In 2000 he was appointed the UK's first Professor or Socio-Digital Systems, at the University of Surrey, England. He completed his PhD at Manchester in 1989, prior to joining Xerox EuroPARC in 1992.

Amongst his professional activities, Richard is Editor-in-Chief of the Springer-Kluwer series on CSCW, member of the Colleges of Reviewers for the EPSRC and the ESRC, as well as on the editorial board of numerous journals, including Personal Technologies and the Journal of CSCW.

Scott Klemmer

Scott Klemmer is an Assistant Professor of Computer Science at Stanford University, where he co-directs the Human-Computer Interaction Group with Terry Winograd.

Scott received his PhD in Computer Science from University of California, Berkeley in 2004.

Scott and his colleagues conduct research into user interfaces that bind physical and electronic representations of artifacts for integrated interaction: manipulation in one medium effects a corresponding change in the artifact's dual medium.

Scott's research includes SUEDE, a wizard-of-oz prototyping tool for speech interfaces, Designers' Outpost, a tangible interface for collaborative web site design, Papier-Mâché, a tookit to support tangible input, ButterflyNet, a mobile capture and access system that integrates paper notes with digital photographs captured during field research, d.tools, a hardware and software system that enables designers to rapidly prototype physical user interfaces, iDeas, notebooks that share and walls that remember, and GIGAprints, interaction techniques for large paper displays.

Chunyuan Liao

Chunyuan Liao received his PhD from Computer Science at the University of Maryland working with François Guimbretière. His dissertation research involves the development of PapierCarft, a gesture-based command system that allows users to manipulate digital documents using paper proxies. He is now a research scientist at FXPAL.

Ron Yeh

Ron Yeh received his PhD from Stanford University working with Scott Klemmer and Terry Winograd. His dissertation research includes work in building tools for field biology researchers. The ButterflyNet system is a mobile capture & access system that enables scientists to capture data in the field (with paper notebooks, cameras, and other devices) and then organize, visualize and share it. GIGAprinst expands the concept of paper interfaces to large interactive paper surfaces. The R3 Paper Applications Toolkit enables designers and developers to more easily create systems like ButterflyNet and GIGAprints. Ron is now at Cooliris.

Overview

Context and History
- Seminal early systems

Myths
- Myth of Paperless Office
- Other myths
- Are we creating a new myth

Pen Technology
- Anoto-based pens
- Anoto pattern
- Other technologies

Descriptions of Systems
- PADD and PapierCraft
- Stanford ButterflyNet, iDeas, and Gigapixel
- A Publishing Infrastructure for Interactive Paper Documents
- Livescribe

Discussion Issues
- Technology
- Research
- Social
- Evaluation

Selected Early Systems

Digital Emulation

- FreeStyle [Wang 89]
- MATE [Hardock 93]
- XLibris [Schilit 98] , [Golovchinsky 02]

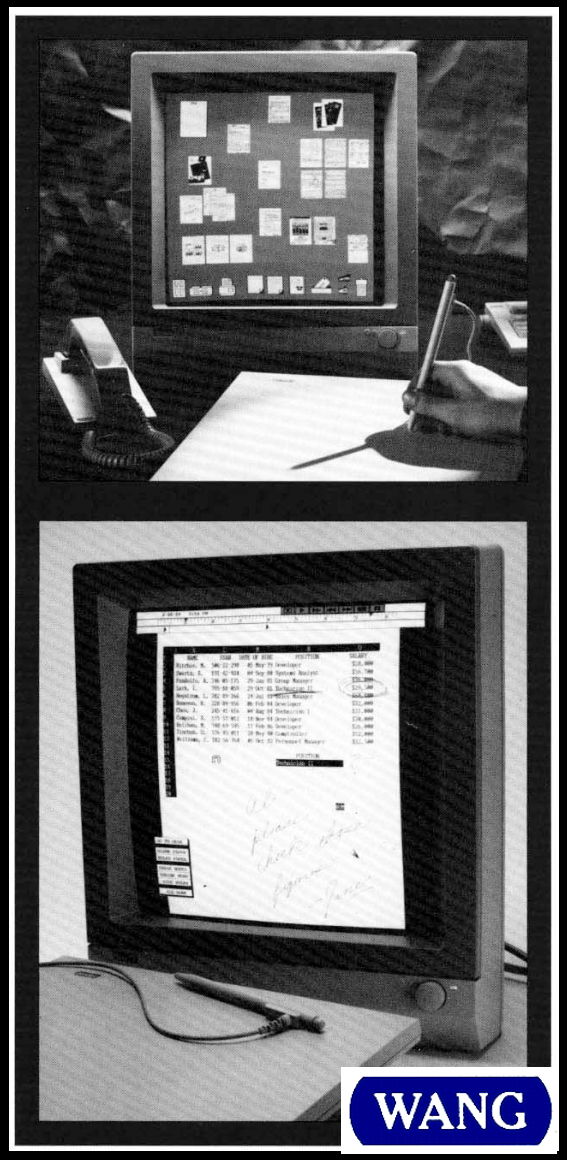
Tight Coupling

- DigitalDesk [Wellner 93], Ariel [Mackay 95]
- A-Book [Mackay 02]
- PaperLink [Arai 97]
- Intelligent Paper [Dymetman 98], Paper++, PaperPoint [Signer 06]

Paper as Input Device

- Xax [Johnson 93]
- Anoto
- Paper PDA [Heiner 99], [Avrahami 01]

Freestyle

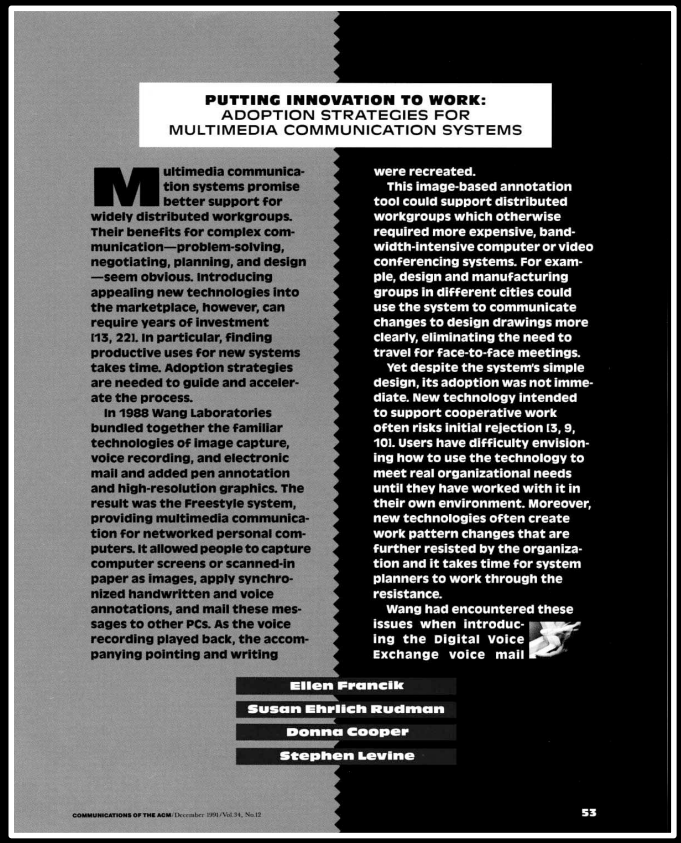


Ellen Froncik, Susan Ehrlich Rudman, Donna Cooper, and Stephen Levine. Putting Innovations to Work, Communications of the ACM ’91, 52-63

Demonstrated at CHI’89

Example scenario:

Take a scanned road map, use the stylus to draw in directions to go somewhere, and record a running audio commentary about what landmarks to watch for. The resulting file could be sent by electronic mail to another Freestyle user who could play it back and watch the directions being redrawn on the background road map synchronized with the spoken comments.



PUTTING INNOVATION TO WORK:
ADOPTION STRATEGIES FOR
MULTIMEDIA COMMUNICATION SYSTEMS

Multimedia communication systems promise better support for widely distributed workgroups. Their benefits for complex communication—problem-solving, negotiating, planning, and design—seem obvious. Introducing appealing new technologies into the marketplace, however, can require years of investment [13, 22]. In particular, finding productive uses for new systems takes time. Adoption strategies are needed to guide and accelerate the process.

In 1988 Wang Laboratories bundled together the familiar technologies of image capture, voice recording, and electronic mail and added pen annotation and high-resolution graphics. The result was the Freestyle system, providing multimedia communication for networked personal computers. It allowed people to capture computer screens or scanned-in paper as images, apply synchronized handwritten and voice annotations, and mail these messages to other PCs. As the voice recording played back, the accompanying pointing and writing were recreated.

This image-based annotation tool could support distributed workgroups which otherwise required more expensive, bandwidth-intensive computer or video conferencing systems. For example, design and manufacturing groups in different cities could use the system to communicate changes to design drawings more clearly, eliminating the need to travel for face-to-face meetings.

Yet despite the system's simple design, its adoption was not immediate. New technology intended to support cooperative work often risks initial rejection [3, 9, 10]. Users have difficulty envisioning how to use the technology to meet real organizational needs until they have worked with it in their own environment. Moreover, new technologies often create work pattern changes that are further resisted by the organization and it takes time for system planners to work through the resistance.

Wang had encountered these issues when introducing the Digital Voice Exchange voice mail

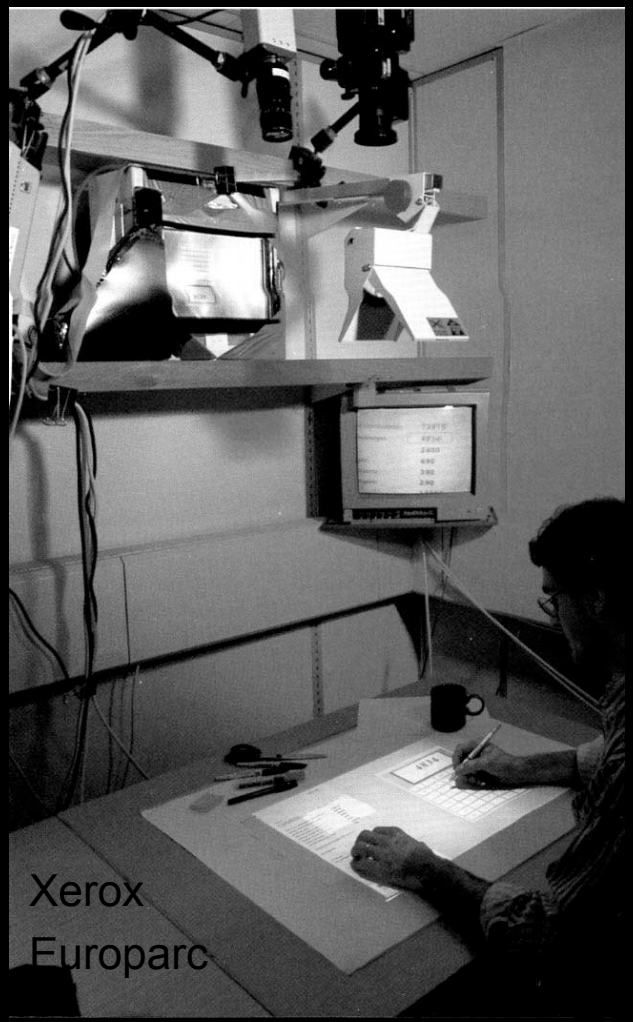
Ellen Francik
Susan Ehrlich Rudman
Donna Cooper
Stephen Levine

COMMUNICATIONS OF THE ACM/December 1991/Vol.34, No.12

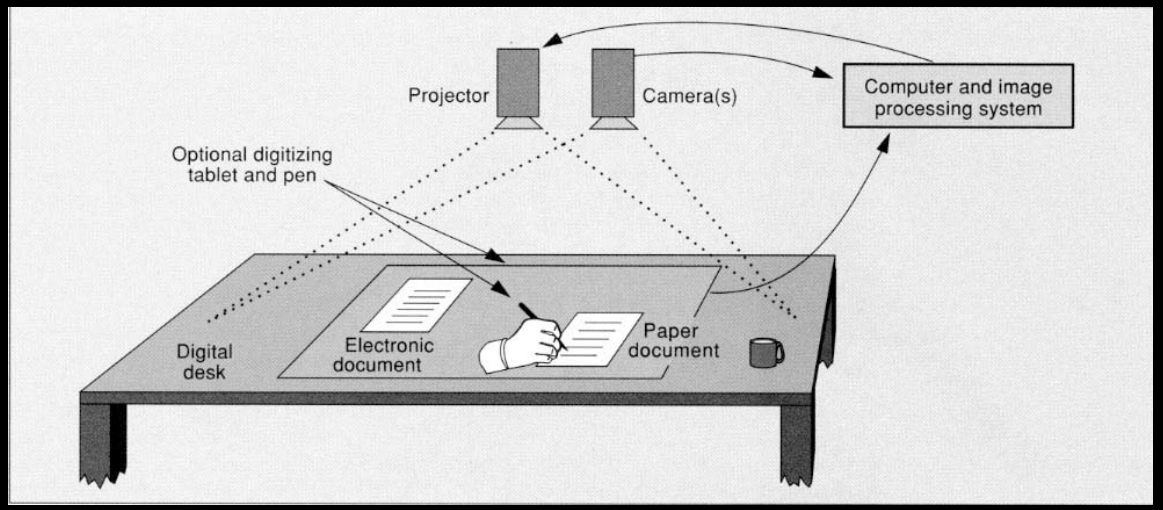
53

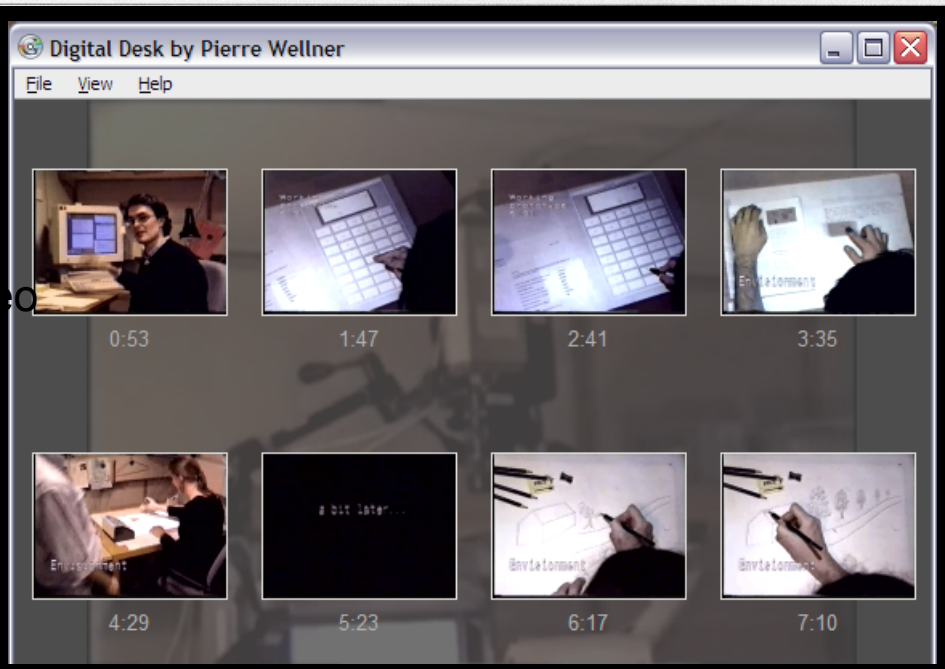
Digital Desk

Pierre Wellner, Interacting with Paper on a Digital Desk, Communications of the ACM, 1993, 87-96.



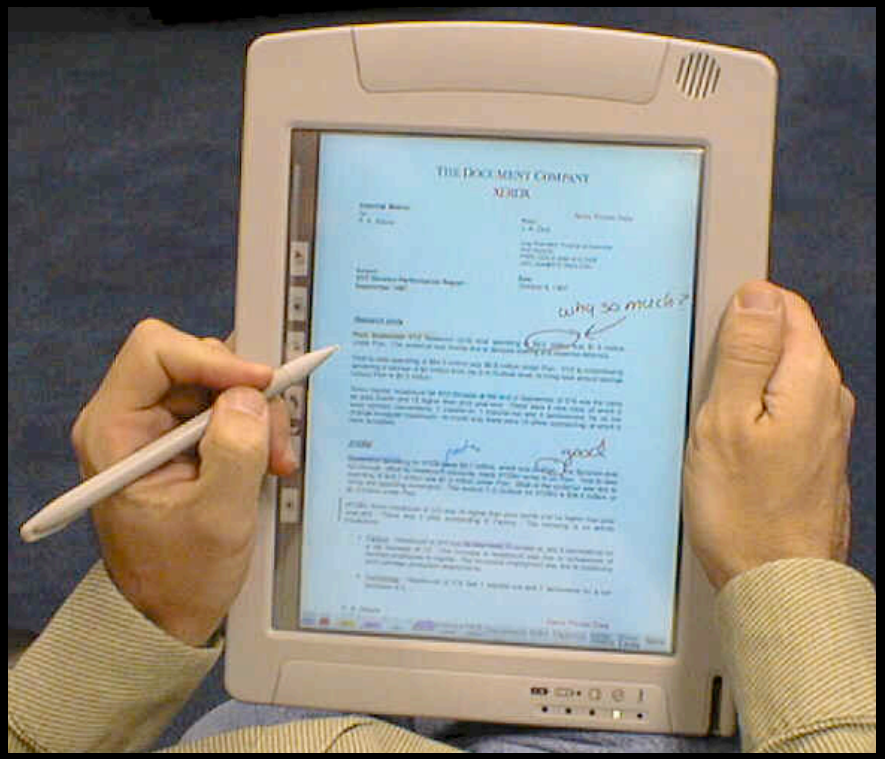
Xerox
Europarc

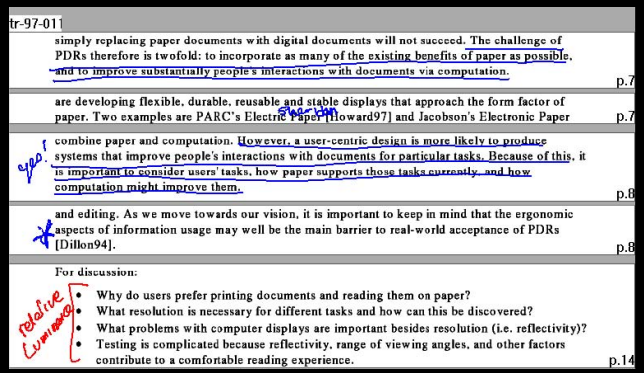


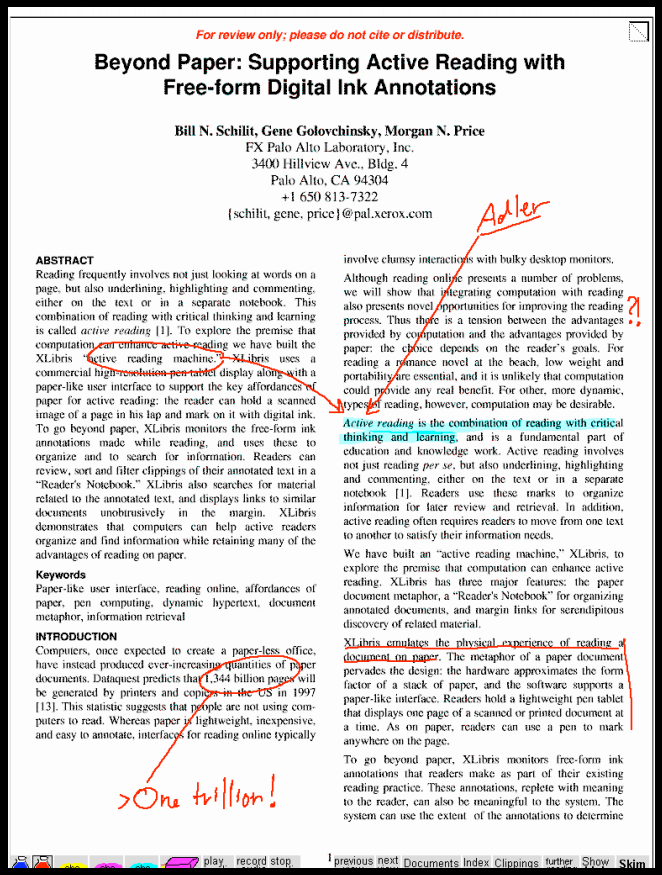


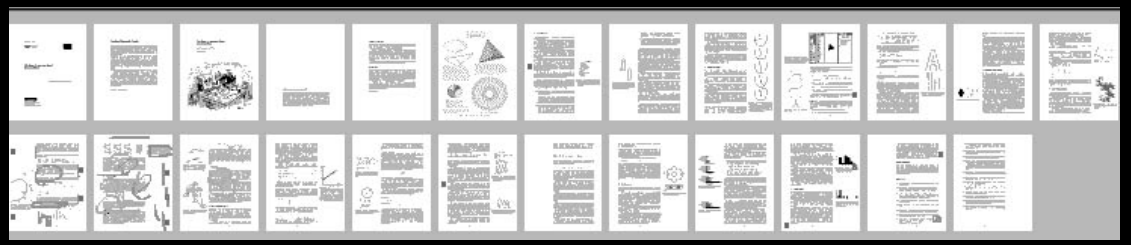
XLibris

Bill Schilit, Gene Golovchinsky, Morgan Price, Beyond Paper: Supporting Active Reading with Free-form Digital Ink Annotations,CHI'98, 249-256.

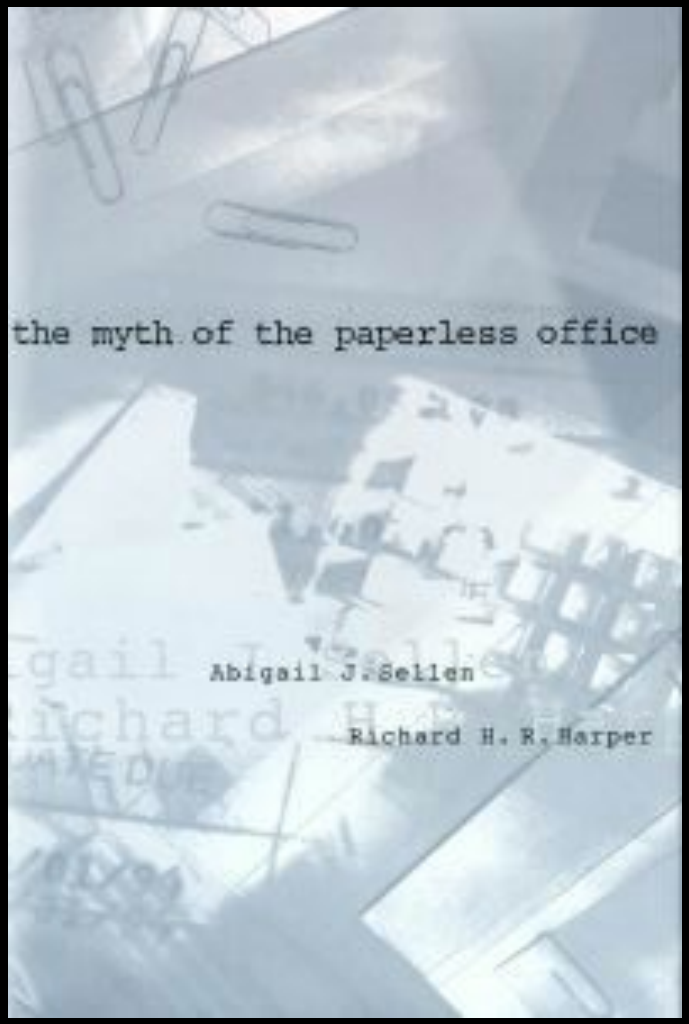








Myths



The Myth of the Paperless Office and Related Myths

Myths

What are the myths in question and why look at them?

What do myths do?

Some example ‘epochs’ and the myths about paper that went with them

- Xerox’s myth: The wimp interface, ethernets
- The web myth: HTML
- The MS Tablet OS myth: Tablets

Contemporary myths

- Are we creating a new one?

How do we learn to design a better, “richer” future?

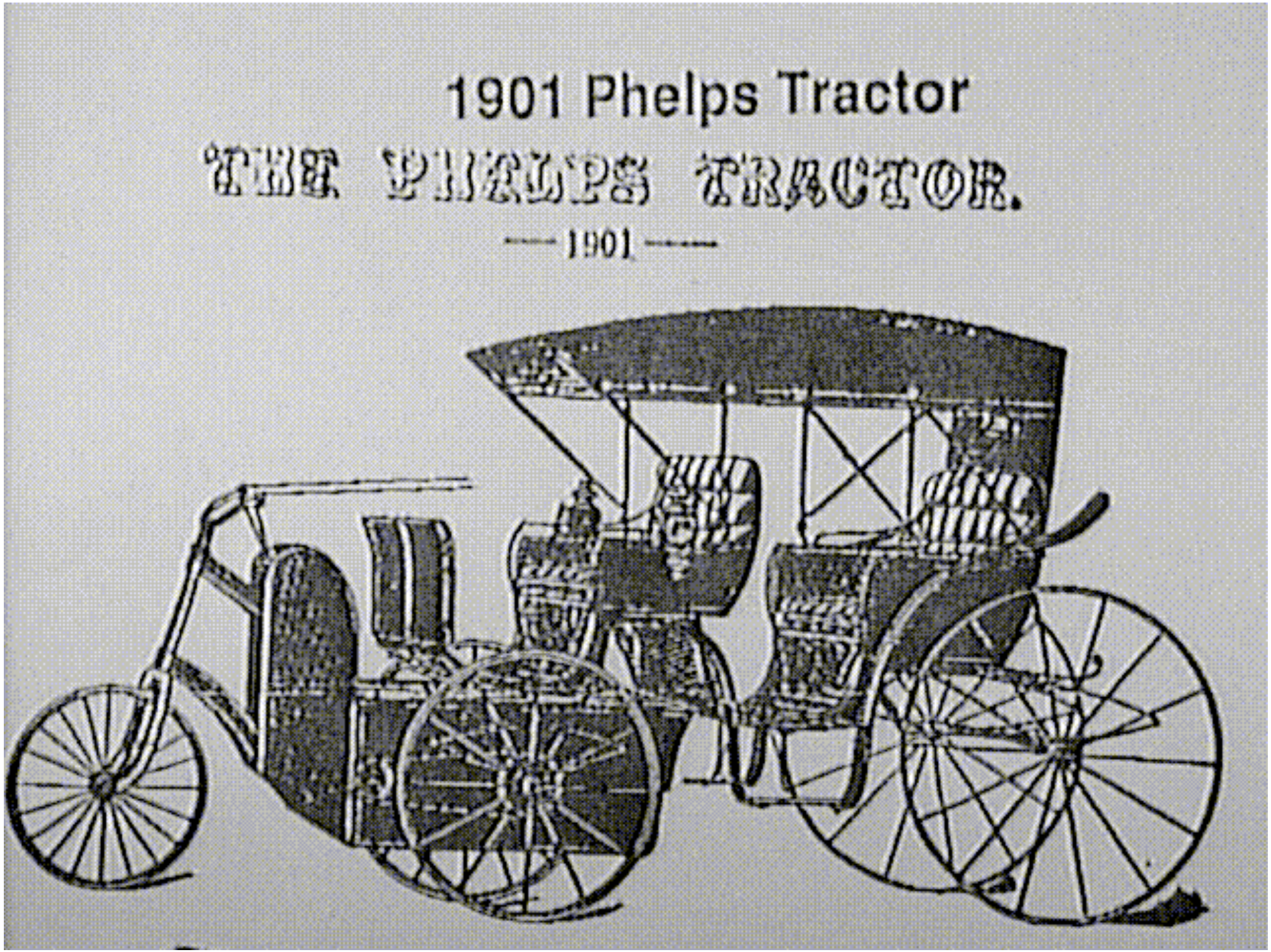
Why look at myths?

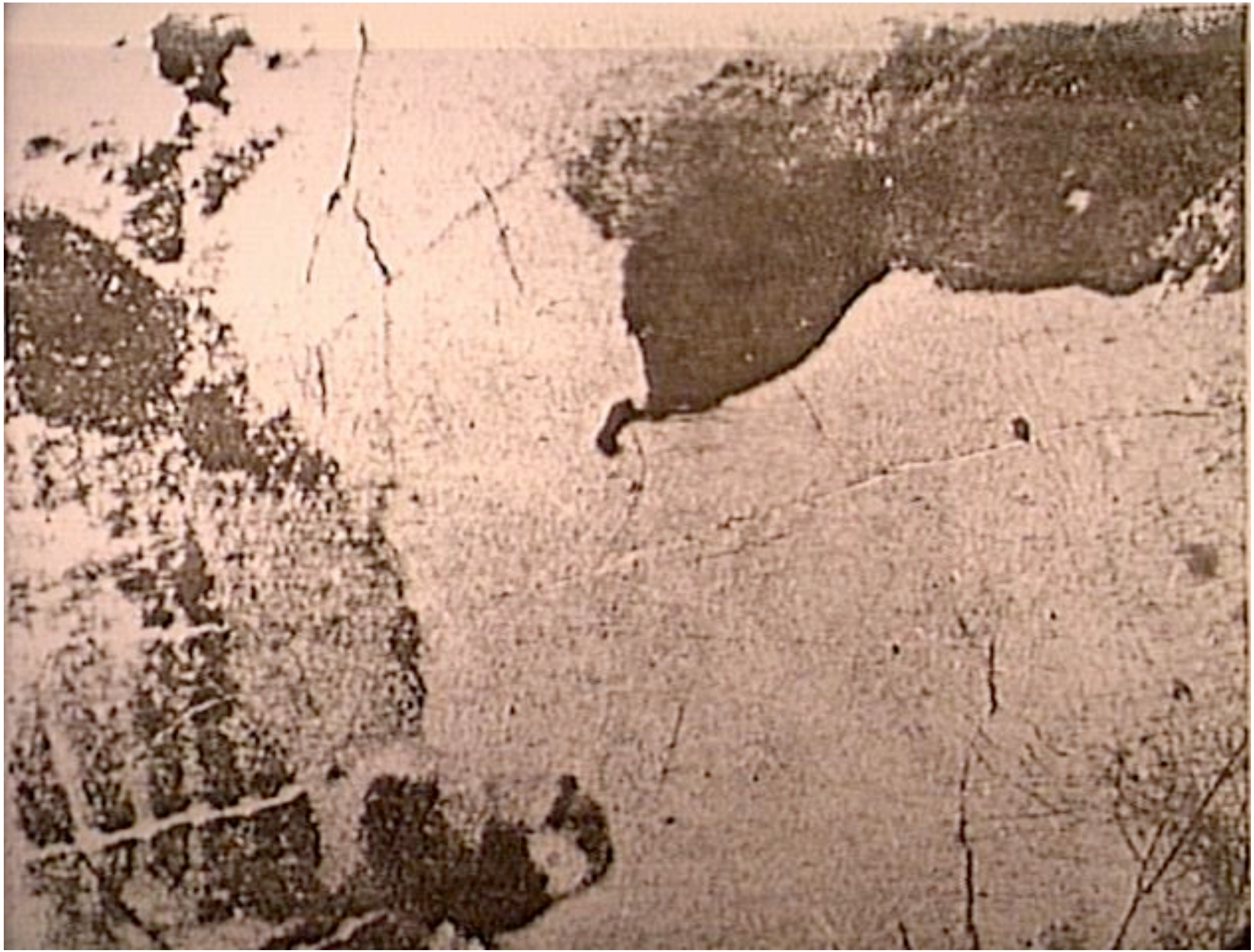
One looks at the myths surrounding past ‘digital epochs’ so as to better understand one’s own goals now

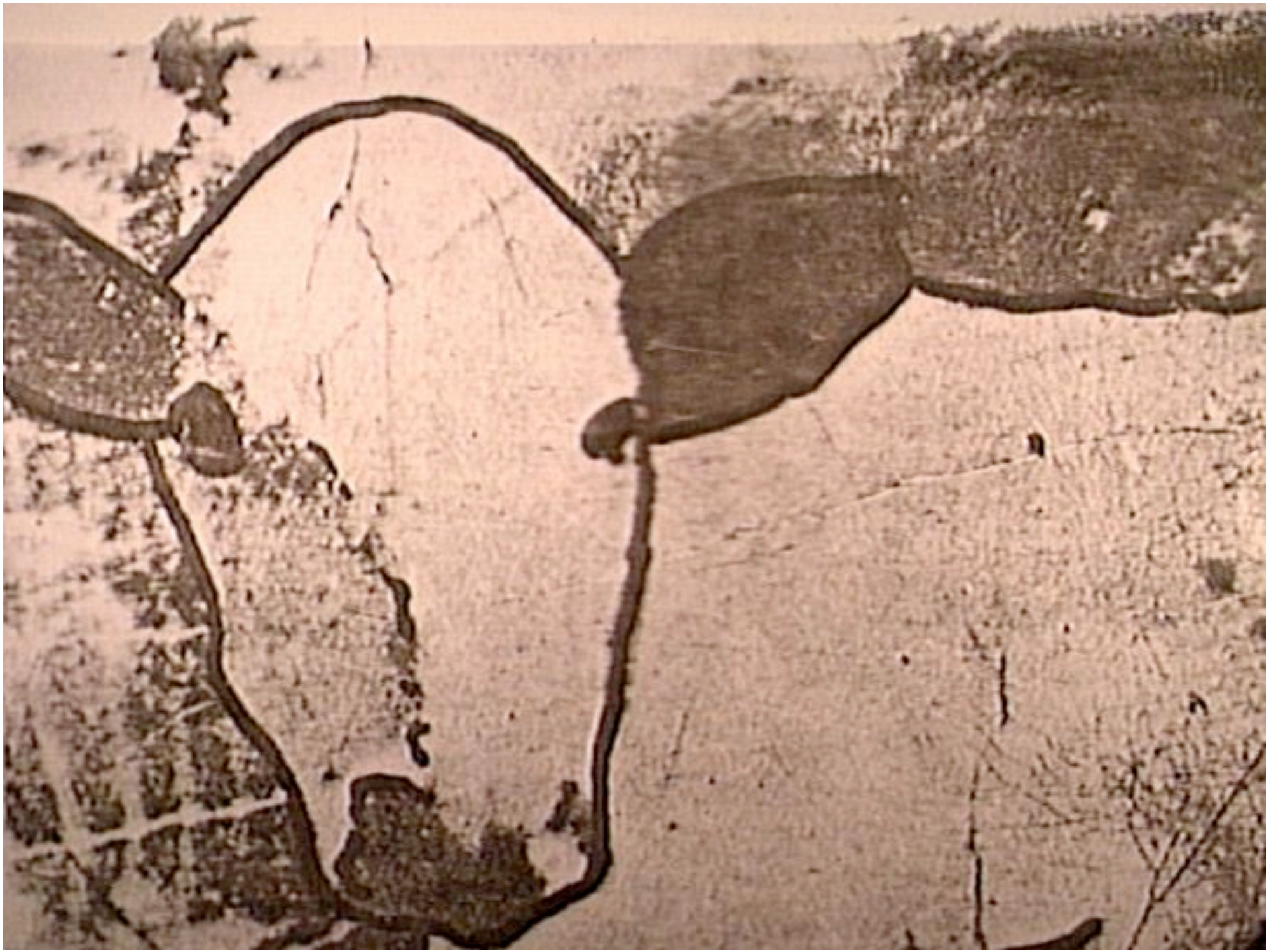
> In particular, one’s assumptions and intentions, and, importantly, presuppositions

It is easier to see old myths, not so easy to see contemporary ones….

1901 Phelps Tractor







Myths

Aren’t simply falsehoods

They are ideas that do ‘work’

But:
What work?

Why? How?

To what ends?

What do myths do?

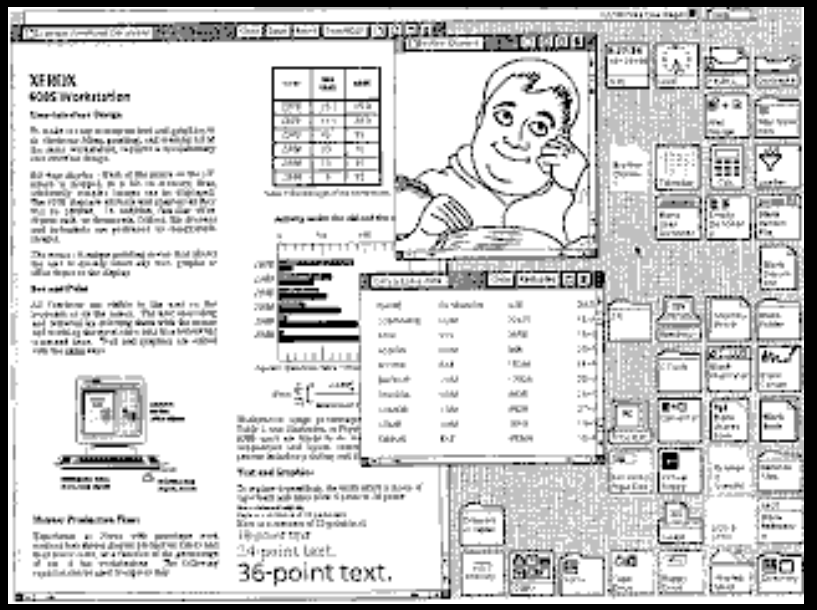
Their work

- They can motivate people to change
- They can give shared direction
- They can become a ‘credo’ that unites people
- They can be tools in political battles over money, strategy, decision making and research

They are tools

- But once created they can have a life of their own…

Some examples: Xerox's



The most well-known

- Xerox Globalview and the ethernet would make for paperlessness

But paper persisted

- Because digital did not afford the same possibilities
- It acted as a tangible, universal network
- As a work-around for bad system design

A second case: the WWW

Through HTML

- Networks were opened up (who needs paper?)
- New document forms (who needs paper?)

But paper persisted

- Because digital did still not afford the same possibilities

Worse-more paper was produced

- Because people downloaded more to read

Office printing increased 56% between 1996 and 2003

The EU Commission generates 83 pages of office paper per person per day

The U.S. uses 4 million tons of copy paper annually

A4 paper demand in Europe reached 5 million tons in 2006

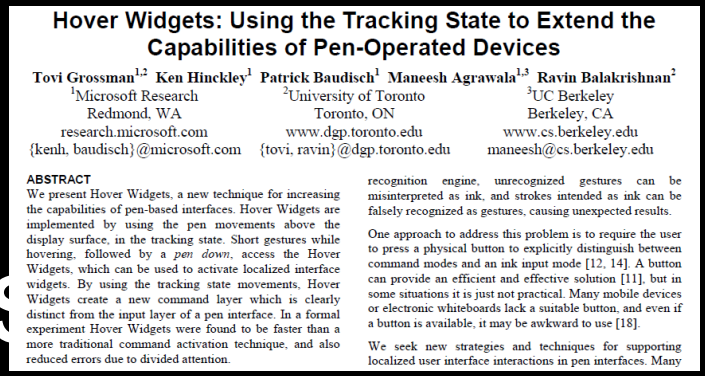
Third:
the assault by tablets

Tablets

- Wireless: away from the desktop
- Pen-based interaction (who needs paper?
- Annotation, editing, note-taking (who need paper?)

But paper persisted

- Because digital did still not afford the same possibilities
- And tablets not quite good enough
  - Heavy
  - Unreliable
  - Batteries limited



Hover Widgets: Using the Tracking State to Extend the Capabilities of Pen-Operated Devices

Tovi Grossman[1,2] Ken Hinckley[1] Patrick Baudisch[1] Maneesh Agrawala[1,3] Ravin Balakrishnan[2]

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ABSTRACT

We present Hover Widgets, a new technique for increasing the capabilities of pen-based interfaces. Hover Widgets are implemented by using the pen movements above the display surface, in the tracking state. Short gestures while hovering, followed by a *pen down*, access the Hover Widgets, which can be used to activate localized interface widgets. By using the tracking state movements, Hover Widgets create a new command layer which is clearly distinct from the input layer of a pen interface. In a formal experiment Hover Widgets were found to be faster than a more traditional command activation technique, and also reduced errors due to divided attention.

recognition engine, unrecognized gestures can be misinterpreted as ink, and strokes intended as ink can be falsely recognized as gestures, causing unexpected results.

One approach to address this problem is to require the user to press a physical button to explicitly distinguish between command modes and an ink input mode [12, 14]. A button can provide an efficient and effective solution [11], but in some situations it is just not practical. Many mobile devices or electronic whiteboards lack a suitable button, and even if a button is available, it may be awkward to use [18].

We seek new strategies and techniques for supporting localized user interface interactions in pen interfaces. Many

Designing Effective Step-By-Step Assembly Instructions

Maneesh Agrawala* Microsoft Research; Doantam Phan Stanford University; Julie Heiser Stanford University; John Haymaker Stanford University; Jeff Klingner Stanford University; Pat Hanrahan Stanford University; Barbara Tversky Stanford University

Abstract

We present design principles for creating effective assembly instructions and a system that is based on these principles. The principles are drawn from cognitive psychology research which investigated people's conceptual models of assembly and effective methods to visually communicate assembly information. Our system is inspired by earlier work in robotics on assembly planning and in visualization on automated presentation design. Although other systems have considered presentation and planning independently, we believe it is necessary to address the two problems simultaneously in order to create effective assembly instructions. We describe the algorithmic techniques used to produce assembly instructions given object geometry, connections, and optional grouping and ordering constraints on the object's parts. Our results demonstrate that it is possible to produce aesthetically pleasing and easy to follow instructions for many everyday objects.

Keywords: Visualization, Assembly Instructions

1 Introduction

Many everyday products, such as furniture, appliances, and toys, require assembly at home. Included with each product is a set of instructions showing how to put it together [Miljkovitaar and Waterbridge 1998]. For modular product lines, such as customizable office furniture, many different versions of the instructions are necessary. As the number of customizable products and demand for task-specific instructions increase, technology will be needed to produce instructions more cost effectively. Already there is a high incidence

Fourth:
the assault by pape.

Eh? Are new augmented papers going to do away with paper?

- Attacking paper by making paper a computer that combines:
  - Paper affordances
    - To read as if on paper
    - To navigate as if on paper
    - To annotate as if on paper
  - Computer affordances
    - To edit as if on a computer
    - To create as if on a computer
    - To save, store, and access as if on a computer

Will this assault succeed?

Will paper and digital merge?

Why? And to what ends?

New myths

Are we creating a myth?

- In this case, a myth about the user
- That users want to ‘interact’ (with augmented paper) in certain, specifiable ways?

That, in the past, the problem (for the user) has been:

- That paper lacks a keyboard and mouse and a computer, meanwhile, lacks paper….
- So that merger of the two provides a ‘solution’?

Why? How? To what ends?

Myths are motivators, yes, but one needs to be careful

Is there a solution to the digital-paper divide?

- By making one or other technology subsume all the other can do?
- Or might we expand the affordances available?

Might this produce more diversity?

Understanding action

When using documents what are ‘users’ doing?

- E.g. being able to use a document that is not dynamic may sometimes be an advantage:
  - Paper bank statements: their fixity is crucial to their value as ‘boundary objects’
- E.g. being able to navigate in complex ways and do nothing else:
  - Paper books afford this and is their key value
- E.g. being able to search but not edit:
  - Web browsers afford this: Is this their key value?

An important discussion topic

The problem for paper-digital interfaces is not what they can do, but why?

- This tutorial is seeking to teach you what they can do
- So that we can begin to answer this question too
- Designing augmented paper interfaces does not need to be a new myth making enterprise
- Nor does it need to be in thrall to old myths

How?

Take a work example:

- Why do people go to work?
- What is it people do there?
  - Do they go there to read?
  - If so why not read at home?
- If not, why not?
- And once this is answered…..
  - When reading (at work), is it all the same?
  - Is the interaction always the same?
  - Are the purposes always the same?

Documents, work, design

Let's approach reading as a question of documents-in-action

- Documents are used to do many things
- E.g. where a document 'is' (in the office) is an important workflow indicator
  - Is this an interactional affordance?
  - Is the interaction the same as those used when reading?
  - When one reads, is one checking that 'it' (the workflow) is done?
  - Or wanting to learn? (Is it didactic)?
  - Or wanting to dispute with 'it'?
- Is a digital design solution to these needs one that can be imported to paper (or vice versa?)

Are all users-uses-one and the same?

Does it not matter what they do?

Do they all interact with documents in the same way?

Augmented paper

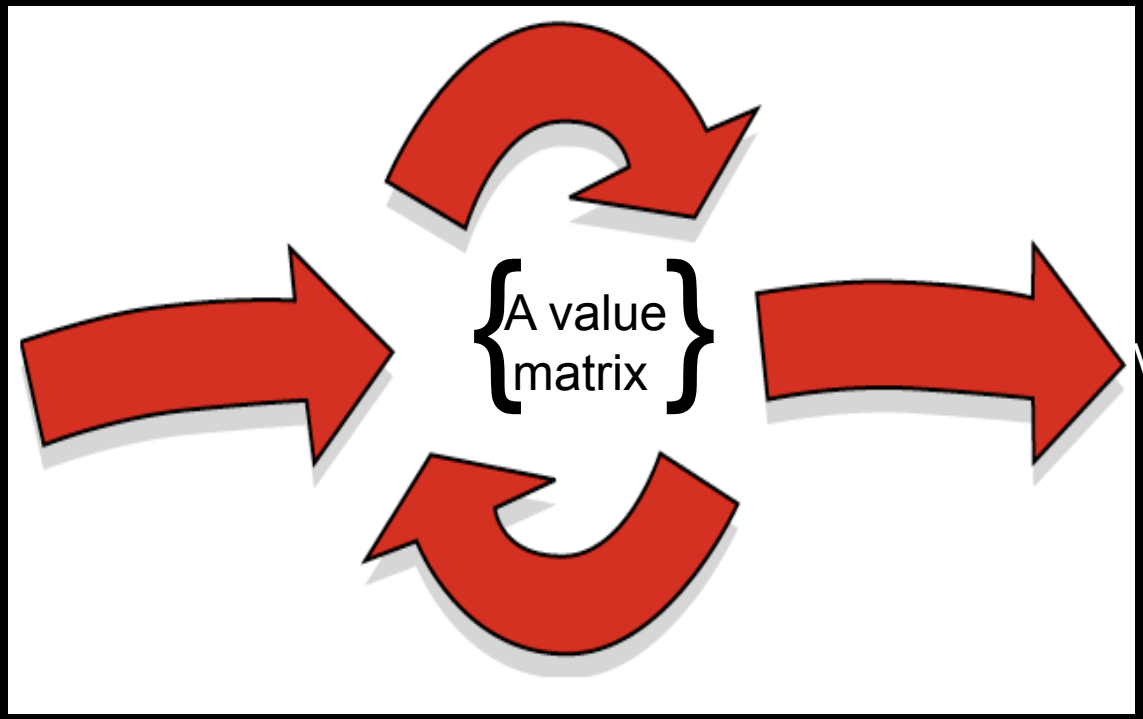
Design is about stretching

- It should not be about merging
- To stretch through both satisficing what users ‘need’ and enabling new possibilities

To produce a value matrix that is more than a status quo ante

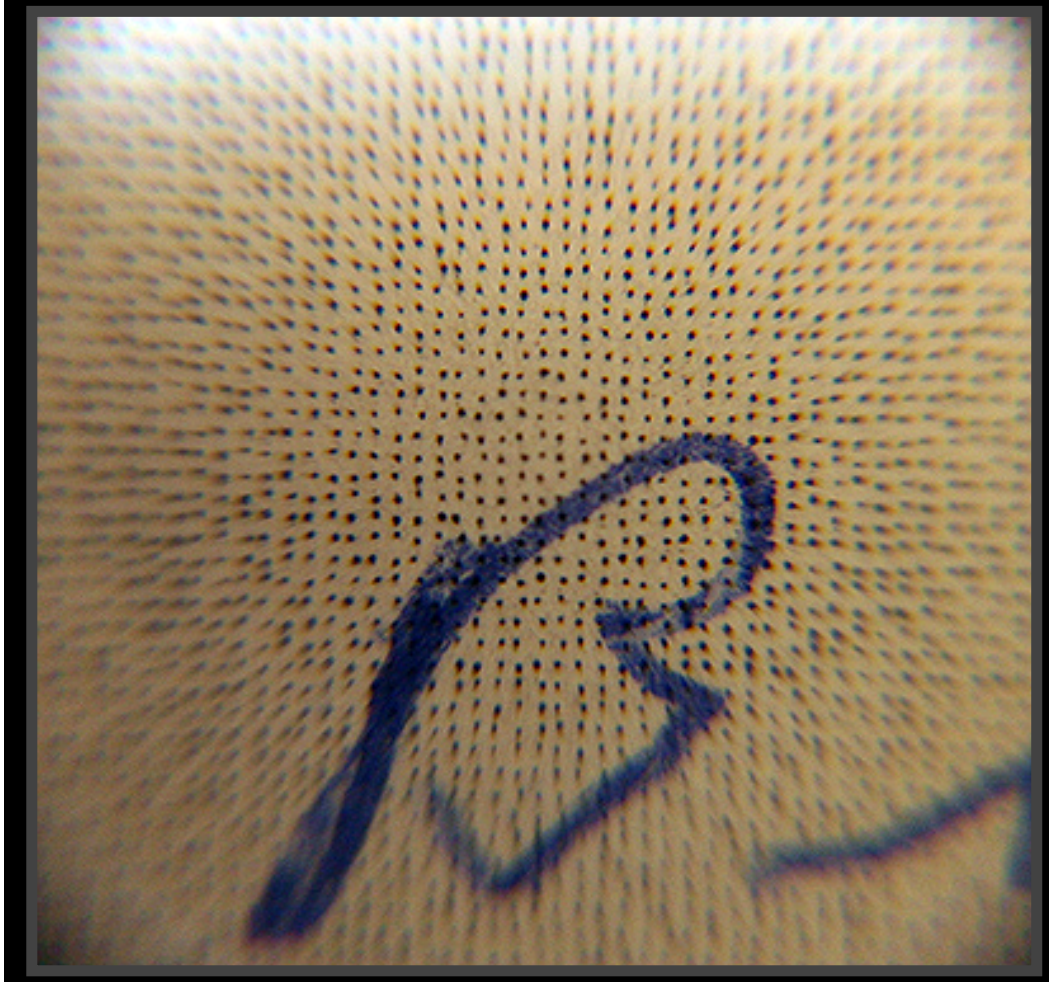
- Not a paper/computer nor a computer/paper
- But a computer plus paper that makes more than each!

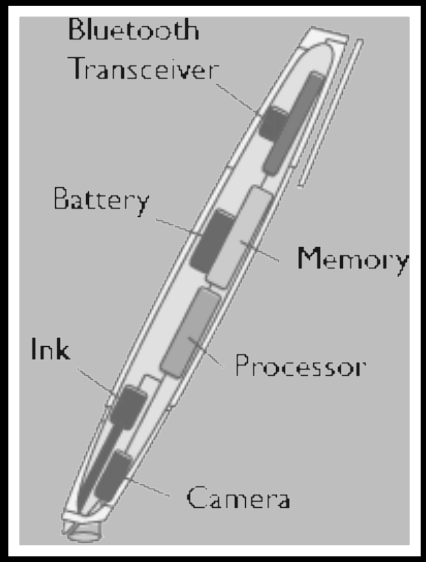
Design stretch



Paper + Computing

Pen Technology





Pen Technology

Anoto
- Pen camera uses IR LED light
- Pattern is printed using IR absorbing inks
- User content must be printed with IR transparent ink
  - C, M, Y are IR transparent
  - Black should be printed as C+M+Y not K

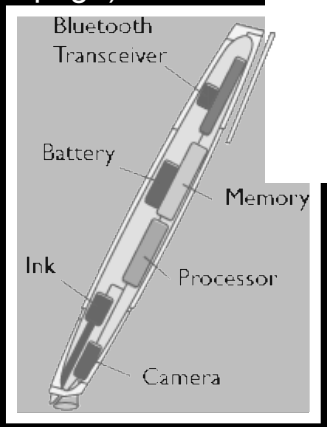
Pens
- Logitech, Nokia, Maxell, ..

Records
- Stroke coordinates (X, Y, relative to page)
- Page ID
- Pressure
- Time stamped (realtime clock)
- 50–100 images / sec
- Potential to read barcodes

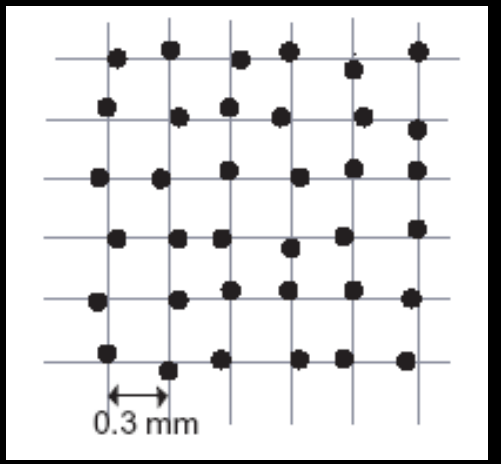
Communication
- USB
- Bluetooth

Pattern is
- Large address space
- Time consuming to print
  - Use pre-printed paper
  - Use color printer

Other technologies
- DataGlyphs [Hecht 94]
- MEMO pen [Nabeshima 95]
- Others



Dots above/below and left/right at each grid position. Each dot carries two bits of information. Pen registers positions by reading a 6 x 6 dot area. $4^{6x6}=4^{36}=2^{72}$ unique combinations. Very large pattern space.



From Anoto documentation

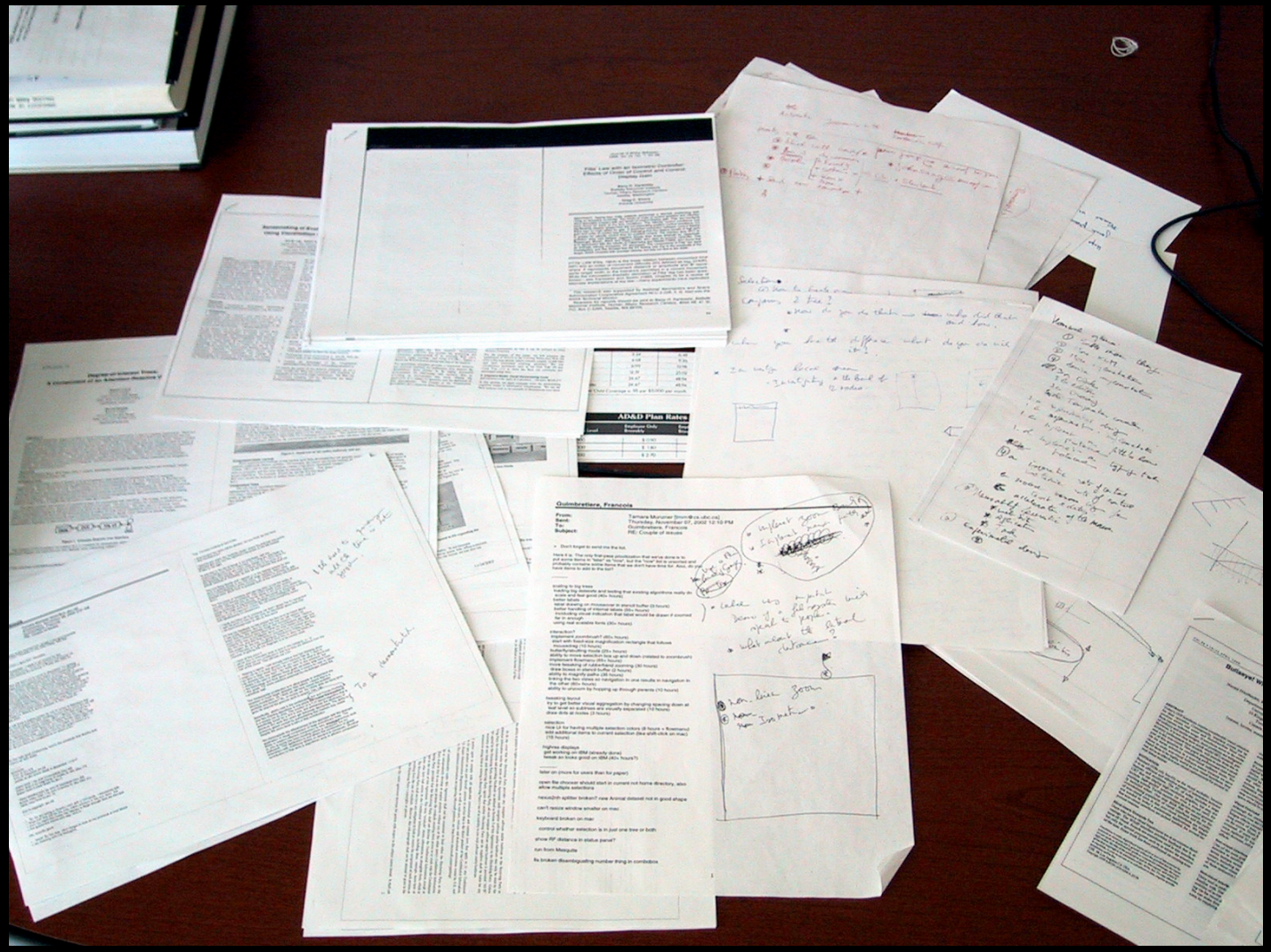
System Descriptions

PADD and PapierCraft

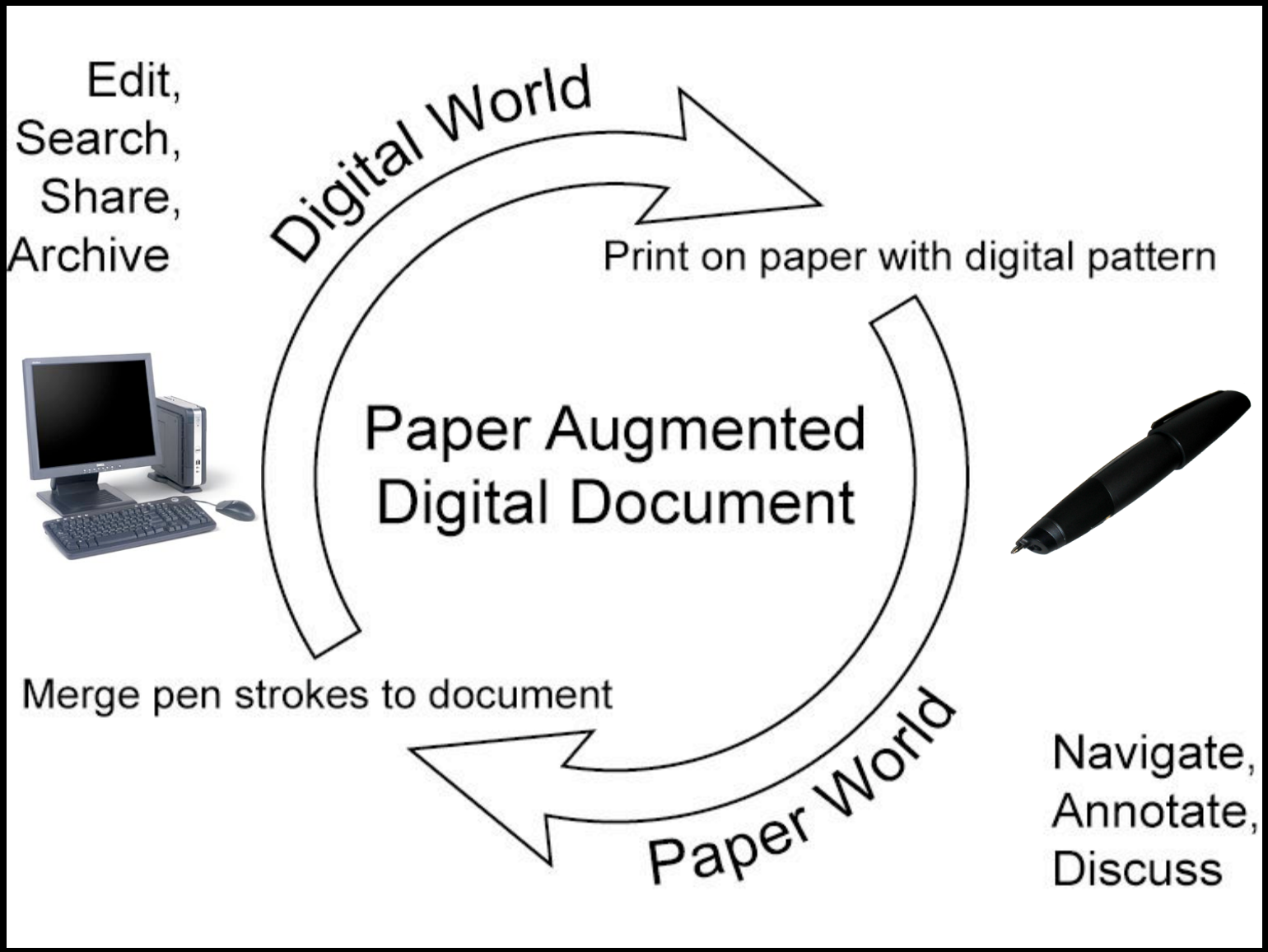
ButterflyNet, iDeas, and Gigpixel

PaperProof: Publishing Interactive Paper Documents

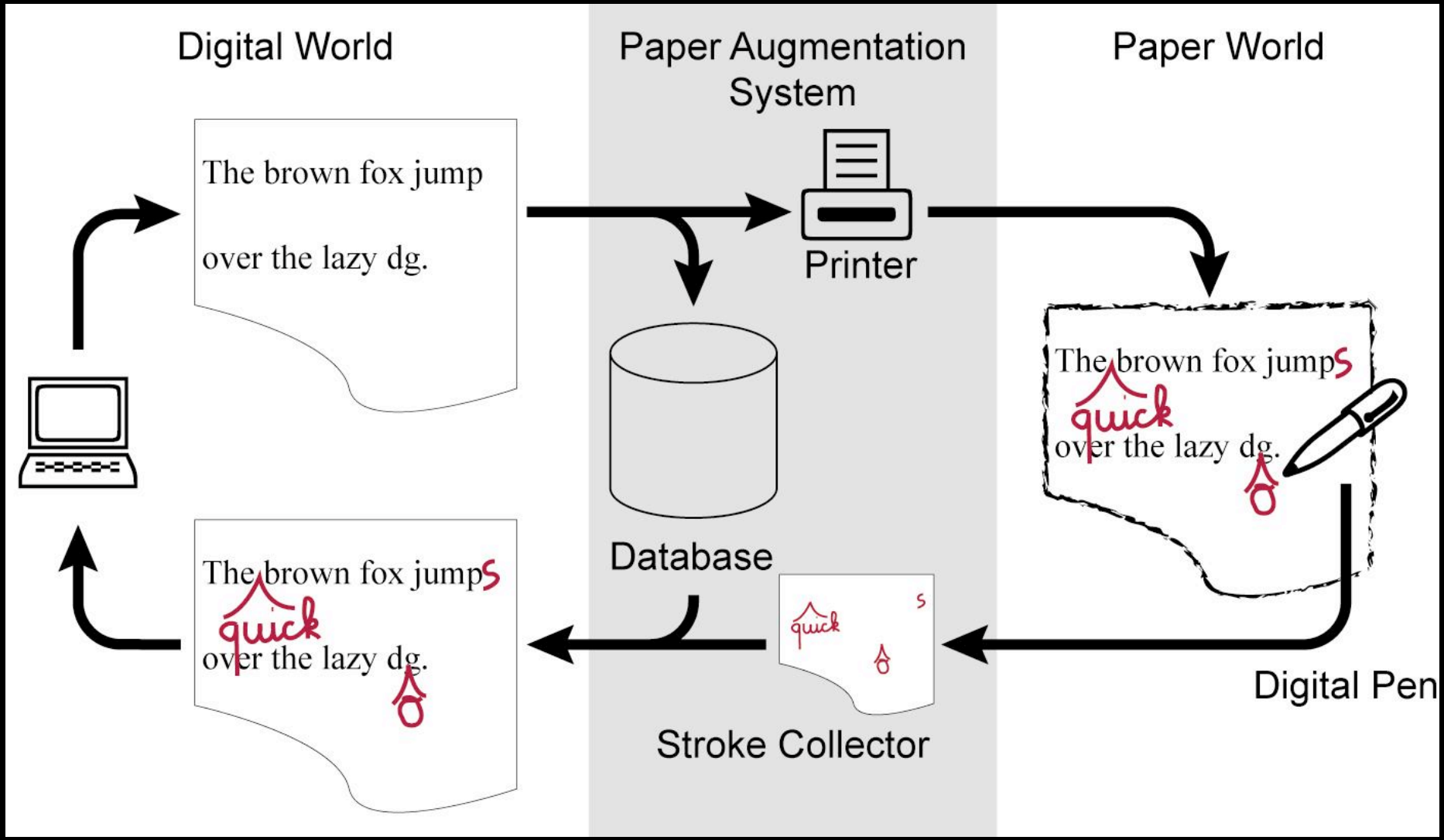
François Guimbretière's desk



François Guimbretière
PADD: Paper Augmented Digital Documents



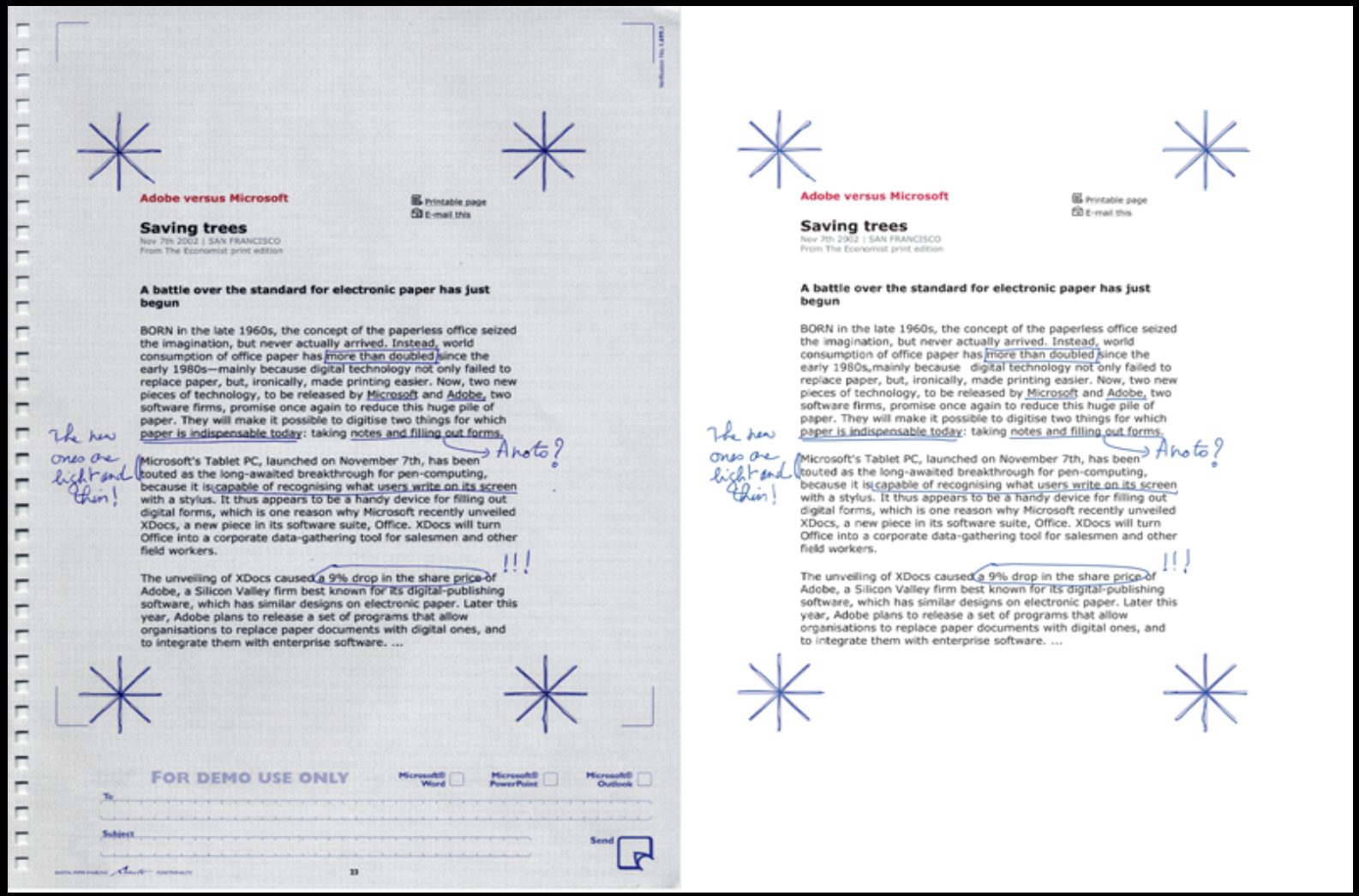
System architecture



PADD prototype as an Acrobat plug-in

- Feasibility study focusing on calibration problems
  - Use pre-printed paper
  - HP 5550 with black cartridge removed
    - Automatically use CMY to emulate black
  - Document acts as its own database
    - Personal use only
    - Only one out-standing copy per document
    - Strokes are simply overlaid on top of the document

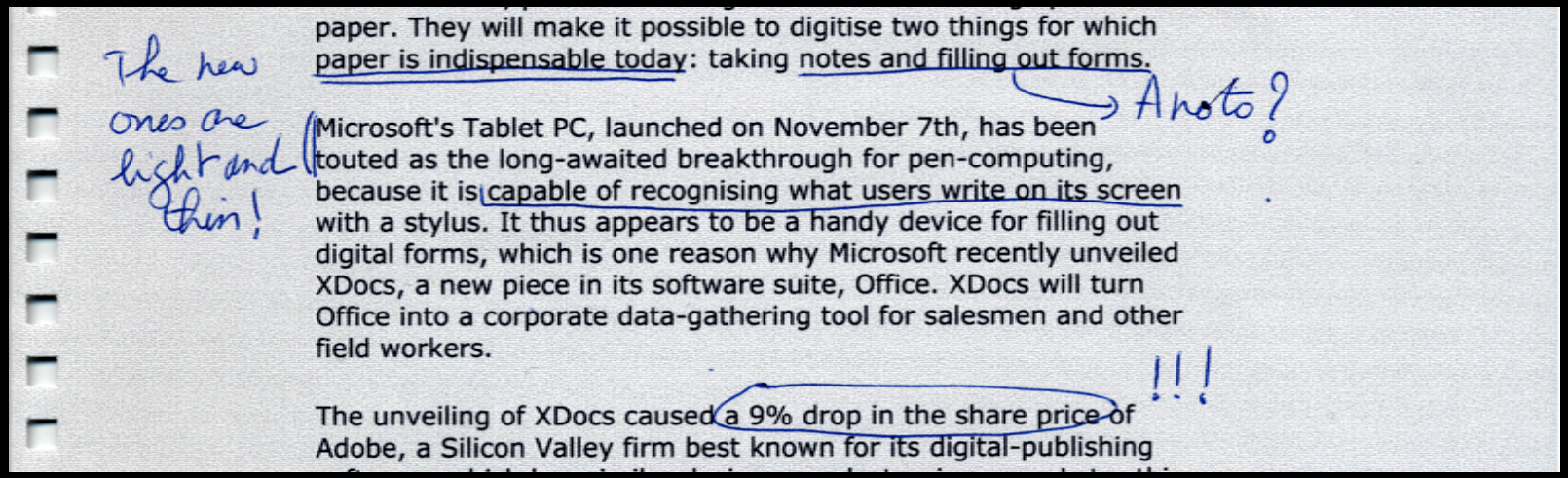
PADD Acrobat plug-in

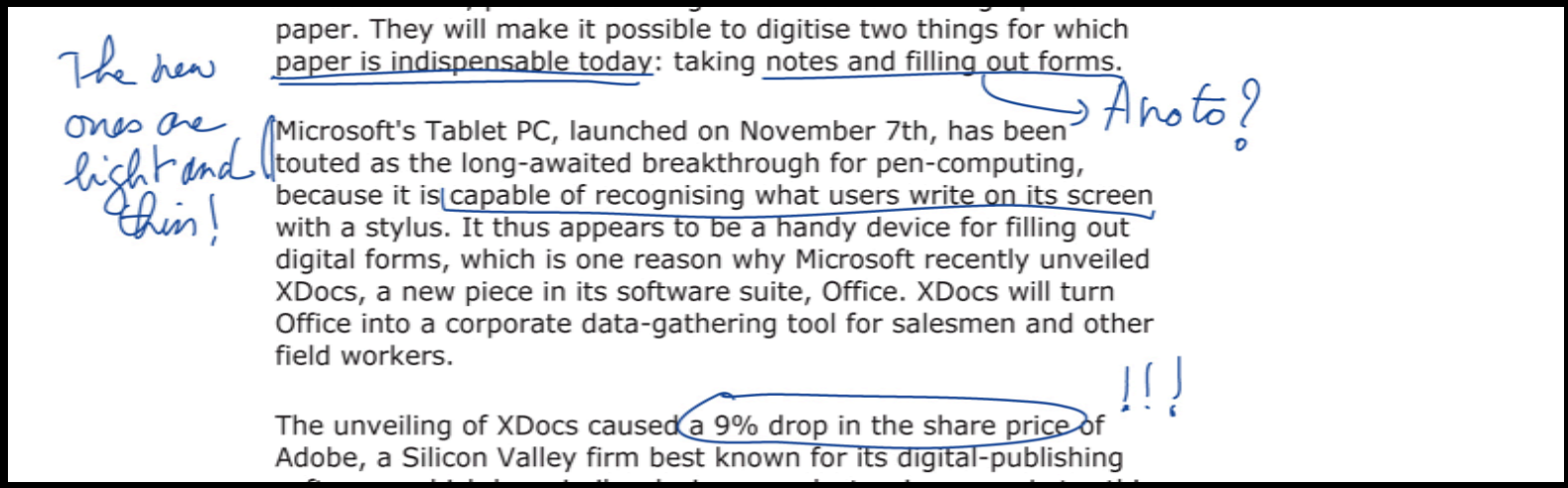


Paper

Digital

PADD: detail I



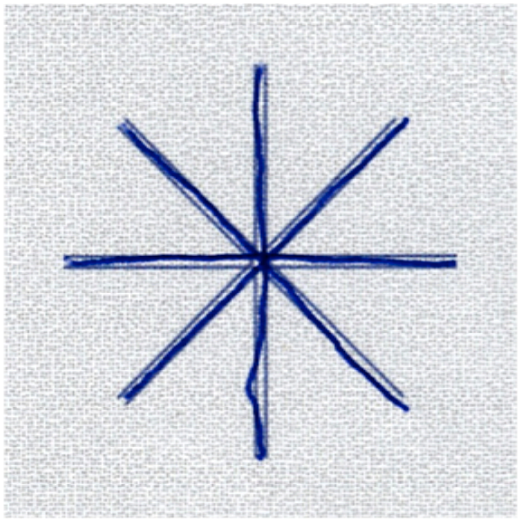


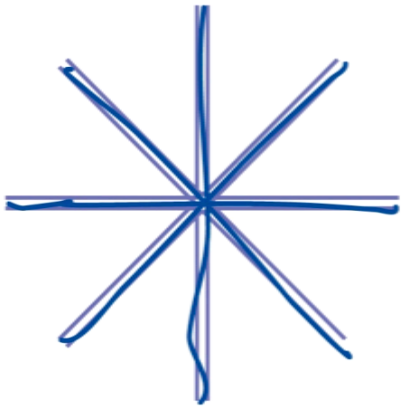
Original text from the Economist

PADD detail II

d a 9% drop in the share price of
best known for its digital-publishin

d a 9% drop in the share price of
best known for its digital-publishin





TabletPC?

Ease of navigation and annotation

- Paper is easy to navigate
- Paper is easy to annotate

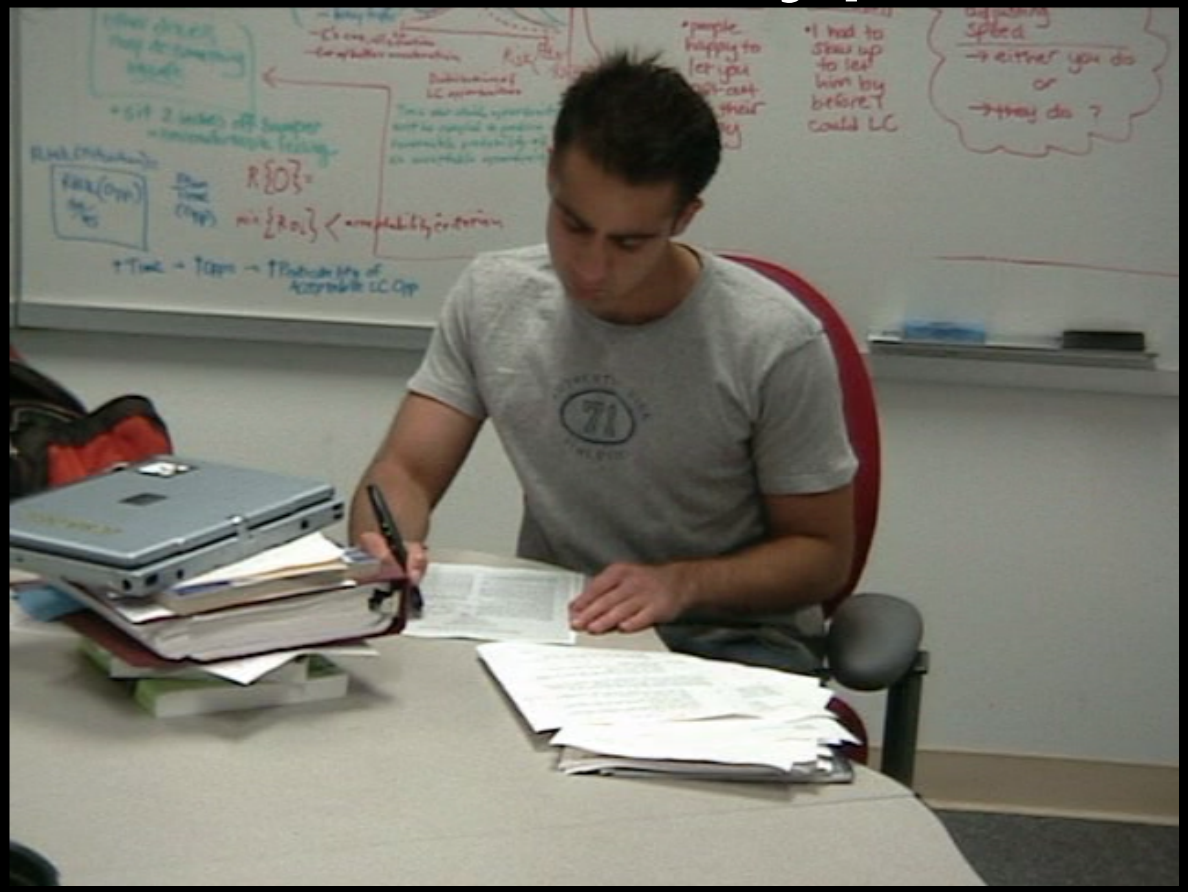
Display size

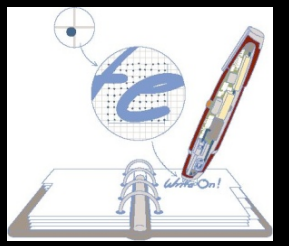
- Digital high-resolution engineering drawing?
- Multi-document interactions?

Practical issues

- Paper is low cost
- Paper is resilient
- Paper does not have batteries (but the pen does!)

A First Prototype





Rod Embrahimi and Jim Hollan

Digital versions of annotated PDF's

Annotation benefits:

What you don't have to say

Exploiting context

Harvesting intent

Do the right thing
where good ideas grow

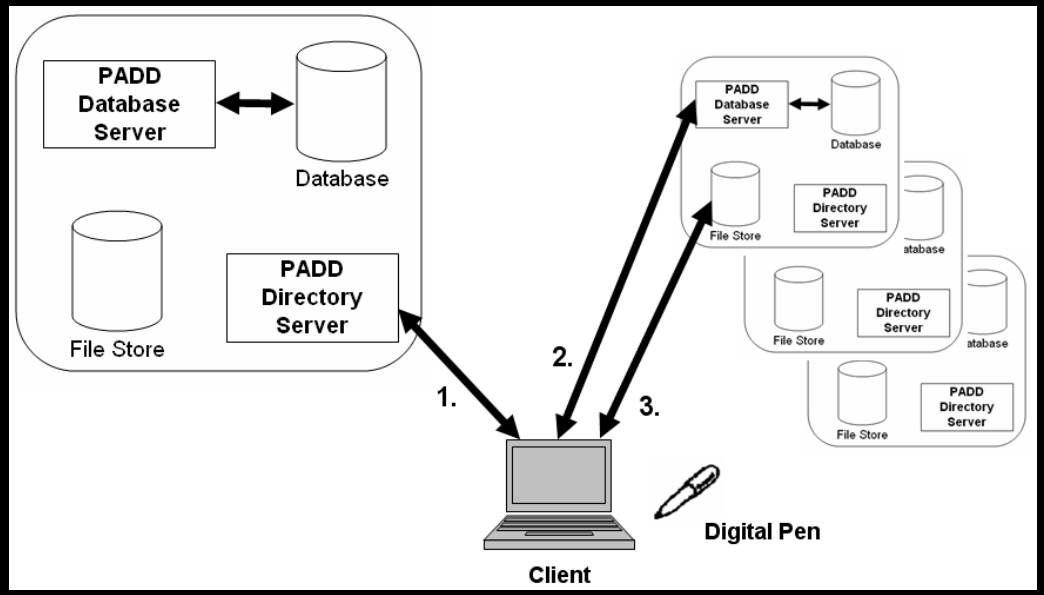
www.dotherightthing.com
Rank companies by impact and whether doing the right thing

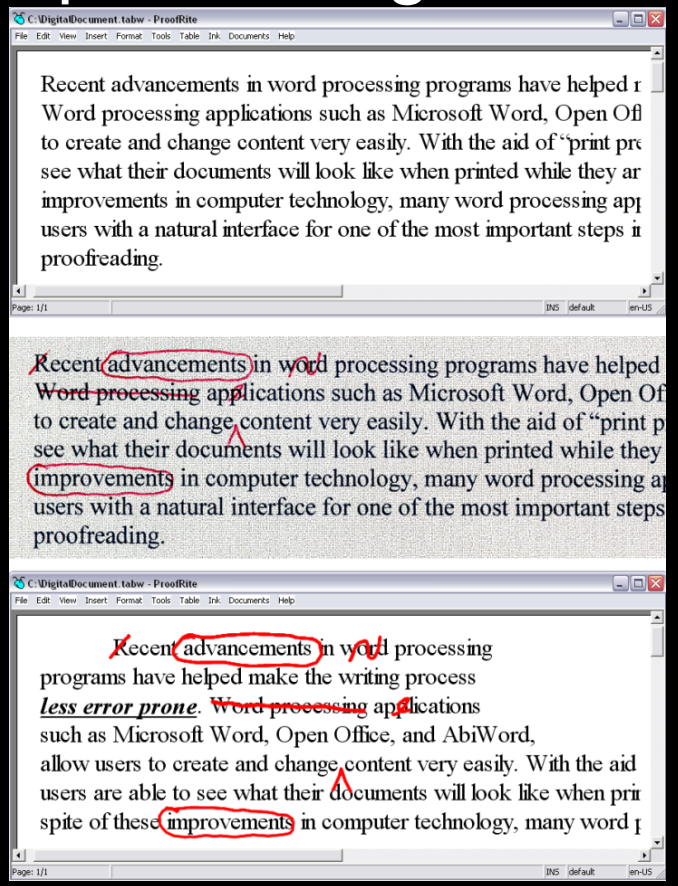
ProofRite

Dave Levin and Kevin Conroy

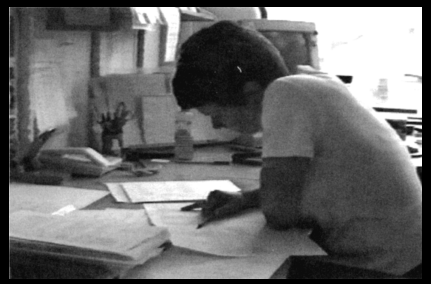
- First fully distributed implementation
- Integrating proofreading and word processing
  - Implemented on top of AbiWord
  - Inserted marks flow with text

[Golovchinsky 02], [Bargeron 03]

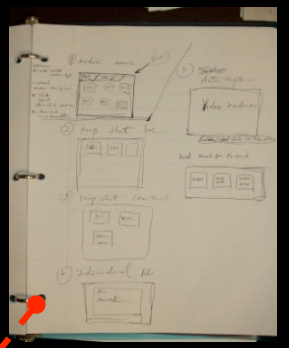




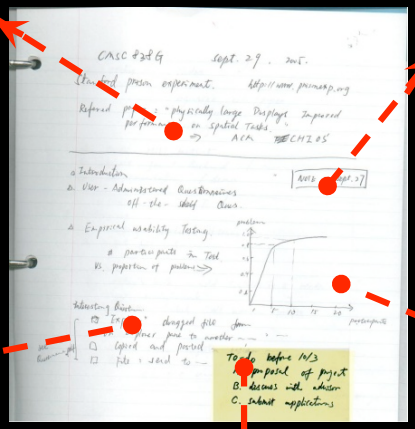
Simple annotations are not enough

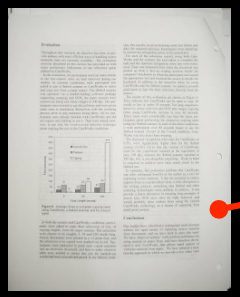


Reference article

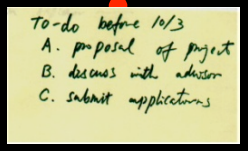


Reference to notes

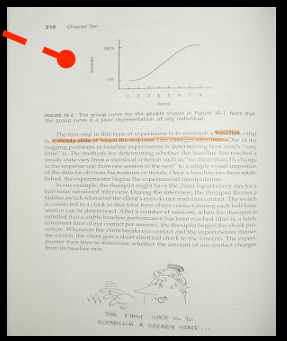




Excerpt text



Collage

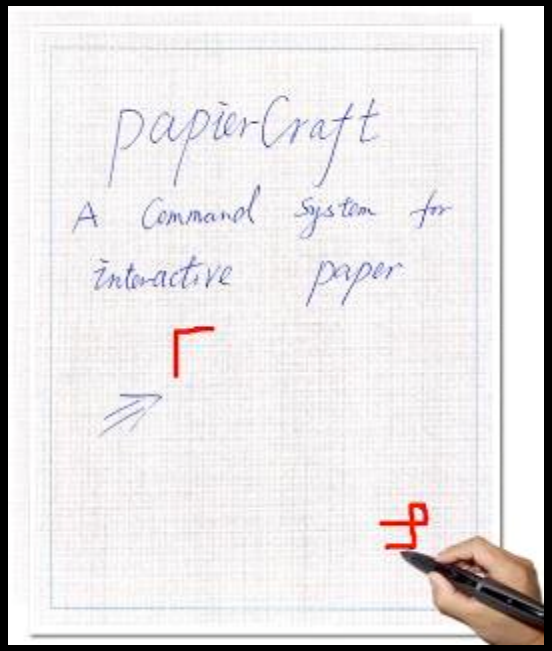


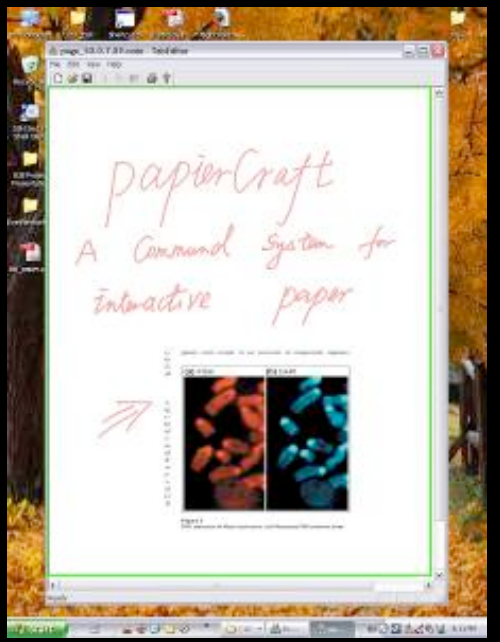
Excerpt graph

PapierCraft

Liao, Guimbretiere, Hinckley
A Command System for Paper-Based Interactions (UIST'05)

Liao, Guimbretière, Hinckley, and Hollan
PapierCraft: A Gesture-Based Command System for Interactive Paper, TOCHI, 2008.





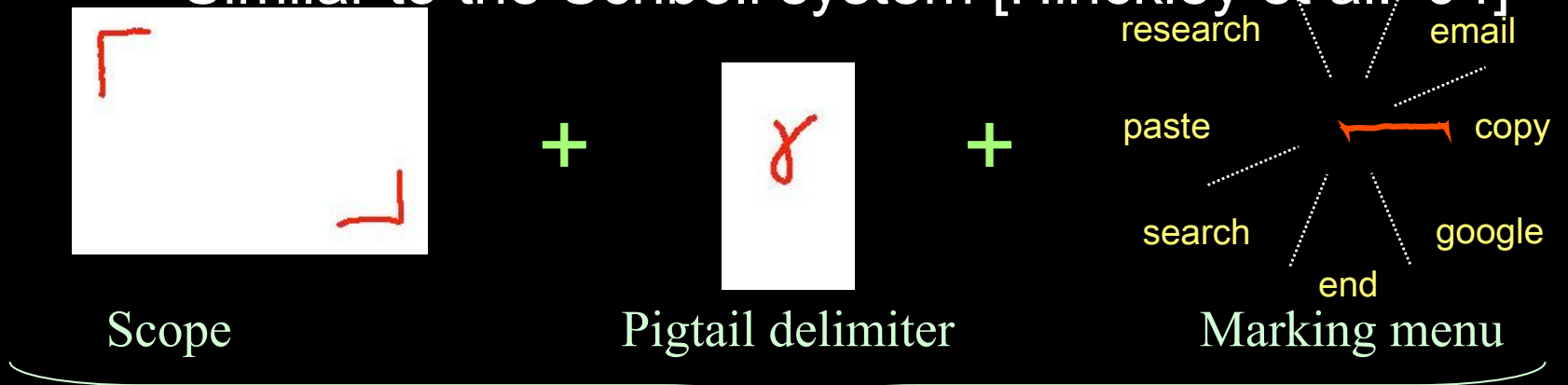
Commands in PapierCraft

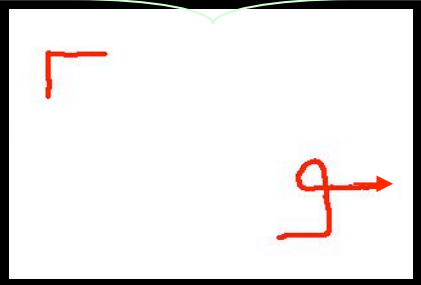
Switch to command mode

- Command button or use a command pen

Mark your command

- Similar to the Scribboli system [Hinckley et al. '04]





Scopes

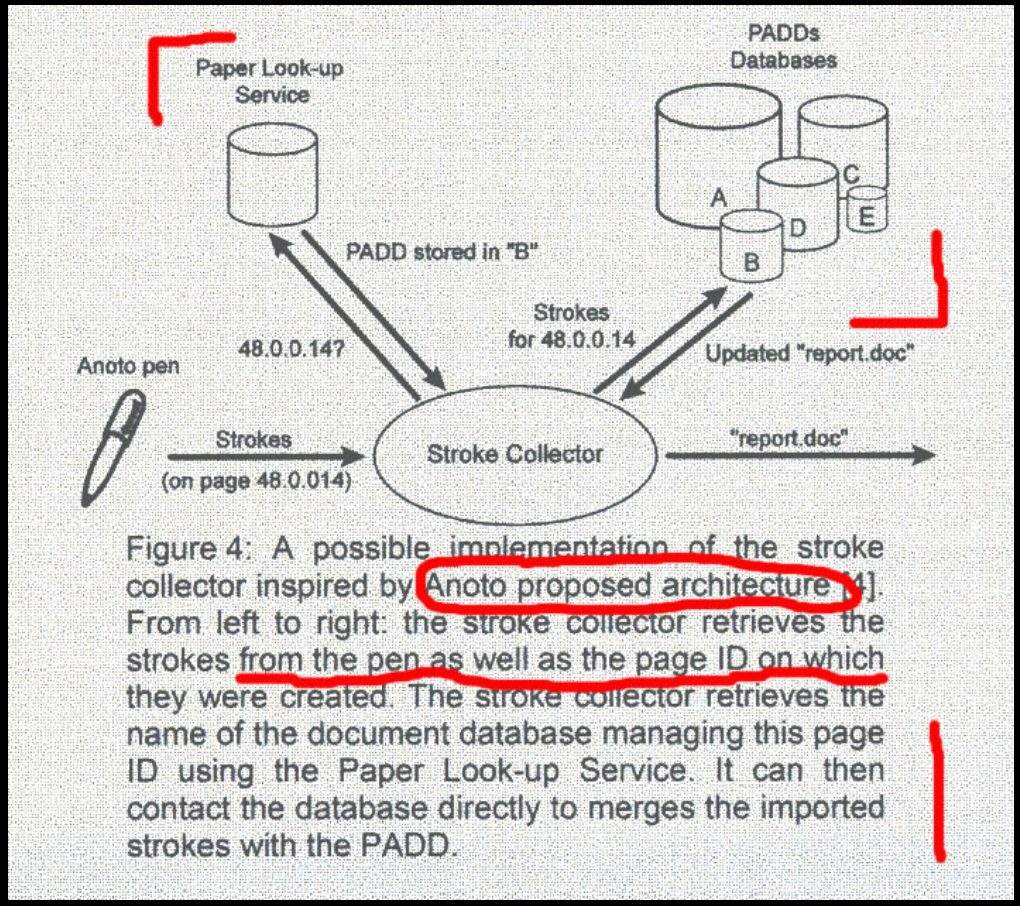
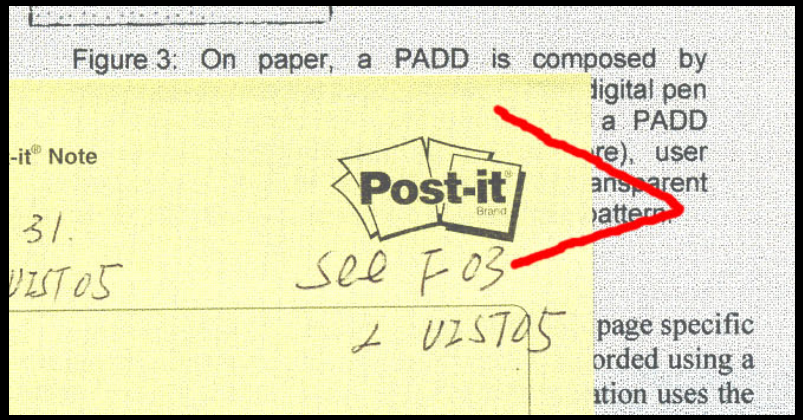


Figure 4: A possible implementation of the stroke collector inspired by Anoto proposed architecture [4]. From left to right: the stroke collector retrieves the strokes from the pen as well as the page ID on which they were created. The stroke collector retrieves the name of the document database managing this page ID using the Paper Look-up Service. It can then contact the database directly to merges the imported strokes with the PADD.



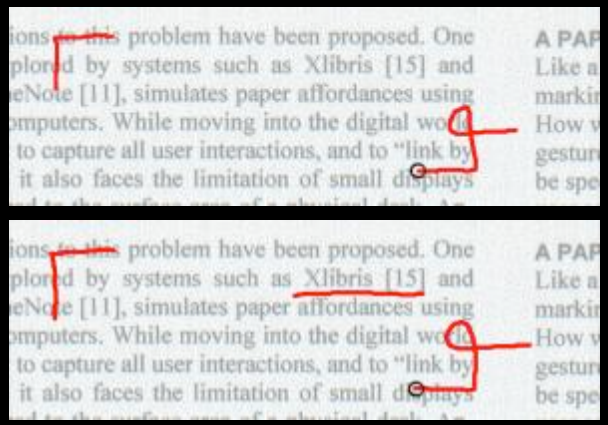
Stitching [Hinckley et al. 04]

Basic commands

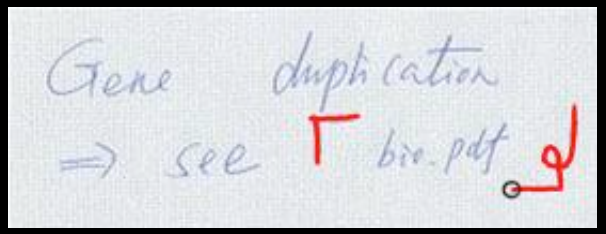
Document 1

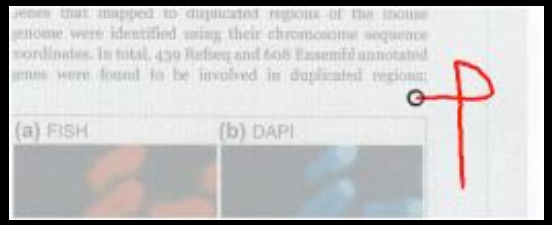
Document 2

Excerption

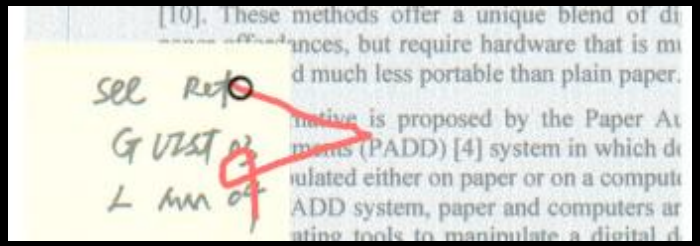


Hyper-linking



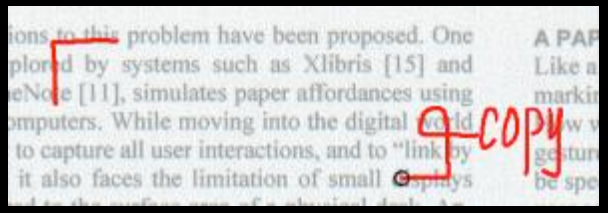


Stitching

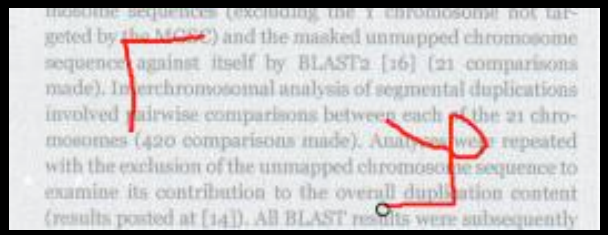


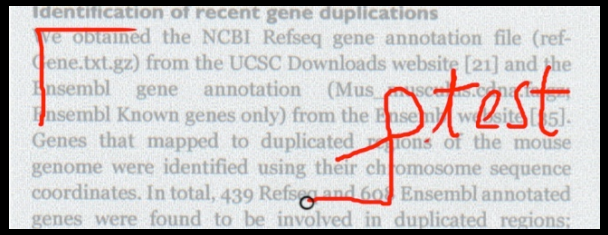
Complex commands

Naming command

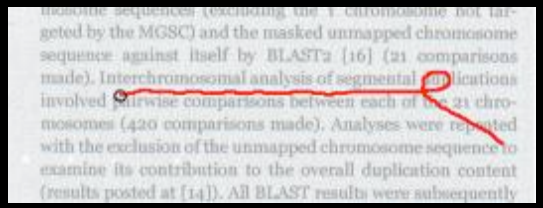


Tagging

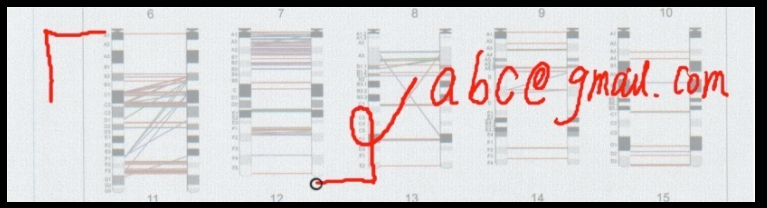




Triggering actions

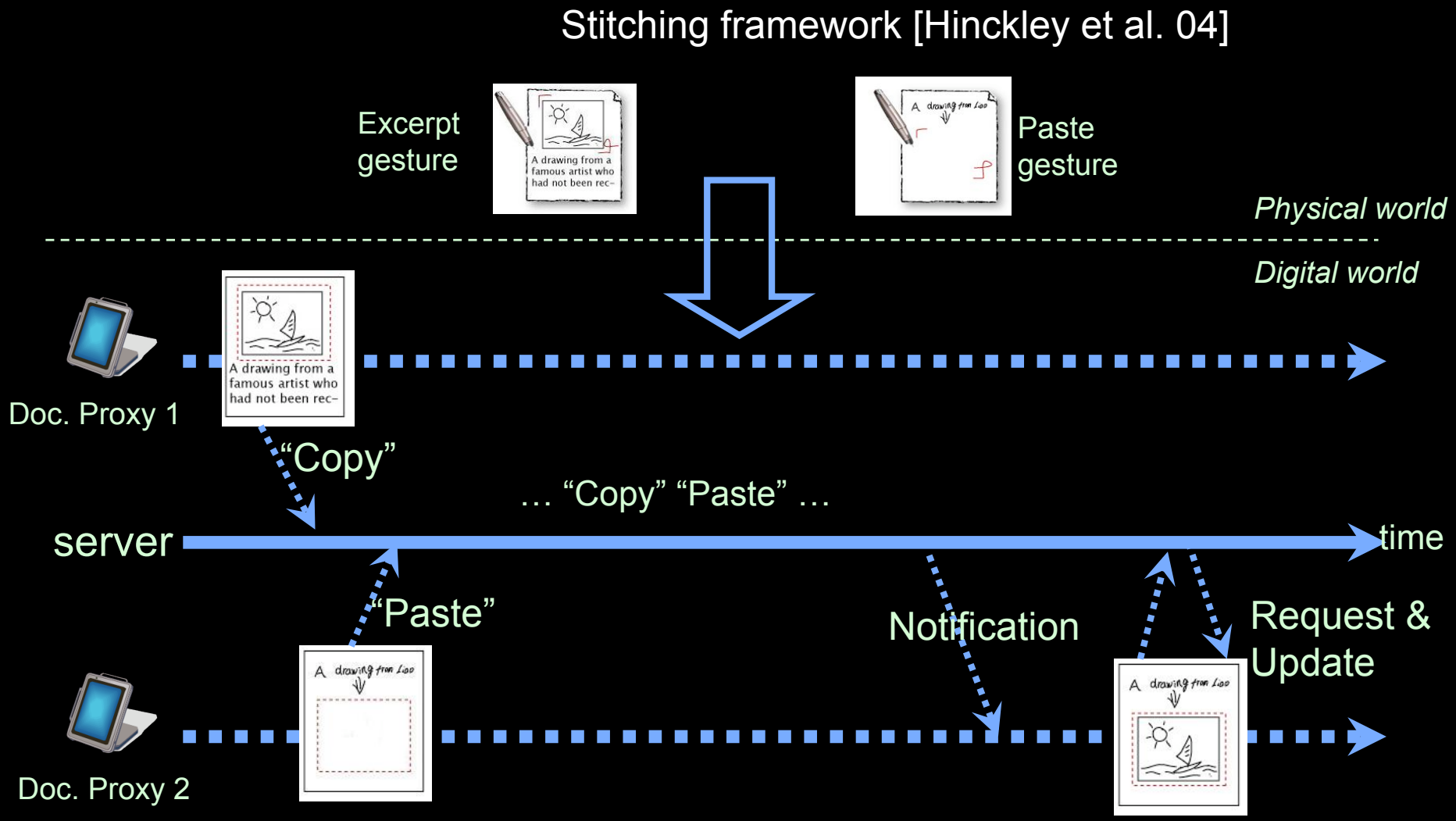


Google



E-mail

Infrastructure for Distributed Interactions



What about errors?

On paper

- Scratch and re-issue

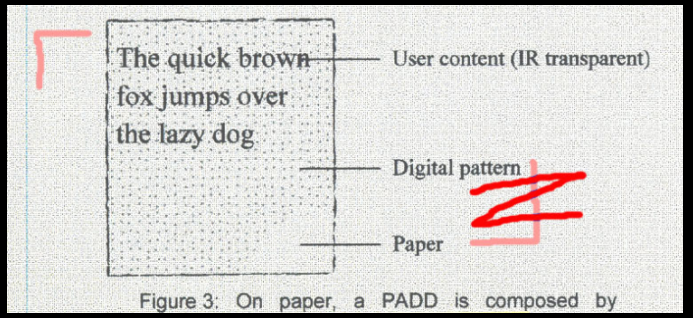


Figure 3: On paper, a PADD is composed by

Feedback is a difficult issue

Users feel uncomfortable!

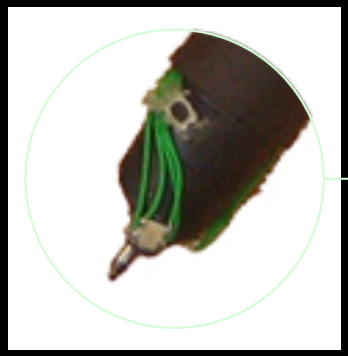
- Unsure about the recognition accuracy
- Unsure about which command to select

A multimodal pen

Liao and Guimbretiere (UIST'06)

Sound provided by a nearby PC

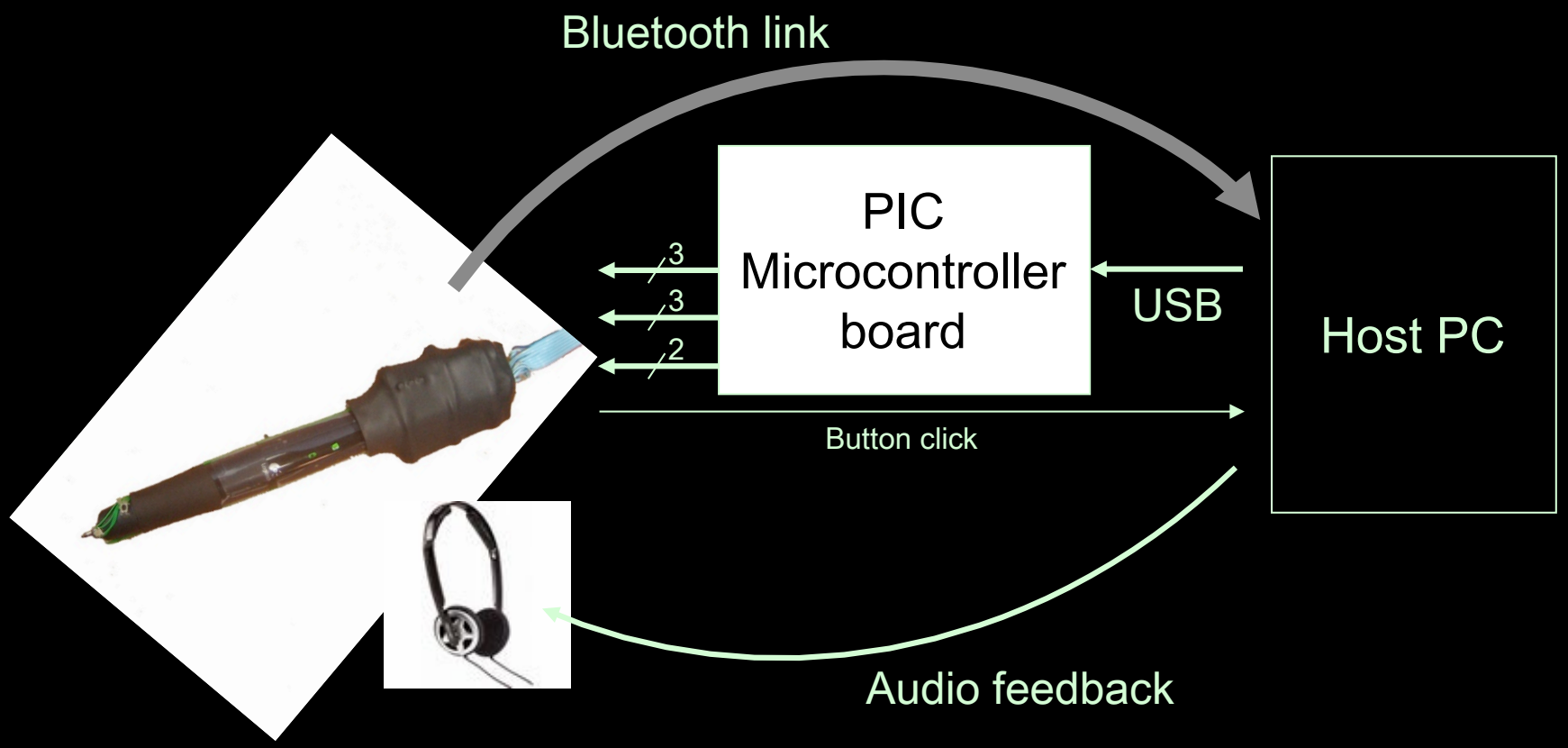
One command button



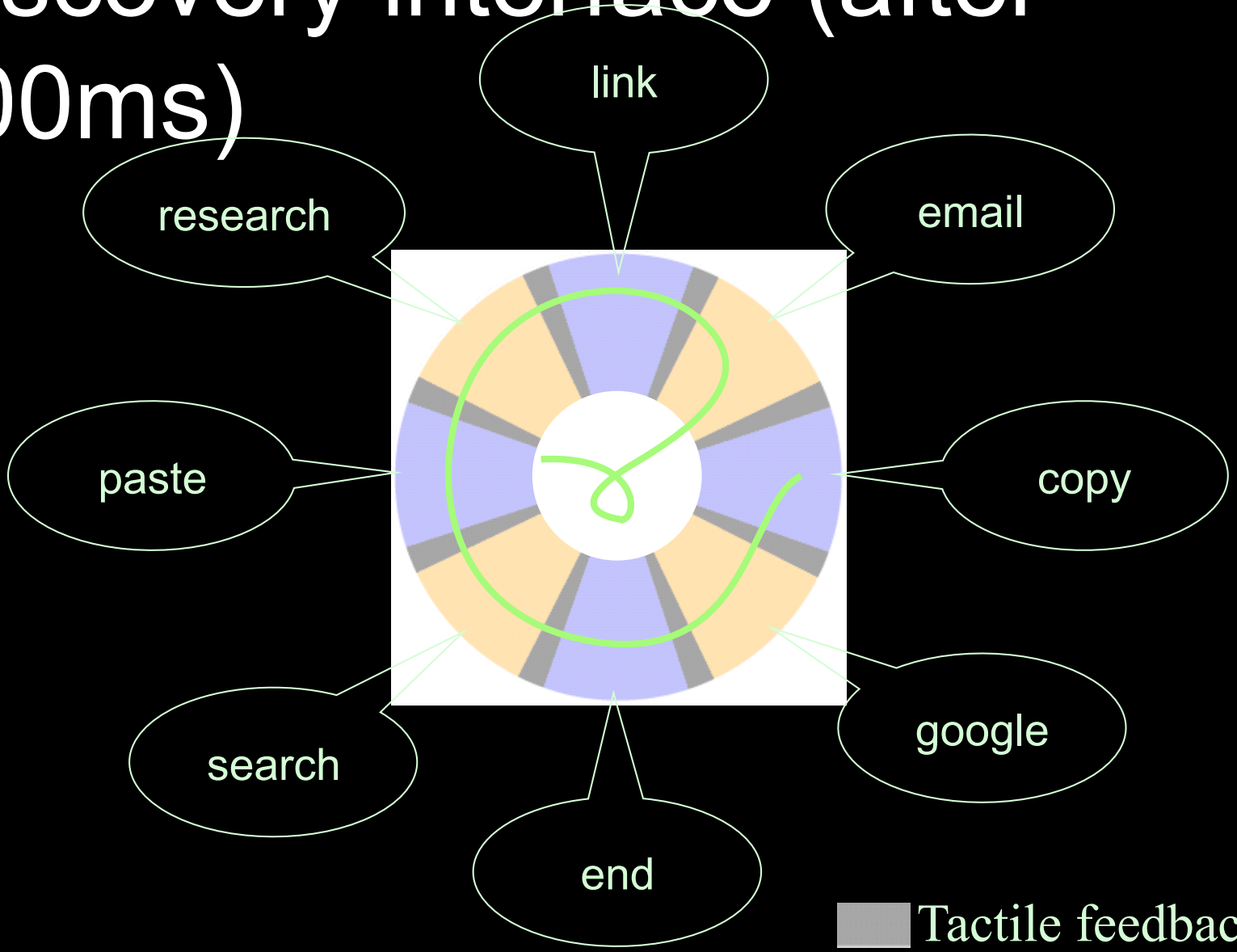
2 Multicolor LED

2 Vibration motors

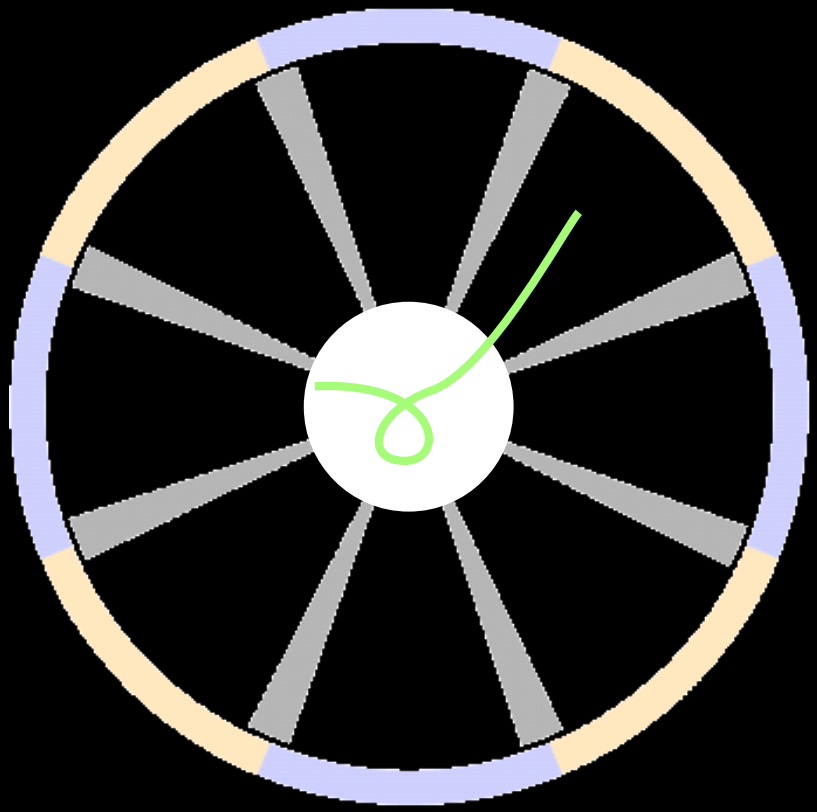
System architecture



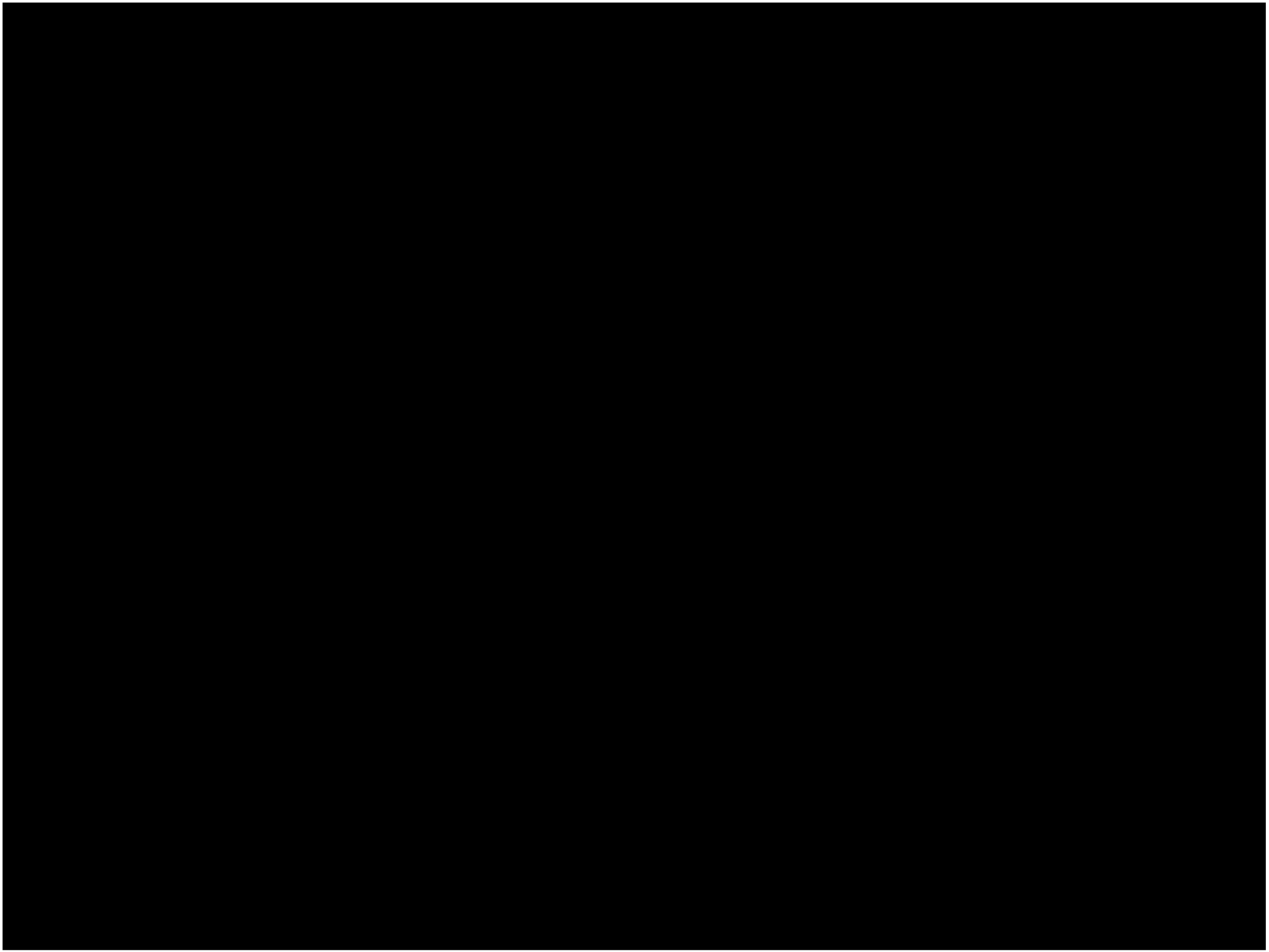
Discovery interface (after 500ms)



Expert interface

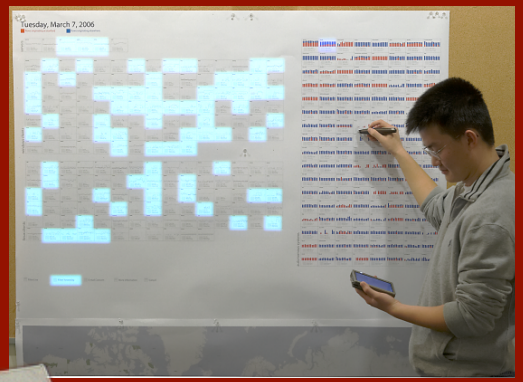


Tactile feedback area



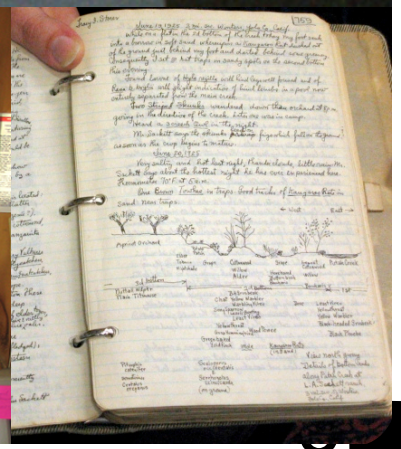
Smart Paper + Digital Tools

for supporting mobility and collaboration

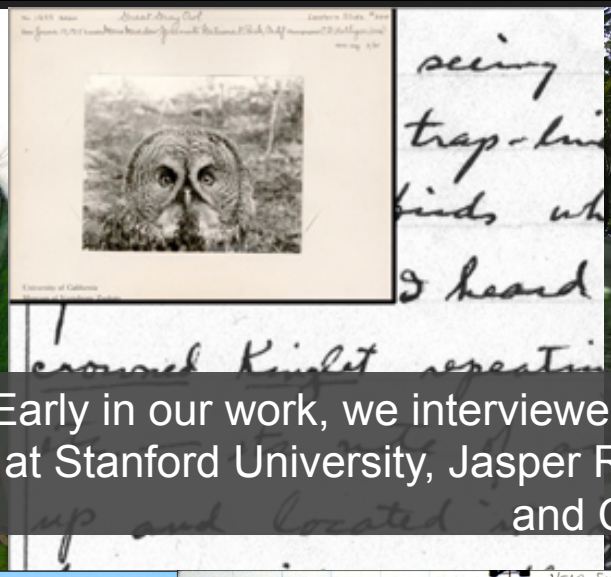


Ron B Yeh
Scott R Klemmer

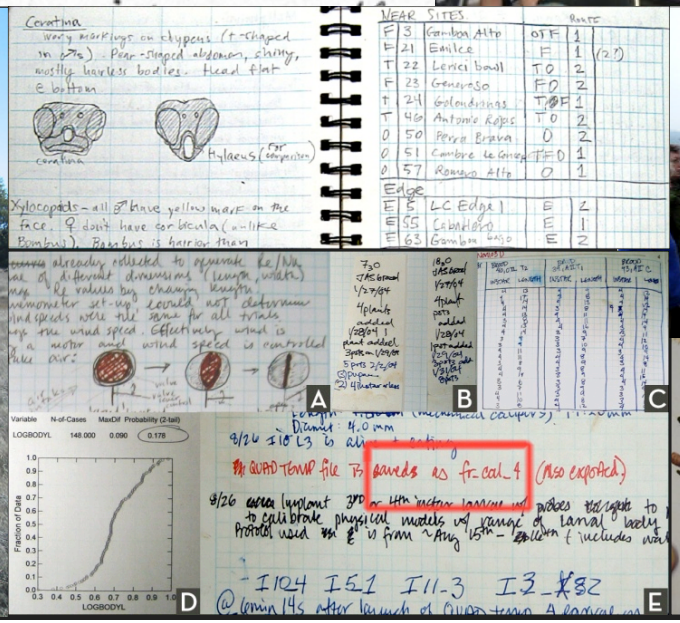
Many domains, including design, biology, and architecture, do not view computers as their primary tools.

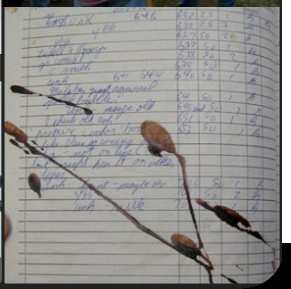


Interviews and Observations



Early in our work, we interviewed and observed biologists at Stanford University, Jasper Ridge Biological Preserve, and Cal Academy of Sciences.



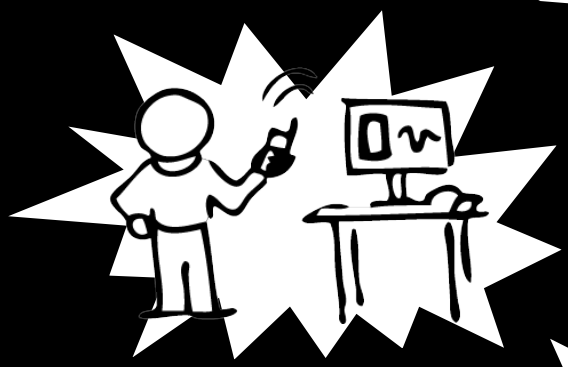


We found that this community used paper notebooks as the central tools for their research, especially in harsh environments such as the rainforest.

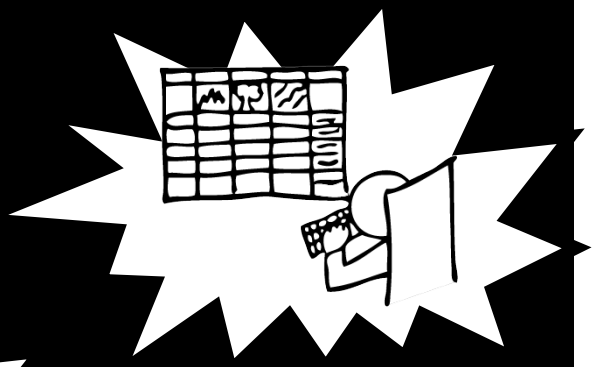
We also observed that…

The process of capturing data is easy, but…

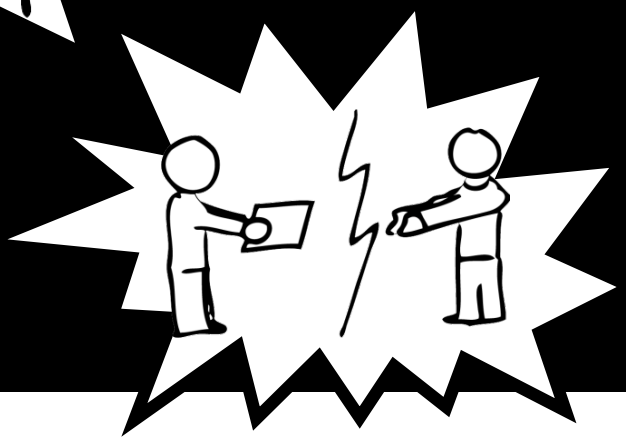
Accessing



Transforming



Sharing



…the data are not.

Paper Centric	Digital
Pens and Pencils	Computers
Paper Notebooks	Cameras
Forms/Datasheet	GPS,GIS, and Sensors
Printers	Spreadsheets and Documents

Of course, biologists also use digital tools for their work. However, the two sides each have their very different advantages.

Clear Difference in Advantages

Paper Notebooks [Robust, ∞ “Battery”, …]

Computers [Search, Storage, Sharing, …]

ButterflyNet

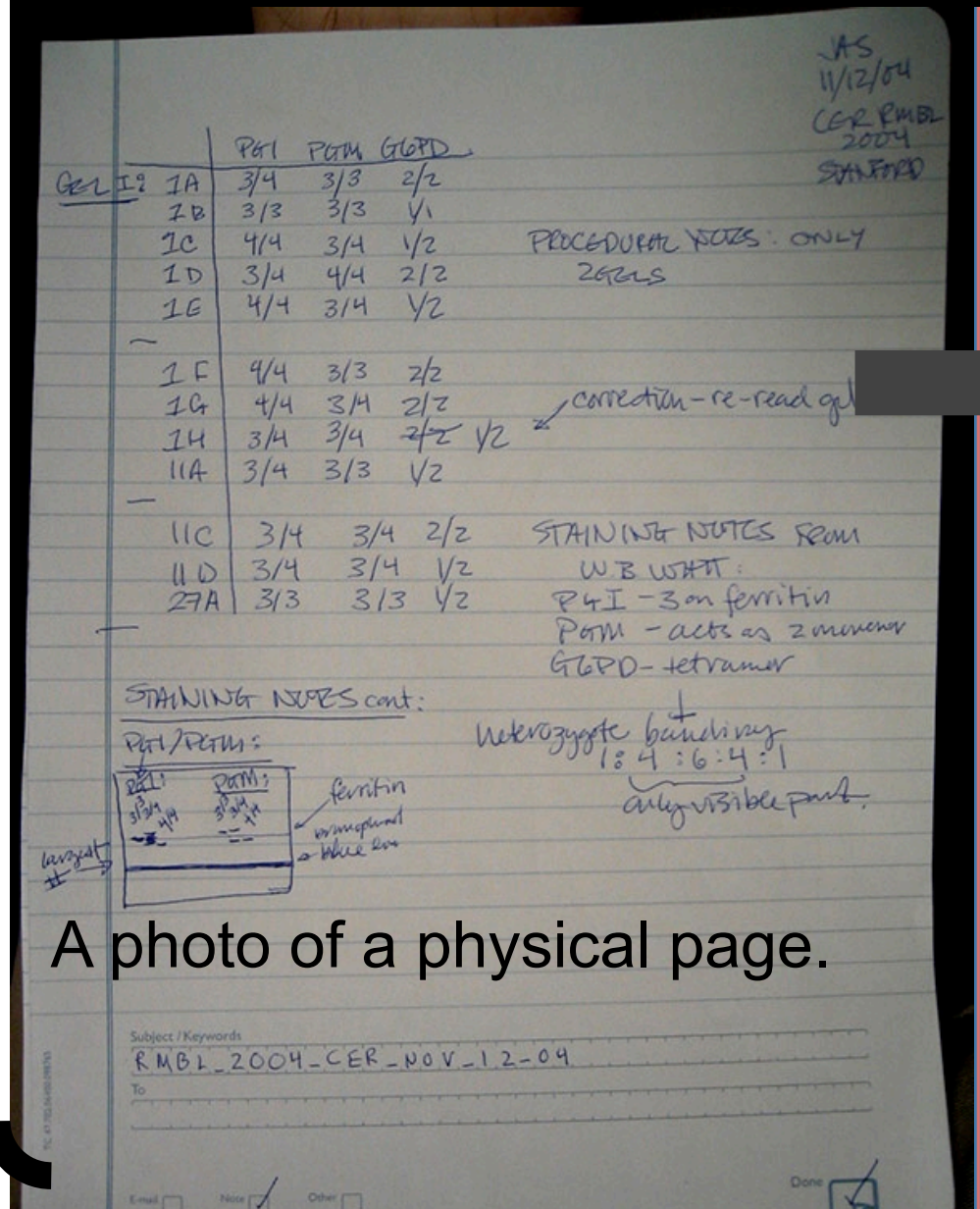
To combine these advantages, we use the Anoto Digital Pen System.

Why Anoto Pens & Notebooks?

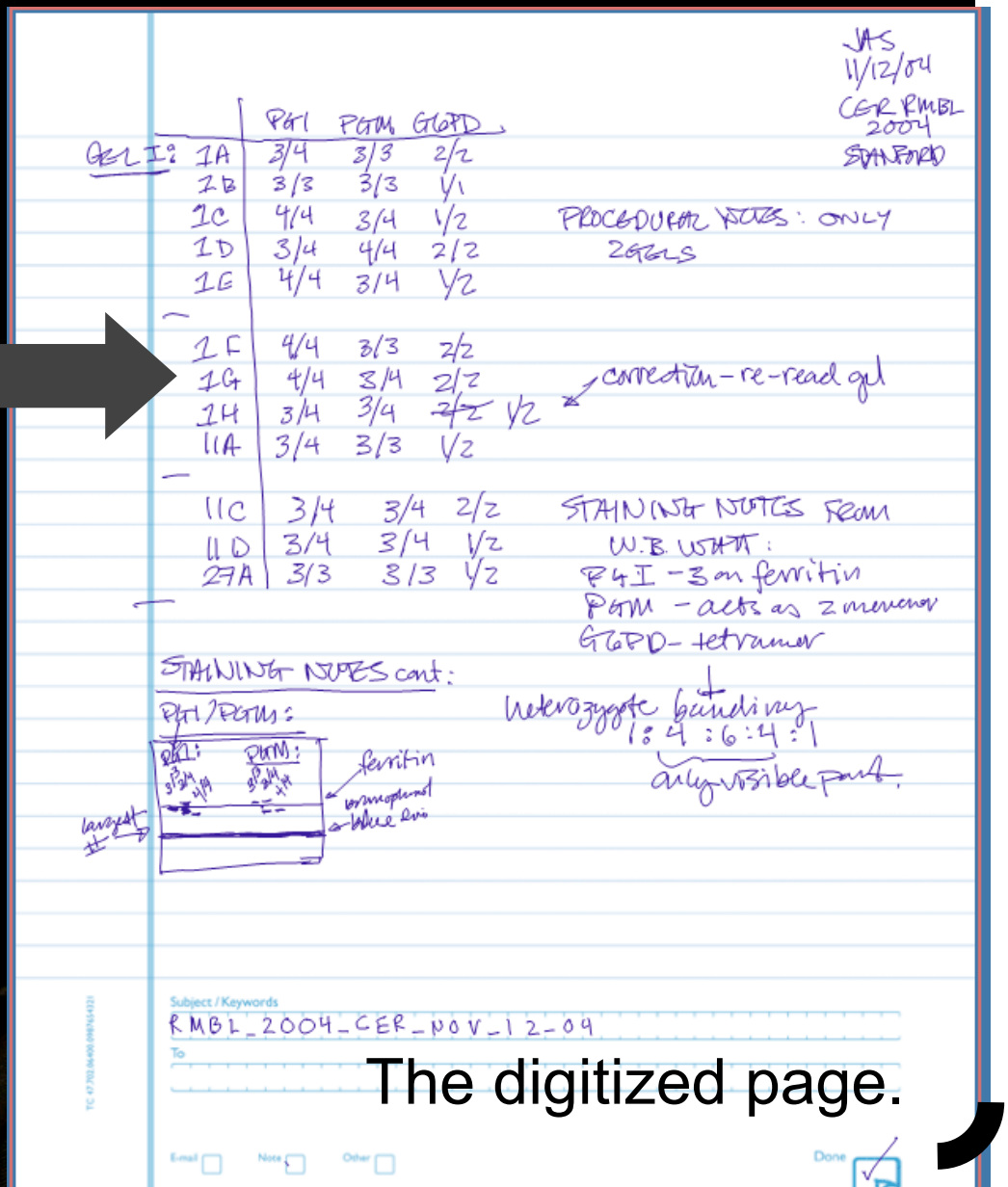
- They Support Existing Practices
- Graceful Degradation in the Field

  The biologist is NEVER worse off than just using regular pen and paper.

Digitizing Pen Technology

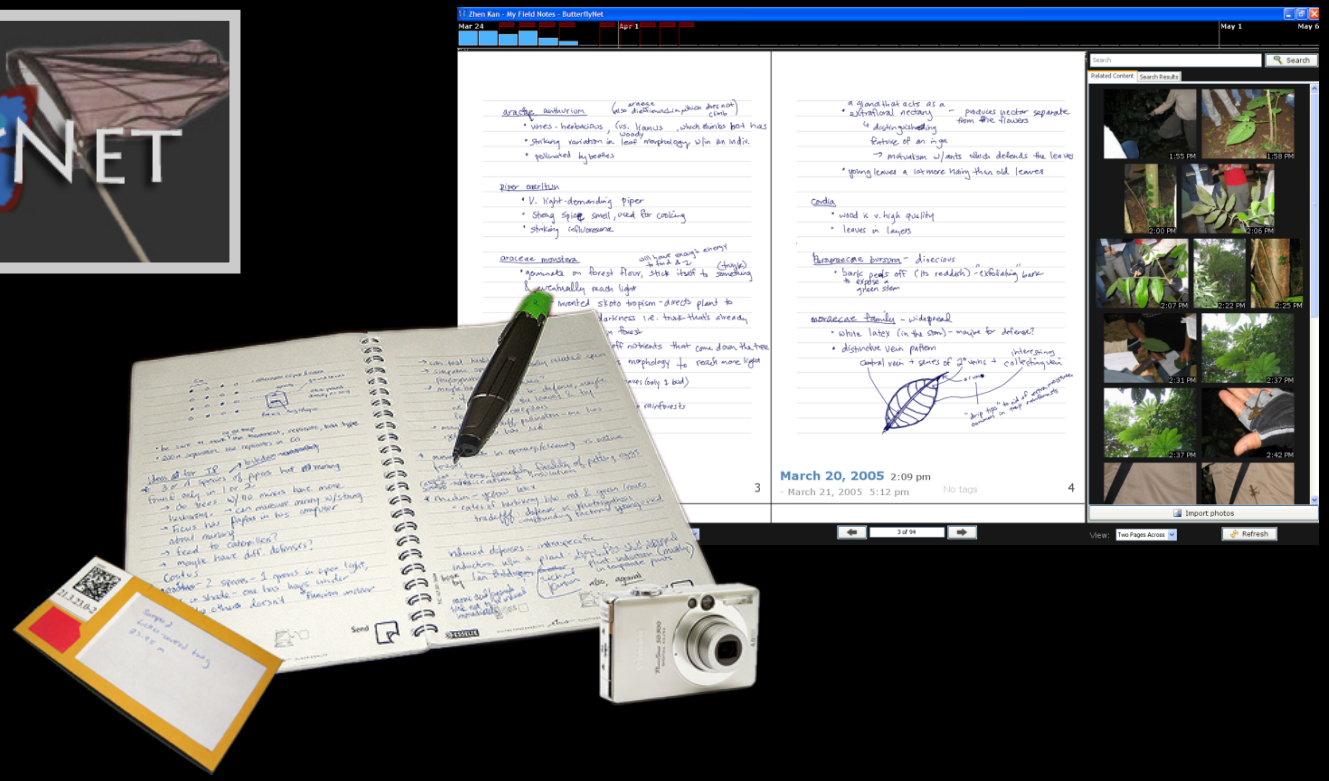


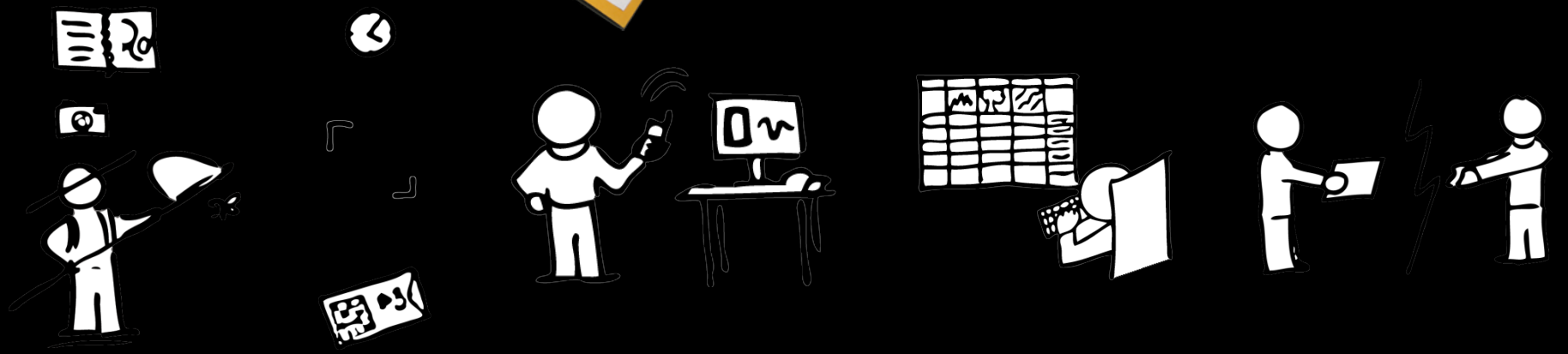
A photo of a physical page.



The digitized page.

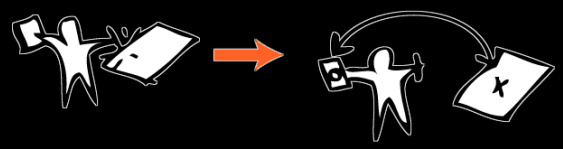
BUTTERFLYNET





Capture Structure Access Transform Share

Automatic Association



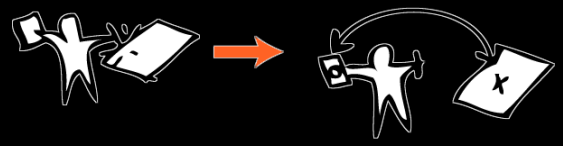
notes @ 4:43pm

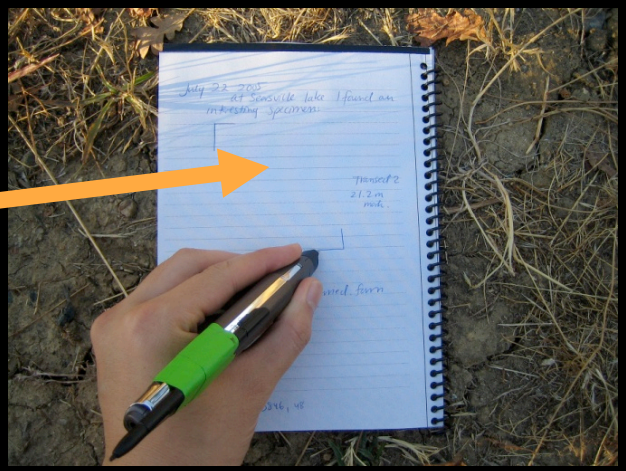
photo @ 4:44pm

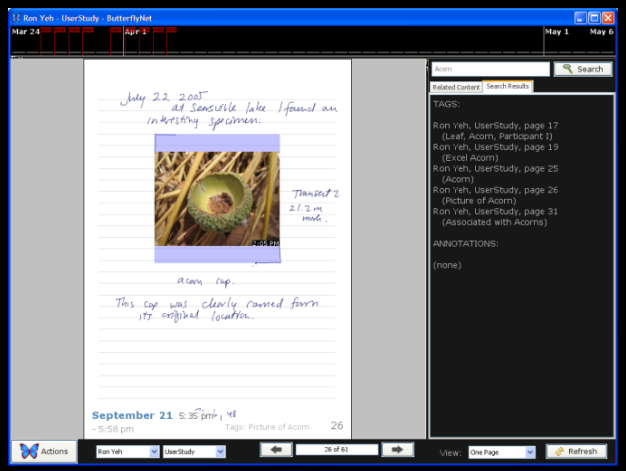
The biologist captures photos and notes as he normally does. The content is automatical associated by the timestamps in the pen and photographs (JPEGs).

Notes + Photos associated by time

Manual Association



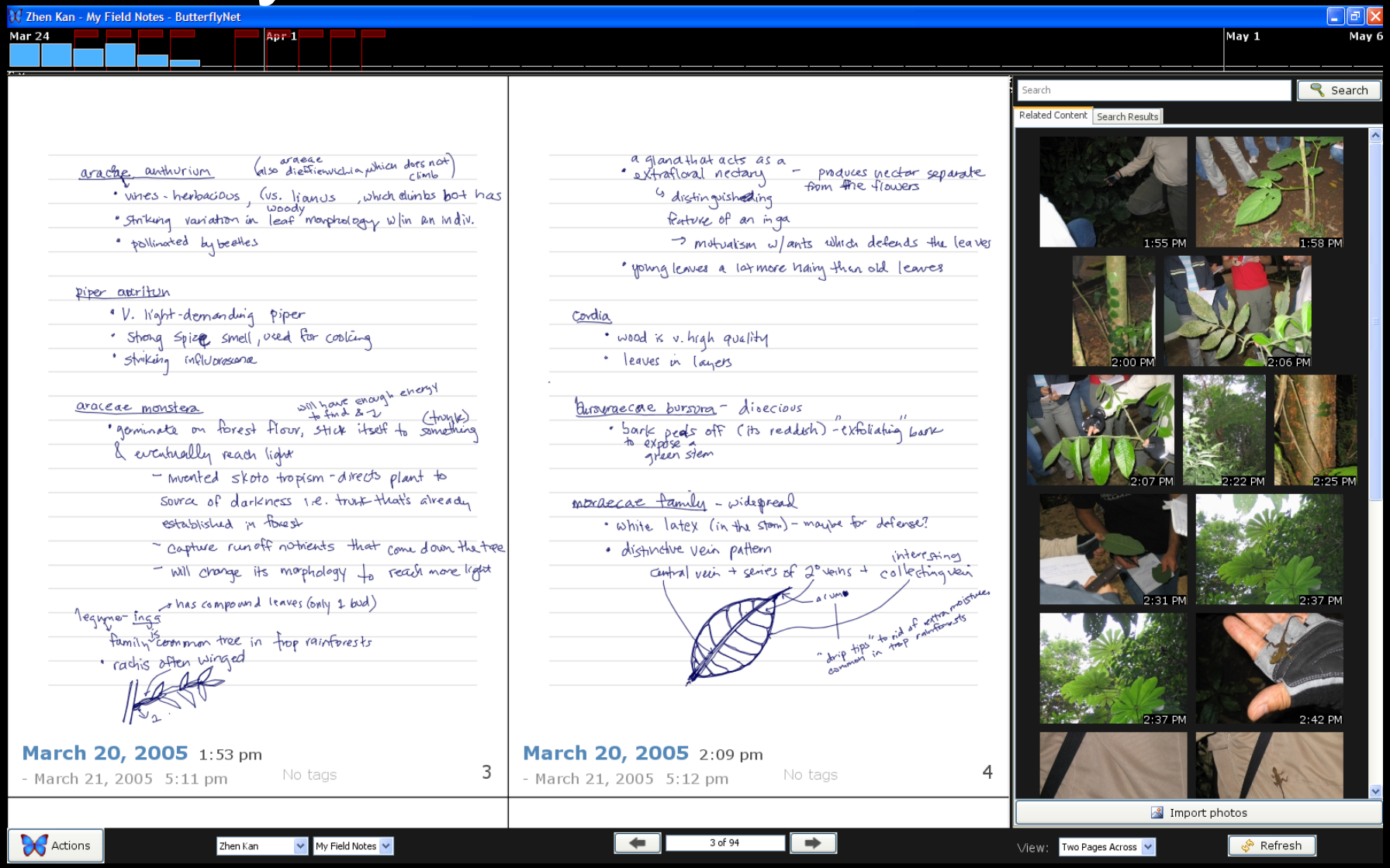




Alternatively, he may take a photo, and draw a box in his notes. This photograph later appears “embedded” in the digitized version of his notes.

Notes + Photos associated by Inked Gesture (Hotspot Gestures)

ButterflyNet Browser



This is the digital browser. As the user flips back and forth in the notes, the photos are automatically updated to show the content MOST related to the current notes. The next several slides show an animation of what this looks like to the user.

Cathy Thompson - Los Tuxtlas - ButterflyNet

Mar 24 | Apr 1 | May 1 | May 6

costus → 2 types here (one is eaten much, one doesn't) → what is the difference → velvety → glaborous

moraceae (figs)
→ white latex, (quickly oozing, dense)
collecting veination pattern
very pointy tips ("acumen") "drip tips"
"actinodromous veination"
latex → waste product, defence

Neotropics vs paleotropics
(NA, SA, CA) (Asia, Africa etc.)

Cecropia (moraceae but new family - (Cecropiaceae)
- ruthis fav.
- very light demanding. needs 600m² gap
- fast growing parasol leaves

Cecropia obtusofolia
→ dioecious

phyllotaxis → very little overlap of leaves.

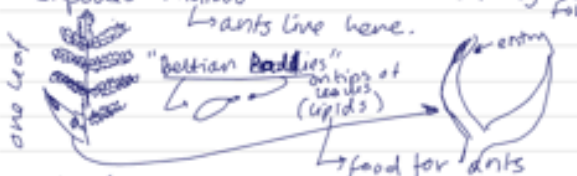
* lizard → dalap → ♂ red neck
anolis ramosi

March 20, 2005 2:31 pm
- March 21, 2005 3:07 pm
No tags
6

piper → monoecious, sassafrass smelling
aduncum → light greedy piper species

Legume
acacia → cornigera → "horns"
→ mutualism (mermyrophily)
ants live in thorns of the acacia
ants defend plant (Dan Jansen)
→ "how to regrow a forest")

Stipules → hollow
→ ants live here.



extra floral nectary → round cup.

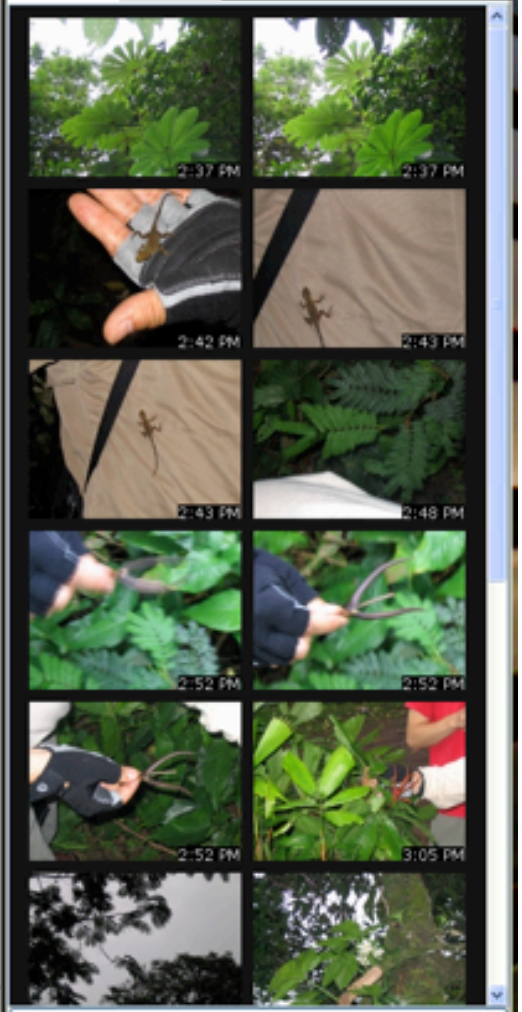
ants → pseudomyrmex sp. (genus) obligates
→ competition btw. ant species.
→ difference in degree of ant defence ability?

ontogenetic → development
plants don't have ants when they are young. what do they do???

Dan Jensen
→ compared ant and non-ant acacia species.
→ non-acacia ant acacia → lots of chemicals

March 20, 2005 2:49 pm
- 4:16 pm
No tags
7

Search | Search
Related Content | Search Results



Import photos

Actions | Cathy Thompson | Los Tuxtlas | 6 of 79 | View: Two Pages Across | Refresh

Cathy Thompson - Los Tuxtlas - ButterflyNet

Mar 24 | Apr 1 | May 1 | May 6

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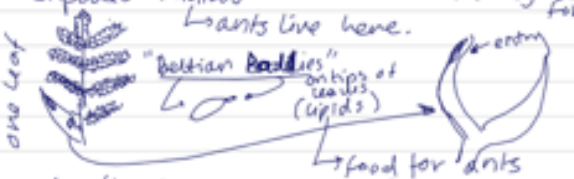

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Dan Janzen
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→ non-associated ant acacia → lots of chemicals

March 20, 2005 2:49 pm
- 4:16 pm
No tags
7

induction → compounds produced when attacked.

arecaceae → rhinhartia gracilis
→ palm, tip herbivory
pre-folliate herbivory makes holes
not from herbivory

can leaf morphology deceive herbivores?
(hypoth) → induction?
→ birds target eaten-looking "natural enemy" plants to find insects
→ probably won't make bad chemicals if it has these other defences.

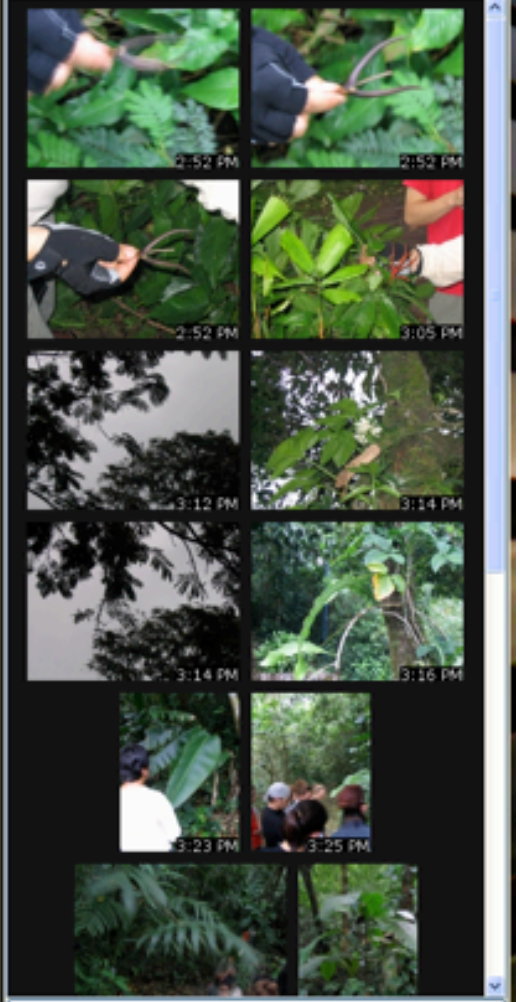
*toucan
→ ramphastos sulfuratus.
almost always find in 2s

~110 sp. orchids here → Catacetum

CAM → cactus (???)
epiphytes → "desert"
epiphyllum

March 20, 2005 3:07 pm
- 3:23 pm
No tags
8

Search
Related Content | Search Results



Import photos

Actions | Cathy Thompson | Los Tuxtlas | 7 of 79 | View: Two Pages Across | Refresh

Cathy Thompson - Los Tuxtlas - ButterflyNet

Mar 24 | Apr 1 | May 1 | May 6

induction → compounds produced when attacked.

arecaceae → Rhinhartia gracilis
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prefoliate herbivory makes holes
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→ ramphastos us Sulfuratus.
almost always find in 2s

~110 sp. orchids here → Catacetum

CAM → cactus (???)
epiphytes → "desert"
epiphyllum

March 20, 2005 3:07 pm
- 3:23 pm
No tags
8

(not woody)
banana → heliconia
→ herbaceous → lamina + petiole, stem below ground

palm - Chamaedorea (~40 sp.)
all dioecious
eaten by one beetle

dioecy
→ principle of resource allocation"
differentiation of resources by sexes.
% total biomass allocated to female sex. → females smaller? slower

"Skeletonizing" → type of herbivory beetles

"galling" → wasps and flies
another herbivory type
insect-change morphogenic structure of leaf (when it's young)

Paulsenia armata
→ galled tree, important in canopy → sapindaceae

March 20, 2005 3:27 pm
- 3:43 pm
No tags
9

3/21/05
Los Tuxtlas FS

Search
Search
Related Content | Search Results

Import photos

Actions | Cathy Thompson | Los Tuxtlas | 8 of 79 | View: Two Pages Across | Refresh

Ron Yeh - UserStudy - ButterflyNet

Mar 24 | Apr 1 | May 1 | May 6

July 22 2005
at Searsville lake I found an interesting specimen:

Transect 2
21.2 m mark.

acorn cap.

This cap was clearly ramed. from its original location.

September 21 5:35 pm - 5:58 pm

Tags: Picture of Acorn

26

The results of the Hotspot Association.

Acorn | Search

Related Content | Search Results

TAGS:

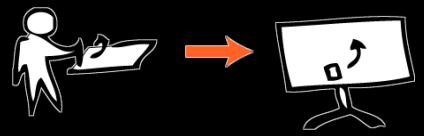
Ron Yeh, UserStudy, page 17
(Leaf, Acorn, Participant I)
Ron Yeh, UserStudy, page 19
(Excel Acorn)
Ron Yeh, UserStudy, page 25
(Acorn)
Ron Yeh, UserStudy, page 26
(Picture of Acorn)
Ron Yeh, UserStudy, page 31
(Associated with Acorns)

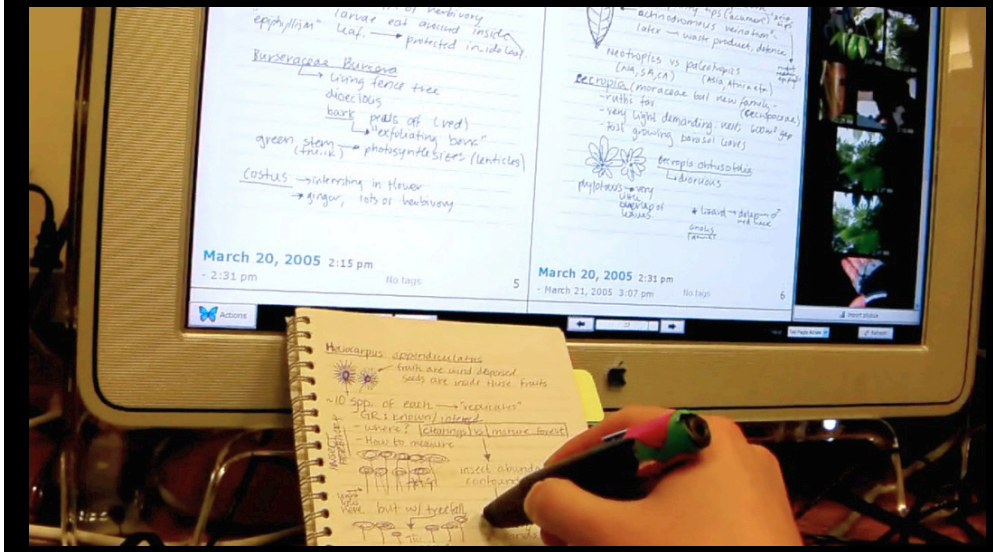
ANNOTATIONS:

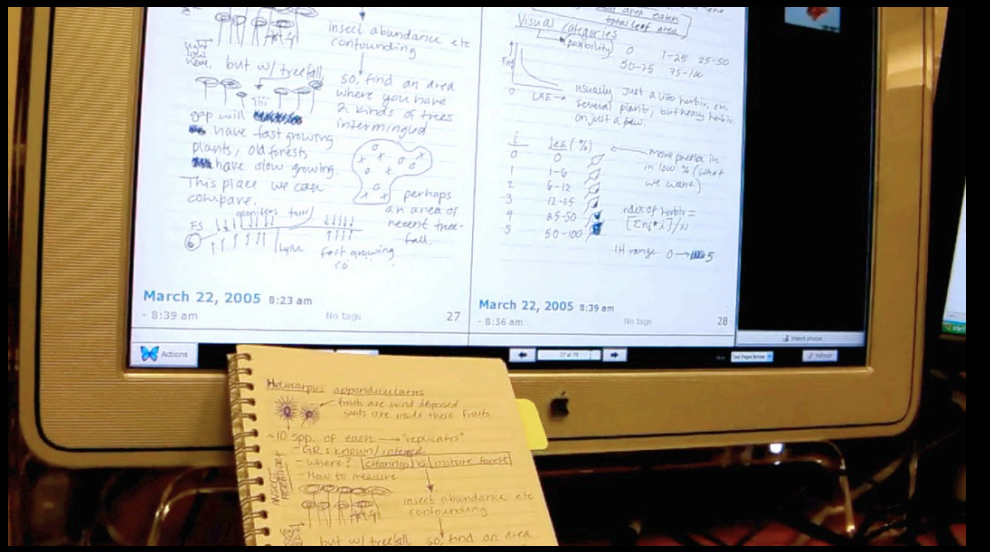
(none)

Actions | Ron Yeh | UserStudy | 26 of 61 | View: One Page | Refresh

Navigate by Pen





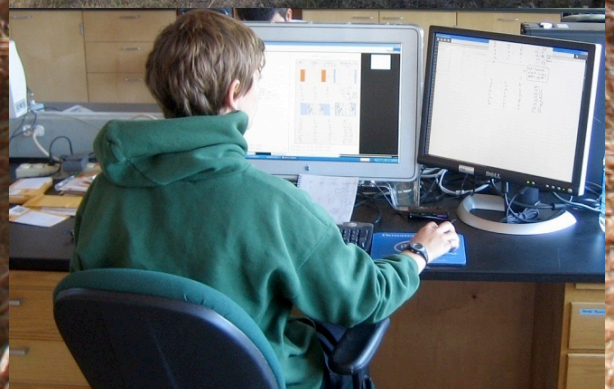


Browse using the Physical Notebook

The pen talk to your computer in real-time. If the biologist taps on his notes, ButterflyNet can flip to the right page. Thus, you can search by using the physical artifact.

A First-Use Study

A first-used study with field biologists. Each session included a tutorial of the tools, and tasks that took place in the field and in the lab.



Requests

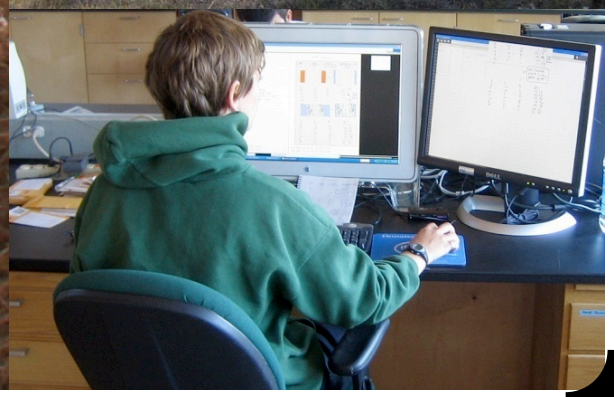
Handwriting Recognition

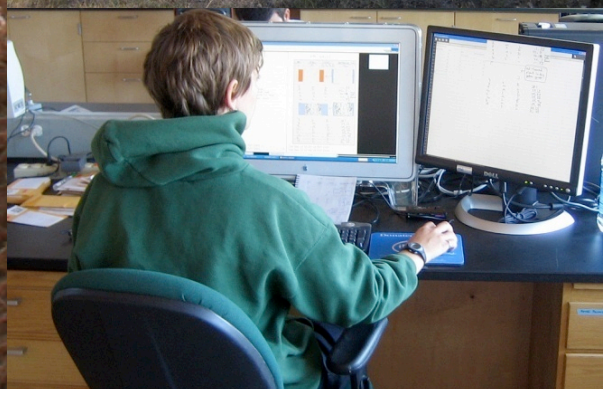
GPS Integration

Support for audio & other content types

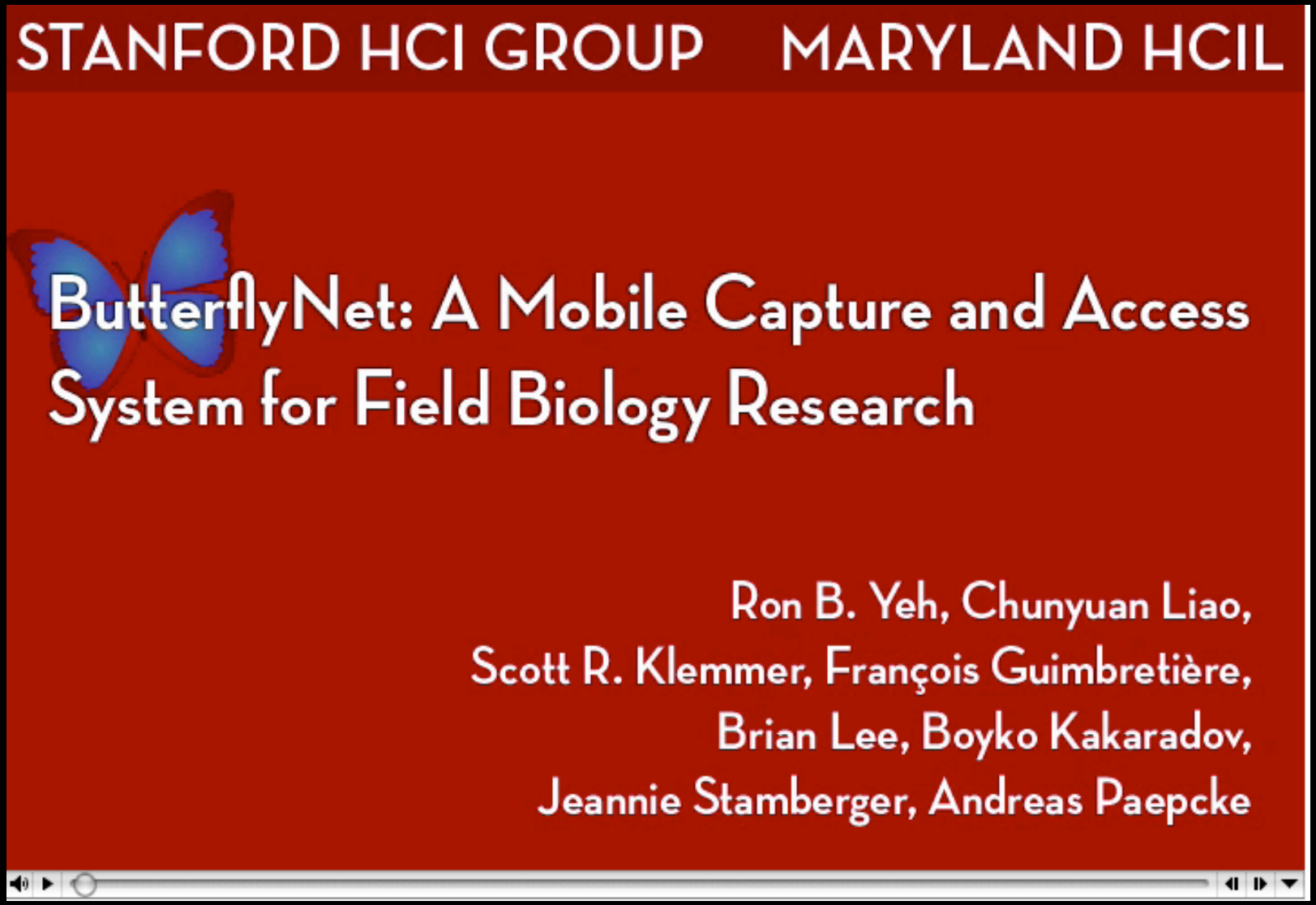
Dislikes

Bulky Pen





ButterflyNet Video



Back to the classroom. Instead of supporting field biology, tools like ButterflyNet can also support designers!

Starting from ButterflyNet, we have now built up the iDeas Learning Ecology, to help designers take advantage of both digital tools and the more traditional physical tools.

iDeas Learning Ecology

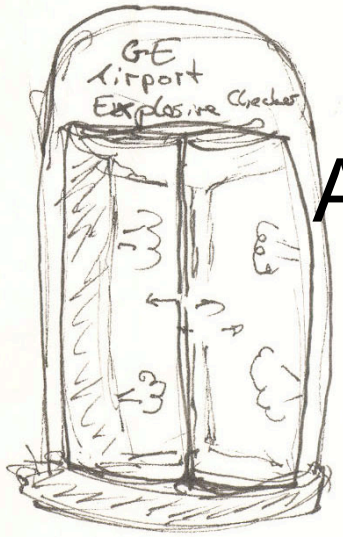
goal: fluidly integrate technologies into existing design practices

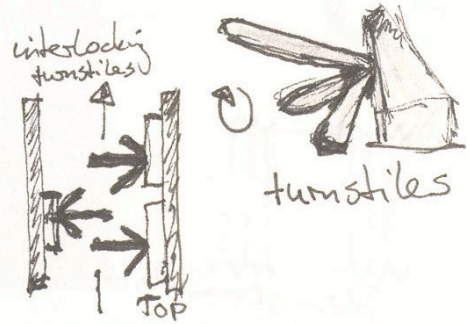
- Allow designers to take advantage of affordances in the digital world while preserving advantages of the physical world

goal: enhance design thinking with these technologies

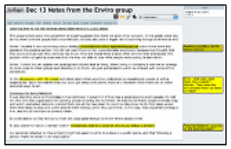
- Increase visibility of design, sharing of design artifacts, documentation, peer discussion…

A design student's idea log.



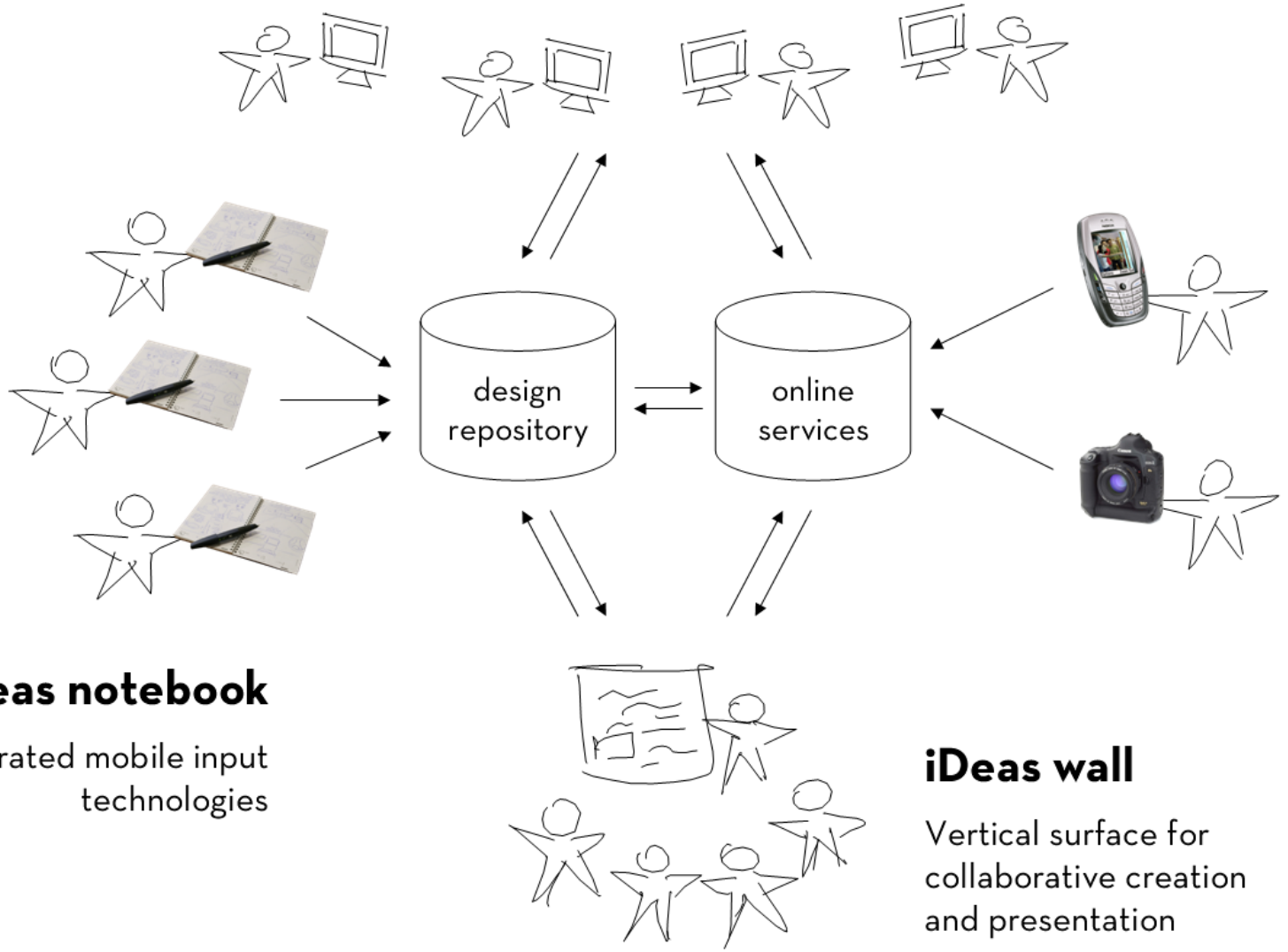


iDeas browser



Digital browsers for text (Wiki)
and sketch (ButterflyNet) design content

Search, browse, annotate, share



iDeas notebook

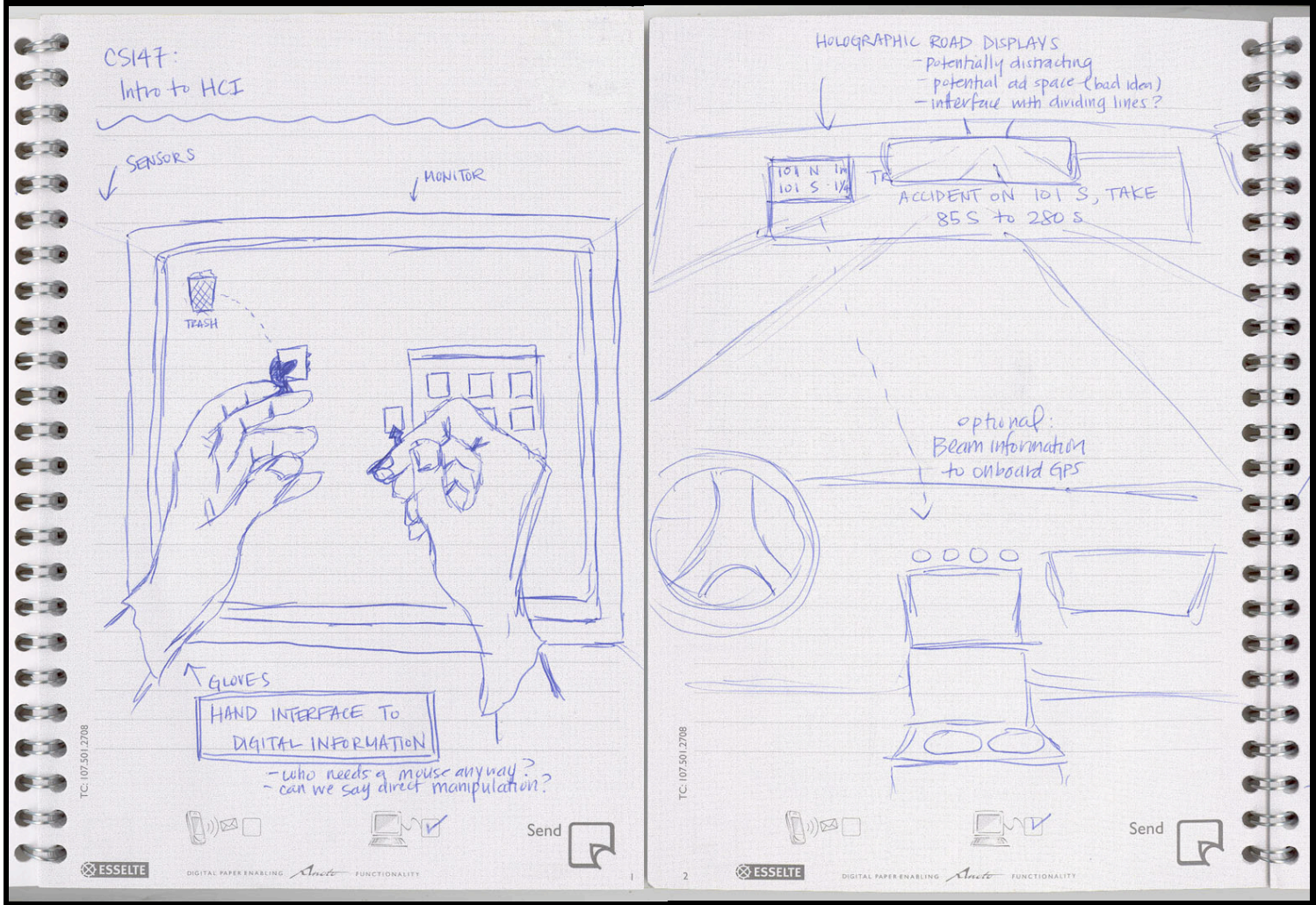
Integrated mobile input
technologies

iDeas wall

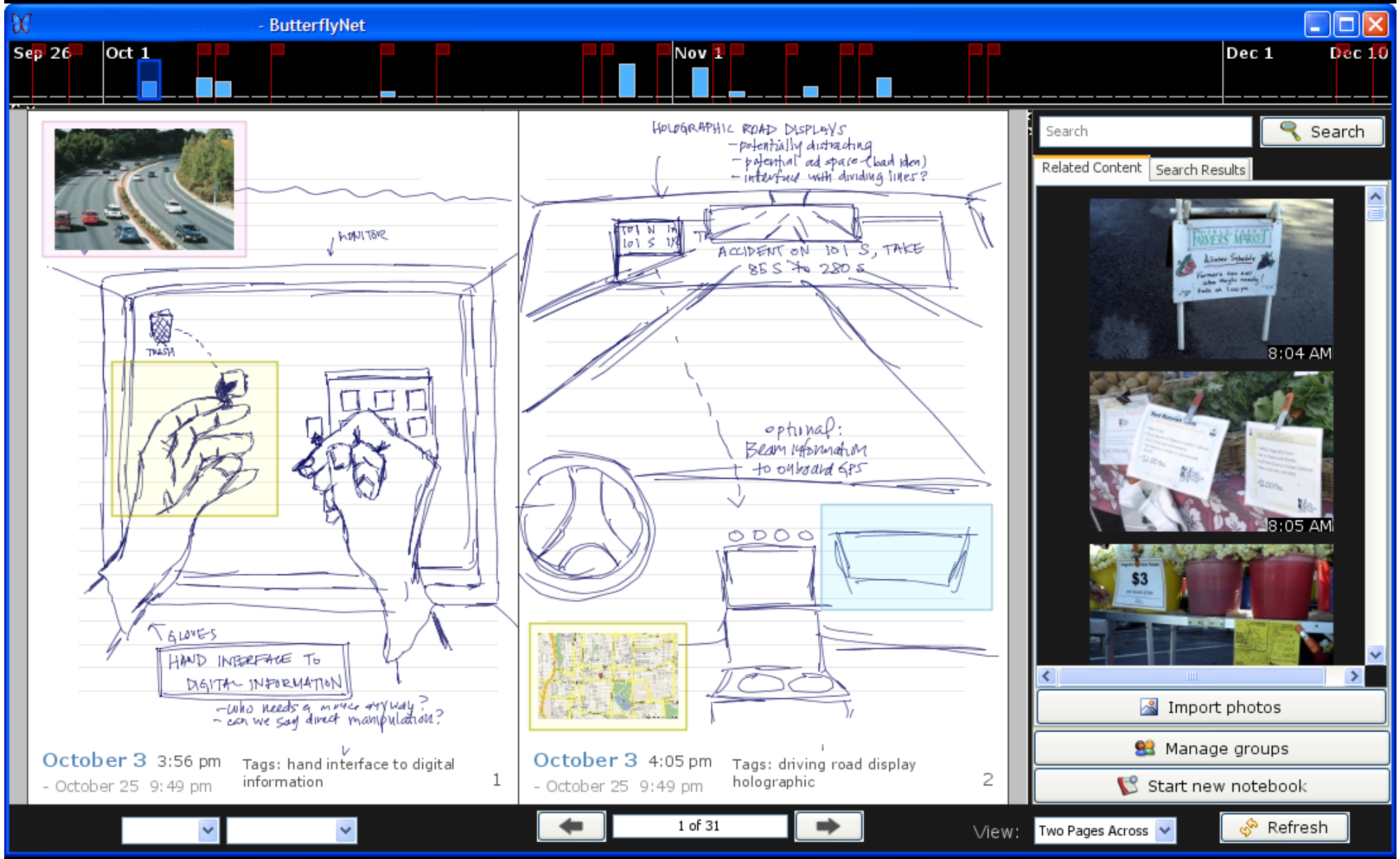
Vertical surface for
collaborative creation
and presentation

Wait! You cannot do this with a regular notebook… because they are two sides of the

same exact page!



Trivial with a digital notebook. ☺



The Next Step: From One to Many

Group notebooks

- Since designers work in groups, they would like to have a view of a group notebook (think wiki for digital notes)

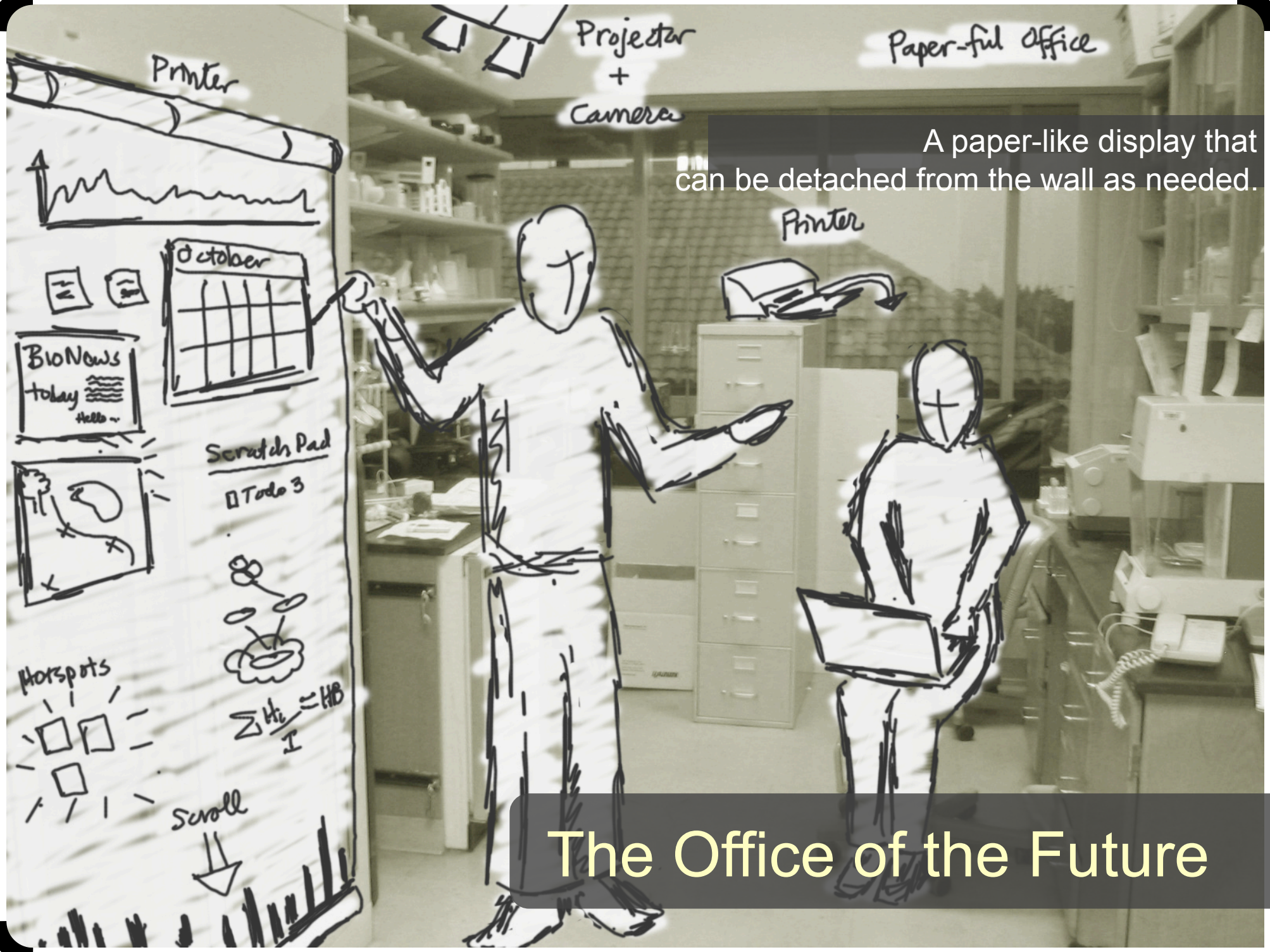
Whiteboards & Implicit Interactions

- When working in a group, designers also use whiteboards to brainstorm. How can we augment these tools?

Adaptive Interfaces

- How can we leverage model-based interfaces to automatically present data from multiple users to a person who is browsing digital notes?

What are GIGAprints?



A paper-like display that can be detached from the wall as needed.

The Office of the Future

Photo Wall

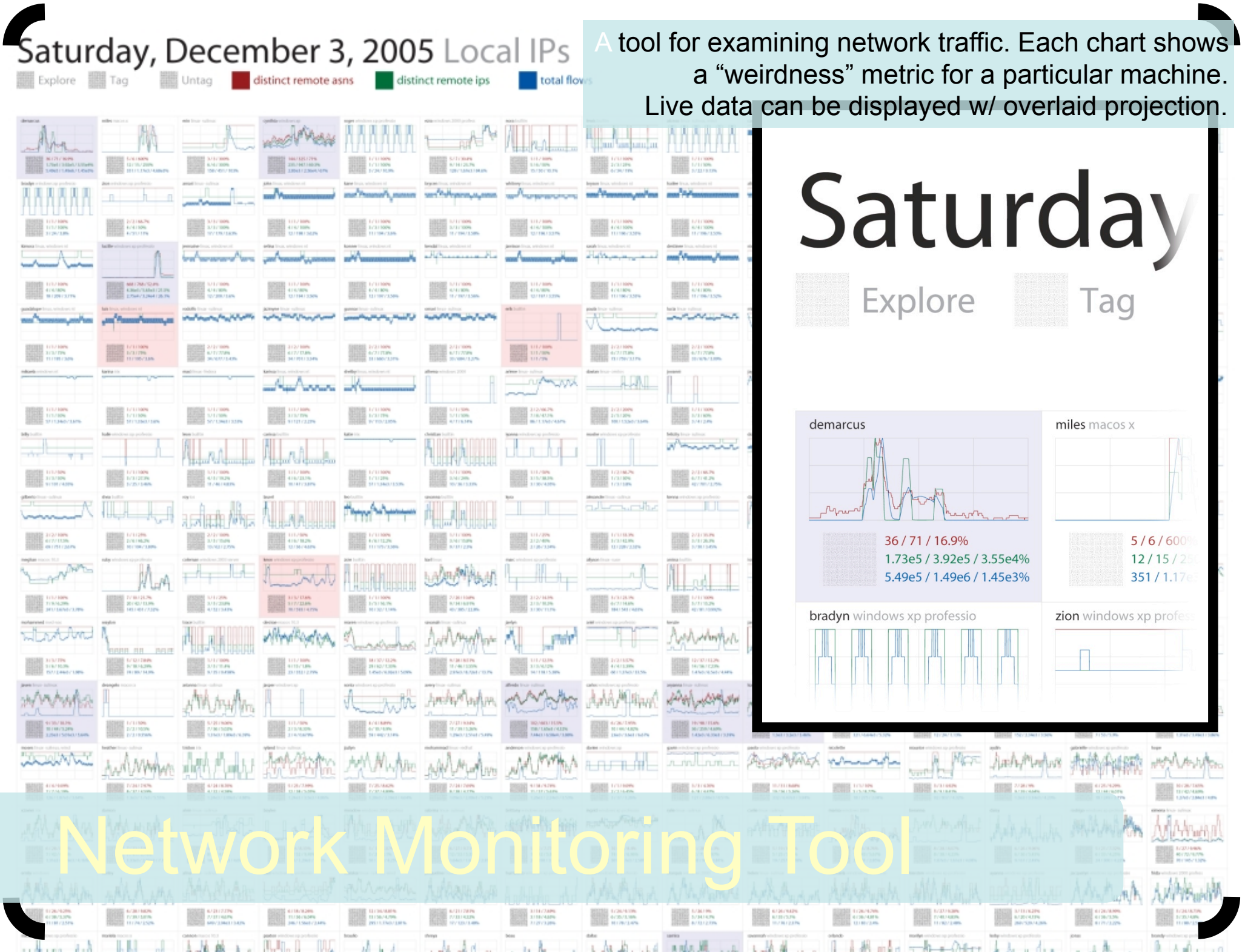
The user taps on a paper “button” underneath a photograph to retrieve it to his handheld.

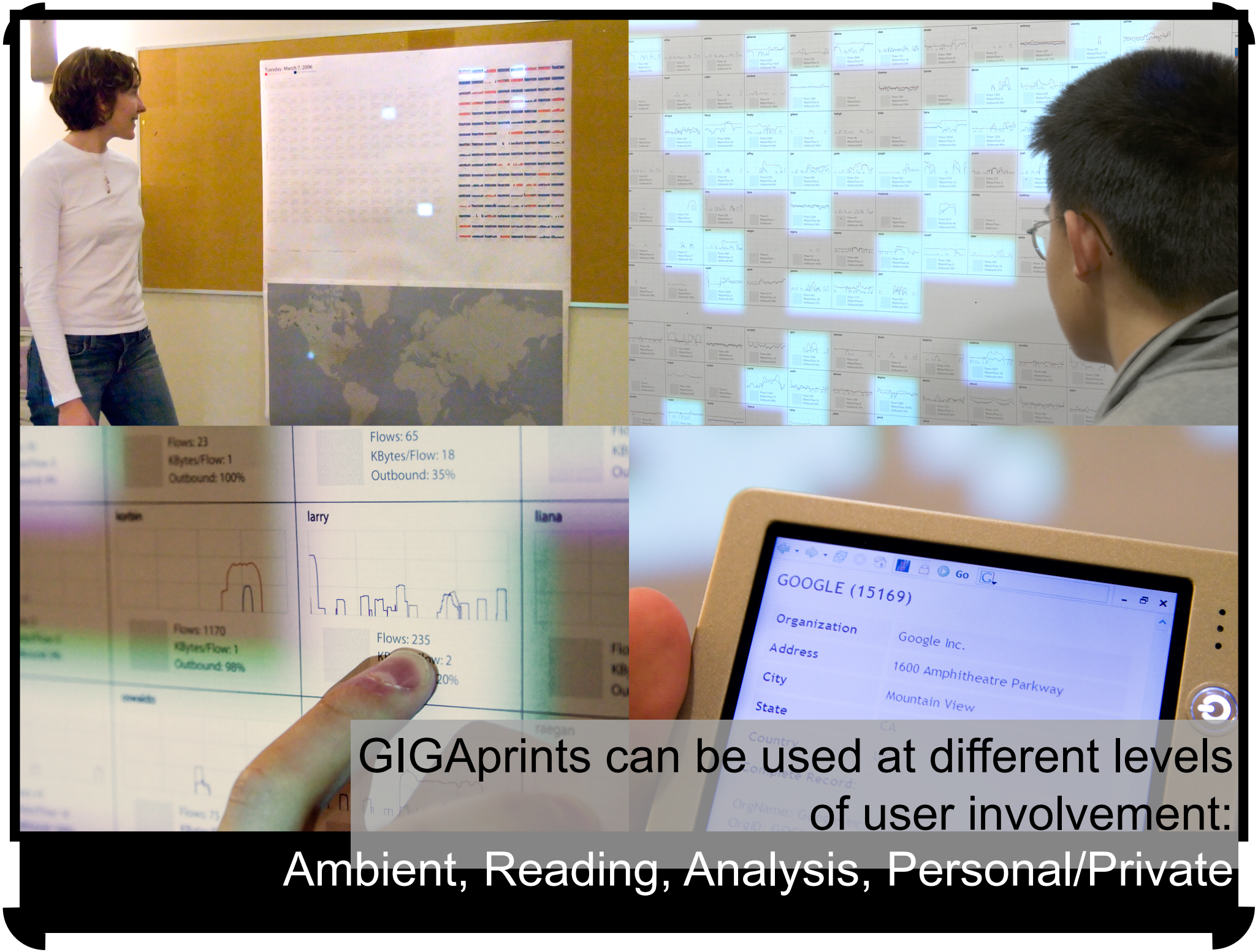
Download Photographs

Map-Based Queries

The user circles a region on a map to retrieve geo-tagged photographs on his handheld.

Search for Photographs


Saturday, December 3, 2005 Local IPs
Explore
Tag
Untag
distinct remote asns
distinct remote ips
total flow
A tool for examining network traffic. Each chart shows a “weirdness” metric for a particular machine.
Live data can be displayed w/ overlaid projection.
Saturday
Explore
Tag
demarcus
36 / 71 / 16.9%
1.73e5 / 3.92e5 / 3.55e4%
5.49e5 / 1.49e6 / 1.45e3%
miles macos x
5 / 6 / 600%
12 / 15 / 25
351 / 1.17e
bradyn windows xp professio
zion windows xp profes
Network Monitoring Tool

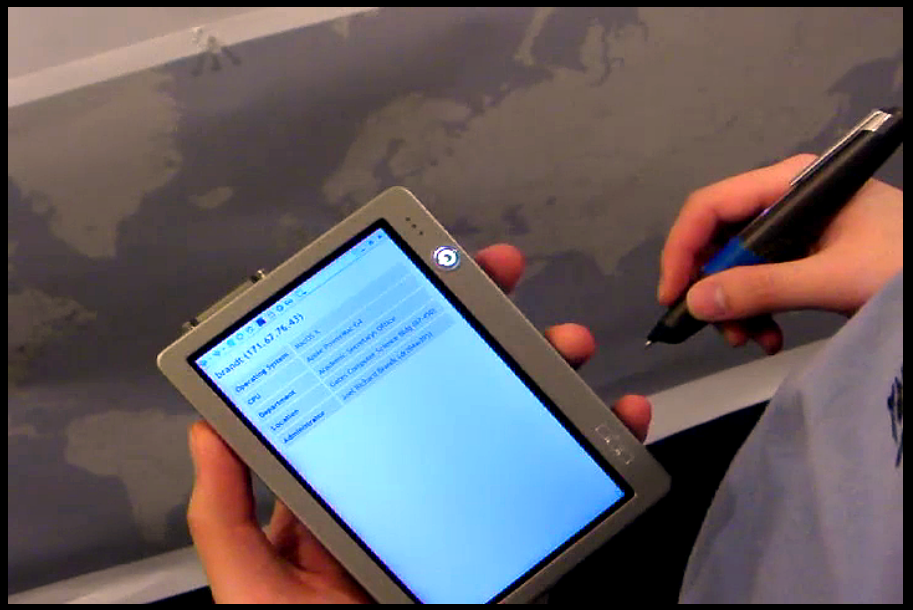


GIGAprints can be used at different levels of user involvement:

Ambient, Reading, Analysis, Personal/Private

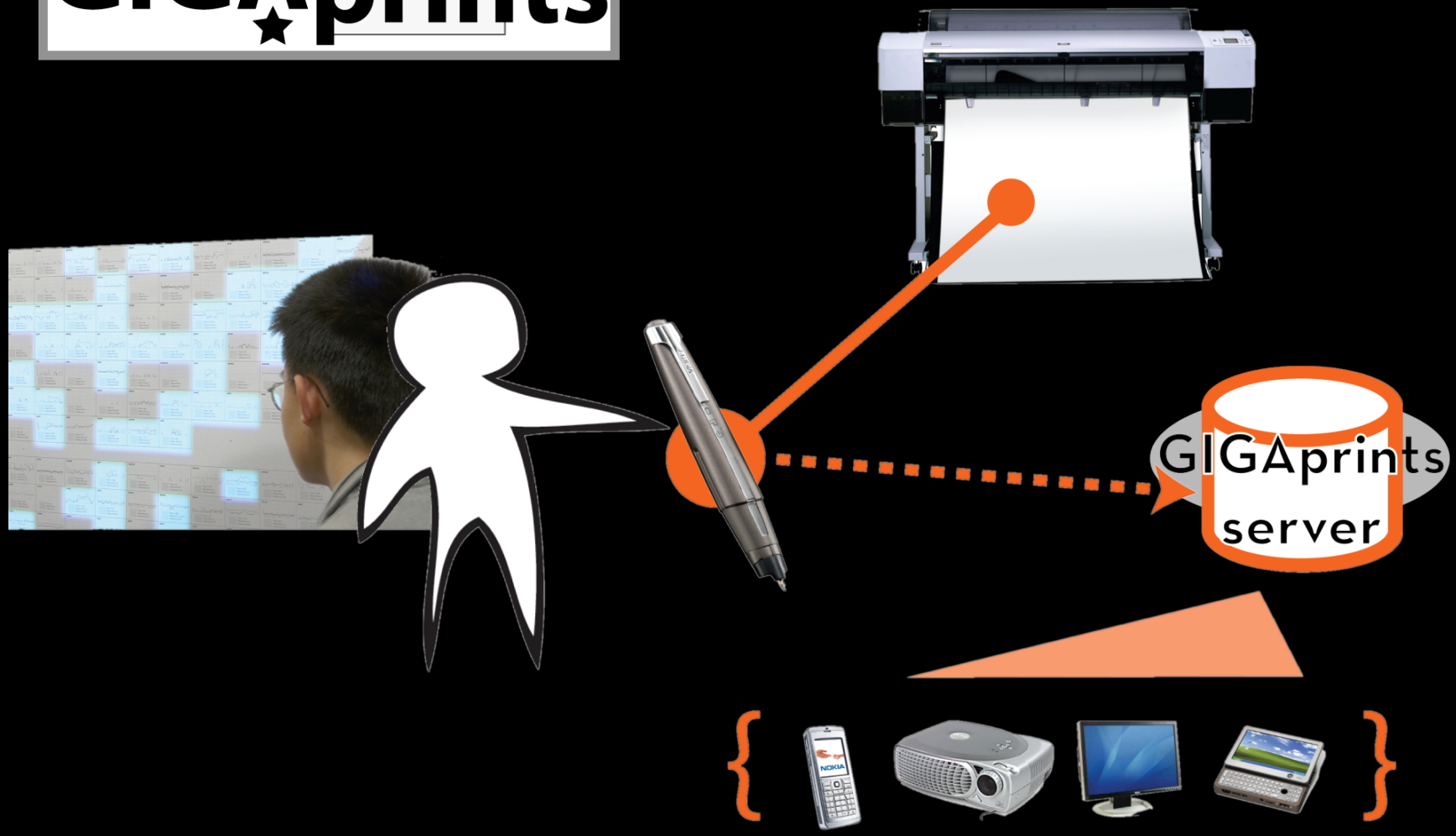
Retrieve Data

Retrieve data by tapping on a chart with the digital pen.
Private information can be sent to the user's handheld.

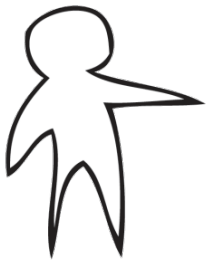


Progressive Information Disclosure

GIGAprints



Achieve benefits of both Paper + Digital…
by using Paper + Devices in concert.







GIGAprints

STANFORD HCI GROUP

Interactive Gigapixel Prints (GIGAprints)

Large, Paper-Based Interfaces for Visual Context and Collaboration

Ron Yeh

Joel Brandt

Jonas Boli

Scott Klemmer

Recent Ph.D. System: Nadir Weibel

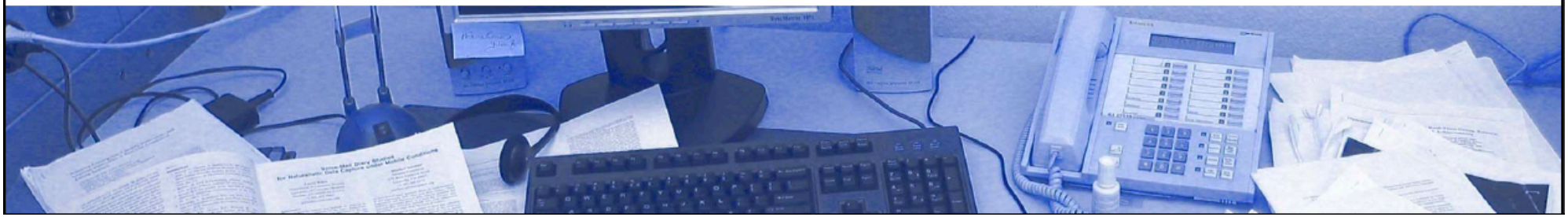
ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

A Publishing Infrastructure for Interactive Paper Documents

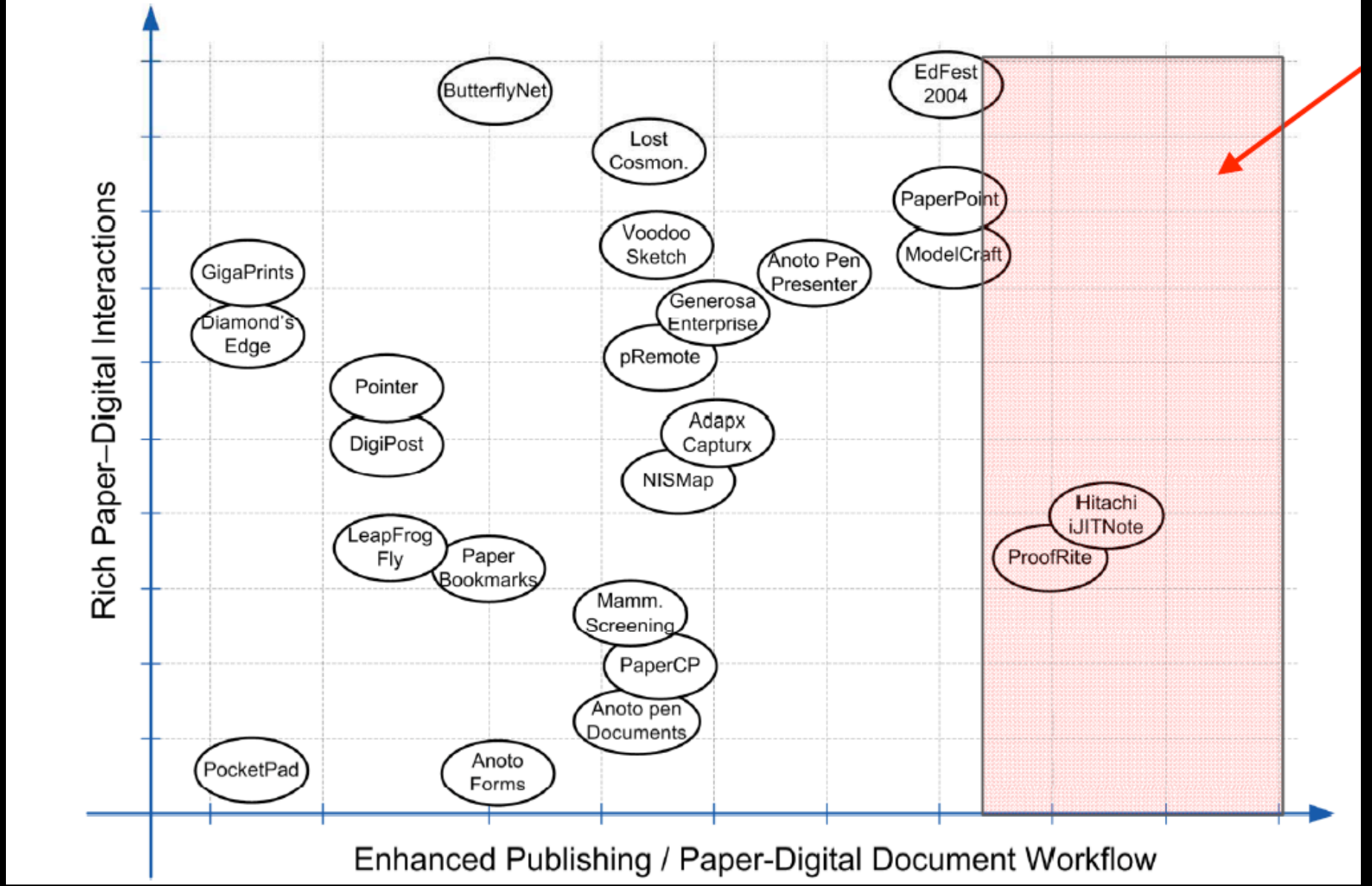
Supporting Interactions across the Paper-Digital Divide

Nadir Weibel

Global Information Systems Research Group
Institute for Information Systems
Department of Computer Science, ETH Zurich



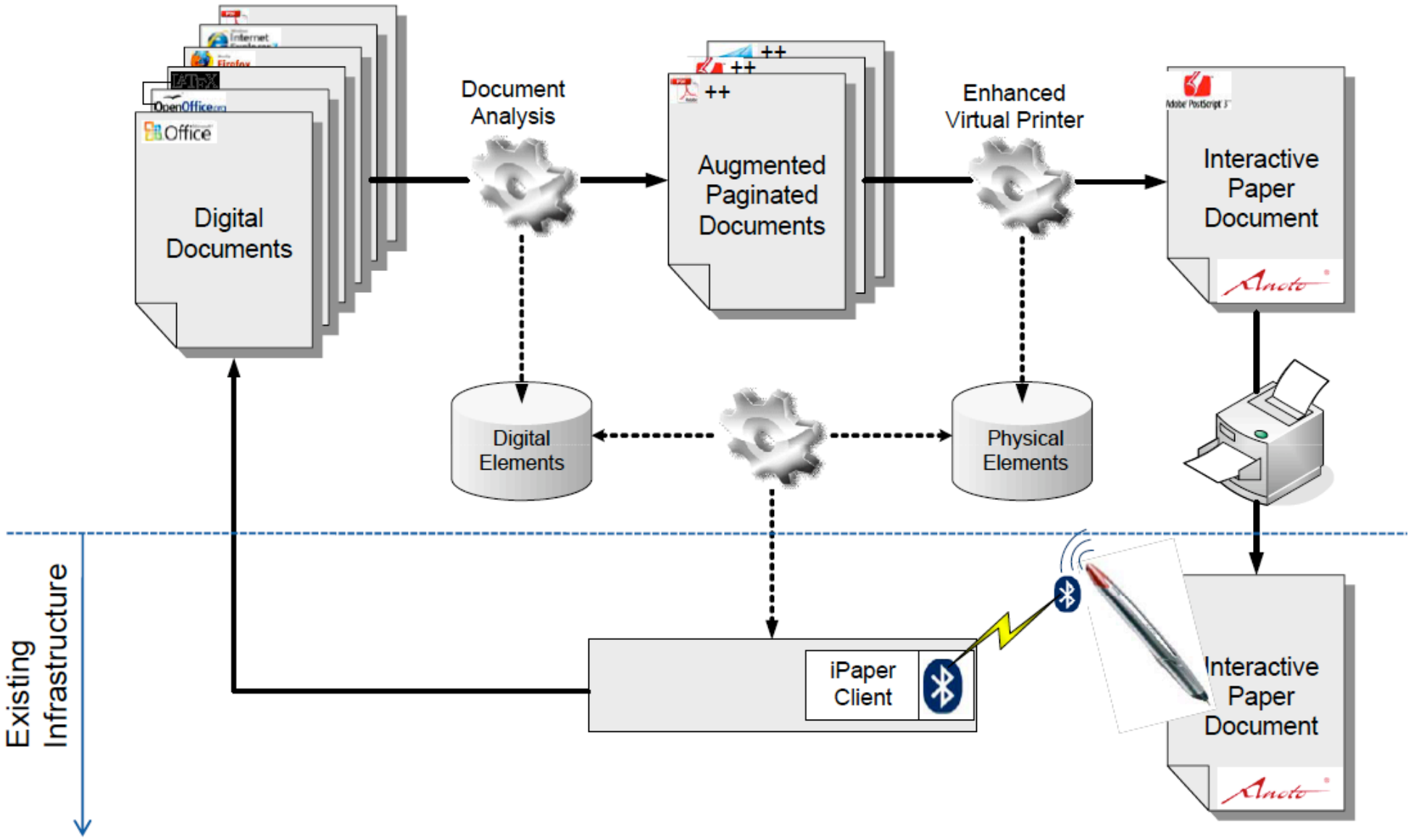
Interplay of Interactions and Publishing



Publishing Interactive Paper Documents

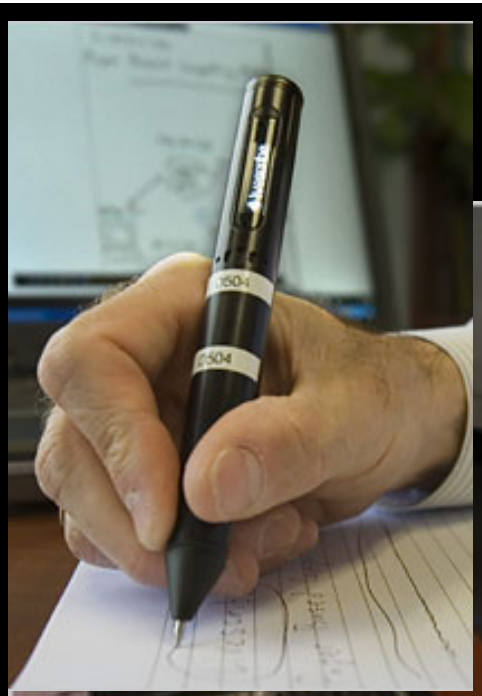
- Core component **intercepting** the **publishing flow** and **enriching** interactive paper documents
  - **Flexible publishing** and handling of rich digital and paper documents
  - Shift from a position-paradigm to an **object-paradigm**
  - **Automatic** and semi-automatic **generation** of paper-links
  - **Integrated** Paper-Digital environment
- Publishing and printing framework built on top of the existing **iPaper/iServer** toolkit

Enhanced Publishing Process



livescribe

TURN YOUR PAPER ON



Jim Marggraff, CEO

Discussion of Technology, Research, Social, Evaluation, and Funding Issues

People, tools, and social contexts are inextricably entangled

What are the cognitive consequences of technology and the technological consequences of cognition?

Potential Topics (How best to move research forward?)

- Technology
  - How is the technology changing?
  - How should it change to better support research and applications?
- Research
  - Scale of research enterprise
  - Importance of collaborations
  - Tools required to advance research
  - Implications of increasingly diverse ecology of devices
- Social
  - Myths
  - Supporting collaborations
  - Privacy and various other issues
- Evaluation
  - Understanding current practices
  - Application domains
- Research Funding: Government and Industrial Sponsors