

Future Directions

Presented at the eRA Symposium
by
Dr. Steven J. Hausman

April 30, 2003



The Overview

- **The Requisite Quotes**
- **The Past**
- **The Present**
- **The Future**
- **Including:**
 - < **New Technologies**
 - < **Changing Work Processes**
 - < **The Really Far Out Stuff**

The Quotes

- **"If we don't know where we came from, we can't know where we are going"**
< **Unattributed Aphorism**
- **"Those who cannot remember the past are condemned to repeat it."**
< **George Santayana, The Life of Reason, Volume 1, 1905**
- **"In times of drastic change, it is the learners who inherit the future. The learned usually find themselves equipped to live in a world that no longer exists."**
< **Eric Hoffer**

The Past

History of Paper

3,000 BC

- **Cyperous Papyrus - the precursor of paper**
 - < **A marsh grass that the Egyptians cut into thin strips, layered at right angles, softened in water, pounded into a thin sheet and left to dry in the sun**
 - < **Lightweight, portable**
 - < **Writing medium of choice for Egyptians, Greeks and Romans**



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History of Paper

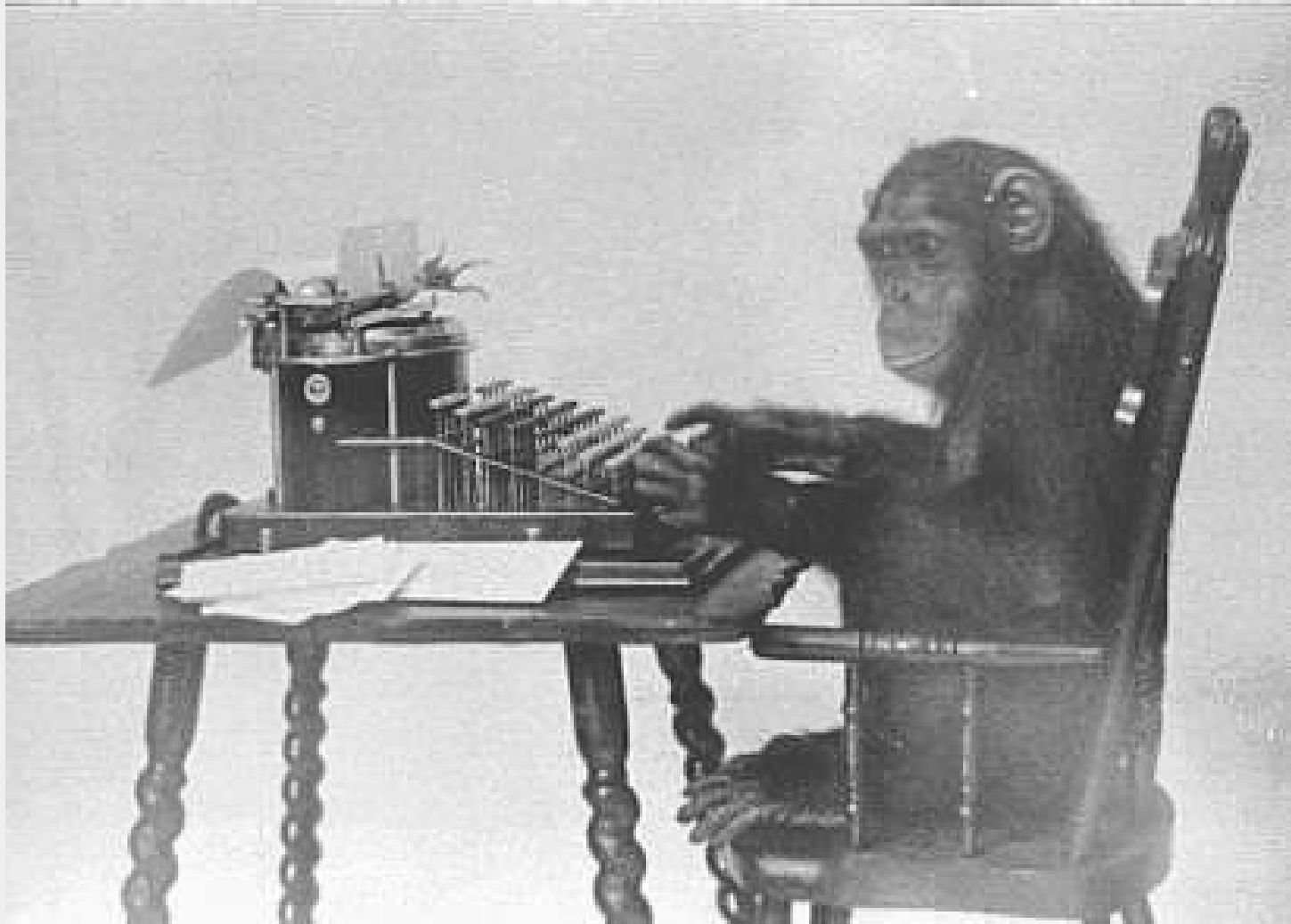
Dissemination

- In Europe, papyrus had been phased out in the 9th century in favor of parchment
 - < It has been estimated that a single handwritten bible required 300 sheep skins
- Paper became the writing medium of choice in the 15th century
- In 1456 Gutenberg perfected movable type and printed his famous bible: this is considered the birth of the modern paper and printing industry

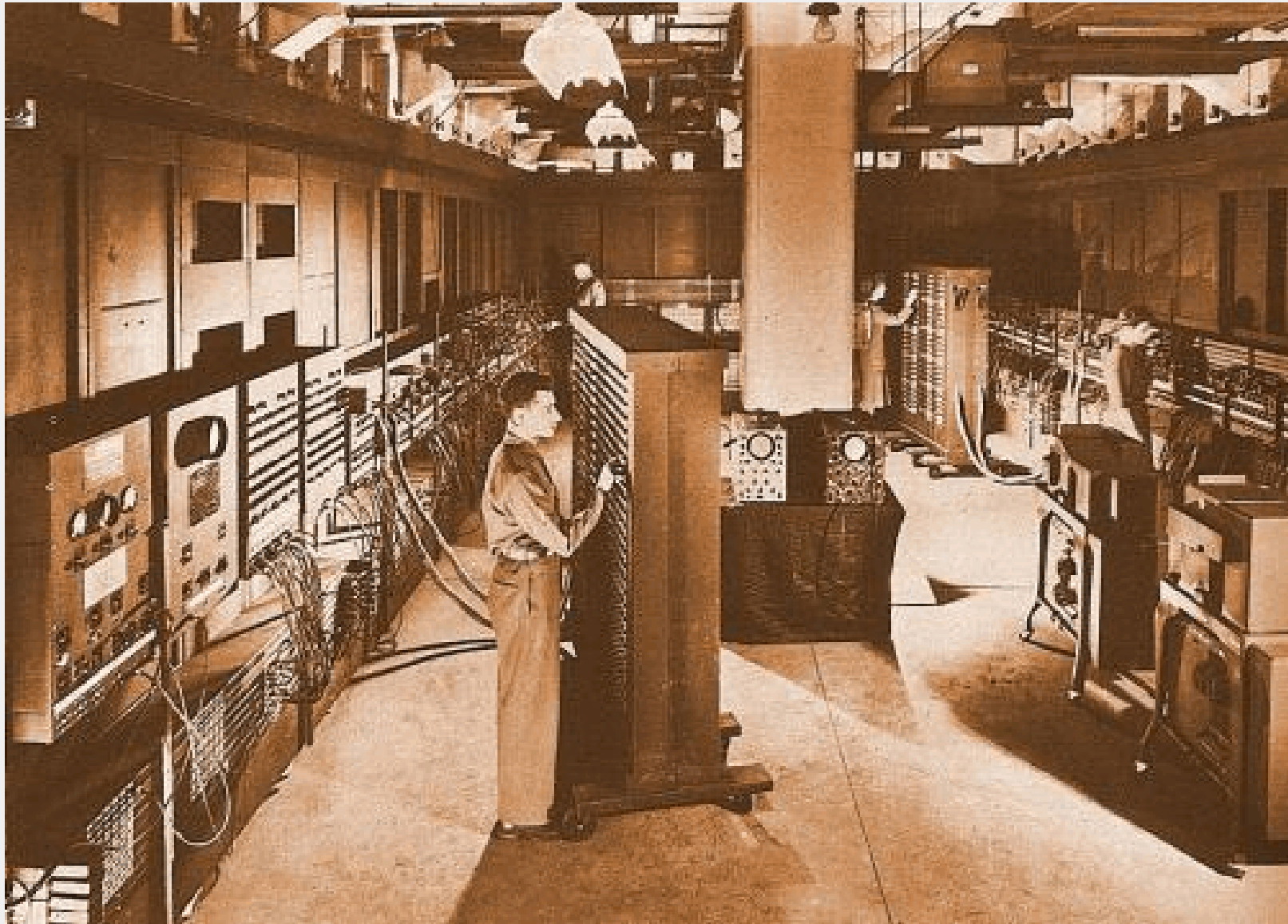
If Gutenberg Were Around Today



High-Tech Word Processing in the Past



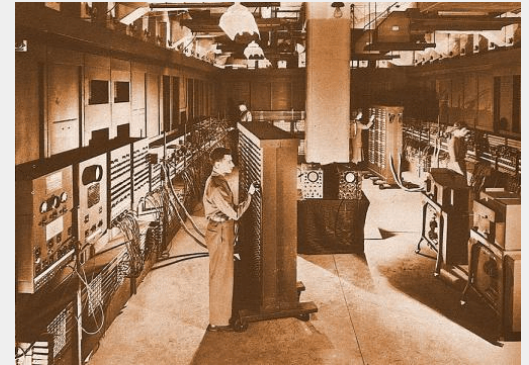
High-Speed Computing - The Way It Used To Be



The Past

Not All That Long Ago - 1

- **ENIAC (1946)**
 - < A 30-ton 17,480 vacuum tube computer
- **First Operating System (1955)**
 - < A monitor program for the IBM 701
- **Dynamic RAM chips replaced core memory (1968)**
- **Winchester hard disks developed (1973)**
 - < “Winchester?”
- **AT&T licenses UNIX (1980) - created in 1969**
- **First IBM PC (1981)**
- **First PC LAN demonstrated (1982)**



The Past

Not All That Long Ago - 2

- **First relational database (1969)**
< **Oracle shipped first SQL database in 1979**
- **Internet E-Mail (1972)**
- **Ethernet (early 1970s)**
- **Laser printer (1969)**
- **Lotus notes, Microsoft Windows, World Wide Web, Java, PDAs, removable storage, bar codes, inexpensive modems, Linux, Portable Document Format.....**

Advances in technology have occurred so rapidly that work processes may not have caught up

Business Practices

~5Years Ago

- **All applications submitted on paper**
- **Review conducted by mailing vast volumes of paper to reviewers**
- **All review materials carried back to the NIH**
- **Reviewers critiques retyped**
- **Summary statements printed on paper and mailed to PI**
- **Council books produced on paper and mailed to each Council member (in some instances NIH staff even assembled Council books by gluing the pages together)**
- **A complete set of applications was assembled and available at the Council meeting**

Technology

~5 Years Ago

- E-mail commonly used, but only on the desktop
- Commercial use of the Internet begins to increase number of users
 - < February, 1999: estimated 800 million pages
- CD-ROM drives uncommon
- Largest experimental desktop drive available was 16.8 gigabytes
- Laptop computers heavy with short battery life
- Most presentations on slides or transparencies
- Palm Pilot introduced in 1996
- Distance communication conducted largely via modem over phone lines

The Present

Let's Talk About Paper

The Facts

- In 1980, a year before the introduction of the IBM PC, world office paper consumption was 70 million tons
- By 1997, total paper consumption had grown to almost 150 million tons
- The average \$1 billion corporation generates 88 million sheets of paper/year
- Paper use is growing 6-8 percent/year
- Up to 60 percent of help desk calls are output related
- E-mail is increasing printing volumes by 40 percent

The Problem with With Paper

- Paper is heavy
- Paper takes up a lot of space
- Paper documents cannot be disseminated simultaneously to many individuals
- Paper documents are not easily searched
- Paper is not conveniently stored in small volumes (i.e. you need a filing cabinet)
- Paper cannot be accessed remotely

What's Good About Paper?

- Paper is portable and accessible
- Paper is durable
- Paper is cheap and disposable
- Paper is usable and familiar
- It is easier to go from data to printout than the other way around
- Paper is “trustworthy” (i.e. signatures)
- No batteries required
- Studies have shown that people are able to retain 30 percent more information if shown on paper versus a computer screen

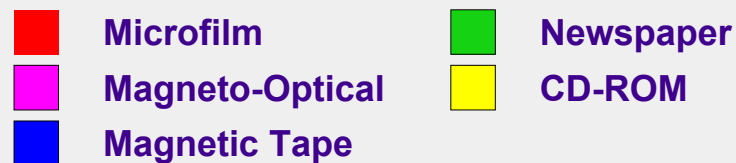
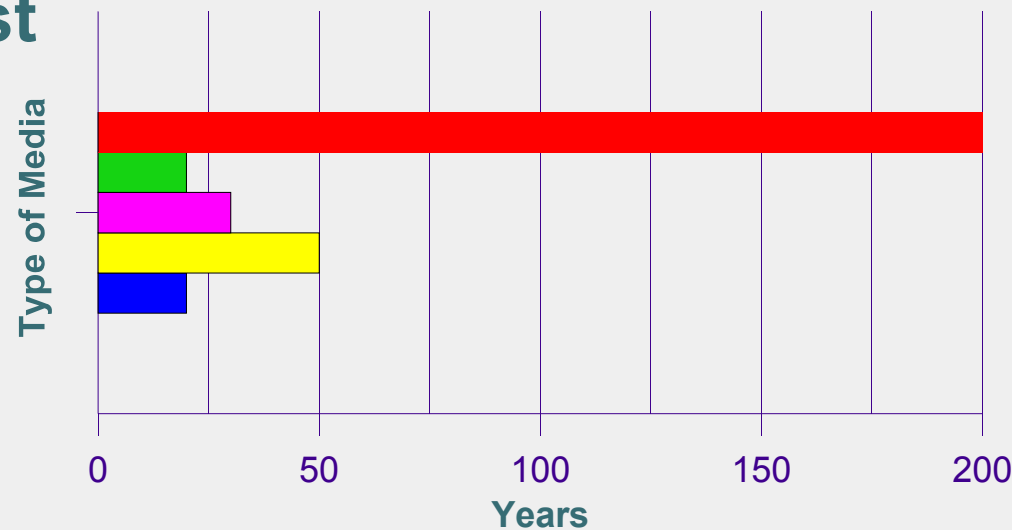
The Conundrum

- On one hand we want to have all of the advantages of paper and on the other hand we want to have all of the advantages of the digital world
- How can we have both? And what does this say about how we do business in the future?
- What we have to do is combine the practicality and usefulness of paper with the functionality of digital technology and make all of these into better and more efficient work practices.

The Paperless Office

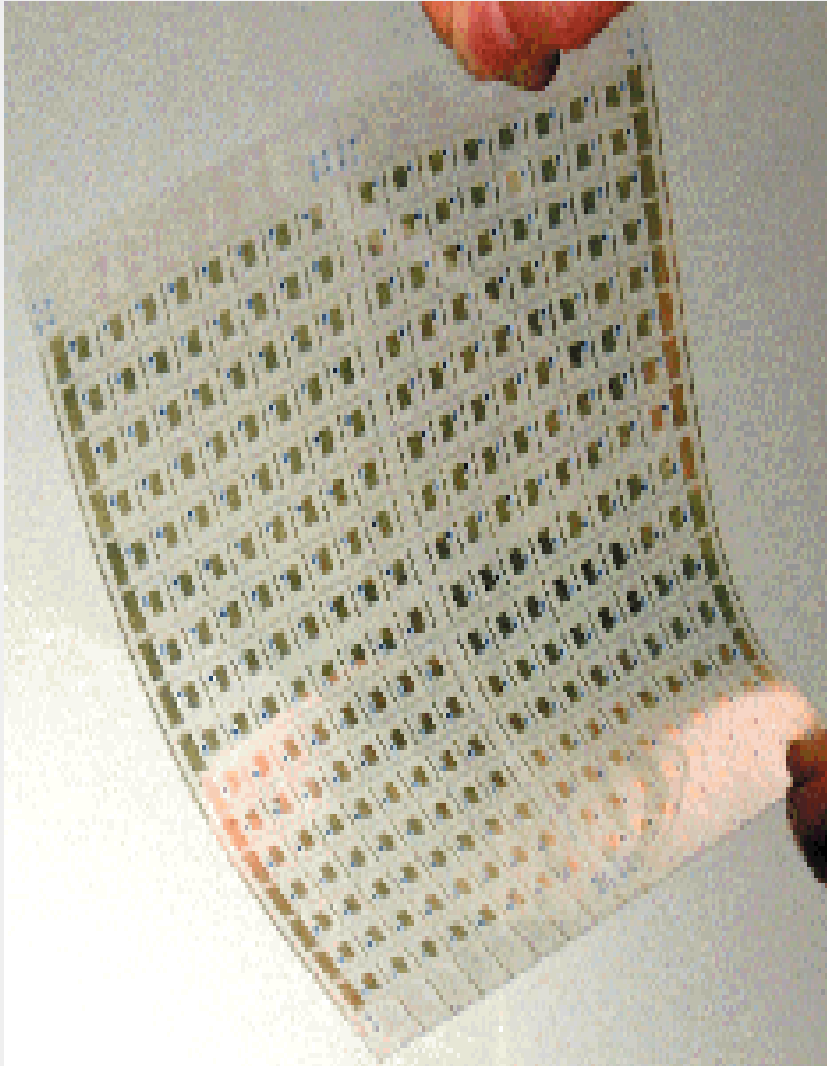
The Issues

- At present there is no substitute on the market that is as portable, durable, simple and accessible as paper
- But there is a problem with how long computer media will last



New Technology

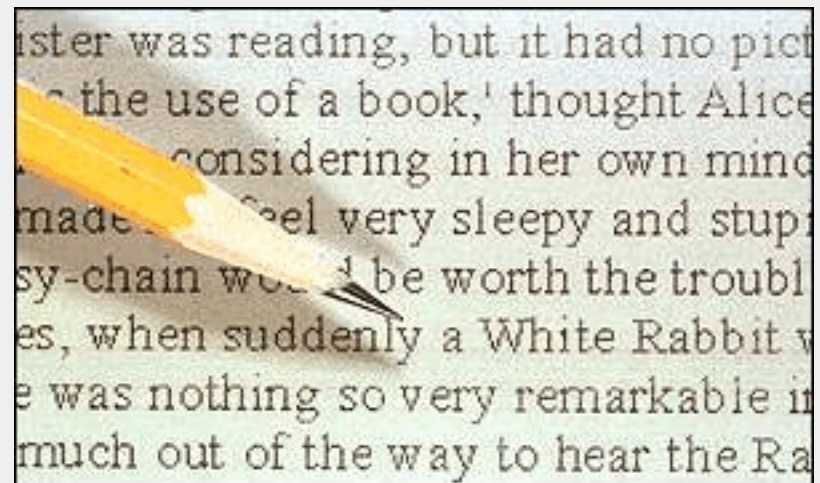
We Need A Better Way to Read Digital Information



- If we are ever going to switch from paper to a digital medium we will need some new devices
- Characters in the movie “Red Planet” use a screen device that unfolds like a thick map or scroll

Digital Paper

- **Using Digital Paper (ePaper and eInk)**
 - < **Electronic reusable paper is a display material that has many of the properties of paper. Unlike conventional paper, however, it is electrically writeable and erasable. It uses a display technology called Gyricon**



Gyricon

- A Gyricon sheet is a thin layer of transparent plastic in which millions of small two-toned beads, somewhat like toner particles, are randomly dispersed. The beads, each contained in an oil-filled cavity, are free to rotate within those cavities.
- When voltage is applied to the surface of the sheet, the beads rotate to present one colored side to the viewer. Voltages can be applied to the surface to create images such as text and pictures. The image will persist until new voltage patterns are applied.



An ePaper Display

- An example of how an ePaper display can be implemented on a **VERY** large scale



Business Practices

Today

- Applications submitted on paper but scanned in upon arrival at the NIH
- Review largely conducted by mailing CDs instead of large volumes of paper to reviewers
- Only CDs instead of paper need to be returned to the NIH
- Reviewers submit critiques on disk or via e-mail
- Summary statements generated in electronic format and e-mailed to PIs
- Printed Council books have been replaced by the Electronic Council Book
- Applications and summary statements available on-line at the Council meeting

Technology

Today

- Most business conducted via e-mail
- Ubiquity of Personal Digital Assistants and Blackberrys for e-mail
- Wireless technology becoming more common
- Broadband connectivity beginning to be more widely available in private homes
- July, 2000, estimated 2.1 billion Internet pages
 - < Growing at 7.3 million pages/day
 - < April, 2003, Google indexes over 3 billion pages
- Virtually all presentations conducted using computers and light projectors
- Laptop computers are as powerful as desktop machines
- High storage capacity (>60 gigabytes) commonly available even on laptops

The Future

New Technologies

What is Possible in the Near Future?

- Collaborative workspaces
- Wireless everywhere
- Office of the Future
- Storage Innovations
- SPOT Technology
- Other New Stuff

New Technologies

Collaborative Technologies

- **How do you process and coordinate the flood of information that is now available?**
- **One way might be to get employees working more collaboratively**
 - < **The “old” way to enhance collaboration includes:**
 - Audioconferencing
 - E-mail
 - Facsimile
 - < **The “new” way includes:**
 - Shared whiteboards
 - Real-time application sharing
 - Audioconferencing/Videoconferencing (“Teleporting” - virtual meetings)

“Teleportation” Conferences

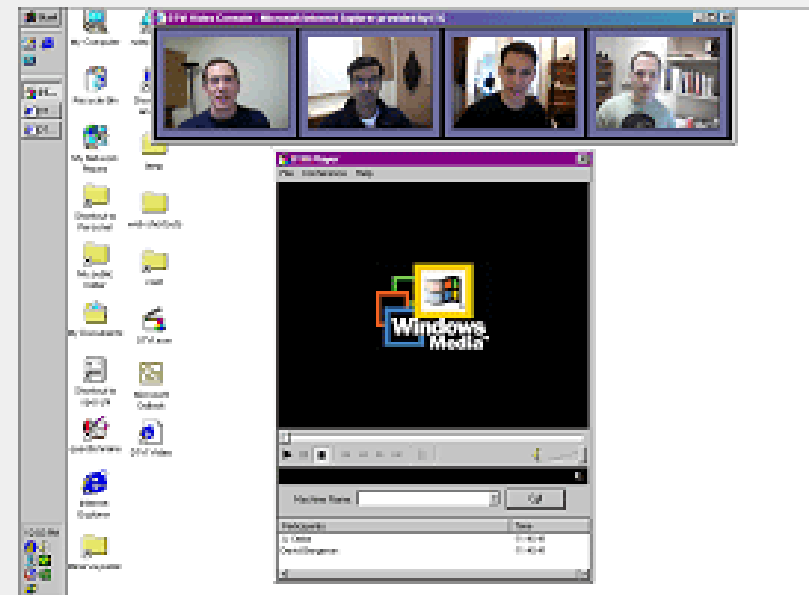
- Unlike videoconferencing, teleportation conferencing generates a life-size image of a person that can exist in a three-dimensional setting
- The live image of a person appears as if they were in the same room
- Benefits include the ability to make eye-to-eye contact and engage in natural two way conversation

The Future Way to Conference



Other Collaborative Systems

- **Video Windows/Virtual Kitchen**
 - < **Constantly-running audio and visual connections in disparate locations**
- **Collaborative Video Viewing**
 - < **Using simultaneous viewing for instructional purposes**

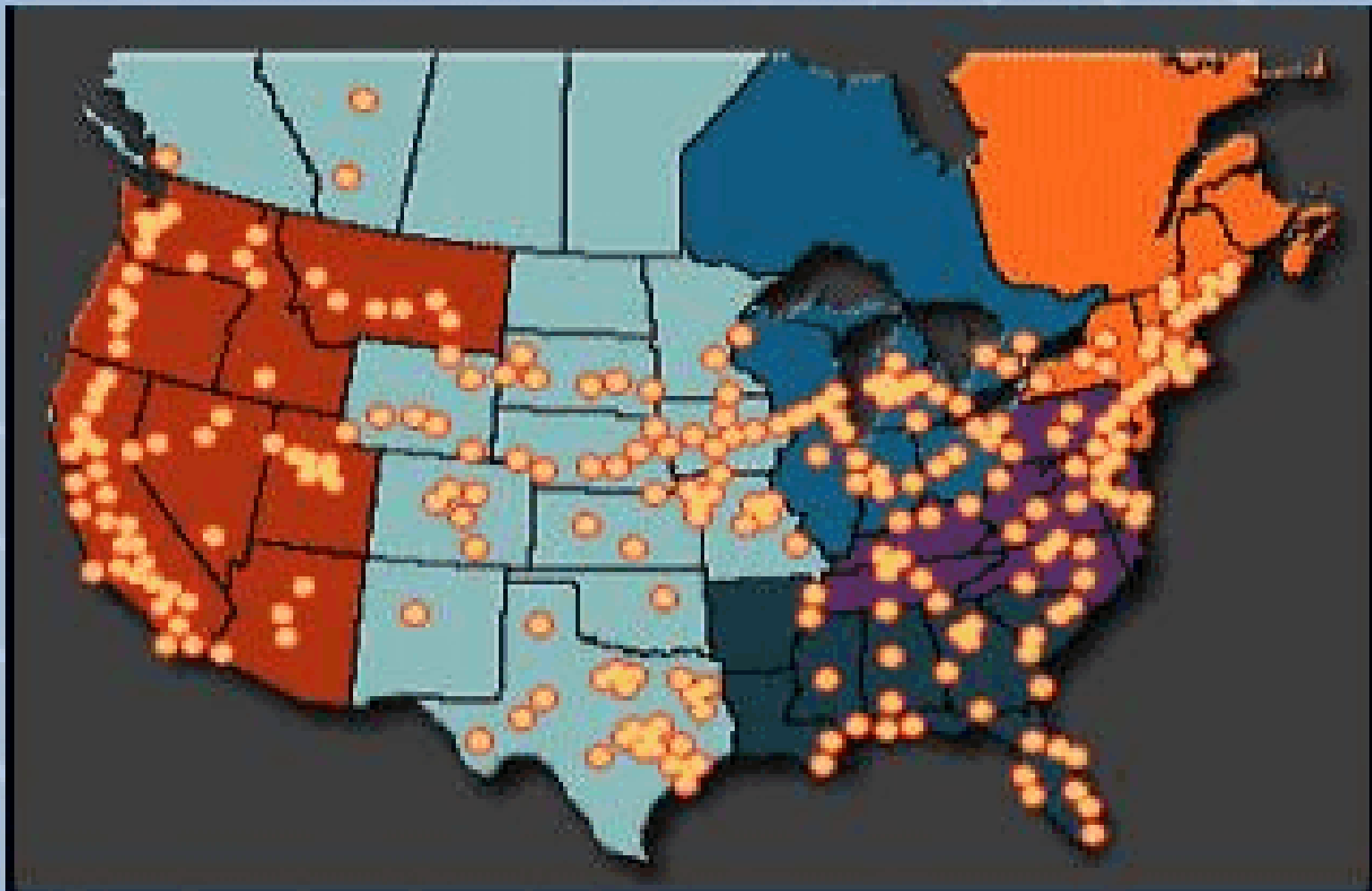


Wireless Technologies

Up and Growing Rapidly

- **Wireless technologies have been proliferating rapidly**
- **These include:**
 - < **Bluetooth (short-range radio link for wireless communication of data and voice)**
 - < **Wi-Fi (Wireless Fidelity; 802.11a,b) - a wireless method of connecting computers to each other, the Internet or to networks at speeds ranging from 11 to 54 Mbps**
 - < **802.16a Wireless broadband (30 miles/70 Mbps)**
- **Specific examples include:**
 - < **Laptops, Blackberrys, Palm, Internet enabled phones**

Public “Hot spots”



Source: NetStumbler.com



eRA and Wireless

- **What does wireless mean to the eRA effort?**
 - < **eRA applications can be accessed from wherever there is a wireless access point or LAN**
 - < **Wireless networks are easy to install (i.e. no cable)**
 - < **Information can be accessed in real time during meetings**
 - < **Wireless can facilitate sharing of files and peripherals**

Office of The Future: CIW

The Center for Information Work

- **Announced September, 2002 by MS**
- **Designed to explore how productivity can be improved in the future by:**
 - < **Managing information overload**
 - < **Accessing data to make decisions**
 - < **Staying connected while away from the office**
- **Technologies used include:**
 - < **BroadBench**
 - **A display that is so wide it wraps around the viewer and gives simultaneous access to multiple applications**
 - < **RingCam**
 - **An omnidirectional videocamera that can record a 360-degree view of a room**

CIW Technology

- **RingCam**

- < **A set of inexpensive omnidirectional video cameras that record a 360-degree view of the room (such as from the center of a conference table during videoconferencing). It uses an array of microphones to determine who is speaking and automatically shows that person's face**

- **BroadBench**

- < **A display so wide it partly wraps around the person viewing it and provides a large virtual desktop**

- **These should be available within 3-5 years**

The RingCam



The Broadbench Display



Big Bytes in Small Places

The StorCard

- **The StorCard:**
 - < A new removable storage device
 - < Credit card size
 - < 100 MB to 5 GB of encrypted data
 - < Either a Type II PCMCIA card or USB 2.0
 - < Read via the StorReader



SPOT Technology

Smart **P**ersonal **O**bjects **T**echnology

- Introduced by Microsoft in November, 2002 and designed to improve the function of everyday objects by including software
- Includes:
 - < Watches that know what time zone they are in
 - < Alarm clocks that ring early when they sense that traffic is a mess
 - < Refrigerator magnets that display sports scores

SPOT Stuff



Other New Technologies

- **Terabyte Optical Disks - holographic**
 - < 5-inch disk
 - < Can hold ~15,000,000 pages
- **Speech recognition software**
 - < The next interface??
- **Tablet computers**
 - < Light-weight, small
 - < Long-lived batteries
 - < Handwriting-to-text conversion
- **USB Storage Devices**
 - < 256 MB currently available



Still More New Stuff

- **3-D LCD display monitors**
- **Real time language translation**
< **Being used in Iraq**
- **Fuel Cells for laptops**
< **Available later this year**
- **Blue-Ray DVD Technology**
< **DVDs that can hold up to 27 GB of data**



Fuel cell



Business Practices

5 Years From Now

- Applications submitted entirely on-line via the NIH eRA Commons
- Internet-Assisted Review could obviate the need for even mailing CDs to reviewers
- Reviewers could discuss the applications by virtual meetings that would dispense with traveling to the NIH
- Summary statements available to PIs on-line shortly after completion of the review
- Council meetings could occur virtually

Upcoming eRA Modules

- **To be utilized initially as pilots:**
 - < **Program Module**
 - < **Web Query Tool**
 - < **QVR for Budget**
 - < **Knowledge Management**

Technology

5 Years From Now

- **Videoconferencing easy and common, both in conference rooms and at the desk; maybe cell phone**
- **Terabyte hard drives common on desktops and laptops**
- **3.5 inch floppy disk drives rare**
- **Content-based intelligent searching will enable users to find desired files even if the name or location is not known**
- **True mobile computing a reality; computers light, powerful, ubiquitous and cheap**
- **Avatar interfaces available to perform web searching**
- **Virtual keyboards and voice input available**

The Really Far Out Stuff....

- **Caffeine Comfort**
- **The Mobile Molar**
- **Harry Potter Stuff**
- **Augmented Cognition**

How Do You Keep *Your* Coffee Warm?

USBホットコースター

パソコンにつないで缶飲料の保温ができるホットコースター。
底面がUSB電源によって温まり、側面の断熱材に保温性がありますので、温かい缶飲料が冷めるのを防ぎます。

時間が経っても
冷めてない!



オレンジ

新発売! カタログページ▶

- 直径90×高さ90mm
- 本体重量: 約120g
- 電源: USB接続ポート
- 企画: USB A-TYPE

Win
&
Mac
対応

PCに合わせて
電力を変更するスイッチ。

パソコン本体のUSBへ



クールグレー

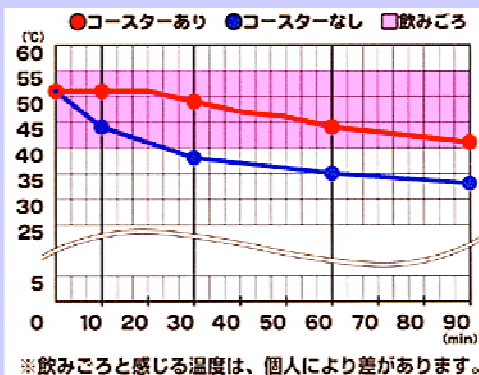


ネイビー



シルバー

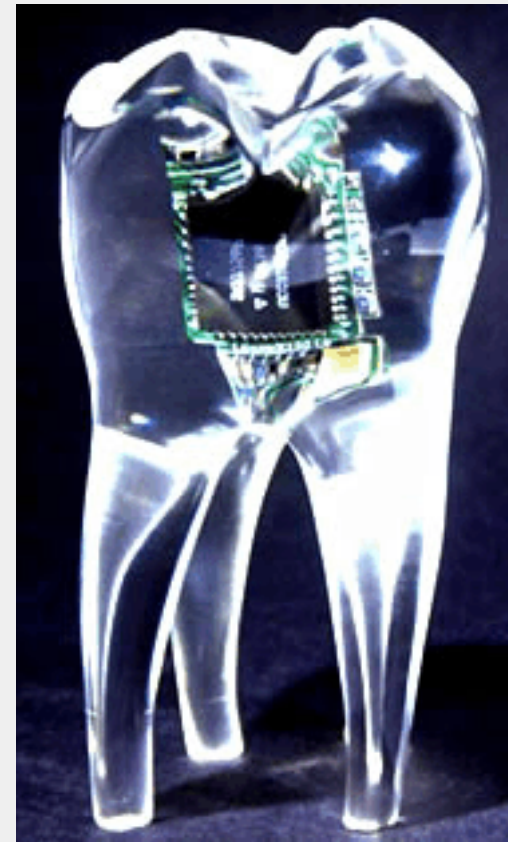
- パソコンのUSB端子に接続して使用する、缶飲料を保温できるコースターです。
- 350ccの缶まで対応するサイズです。
- 低温の缶飲料を適温まで温めることはできません。
- 45°Cの缶コーヒーを30~60分間、40°C前後に保つことができます。
(23°Cの室内で250cc缶でのテスト数値です。)
- 一部の飲料缶・四角ペットボトル等では使用できませんのでご注意ください。
- 必ず、パソコン本体のUSB端子でご使用ください。



Mobile Molar: Want One in *Your* Mouth?

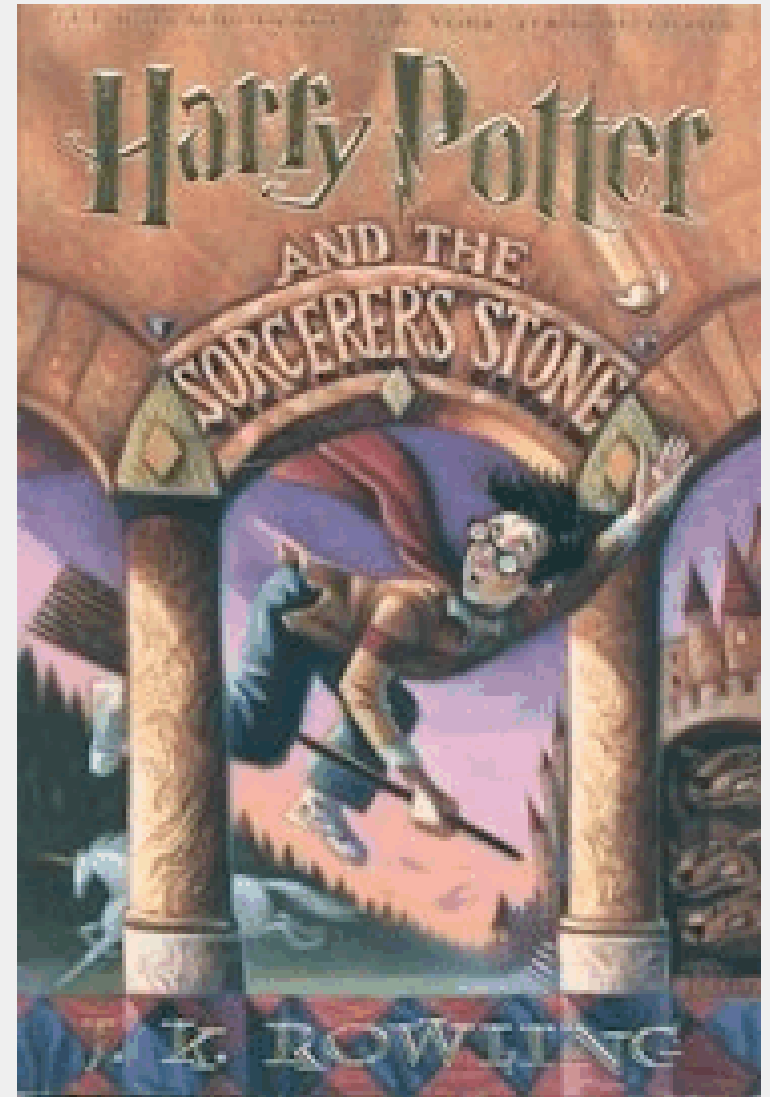
Putting the Bite on New Technology

- **The “Telephone Tooth”:**
 - < **Wireless low-frequency receiver inserted into a back molar**
 - < **Turns audio signals into vibrations which are passed by bone conduction to the inner ear as audible messages**



The Cloak of Invisibility

- From the back cover:
< “Harry Potter has never played a sport while flying on a broomstick. He's never worn a **cloak of invisibility**, befriended a giant, or helped hatch a dragon.....”



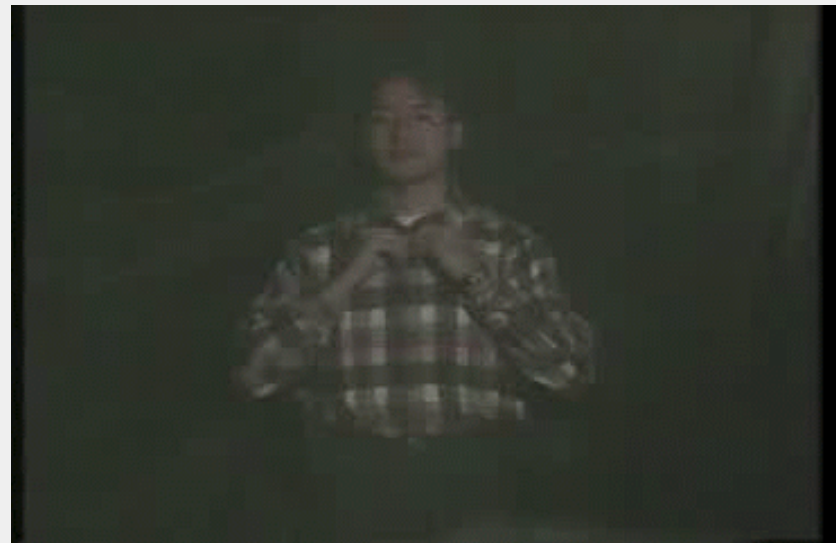
Can There Really Be a “Cloak of Invisibility?”

Optical Camouflage

- Research being conducted at the University of Tokyo
- It works by projecting the background image onto the masked object such as to make it appear virtually transparent



Optical Camouflage: The Movies



Augmented Cognition

Courtesy of DARPA

- A technology designed to extend (by an order of magnitude or more) the information management capability of humans
- Accomplished by a human-computer symbiosis
- It will:
 - < Enhance memory
 - < Automate problem solving
 - < Develop new visualization techniques to increase “human-computer bandwidth”
 - < Enable one person to do the work of three **A-76?**

Augmented Cognition - Netscape

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Location: <http://www.augmentedcognition.org/> Go to Netscape's Home Page



AUGMENTED COGNITION

LCDR Dylan Schmorow, Ph.D.

[Overview](#) | [Objectives](#) | [Challenges](#) | [Projects](#) | [People](#) | [Documents](#) | [Meetings](#) | [Updates](#) | [Related Work](#)

Welcome to the new Augmented Cognition website!

The mission of the DARPA Augmented Cognition program is to extend, by an order of magnitude or more, the information management capacity of the human-computer warfighting integral by developing and demonstrating quantifiable enhancements to human cognitive ability in diverse, stressful, operational environments. Specifically, this program will empower one human's ability to successfully accomplish the functions currently carried out by three or more individuals.

A key objective of the program is to foster development of novel- and improvement of identifiable- prototypes and enabling technologies, in order to experiment with and understand the means by which they may be integrated into existing operational systems, as well as those in development. The program will accomplish this by delivering new design principles for human-computer symbiosis.

The Augmented Cognition program will explore the interaction of cognitive, perceptual, neurological, and

Go to Netscape's Home Page

Start

1:24 PM

AugCog: The Movie

Down the Road

- **Grid Computing**
- **“Smart Dust”**
- **Foveon Cameras**
- **Nanocomputing**
- **Electric Broadband**
- **Flexonics**
- **Quantum Computers**
 - **Schroedinger's cats**

Information, Science, and
Technology in a Quantum World





**Notice all the computations, theoretical scribbles, and lab equipment, Norm.
Yes, curiosity killed these cats.**

The Final Quote

- **The cure for boredom is curiosity. There is no cure for curiosity.**
< **Dorothy Parker**

THIRD ANNUAL eRA SYMPOSIUM

*Progress in
Program:
Tying It
All Together*



2003
Building #45
Auditorium

<http://era.nih.gov/>