Cognitive Science 120:
Human Computer Interaction

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Cogsci 120: Human Computer Interaction

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Office Hour: CSB 159 Wednesday 9 – 10 AM and by appointment.

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 also adapt to the structure of tasks, the context of activities, and even our relationships with others. The goal is to better understand the cognitive, computational, and social ecology of these 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) 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, Sony, and the UC MICRO Program.
Beijing, China

Invited by Chinese Academy of Science

Talks at:
- IPCAS: Institute of Psychology, Chinese Academy of Science
- ISCAS: Institute of Software, Chinese Academy of Science
- MSRA: Microsoft Research Asia
- Tsinghua University
- VINCI’10: International Visual Communication Conference

(Currently a little after 5AM Wednesday in Beijing)
The Food
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

Have you ever done your absolute best in a course?

Prepare Yourself

The time to start is now

Do what you love and learn to 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

Take time to think important thoughts

Refuse to let the urgent drive out the important

Be careful about who you spend time with
Even Better Advice: Really Achieving Your Childhood Dreams, Randy Pausch’s Last Lecture
CMU 9/18/2007

12,212,2239 Views
Creative Research
we study how people crash into technology

bolt | peters is a creative research firm.
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

A Morphable Model for the Synthesis of 3D Faces
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 Image Resizing

Shai Avidan
Mitsubishi Electric Research Lab
Ariel Shamir
The interdisciplinary Center & MERL
Seventy 30” displays, arranged in fourteen columns of five displays each. Each ‘tile’ has a resolution of 2,560 by 1,600 pixels – bringing the combined, visible resolution to 35,640 by 8,000 pixels, or more than 286.7 million pixels in all. (Almost 1 pixel per the each of the 300 million US residents)
High Resolution Portals to Global Science Data

Green: Purkinje Cells
Red: Glial Cells
Light Blue: Nuclear DNA

Source: Mark Ellisman, David Lee, Jason Leigh
Scalable Displays Allow Both Global Content and Fine Detail

30 MPixel SunScreen Display Driven by a 20-node Sun Opteron Visualization Cluster

Source: Mark Ellisman, David Lee, Jason Leigh
Allows for Interactive Zooming from Cerebellum to Individual Neurons

Source: Mark Ellisman, David Lee, Jason Leigh
650 Mpixel 2-Photon Microscopy
Montage of HeLa Cultured Cancer Cells

Green: Actin
Red: Microtubules
Light Blue: DNA

Source: Mark Ellisman, David Lee, Jason Leigh, Tom Deerinck
IBM: The Everywhere Displays Project
A Rapidly Evolving Technology Landscape

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
Cameras Everywhere
Cameras: Omni, Front, Rear, Face, Foot,
Trunk Full of Computer & Disks
Time and Location Synched Notes During Drive
Multiple Video Streams
Book Interface
ASSIGNMENT I:
Choose an interface that you find particularly worthy of praise or blame in terms of its usability. The interface can be for a PC application, a web-based application, or an interactive device. It can also be a non-computer interface (e.g., a light switch, controls for an appliance, etc).

Identify aspects of the chosen interface that exemplify why the interface should be inducted into the Hall of Fame or the Hall of Shame.

In a short paper (approximately 4-5 pages) describe the interface and explain why you are nominating it. While the paper should give an overview of the interface (images and figures are useful), who the users are, and what tasks the the interface is designed to support, the focus should be to characterize as clearly as you can the specific reasons the interface is particularly effective or ineffective and thus deserving of entry into the Hall of Fame or Hall of Shame.

Should not be unsupported opinion. Support your arguments and convince the reader. Provide a balanced substantive assessment.

Turn in a hard copy version in class on 10/14. There is no requirement to add a version to your wiki page. Assignment I is 5% of grade.
Assignment I: Nomination for Interface Hall of Fame or Hall of Shame (Due 10/14)

Focus on Usability Factors
- Learning
- Visibility of system status
- Match between system and tasks
- Using existing knowledge
- Control and freedom
- Consistency with other interfaces and standards
- Error prevention
- Errors: Recognize, diagnose, and recover
- Recognition/recall
- Flexibility and efficiency of use
- Aesthetic design
  …

Make use of the textbook (Chapters 1 – 4) and lectures
- Provide a balanced assessment
- Think about and discuss the tradeoffs involved
- Be careful about your choice.

Goal is for you to start **thinking critically about interfaces**
- We will judge the arguments you advance. Good to focus on an interface you know.

  Should be a balanced presentation. Not only positive aspects for Hall of Fame or negative for Hall of Shame. Think about and discuss the tradeoffs involved.

  Difficult to adequately discuss a complex interface in a short paper. Fine to focus on a part.
A Rapidly Evolving Technology Landscape

**HCI is becoming increasingly important and complex**

For good and for ill, our professional, personal, and social activities are increasingly dependent on and intertwined with digital computation and communication facilities.

Moore’s Law continues. Moving from serial to parallel computing (multicore, now quadcore, in lab 80 cores, soon hundreds)

Computing is moving off the desktop and into the world

The monolithic computer is coming apart. The components are starting to reemerge coalesced in a multitude of rapidly evolving forms

The boundaries between the private and public, home and work, local and remote, physical world and digital world are increasingly permeable
Augmented Surfaces, Jun Rekimoto
Sony Computer Science Lab, CHI’99
Networked cameras in “the wild”
Can these cameras support remote exploration?
RealityFlythrough makes it possible
Bridging the Gap Between Virtual and Physical Controls on Tabletops

SLAP Widgets: Bridging the Gap Between Virtual and Physical Controls on Tabletops
Malte Weiss, Julie Wagner, Yvonne Jansen, Roger Jennings, Ramsin Khoshabeh, Jim Hollan, Jan Borchers. CHI, 2009, 481-490.

Augmenting Interactive Tabletops with Translucent Tangible Controls
Malte Weiss, Jim Hollan, and Jan Borchers. Tabletops - Horizontal Interactive Displays (Christian Müller-Tomfelde, Editor), in press.
SLAP Widgets: Silicon Illuminated Active Peripherals

Bridging the Gap Between Virtual and Physical Controls on Tabletops
FTIR: Multitouch

Wipe–Off: an intuitive interface for exploring ultra–large multi–variate data sets