Overview of User Interface Software & Technology

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History of User Interface Software & Technology

- Specific Application areas
  - Technology that facilitates human-computer interaction
    - Touchscreens
    - Motion tracking
- Interactions with computers as a medium
  - Technology that facilitates human-human interaction
    - Messaging apps
  - Technology that facilitates human-anything interaction

Three Sub-Committees

- Consists of different sub-committees
  - Building Devices
  - Interacting with Devices
  - Blending Interactions
- Each with different application areas, research fields, and implications. But all similar and complementary

IN THE BEGINNING!

- The lines between the three sub-committees has always been blurred
- Four sub-committees in 2009 that spanned the 2022 versions.
  - Technology, Systems, Tools, and Infrastructure
  - Interaction Techniques and Devices
  - Interaction in New Contexts
  - Interaction using Specific Capabilities or Modalities

History of Building Devices

Chi 2009 - 2013: Technology, Systems, Tools, and Infrastructure

Chi 2014 - 2016: Technology, Systems and Engineering

Chi 2017 - 2021: Engineering Interactive Systems and Technologies

Chi 2022 - ????: Building Devices: Hardware, Materials, and Fabrication

Technology, Systems, Tools, and Infrastructure
2009 - 2013

This subcommittee will focus on contributions which enable others to create better applications, systems, and designs. These contributions will be judged in part by their ability to extend the range of what can be created or make creation of existing artifact types substantially easier or accessible to more people.

(From Chi 2009 Website)

Technology, Systems and Engineering
2014 - 2016

This subcommittee will focus on technology, systems and engineering contributions that enable, improve, or advance interaction. This will include software and hardware technologies and systems that enable and demonstrate novel interactive capabilities, as well as languages, methods and tools for construction and engineering of interactive systems. Engineering contributions should clearly demonstrate how they address interactive systems concerns such as, for example, scalability, reliability, interoperability, testing, and performance. Systems and technology contributions will be judged by their technical innovation and/or ability to connect, simplify or enrich interactions, for example in intelligent interfaces and mobile/ubiquitous computing.

(From Chi 2014 Website)

Engineering Interactive Systems and Technologies

2016 - 2021

- A change in name, but not in content
- Maintained very similar call for papers as the previous iteration
    - Differences mostly limited to specifically calling for Machine Intelligence and other emerging fields

Building Devices: Hardware, Materials, and Fabrication

2022 - ????

This subcommittee focuses on advances in interactive hardware, new sensing, display, and actuation approaches, developments in materials that lead to novel interactive capabilities, and new fabrication techniques. Contributions will be judged based on the novelty of the resulting hardware prototype, the quality of the implementation, and the demonstrated improvements over existing hardware through a technical evaluation and where appropriate a user study. In addition, work in this subcommittee covers design tools that extend the type of interactive hardware we can build today.

(From Chi 2022 Website)

Discussion

Why do you think Building Devices has changed so much over the past 13 years?

History of Interacting with Devices

Chi 2009 - 2016: Interaction Techniques and Devices

Chi 2017 - 2021: Interaction Techniques, Devices and Modalities

Chi 2022 - ????: Interacting with Devices: Interaction Techniques & Modalities

Interaction Techniques and Devices

2009 - 2016

This subcommittee will focus on contributions in the form of new input or interaction techniques, or devices. These contributions will be judged in part based on their novelty or on a demonstrated improvement in an existing interaction type of interest to the HCI community.

(From Chi 2009 Website)

Interaction Techniques, Devices and Modalities

2017 - 2021

This subcommittee focuses on advances in interaction and enabling technologies as well as exploration of emergent computing domains and experiences. It welcomes contributions that are fundamentally new, those that examine capabilities/modalities that have not yet been fully exploited, and those which describe substantive improvements on prior work that open new interactive possibilities.

(From Chi 2020 Website)

Interacting with Devices: Interaction Techniques & Modalities

2022 - ????

This subcommittee focuses on enabling interactions using different modalities, such as touch, gestures, speech & sound, haptics & force feedback, gaze, smell, and physiological signals (e.g., heart rate, muscle tension, brain waves, and breath), on different devices (hand-held, stationary, head-mounted, wrist-mounted, in midair, on-body) and for different domains (on 2D screens, in 3D environments, as tangibles).

(From Chi 2022 Website)

History of Blending Interactions

This subcommittee focuses on the development of novel interactive systems and “enabling” contributions, which are resources that facilitate the development of future interactive systems and inspire future interface design explorations.

(From Chi 2022 Website)

Discussion

Why do you think the Interface Software & Technology sub-committees are structured like this? Is this divide correct?

The significance of device interaction sub-committees seems to have declined since 2009. What does this say about CHI and HCI in general?

Related Disciplines

System Design

Human Factors and Ergonomics

Software Design and Engineering

Augmented Reality

Virtual Reality

User Centric Design

UX/UI Design

Accessibility

UIST: User Interface Software and Technology

- 2019 ~ Current
  - **Enabling software and/or hardware technologies that open novel opportunities for interaction.**
  - **Designs that demonstrate compelling new interactive experiences.**
  - **Methods, architectures, and infrastructures for interactive systems.**

Topics: input and output devices, augmented/virtual reality, programming tools, mobile interaction, haptic and tactile interfaces, human-robot interaction, **AI and HCI**, fabrication, design and prototyping tools, creativity tools, ubiquitous computing, accessibility, visualization, information management, wearable computing, social computing, toolkits, education, crowdsourcing, and computer-supported cooperative work.

UIST: User Interface Software and Technology

- Before 2019
  - **Significantly novel enabling technologies** such as innovative input devices, new interaction techniques**, or new media that extend the boundaries of traditional interaction**, such as natural user interfaces, augmented reality, mobile interaction, haptic and tactile interfaces, ubiquitous computing, wearable computers, social software, and computer-supported collaborative work.
  - **Novel interactive hardware prototypes, prototype fabrication methods or tools, or processes for creating user experiences** that involve physical devices, sensors, prototypes, or systems.
  - **Innovative user interfaces for difficult interaction contexts or challenging applications.** Examples include managing large and complex information sets, usable privacy and security, multi-user interaction, crowdsourcing, fabrication, or techniques that span devices distributed in time and space.
  - **Breakthrough user experiences leveraging techniques** such as machine learning, computer vision, computer graphics, speech processing, networking, or human perception and cognition.
  - **Innovative software** architectures, tools, toolkits, programming systems, development environments, tutorial and help systems that support the development and use of the above technologies in user interfaces.

EICS: Engineering Interactive Computing systems

- Topics
  - Modeling,Specification and Analysis
  - Methods, Tools, and Processes
  - Applications and integrations

- EICS 2020 focuses on models, languages, notations, methods, techniques and tools that **support designing and developing interactive systems**.

ISS: Interactive Surfaces and Spaces

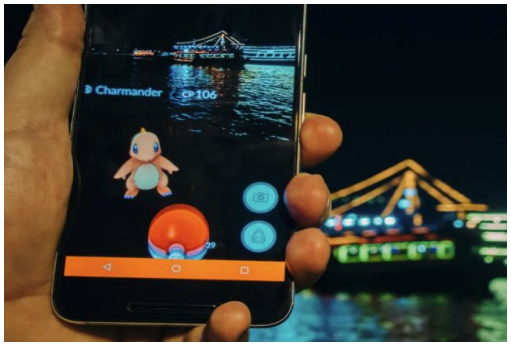
- Mainly focusing on “Spaces” and some interface technologies
  - Large display interfaces and multi-display environments
  - Gesture-based interfaces (hands, finger, body)
  - Multi-modal interfaces
  - Tangible user interfaces
  - Novel interaction techniques and paradigms
  - Interaction with mobile and body-worn devices
  - Different materials and form factors: curved, sand, water, ...
  - Interactive 3D spaces (Mixed Reality and Augmented Reality, mid-air displays, ...)

ISS: Interactive Surfaces and Spaces

- Before 2016: ITS (Interactive Tabletop and Surfaces)
  - Applications and/or evaluations of interactive surfaces in specific domains (public spaces, education, science, business, entertainment, health, homes, etc.)
  - Accessibility of interaction surfaces
  - Gesture-based interfaces
  - Multi-modal interfaces
  - Tangible interfaces
  - Large display interfaces and multi-display environments
  - Novel interaction techniques and technologies

VRST: Virtual Reality Software and Technology

- Focusing on XR (Extended Reality)
  - VR (Virtual Reality)
  - AR (Augmented Reality)
  - MR (Mixed Reality)



VRST: Virtual Reality Software and Technology

- Sessions
  - Navigation & Locomotion
  - Avatars
  - Engagement
  - Collaborations
  - Haptics
  - 3D Reconstruction

Target Audience

- UIST
  - HCI Researchers and Industry
- EICS
  - Industry and Developers
- ISS
  - HCI Researchers, Industry, Developers
- VRST
  - Researchers, Industry, and Developers
- CHI
  - HCI Researchers and Industry

Discussion

- What is the main difference of CHI, UIST? How can researchers choose those conferences to submit their papers?

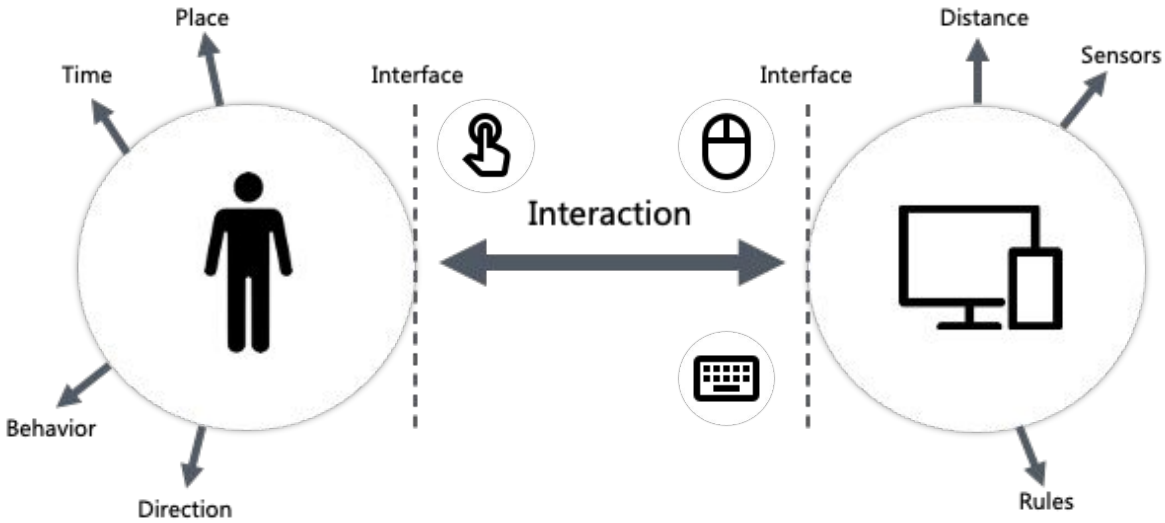
Tangible Bits: Towards Seamless Interfaces between People, Bits and Atoms

- Keywords: Tangible user interface, ambient media, graspable user interface, augmented reality, ubiquitous computing…, **metaphor**
- Proposed a new view of interface rather than propose a solution to any one single problem
  - Bits - Atoms : Cyberspace - Physical world
  - GUI (Graphical User Interface) established and integrated “Desktop **metaphor**” from the viewpoint of important HCI disciplines
  - However, the author argues that the interaction between human and cyberspace are constrained by traditional GUI
    - Lack of haptic interactions and peripheral senses
    - Lack of input/output

Tangible Bits: Towards Seamless Interfaces between People, Bits and Atoms

- A brand-new paradigm of computing: Ubiquitous Computing
- Future direction of computational devices: **TUI** (Tangible User Interfaces)
  - Wearable computers
  - **Integration of computational augmentations into the physical environment**
- Inspirations of Tangible Bits
  - Human beings developed and utilized physical artifacts, which are rich aesthetics and affordances
  - Developed rich languages and cultures which valued haptic interactions with real objects
  - **Affordance**: The perceived and actual properties of the thing, primarily those fundamental properties that determine just how the thing could possibly be used

Tangible Bits: Towards Seamless Interfaces between People, Bits and Atoms



Tangible Bits: Towards Seamless Interfaces between People, Bits and Atoms

- Three practical scenarios

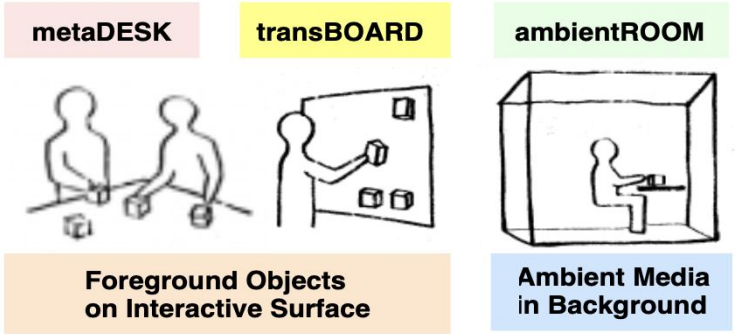


Fig. 7 Three Research Platforms of Tangible Bits

- Design approach

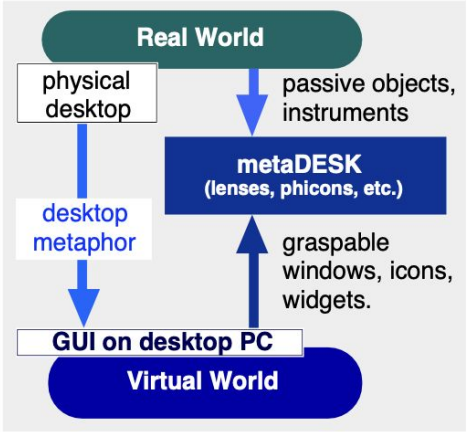


Figure 8 metaDESK design approach

https://www.youtube.com/watch?v=WO939s7FARQ

Discussion

- Metaphor vs. Affordance: Differences? Which is more important?

Past, Present and Future of User Interface Software Tools

- Keywords: User Interfaces, Human Factors, User Interface Management Systems, Windowing systems, Software
- “Desktop metaphor” had remained for 15 years at that time
- The author predicted that the new era of increasing diversity of computerized devices would come
- What we can learn from past failure and success cases of user interface design to fit the new design principles
- Recognition-based systems such as speech and camera-based vision would emerge in the future

Past, Present and Future of User Interface Software Tools

- Themes for evaluation tools
  - The parts of the user interface that are addressed
  - Threshold and Ceiling
  - Path of Least Resistance
  - Predictability
  - Moving targets

Past, Present and Future of User Interface Software Tools

- Future predictions
  - Popularization of computers
  - Ubiquitous computing
    - Various input/output capabilities
    - Tools to rapidly prototype devices
    - Tools for coordinating multiple, distributed communicating devices
  - Recognition-based user interfaces
  - 3D technologies
  - End-user programming, customization and scripting

Discussion

- How effective were the authors at predicting the future?
  - Do you think this had more to do with their good/bad guesses, or inevitable improvements on new designs?

Pick-and-Drop: A Direct Manipulation Technique for Multiple Computer Environments

- Keywords: Direct manipulation, GUI, stylus interfaces, drag-and-drop, multi-computer user interfaces, **natural behavior**
- Different computers have its own operating system with advantages and disadvantages - Multiplatform
- Problems
  - Restriction of input devices
  - Lack of user interface techniques designed for multi-computer environments
- Proposed multi-computer and a pen-based direct manipulation technique that can be used for data transfer between different computers as well as within the same computer

Pick-and-Drop: A Direct Manipulation Technique for Multiple Computer Environments

- Remote copy vs. Pick-and-Drop
- Symbolic vs. Physical

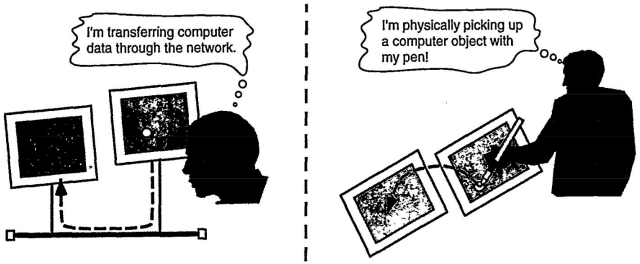


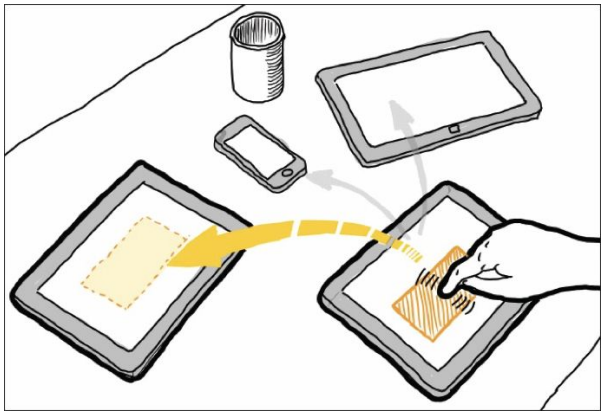
Figure 2: The conceptual difference between remote copy and Pick-and-Drop

- Philosophy of User Interface design: Understanding real and virtual world
  - Balancing the virtuality and physicalness of the target area

https://www.youtube.com/watch?v=TM4ORIVZXyg

Discussion

- Do you think the pen concept has a place in modern system design?
  - How would it change with modern technology?



From: weiser@xerox.com
Subject: "Tangible Bits"
Date: January 27, 1997 2:34:10 AM EST
To: ishii@media.mit.edu, ullmer@media.mit.edu

Dear Hiroshi and Brygg,

I recently had a chance to read your CHI 97 paper "Tangible Bits"!
Great work! In my opinion this is the kind of work that will characterize the technological landscape in the twenty-first century.

I do have a request. As a former professor with tenure I well understand the need to distinguish one's work from all that comes before. And I very much appreciate your kind acknowledgement to me. Thanks! My request is that you help me stop the spread of misunderstanding of ubiquitous computing based simply on its name. Ubicomp was never just about making “computers" ubiquitous. It was always, like your work, about awakening computation mediation into the environment. The Tabs, Pads, and Boards were simply a way to break out of the mold while still engaging traditional computer scientists -- although sponsoring Natalie to work on the String turned out to be as important as any of them!

I tried to stop using ubiquitous computing because of its misleading implication, but it keeps cropping up again, so I keep returning to it as my umbrella name for lots of work, including Things That Think. Augmented reality was in use for awhile, but again got balkanized in meaning. I have started to talk about Calm Technology as a theme, but it better names a goal than a research project. "Tangible Bits" is very nice, and maybe could serve as an overall umbrella, but then you might lose it as the name of your research project! I think we would all benefit if we could have an allegiance to some one common thing, and define our differences within that.
But we struggle with what to call that allegiance.

Anyway, great work, and I hope to visit soon and have some good chats now that Xerox has joined the Media Lab (and I am one of the two official Xerox liaisons).

-mark
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