Introduction to Mobile HCI

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Welcome to Mobile HCI!

This course will:

- Introduce you to Mobile Human-Computer Interaction;
- Introduce the challenges of designing for mobility:
  - Small touchscreens, poor connectivity, interaction on-the-move, etc;
- Introduce opportunities for new interactions:
  - Embedded sensors, location/context sensing, wearables, AR/VR, etc;
- Introduce software engineering on Android:
  - This is not a software engineering course…
- Look at issues like privacy, security, social acceptability, etc.

ILO1: Design Challenges

"Explain the problems associated with development in embedded, ubiquitous computing and mobile systems and services. These relate to the challenges of the software development environment, power and processing constraints and the difficulties of outdoors use, and the small screen and keyboard"

Key points:

- Mobile and ubiquitous computing devices have many constraints (size, power, connectivity, etc) and are used in many contexts (walking, etc);
- This course looks at how to address these challenges and take advantage of the opportunities afforded by mobility;

ILO2: Context, Privacy, Safety

"Describe the range of contexts-of-use of mobile systems development, and associated safety and privacy issues"

Key points:

- Understand the contexts in which your users might interact with your apps and the advantages/disadvantages associated with these;
- Understand the privacy, safety and security issues associated with mobile and ubiquitous computing;

ILO3: Device Constraints

"Analyse proposed engineering solutions, and comment on their suitability for use with mobile systems, taking into account the difficulties of the usage environments, and the hardware limitations of the devices"

Key points:

- Appreciate the limitations of developing software for constrained hardware devices;
- Be able to identify difficulties imposed by the user's environment;

ILO4: Evaluation

“Run basic mobile system evaluations”

Key points:

- Mobile and ubiquitous computing devices are used “in the wild” and may need to be evaluated in situ;
- Apply methods like paper prototyping, interface sketches and mock-ups, think-aloud evaluations, user studies, etc.

ILO5: Development

"Use a software development environment for a mobile device such as the iPhone or Android platforms, and be able to develop, deploy and test simple embedded software on mobile devices"

Key points:

- This course introduces Android;
  - Optional: enough to get started, but self-study needed to master it;
- You'll develop and deploy apps for testing & evaluation;

ILO6: Novel Technologies

“Discuss leading edge developments such as context-aware systems, sensor-based interaction, location-based interaction, mobile Augmented Reality”

Key points:

- Mobile and ubiquitous computing devices have many novel capabilities, which create novel opportunities for interaction;
- Understand how to take advantage of context, location, sensing capabilities and the privacy/security/safety implications of these;

Human-Computer Interaction

“Human-computer interaction (HCI) is a multidisciplinary field of study focusing on the design of computer technology and, in particular, the interaction between humans (the users) and computers. While initially concerned with computers, HCI has since expanded to cover almost all forms of information technology design.”

Source: https://www.interaction-design.org/literature/topics/human-computer-interaction

Human-Computer Interaction

Human-Computer Interaction is a huge academic field!

- CHI is one of the biggest computing science conferences in the world;
  - CHI was hosted in Glasgow in 2019, almost 4000 academics…

This course is mostly interested in mobile human-computer interaction;

- Several branches of HCI investigate issues relating to mobile, ubiquitous, pervasive and wearable computing;
- The definition of "mobile" is constantly evolving…
  - Handheld devices, wearable devices, in-vehicle interfaces, AR/VR devices, smart clothes and textiles
- Research into mobile computing long precedes the invention of the smartphone
  - First commercially available "mobile phone" from Motorola in 1983
  - iPhone first announced in January 2007
  - Devices have evolved significantly from then until now

ACM Mobile HCI

ACM Mobile HCI started in Glasgow in 1998;

"MobileHCI seeks contributions in the form of innovations, insights, and analyses related to human computer interaction and experiences with mobility and beyond. The conference series has shaped research, development, and practice in mobile devices and services for over 20 years. Our interpretation of mobility is inclusive and broadly construed."

Source: https://mobilehci.acm.org/2019/call-for-papers/

ACM Mobile HCI

Form factor and capabilities have changed, but many of the basic interaction challenges have not…

From "User Needs for Mobile Communication Devices" by Väänänen-Vainio-Mattila et al. (Mobile HCI 1998)

See: http://www.dcs.gla.ac.uk/~johnson/papers/mobile/HCIMD1.html

Ubiquitous Computing

ACM UbiComp started in Seattle in 1998;

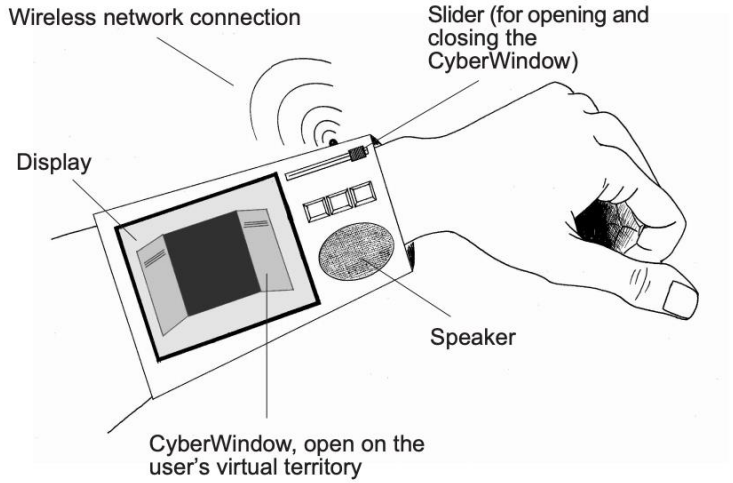


Figure 1. Tentative sketch of a wearable CyberWindow

From "Supporting Social Awareness on the World Wide Web" by Liechti et al. (Handheld CSCW 1998)

See: http://www.teco.edu/hcscw/

Wearable Computing

Right: Thad Starner (now at Google Glass) at MIT in 1995

Contemporary Mobile HCI

Today's devices are more refined than those in the 90s;

- … but the tasks we do with them haven't changed much;
- … and the interaction challenges aren't solved yet;

Today's devices and design practices are inspired by the past two decades of research;

- … and today's research shows what the future of mobile computing might look like;

Mobile Devices

This course is not just about smartphones;

Mobile and ubiquitous computing devices can be:

- Held in your hand: phones, tablets, etc
- Worn on the body: watches, rings, glasses, headsets, shoes, clothes, etc
- Embedded in the environment: beacons, IoT devices, sensors, etc
- Inside your body?: implants, ‘smart tattoos’, etc

In most cultures, mobile phones are seen as ‘essential’: always with you when you leave the house;

Context: Challenging Environments

Mobile devices are used in many contexts:

- E.g., when walking, running, driving, on the train;

Interaction subject to many challenges and disturbances:

- Connectivity problems, noise, movement, inconsistent lighting, etc.
- Users must divide their attention with their surroundings and other tasks;
  - Leading to "fragmented" interaction in "micro-bursts"

Both input and output are affected by the environment:

- E.g., difficult to type when walking, difficult to hear on the subway

Context: Social Acceptability

Source: http://www.metrocf.or.jp/manners/poster.html

New Interaction Opportunities

Mobile HCI isn't just about challenges… it's also about the amazing possibilities offered by increasingly capable portable devices;

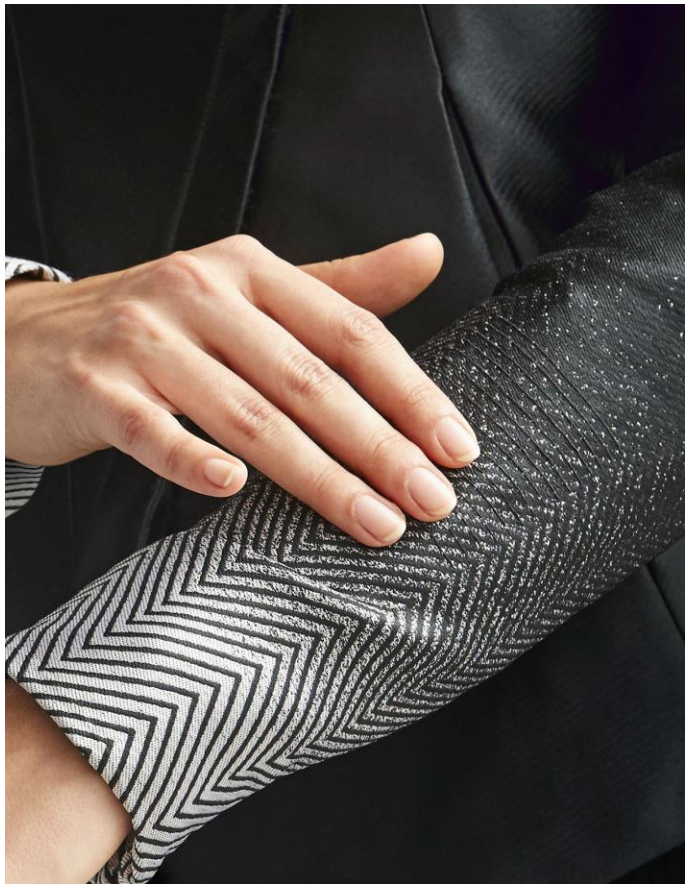
Mobile devices have many capabilities lacking in 'fixed' devices:

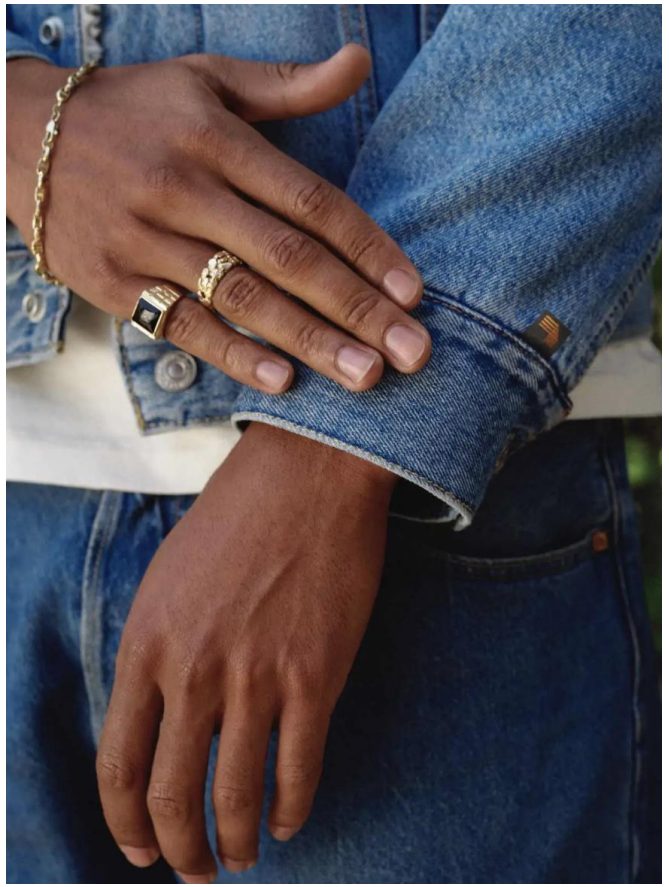
- Cameras (nowadays, really good cameras…)
- Sensors:
  - Location, motion, orientation, magnetic, ambient light, temperature, heart-rate, microphones, proximity, radar, pressure/grip
- Wireless communication:
  - Radio, Wi-fi, Bluetooth, ANT+, NFC, RFID

New Interaction Opportunities

New sensing methods are changing what ‘computing devices’ look like…

E.g., Project Jacquard from Google sees interaction literally woven into clothing;



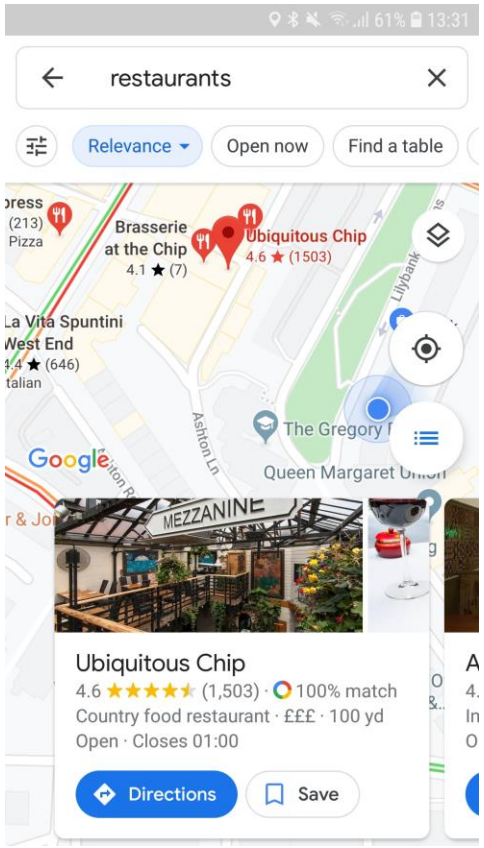


Google Project Jacquard: https://atap.google.com/jacquard/

New Interaction Opportunities

Google Project Soli, full video: https://www.youtube.com/watch?v=0QNiZfSsPc0

New Interaction Opportunities



Impact on Society?

Is ubiquitous computing always a good thing?

- New capabilities enrich our lives, but what are the long-term impacts?

Computing is now "always-on":

- Difficult to disconnect – impacts on mental health?
- A continuous distraction – impacts on social interaction?
- "There's an app for that" – relying on tech too much?
- Continuous video & audio sensing – privacy and security implications?

“I Forgot My Phone” by Miles Crawford: https://vimeo.com/73085316

Windows Phone advert (2010): https://www.youtube.com/watch?v=4mhrKWVQ0sk

What can you do?

Mobile and ubiquitous computing devices are the main way we access and interact with digital information;

- New opportunities for interaction…
- … with new challenges

MHCI introduces the possibilities and challenges of mobile computing;

- So you can design good mobile experiences that enrich peoples life;