IN4MATX 133: User Interface Software

Beyond Web & Mobile

Socrative Quiz!

Enter your UCI Email when prompted for name!!!
e.g.,

xxxxx@uci.edu

Three waves of computing

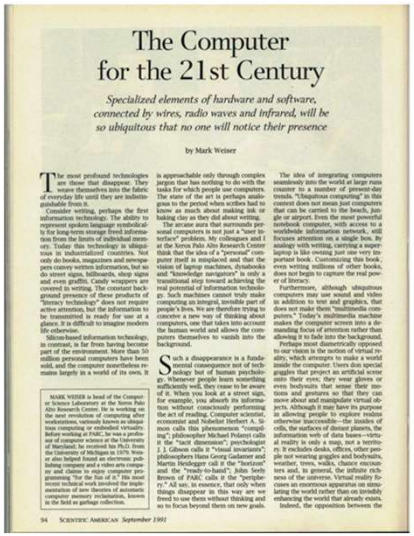
Mainframe computing

Personal computing

Ubiquitous computing

Third wave: ubiquitous computing

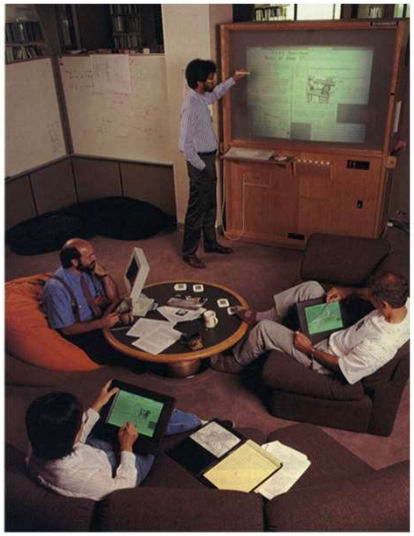
- Weiser speculated people would interact with three types of computers
  - Tabs: inch-scale devices, like post-its
  - Pads: foot-scale devices, like paper
  - Boards: yard-scale devices, like whiteboards
- Speculated devices would have shared ownership



The Computer for the 21st Century

Specialized elements of hardware and software, connected by wires, radio waves and infrared, will be so ubiquitous that no one will notice their presence

by Mark Weiser

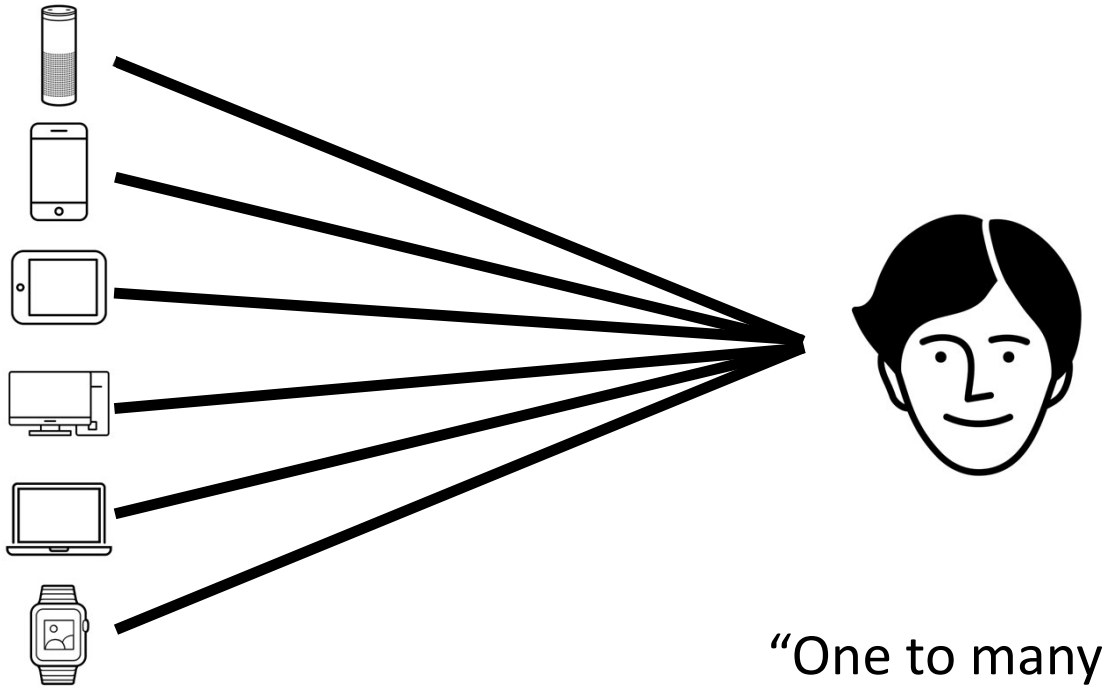


Third wave: ubiquitous computing

Third wave: ubiquitous computing

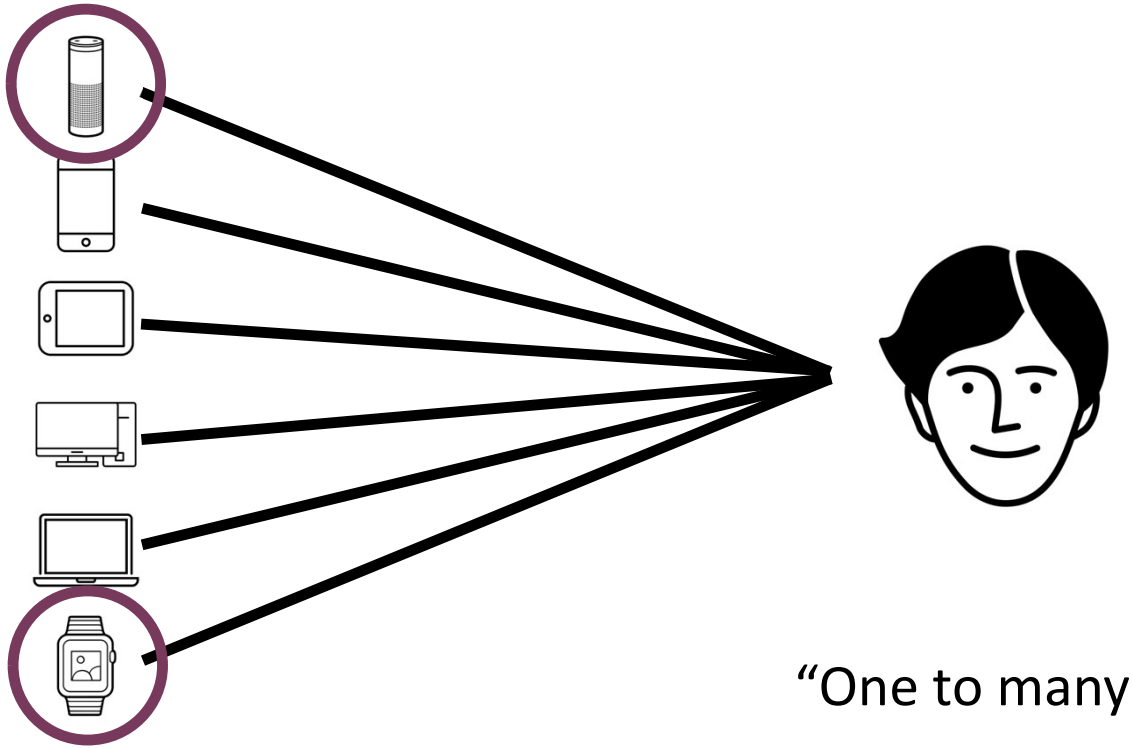
- Lines up with what we use today, for the most part
  - Tabs = phones and watches
  - Pads = tablets and laptops
  - Boards = interactive projectors? smart TVs? augmented reality?
- Still a strong sense of device ownership

Third wave: ubiquitous computing



"One to many"

Third wave: ubiquitous computing



"One to many"

What is a wearable computer?

What is a wearable computer?

- A computer on the body that is:
  - Always on
  - Always accessible
  - Always connected
- Other actions:
  - It augments user actions
  - Is aware of the user and their surroundings

Rhodes, B.J. 1997. The wearable remembrance agent: a system for augmented memory. *Personal Technologies*, 1(4), 2018-224.

The ideal wearable

- Persists and provides constant access
  - Designed for everyday and continuous use over a lifetime
- Senses and models context
  - Models the user's environment, mental state, and it's own state
- Augments and mediates
  - Information support for the user in both physical and virtual realities
- Interacts seamlessly
  - Adapts input and output modalities to those most appropriate at the time

Starner, T.E. 1999. Wearable computing and contextual awareness. *Dissertation, MIT*

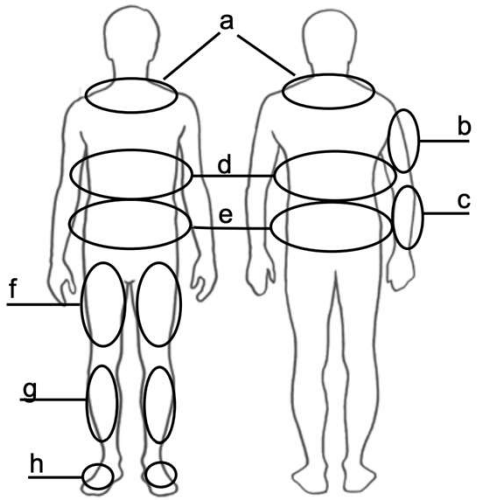
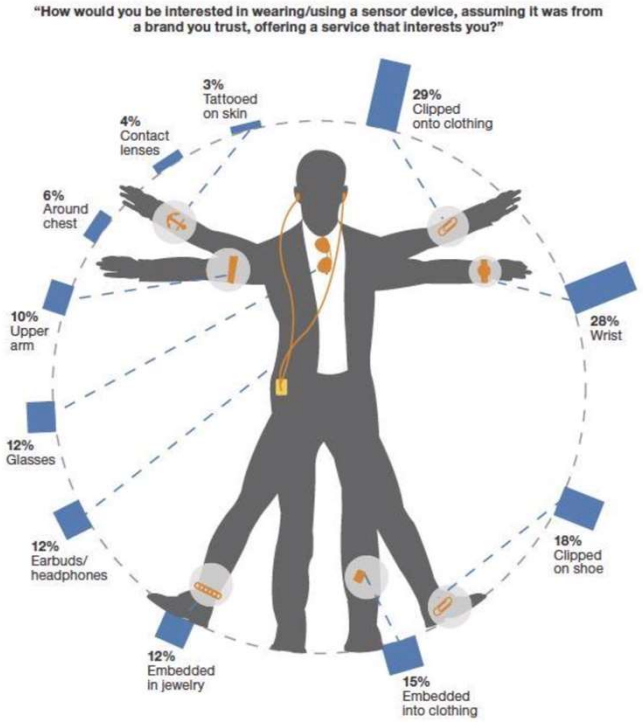


Fig. 1, The general areas we have found to be the most unobtrusive for wearable objects are: (a) collar area, (b) rear of the upper arm, (c) forearm, (d)rear, side, and front ribcage, (e) waist and hips, (f) thigh, (g) shin, and (h) top of the foot.

Gemperle, F. Kasabach, C., Stivoric, J. Bauer, M. Martin, R. Design for Wearability. ISWC 1998.



North American Technographics Consumer Technology Survey, 2013.

Wrist-worn wearables

Fitbit (2011)

- One of the first commercially successful digital pedometers
- Early versions were hip-worn, now almost exclusively wrist-worn
- Current models are “fitness-first” smartwatches
  - Activity prominently included on the home screen
- Acquired by Google in 2019

Pebble (2013)

- Arguably the first commercially successful smartwatch
  - Two of the most funded Kickstarter projects ever
- E-ink display led to high battery life (a week vs. a day)
- Paired with a phone via Bluetooth
  - Could retrieve email, control music, receive notifications, etc.
- Acquired by Fitbit in 2016

Apple Watch (2015)

- From the onset, it was intended to be a “second screen” companion to iOS devices
- Original versions could do almost nothing without pairing to an iOS device
- Apps add a secondary component to an existing iOS app
- Today they are quite powerful on their own

Wearables in Research

https://chrisharrison.net/index.php/Research/Welcome

Design recommendations for (wrist-worn) wearables

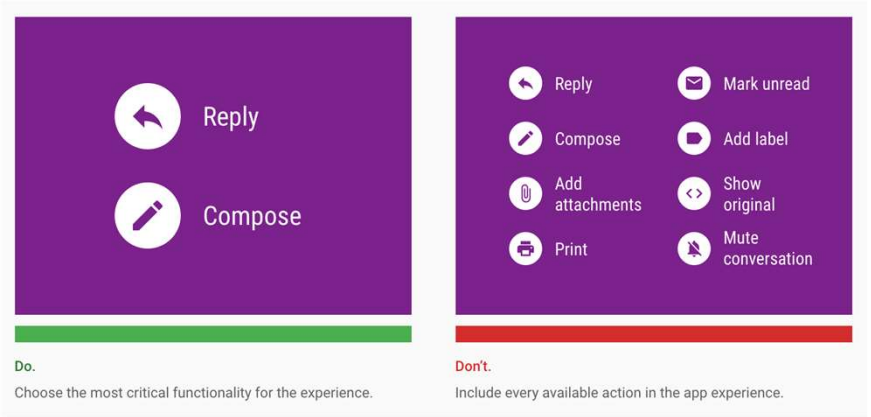
One visual thought per screen

- Real estate is extremely valuable on watches
- Shrinking a mobile or desktop app will create a bad experience
- Keep words and interactions to a minimum

https://mayvendev.com/blog/10-tips-for-designing-for-wearables-and-watches

Reduce input options

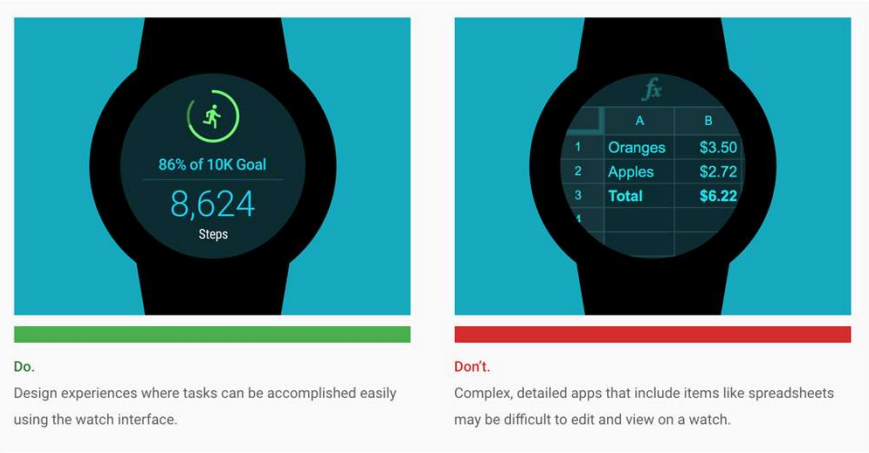
- Have only a couple of buttons per screen
- This may mean a watch app has fewer features than a mobile app
  - That's okay!
  - The watch augments the experience
- Consider voice input when longer instruction is needed



https://designguidelines.withgoogle.com/wearos/wear-os-by-google/designing-for-watches.html

Some apps don’t need a watch interface

- For some apps, a watch app may not add to the experience
- Focus on use cases which make sense
  - Quick input
  - Glanceable feedback



https://designguidelines.withgoogle.com/wearos/wear-os-by-google/designing-for-watches.html

Questions to consider

- Would a watch app add anything to my mobile app?
  - Is there timely information the app needs to provide?
  - Can it be shown in a very small format?
  - Are there simple controls to the app that would be added to a watch?
- Do I have the resources/time to do this?
  - Currently limited market impact, but growing
- What type of interaction do you want the user to have?

Implementing watch apps

- Requires native development, as far as I know
  - WatchKit for iOS, Wear OS for Android
- Requires a companion iOS or Android app for building/deploying, though may be able to run as a standalone
- However, you can develop a hybrid mobile app and connect it to a native watch app

https://developer.android.com/training/wearables/apps

https://developer.apple.com/documentation/watchkit

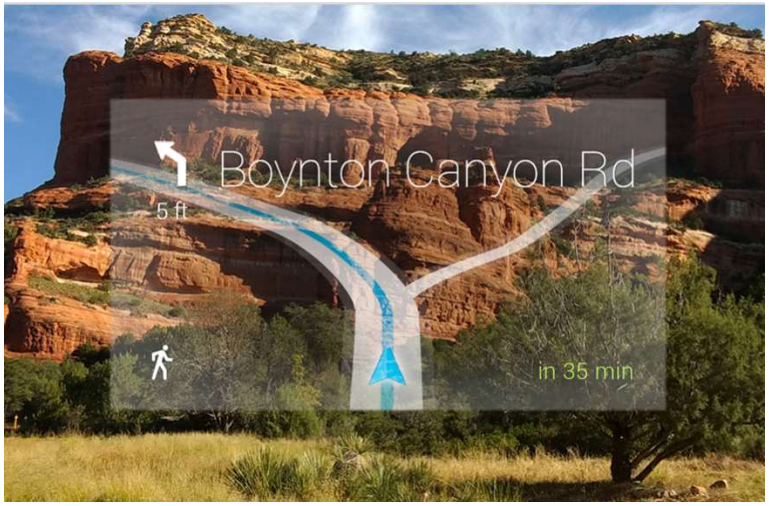
Body and head-mounted wearables

MIT Wearable Computing (1996)

Google glass

- Commercial smart glasses, released in 2013
  - Technology lead by Thad Starner, part of the MIT group
- Front-facing camera, rear-facing display
- Gyroscope/accelerometer/magnometer
- Natural language input capabilities

https://www.x.company/glass/



https://www.x.company/glass/

Google glass

- Privacy and safety concerns and poor marketing prevented take-off in the consumer space
- Lived on in enterprise spaces
  - New version released in 2017
  - Used in manufacturing, healthcare
- As of Sept 15th 2023, no longer supported

https://www.x.company/glass/

Enterprise

- Purpose-built, niche products fill some gaps
- Still no general-purpose head-mounted wearable computer
- (Not including VR!)

https://www.realwear.com/

TODO: META Glasses

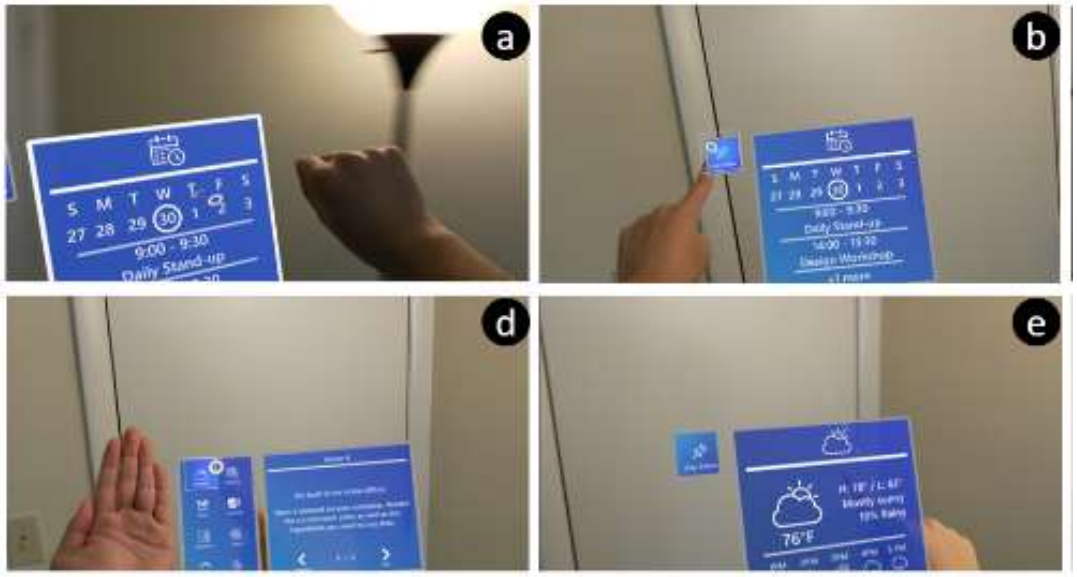
Do you need a screen?

- Watches, small touch screen – limited options for input/output
- Yet…all wearables are increasingly becoming more powerful

Head Mounted Display Interaction

Head Mounted Display Interaction

- Look familiar?
  - Gestures
  - Touch
  - Context recognition
  - Prediction?



https://dl.acm.org/doi/pdf/10.1145/3491102.3517723

Wearables in Research

- In a study of AR widget interaction, authors evaluated use across several design considerations:
  - Attention cost
  - User agency
  - Cognitive load
  - Task efficiency
  - Error recovery

https://dl.acm.org/doi/pdf/10.1145/3491102.3517723

Wearables in Research

- Authors found:
  - Manual movement of widgets posed higher workload on participants, low efficiency
  - Automated layout reduced effort and attention cost, but reduced user agency and increased error correction
  - Semi-automated layout eased error recovery and increased user agency

https://dl.acm.org/doi/pdf/10.1145/3491102.3517723

Screenless and Partial-display Wearables

Meta Smart Glasses

- No display
- Have speakers, touchpad, buttons
- What are some other ways one might interact?

Screenless User Interfaces

What are some ways that we might support interaction with a computational system that does not have a screen?

Screenless User Interfaces

- Voice
- Gestures
- Touch
- Body motion