

# **IN4MATX 133: User Interface Software**

**Lecture 17:**  
**Small & Large Displays**

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# Announcements

- A5 is posted
  - Intentionally less programming than previous assignments
  - Timezone converter, can choose from three frameworks to implement it
  - Let us know if we can better clarify setup instructions or requirements
- A3 grades will be out soon, finishing grading ones which were too large to download

Q1: How, if at all, does this framework support package and library management?

[Your answer here]

Q2: How, if at all, does this framework support principles for code separation, like Model-View-Controller? Would the separation principles effectively support creation of a larger application? Why or why not?

[Your answer here]

Q3: In lecture, we discussed a few design recommendations for each respective device. How, if at all, does the framework support the recommendations for that device? What recommendations are left to the developer to decide how or whether to implement?

[Your answer here]

Q4: What appear to be benefits to using web technologies for development on this device? Conversely, what advantages might a native framework have over the framework you used?

[Your answer here]

Q5: What did you find easy and challenging about development in this framework?

[Your answer here]

# Announcements

- I won't have office hours a week from today (3/8)
  - It was the only time a very difficult-to-schedule meeting could be
- We'll make sure there are still hours, but the schedule may shuffle around some
  - I'll update on Thursday

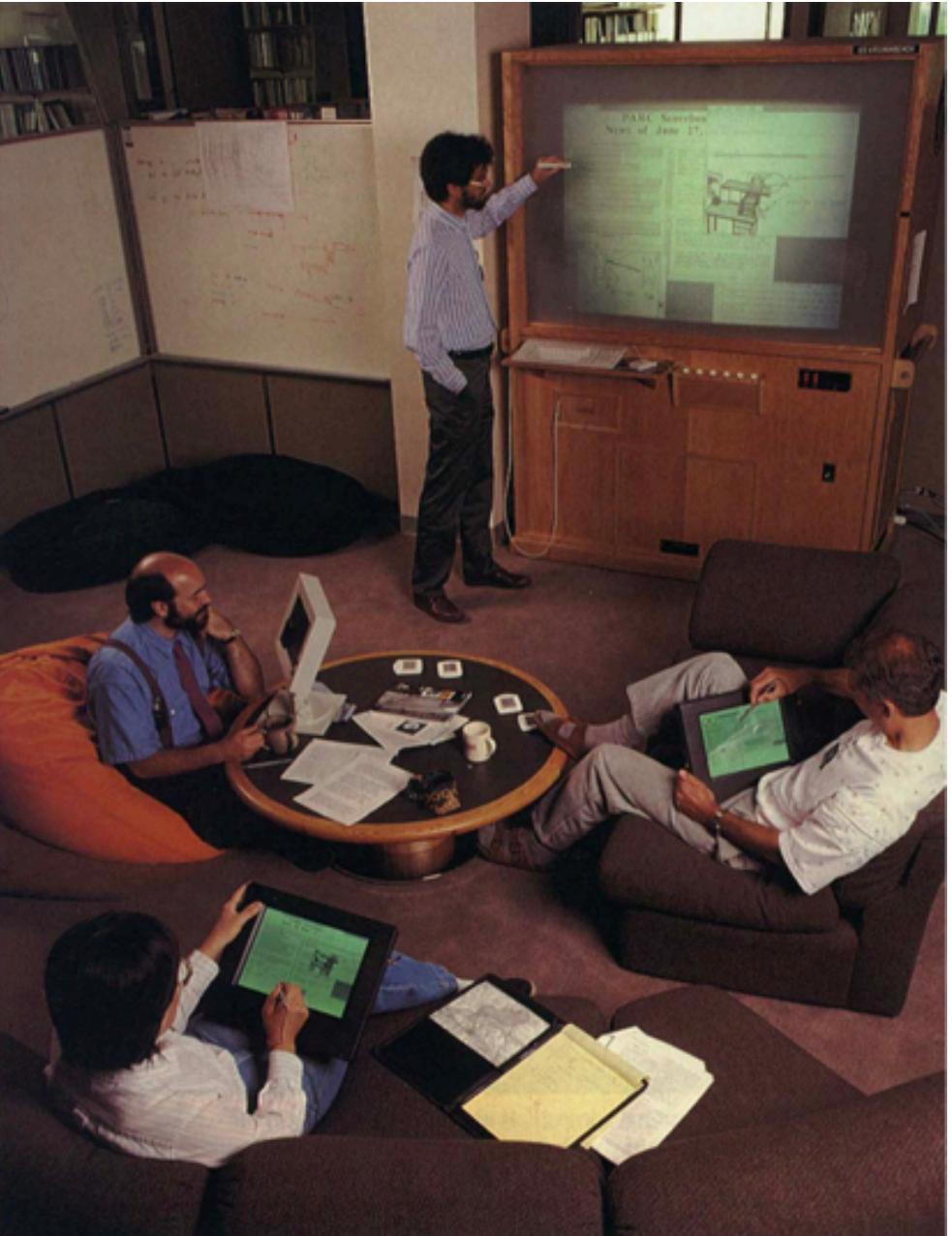
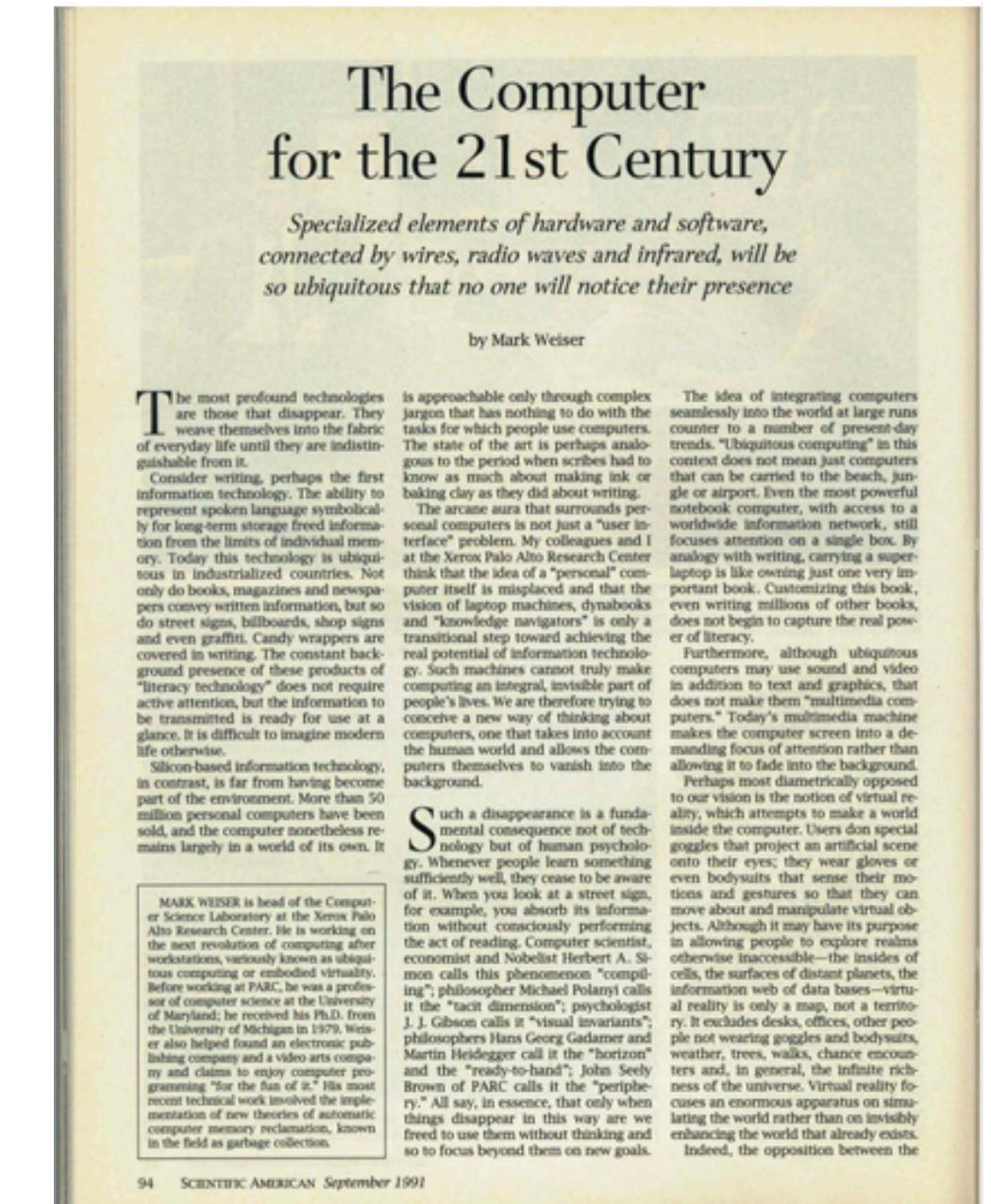
# Today's goals

**By the end of today, you should be able to...**

- Describe some of the history of wearable computing and large scale displays
- Explain key principles for designing a good wearable experience
- Articulate some principles for creating experiences with large displays
- Identify a few potential libraries for developing wearable and TV apps

# 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



# Third wave: ubiquitous computing



# **What is a wearable computer?**

## A MUCH More Diversified Market Than Investors Realize

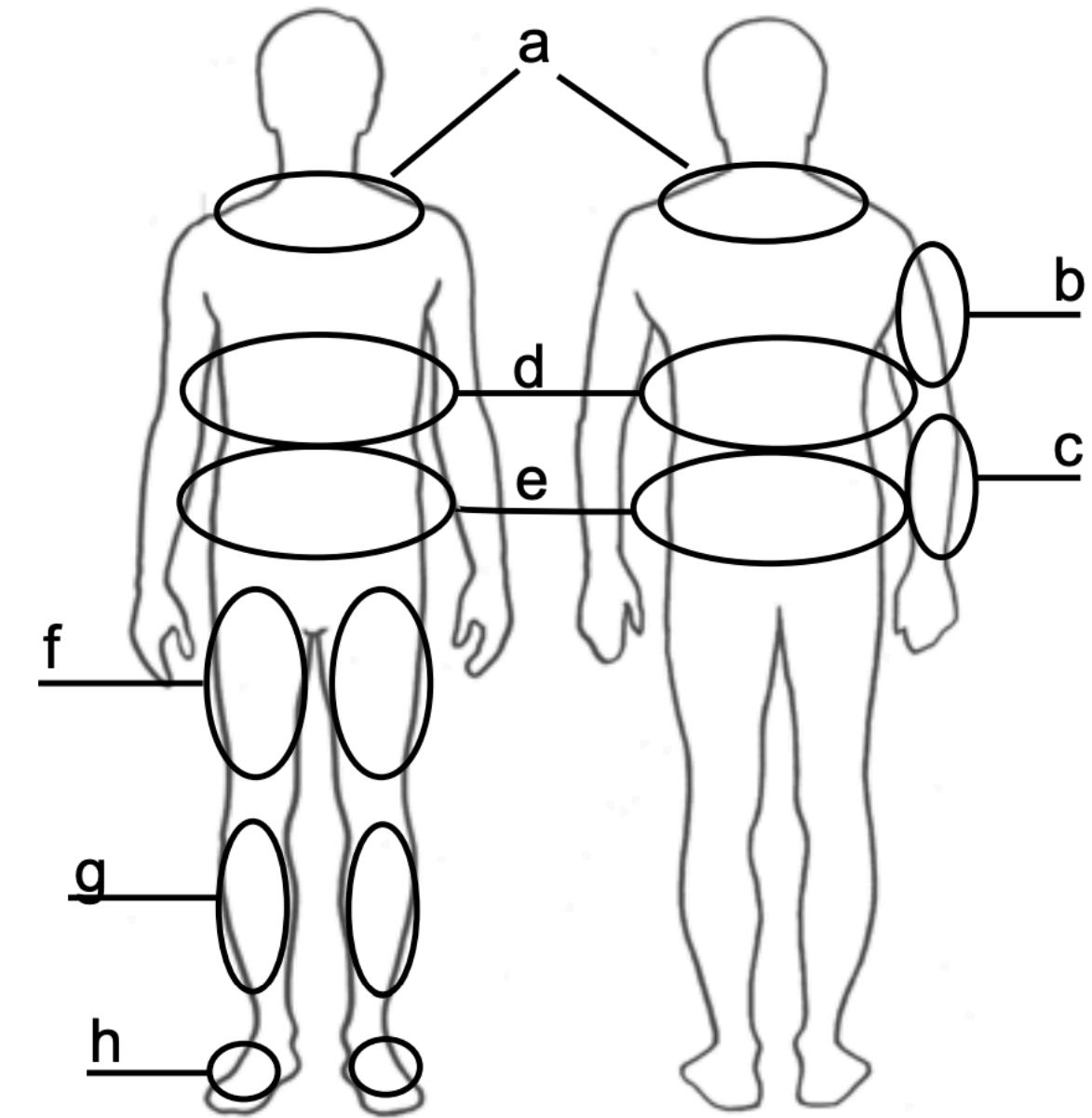


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# What is a wearable computer?

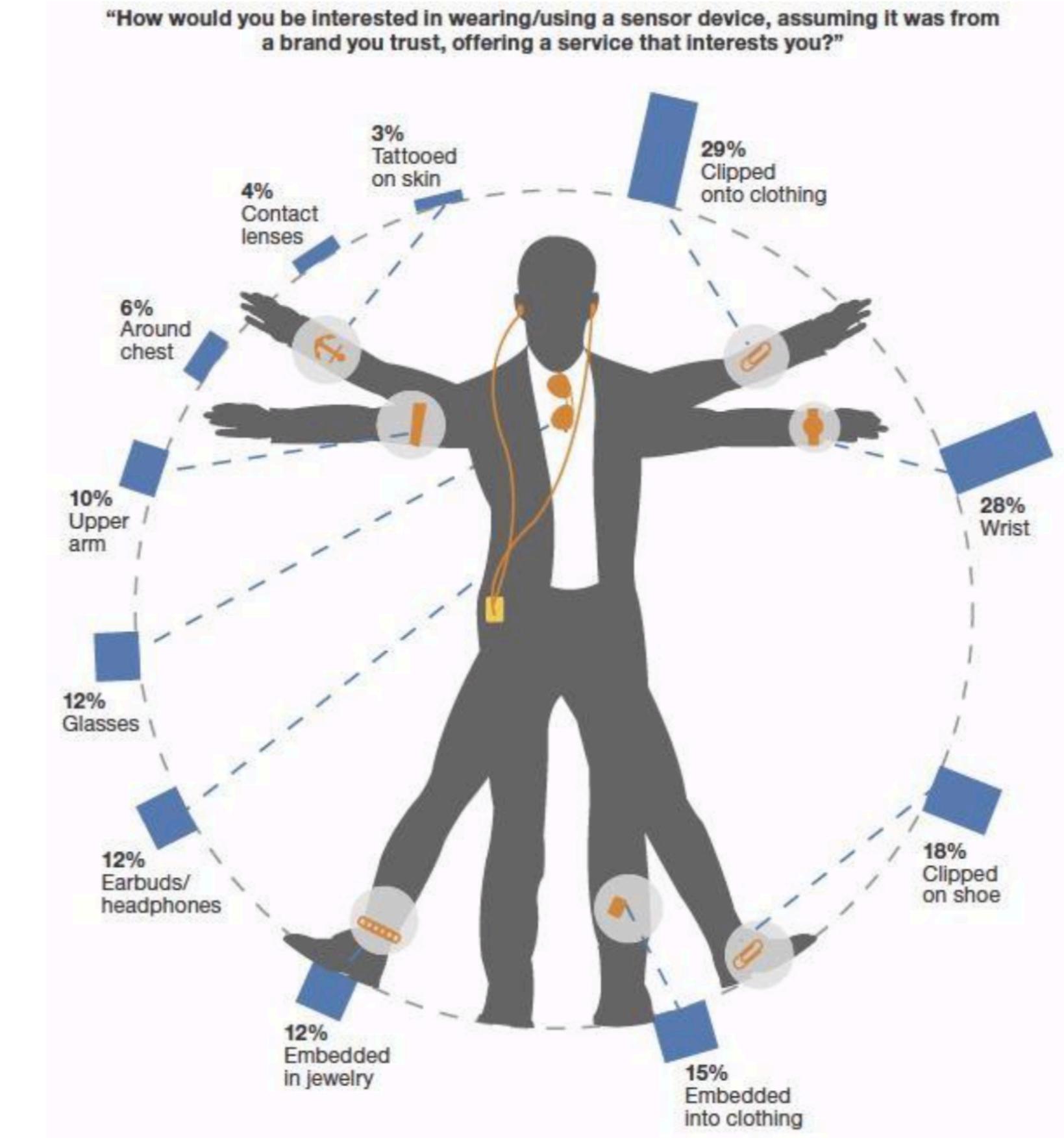
- A computer on the body that is:
  - Always on
  - Always accessible
  - Always connected
- Other actions:
  - It augments user actions
  - Is aware of the user and their surroundings

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



**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.

# **Body and head-mounted wearables**

# MIT Wearable Computing (1996)



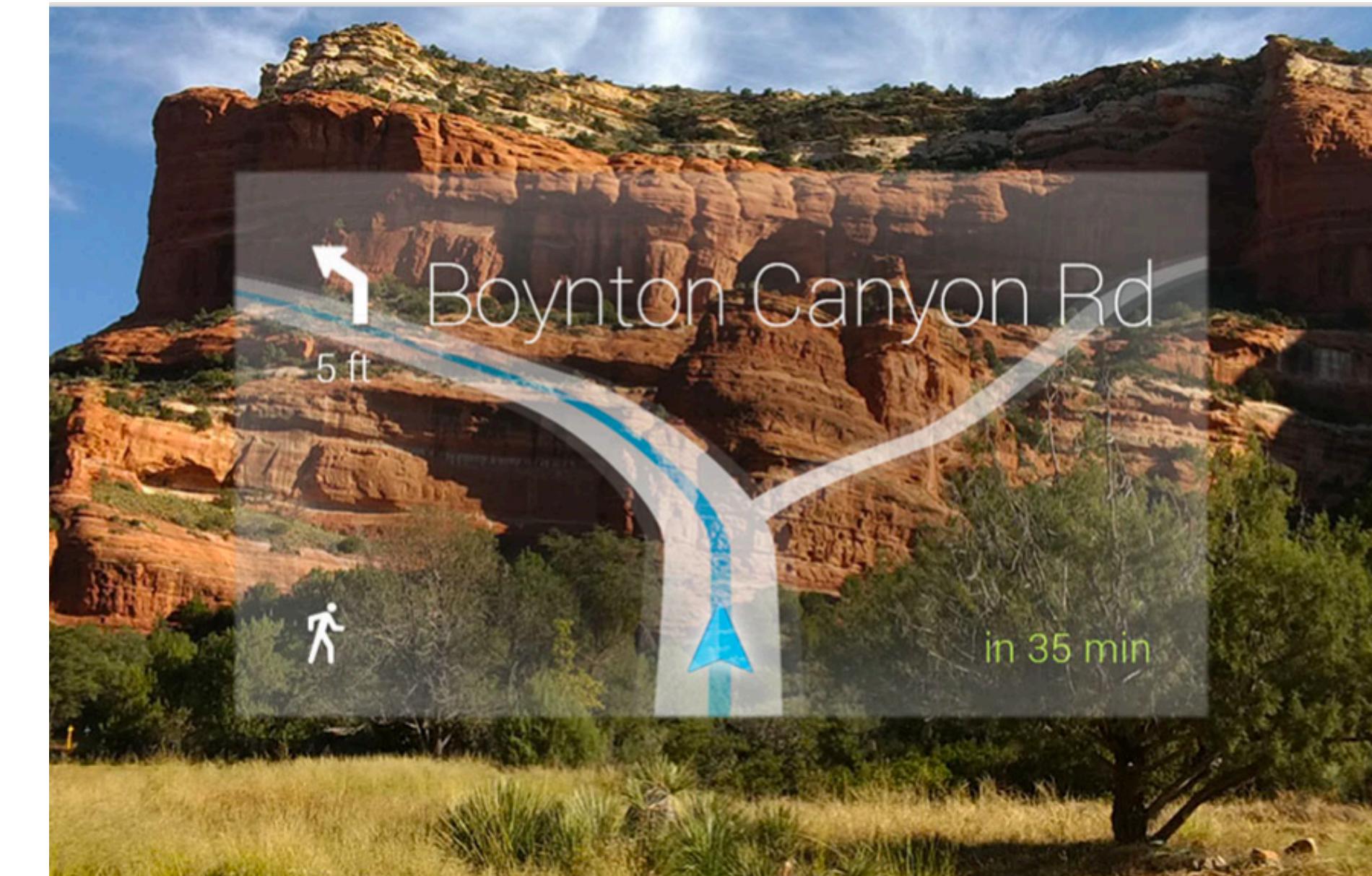
# Google glass

- 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/>

# Google glass



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

# Google glass

- Privacy and safety concerns prevented take-off in the consumer space
- Lives on in enterprise spaces
  - New version released in 2017
  - Used in manufacturing, healthcare



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

# **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



# **Design recommendations for (wrist-worn) wearables**

# One visual thought per screen

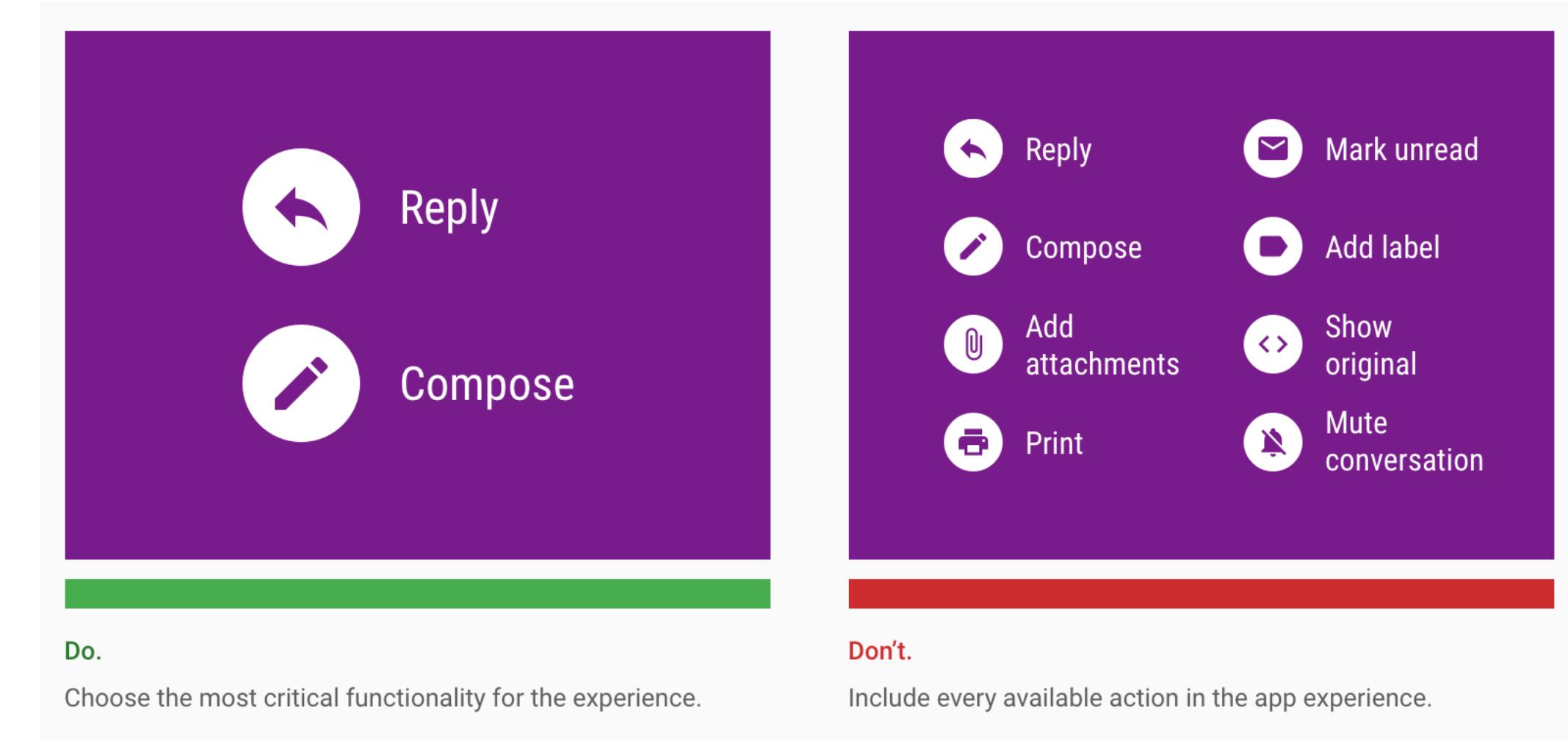
- Real estate is extremely valuable on watches
- Shrinking a mobile or desktop app will create a bad experience
- Keep words and interactions to a minimum



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

# Reduce input options

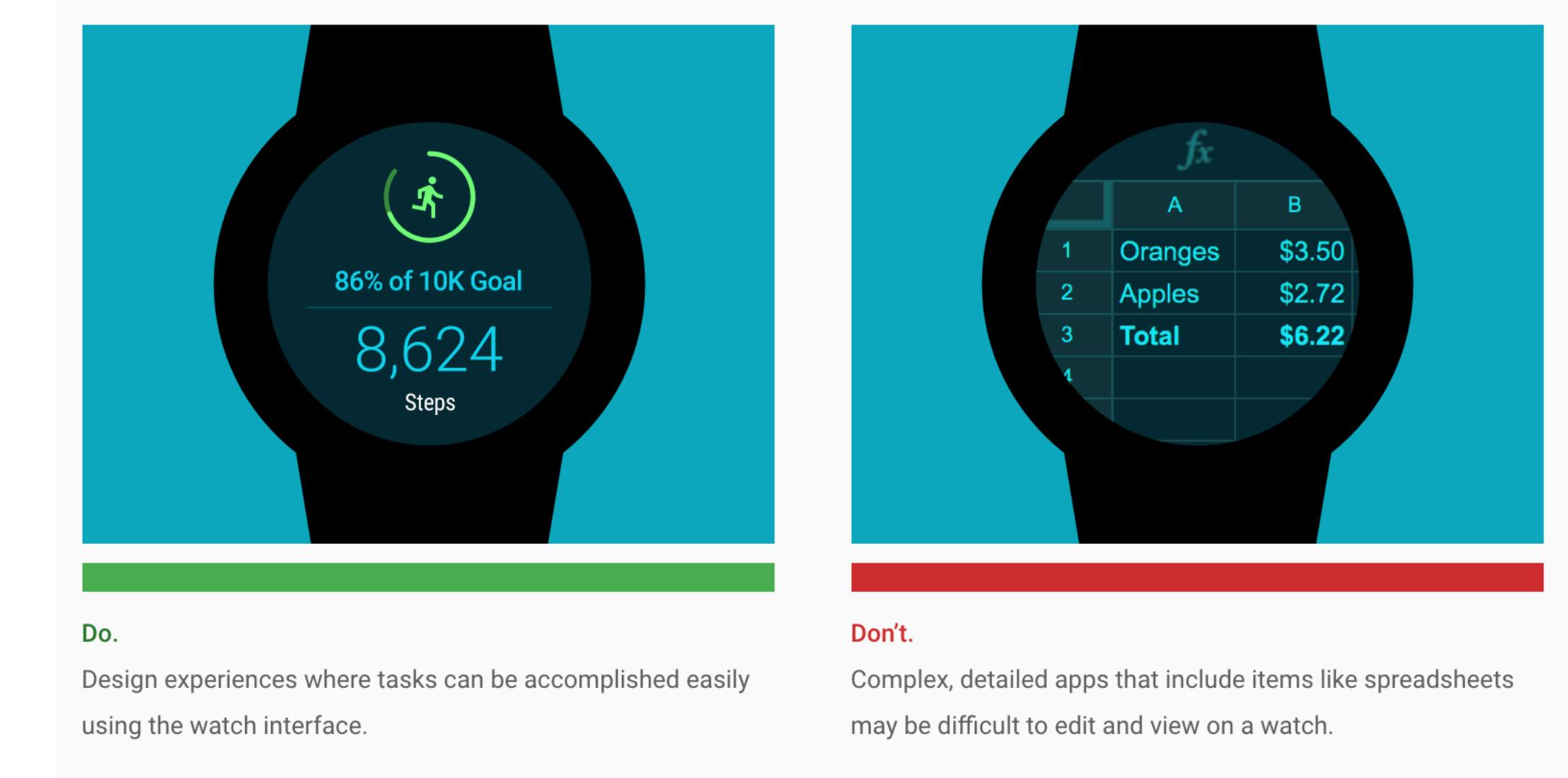
- Have only a couple of buttons per screen
- This may mean a watch app has fewer features than a mobile app
  - That's okay!
  - The watch augments the experience
- Consider voice input when longer instruction is needed



<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>

# Question



These are all Apple Watch apps.  
Which have a compelling use case?

Pick whichever choice is closest to what you believe.

- A None of them have a compelling use case
- B Dark Sky
- C Dark Sky, RunKeeper, Fandango
- D Dark Sky, RunKeeper, New York Times, OneNote
- E All of them have a compelling use case



New York Times (news)  
Dark Sky (weather)  
Fandango (movie purchase)  
RunKeeper (fitness)  
OneNote (notetaking)

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New York Times (news)  
Dark Sky (weather)  
Fandango (movie purchase)  
RunKeeper (fitness)  
OneNote (notetaking)

Open to interpretation,  
I think NYT and Fandango  
are a stretch but there are  
potential uses

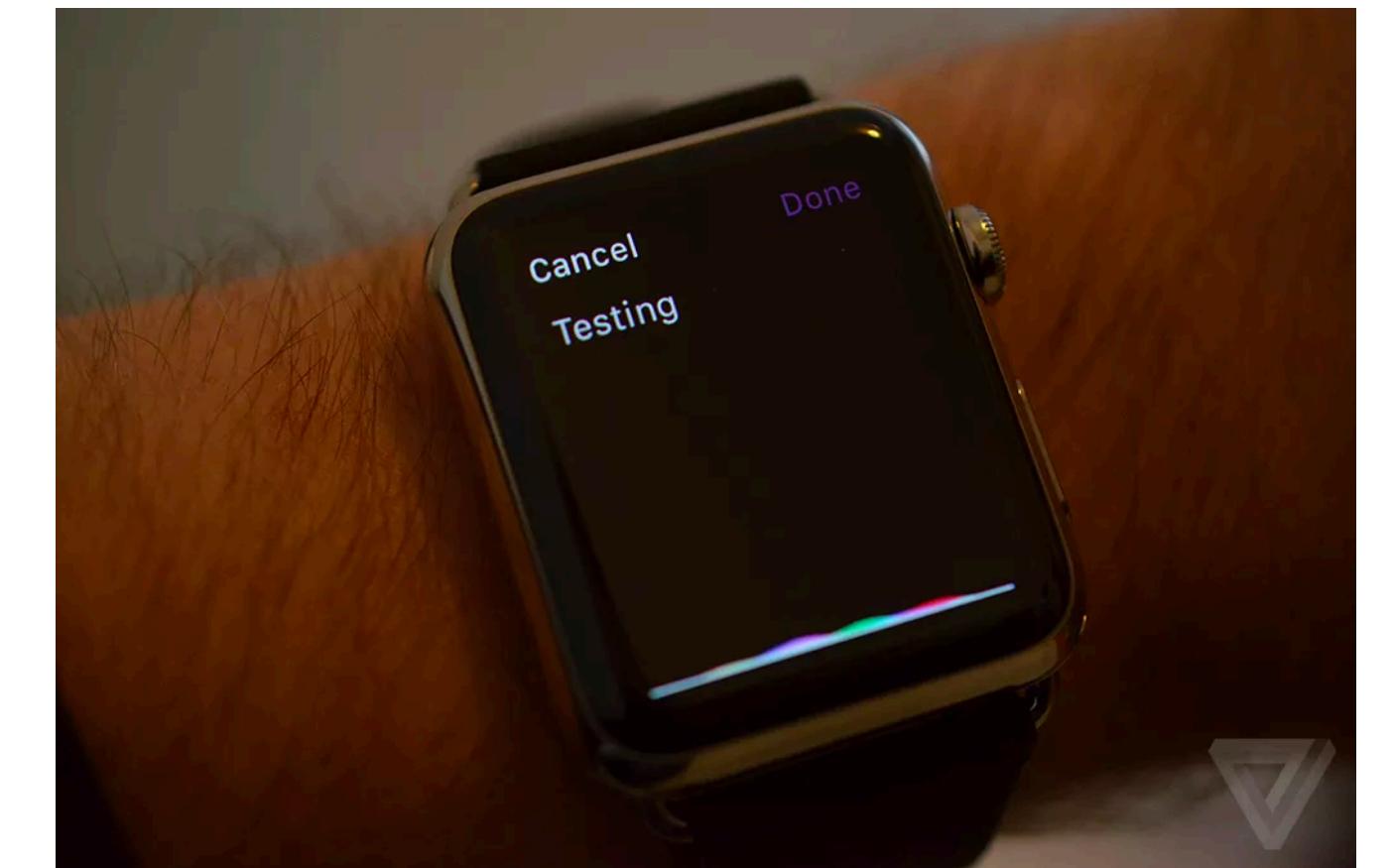
# Microsoft apps for Apple Watch



Powerpoint remote



Skype messaging



OneNote voice memos

Are these compelling use cases?

<https://www.theverge.com/2015/4/28/8508445/microsoft-apple-watch-apps-hands-on>

# 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

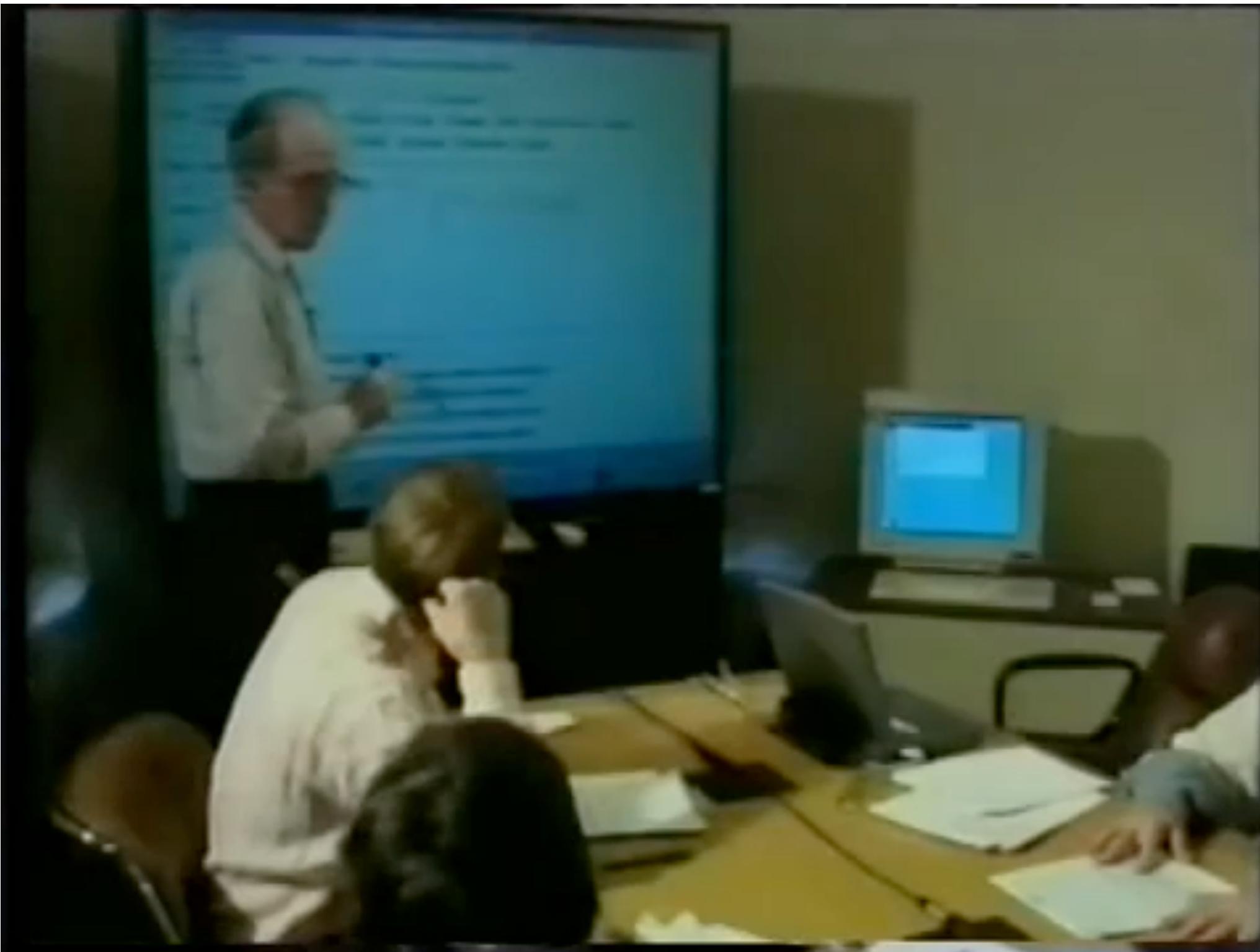
- Requires native development for many watches
  - WatchKit for iOS, Wear OS for Android
- Requires a companion iOS or Android app for building/deploying, though may be able to run as a standalone
- However, you can develop a hybrid mobile app and connect it to a native watch app

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

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

# **Large-scale displays**

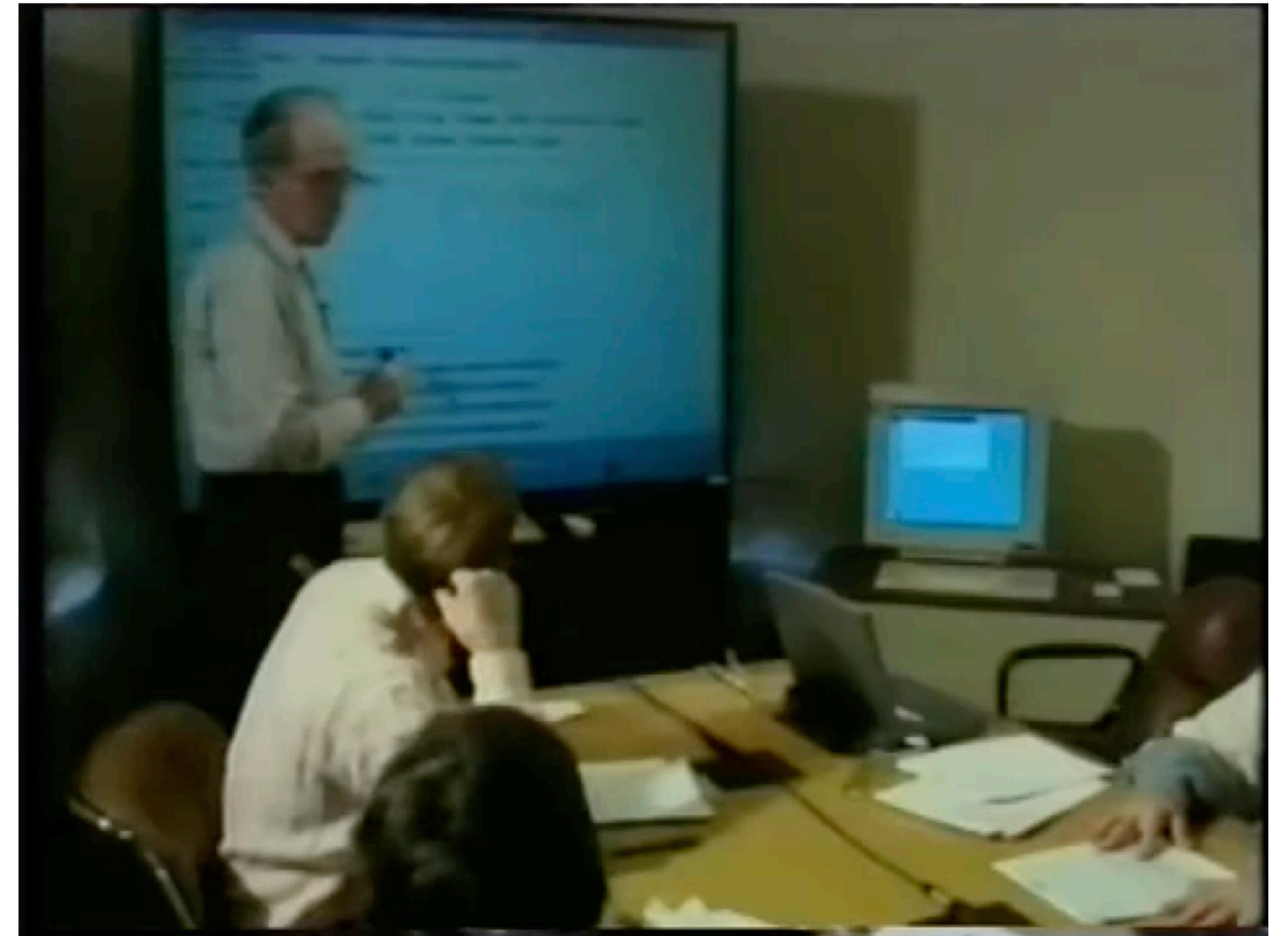
# Project Tivoli



Tivoli: An Electronic Whiteboard for Informal Workgroup Meetings. INTERCHI, 1993.

# Project Tivoli

- Pen-based gestures
  - Writing
  - Increasing size
  - Pick up and drag
- Inherently collaborative use
- Value in connecting information to other computers



Tivoli: An Electronic Whiteboard for Informal Workgroup Meetings. INTERCHI, 1993.

# Interactive Whiteboards (~2005)

- Widely introduced for educational purposes
- Mostly served as external monitors for computers
- Operated as a projector with a resistive touchscreen



# Public Displays

- Often focused on immersion
- Close integration with the environment is important, from both a technical and a design perspective
- Very few libraries or toolkits to help with development



# Large-scale displays

- Rarely for consumer use
- Often blend personal with interpersonal interaction



# Question



large

Would touching a button be easier on a tablet computer or a typical monitor, assuming the button is scaled?

- A Large display
- B Typical monitor
- C They would be about the same
- D
- E

# Question



large

Would touching a button be easier on a tablet computer or a typical monitor, assuming the button is scaled?

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# **Designing for large displays**

# Scale everything up

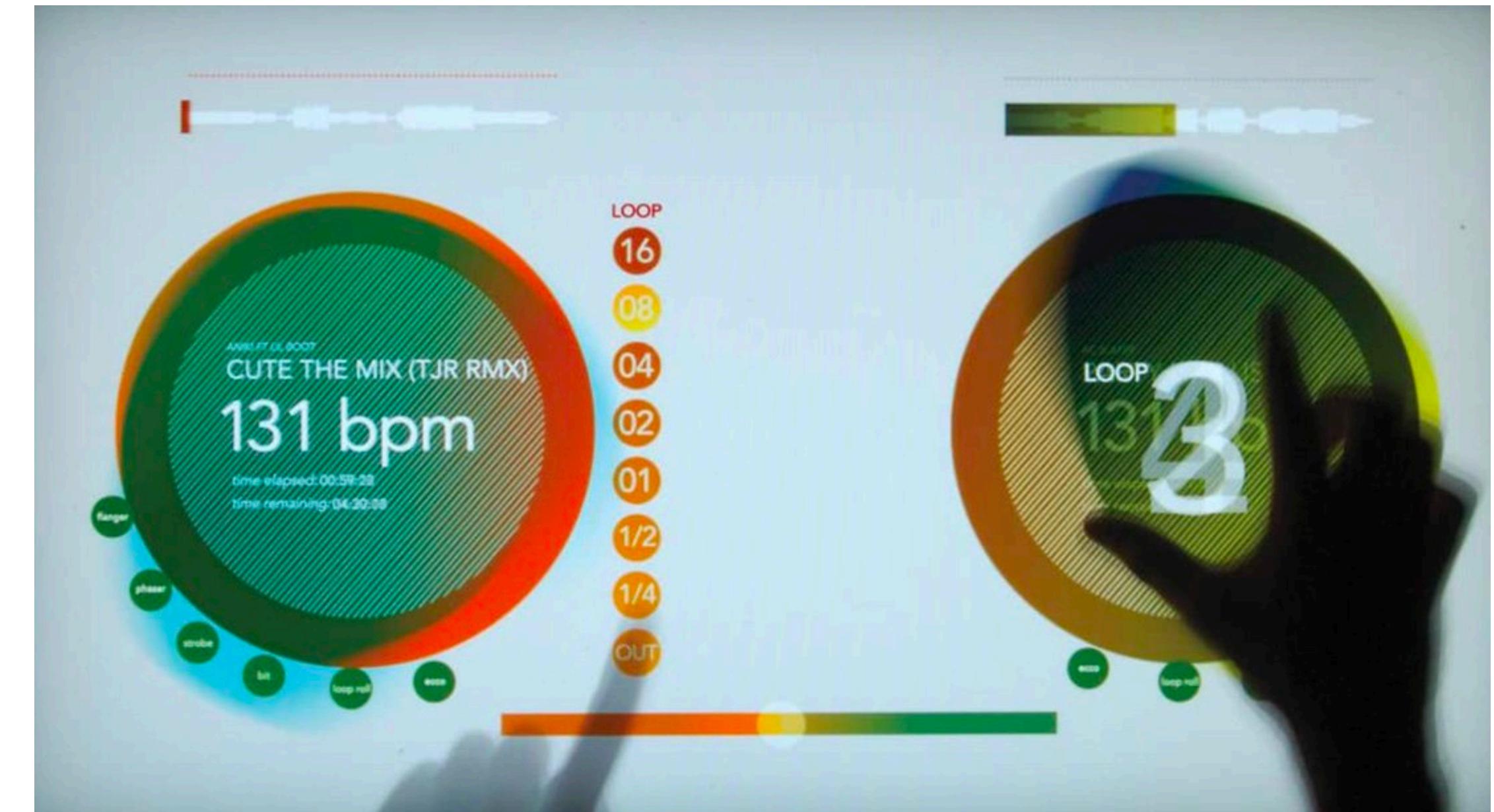
- A person is likely to be viewing the screen from further away
- Displays are often in public spaces, so large elements can encourage someone to come interact
- Often in new or unfamiliar environments, so interaction needs to be obvious

<https://designshack.net/articles/ux-design/tips-for-designing-oversized-touchscreens/>

<https://uxdesign.cc/designing-for-large-touch-screen-always-have-the-user-context-in-mind-878b6d2e02a9>

# Enable more complex gestures

- Consider using a person's entire hand
- Movement will be exaggerated, avoid requiring high precision
- Minimize overall arm movement, avoid long swipes



<https://designshack.net/articles/ux-design/tips-for-designing-oversized-touchscreens/>

<https://uxdesign.cc/designing-for-large-touch-screen-always-have-the-user-context-in-mind-878b6d2e02a9>

# Respect privacy

- The bigger the screen, the more likely someone else can see the interaction
- Large screens will often have smaller pop-ups for data entry
- Consider risks of requiring internet connection

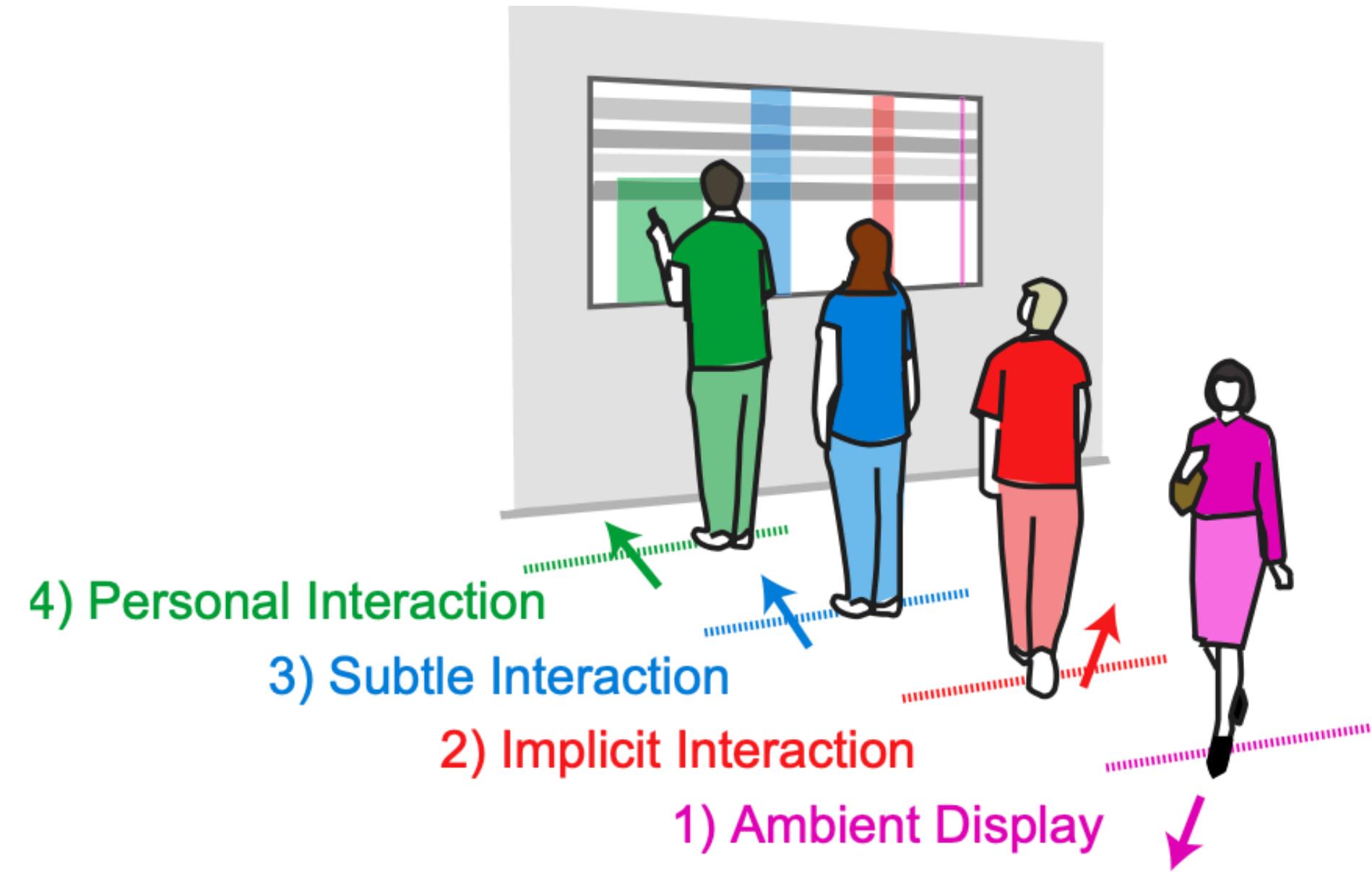


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# Respect interaction phases

- There are different “phases” of interaction in public spaces
- Layout needs at each phase are different
- Can draw people in with large elements, then start presenting more personal information

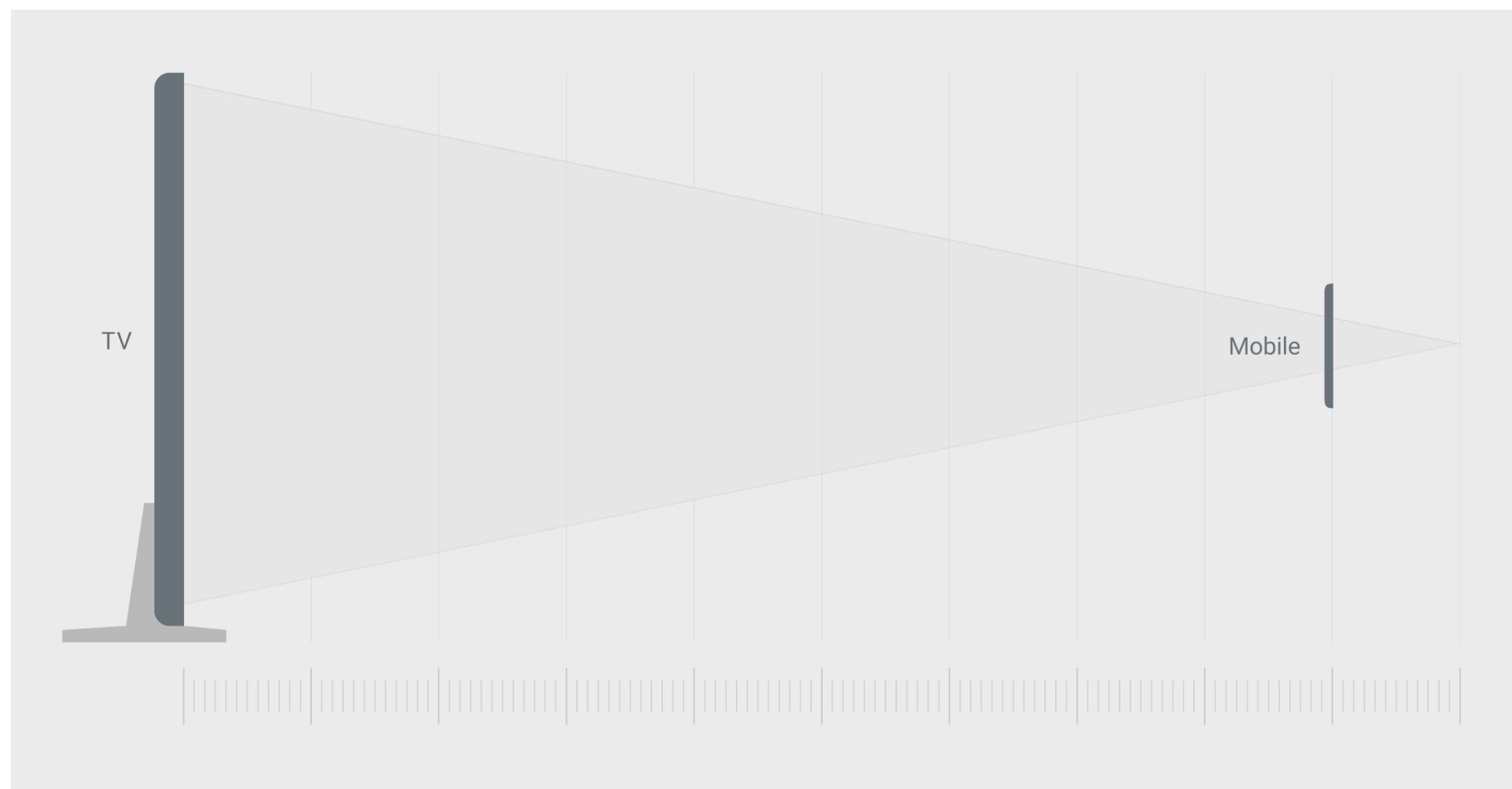


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# Smart TVs

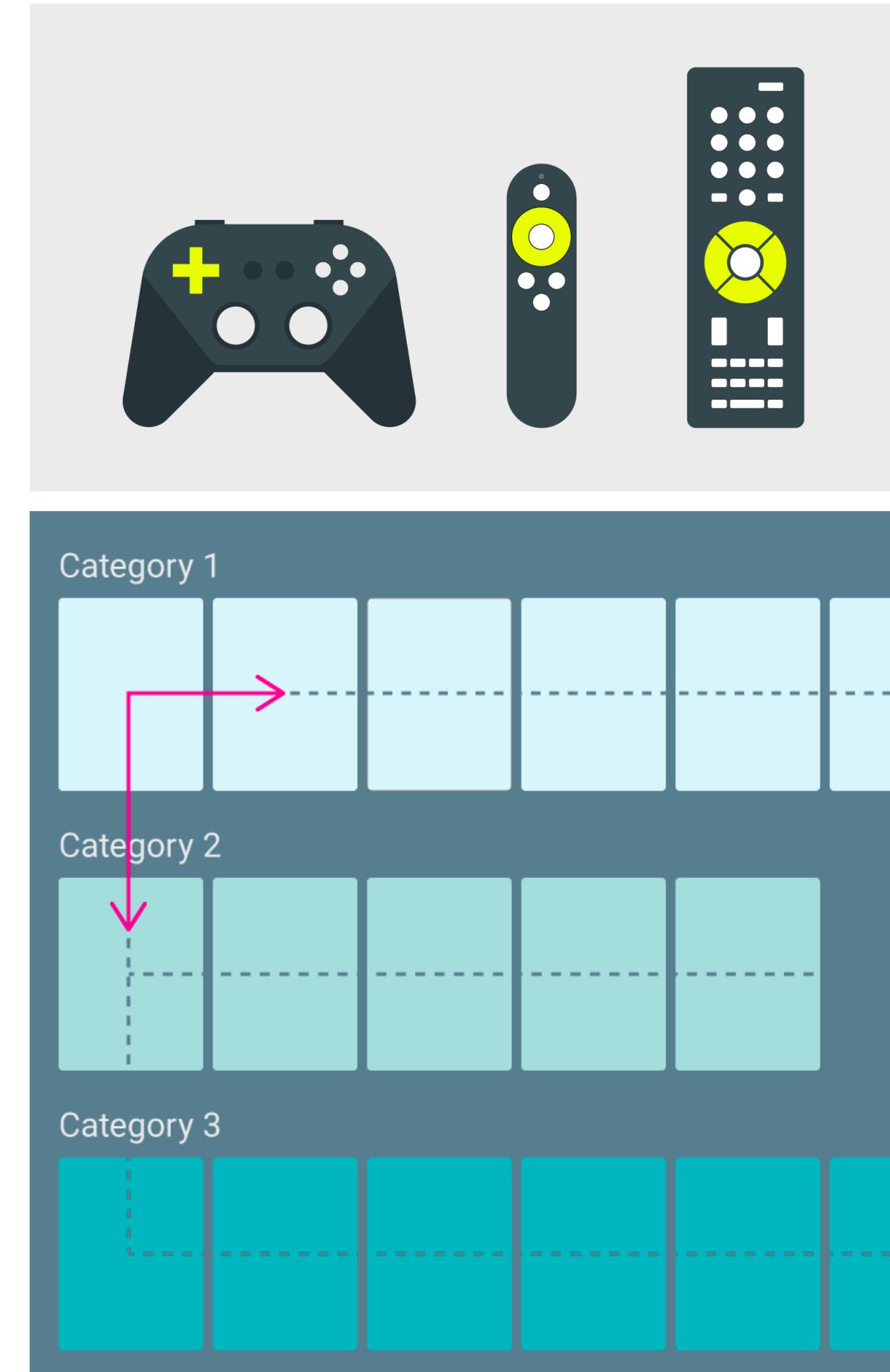
- The “smart” implies internet access
- Can safely assume that people are far away



<https://tv.withgoogle.com/design-principles/designing-for-tv.html>

# Smart TVs

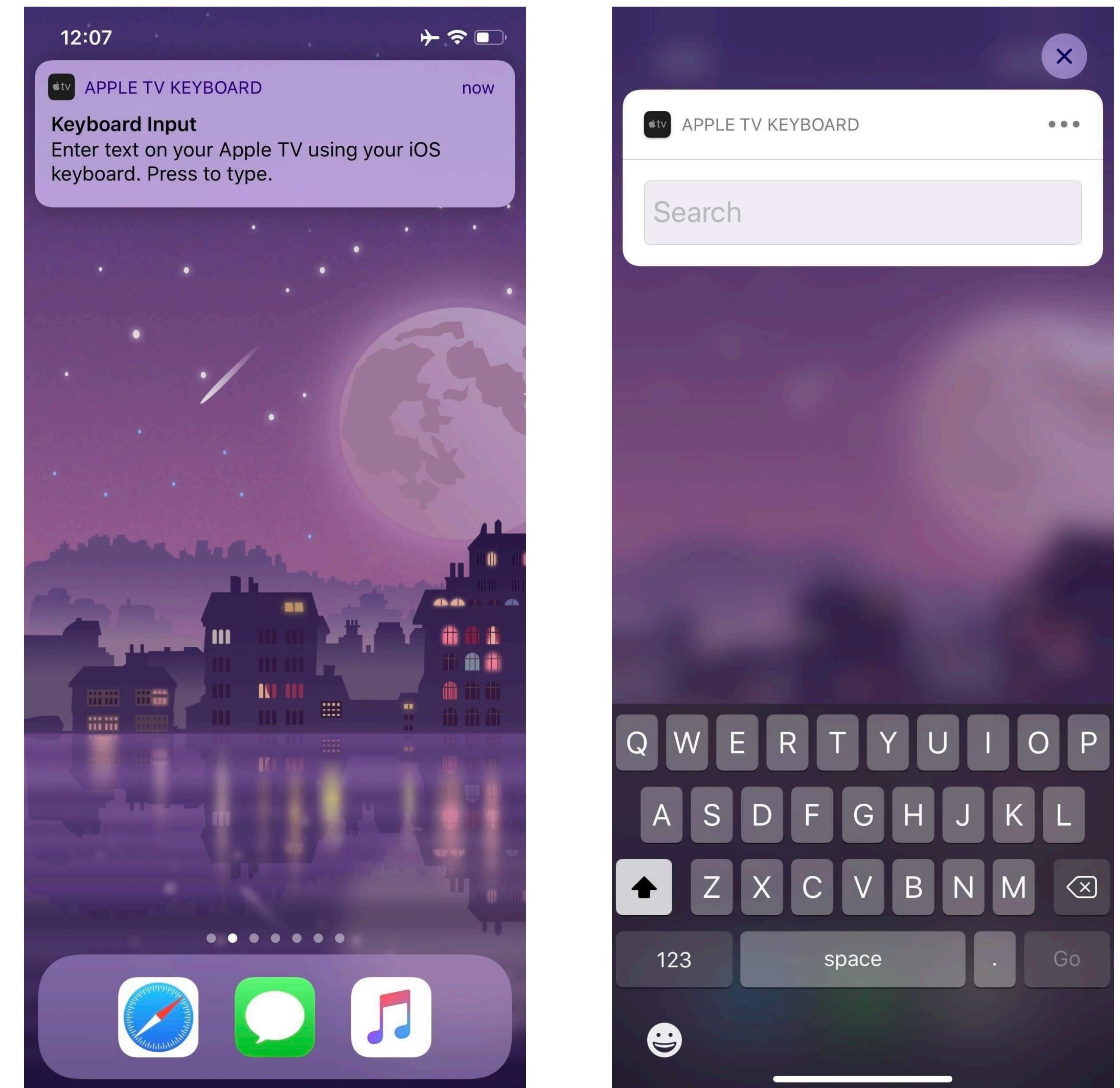
- Interaction is often via directional pads, so axis-based navigation is important



<https://tv.withgoogle.com/design-principles/designing-for-tv.html>

# Smart TVs

- Text input via D-pads is slow
  - Voice-based interaction can help
  - Can offload to mobile devices, if paired



<https://tv.withgoogle.com/design-principles/designing-for-tv.html>

# **Developing for large displays**

# Developing for large displays

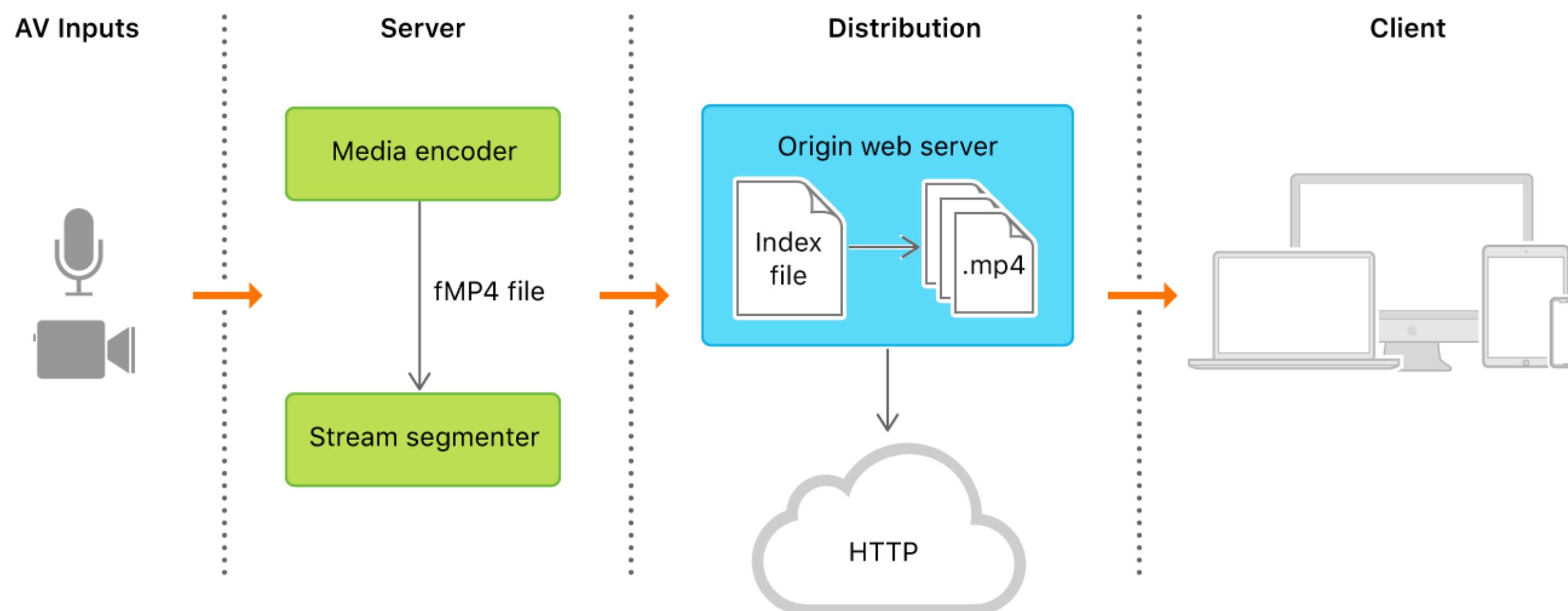
- Displays often have access to browsers, even offline
- Can use plain old HTML, CSS, and JavaScript
  - Bootstrap has an `xl` class for extra large displays
- More complex environments require custom software for gesture recognition, integrating other sensors

# Developing for large displays

- Android TV
  - <https://developer.android.com/tv>
- tvOS (Apple)
  - <https://developer.apple.com/tvos/>
- Both provide native apps for interaction
  - Swift for tvOS, Java for Android TV

# Developing for large displays

- Most media is still streaming, so falling back to HTTP and JavaScript is useful
  - Webservers host media content to play



[https://developer.apple.com/documentation/http\\_live\\_streaming](https://developer.apple.com/documentation/http_live_streaming)

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