

Wearable Computing

Personal devices.

The rise of hybrid input and interaction models.



Wearable tech

“Wearables” embed sophisticated technology in personal, wearable items – upgrading old technology or inventing new categories. It’s a broad term.

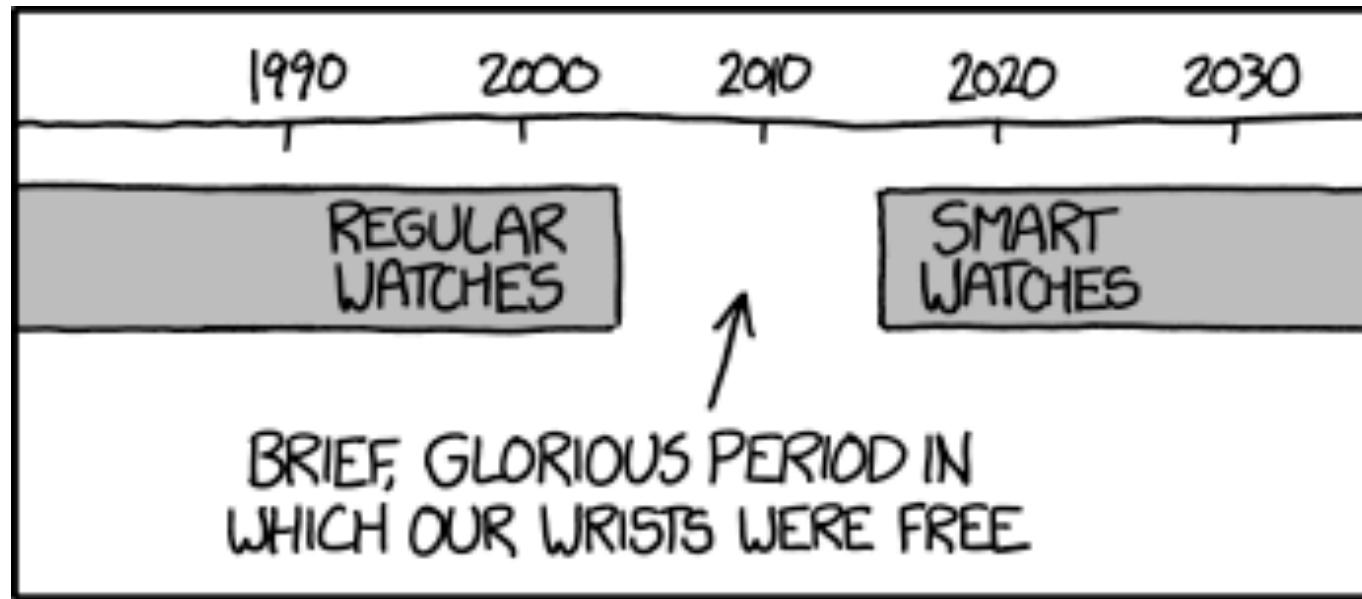


We've been building wearable technology for a *very* long time...

- Smartwatches.
- Calculator watches.
- Wristwatches.
- Eye glasses.
- Clothes.

This is just the latest iteration, with a few twists.





“Old people used to write obnoxious thinkpieces about how people these days always wear watches and are slaves to the clock, but now they've switched to writing thinkpieces about how kids these days don't appreciate the benefits of an old-fashioned watch.”

So, is this a good idea?

Do we need shirts that monitor our heartbeat, or shoes that track our steps?

Do we really want our jackets controlling our music?



The Levi Commuter Jacket
<https://goo.gl/QXYY6p>

How do you interact with these devices?

- Do you tap your chest rhythmically to "start" your shirt?
- Touch interaction? Discrete controls?
- Do you need a smartphone to interact with these devices?

Let's talk about smartwatches – as an example of a successful wearable category.



Released: April 24, 2015
Watch OS, pairs with iOS 8+

- Notifications
- Control phone functions via voice
- Few dedicated apps
- Pairs with phone for radio
- Apple Pay

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Released: March 18, 2014
Based on Android 6.0.1

- Notifications
- Control phone functions via voice
- Few dedicated apps
- Pairs with phone for radio
- Android Pay

Apple Watch Features



Apple Watch Series 2

https://www.youtube.com/watch?v=p2_O6M1m6xg

Apple Watch Features

So, *what* are they selling?

- Lifestyle – swimming, tennis, running, basketball, biking, dancing

Integration of technology into daily life

- Activity tracking (heartrate, steps).
- Messaging (emojis?)
- Turn-by-turn directions
- “Hey Siri, start an outdoor workout”
- Breathe
- Phone call
- Time

Features

- GPS
- Dual-core
- Water resistant 50 M

A very personal device. *i.e. you would lend your phone to a friend, but you would never lend your watch.*

Do you need a smartwatch to accomplish any of these things?

Why doesn't everyone have a smartwatch?

- Lack of radios on the watches means they're tethered and seen as phone extensions rather than standalone devices.
- Yet-another device to charge every day?
- Cost?
- Are watches fashionable or utilitarian?
 - Fashion/expression, and not just serving a function
 - What about smartwatches? What are they?
- No killer app yet. Candidates?
 - Proxy for phone: Use as an alternate output device (limited!)
 - Fitness: Tracking heartrate, activity.
 - Healthcare: Early detection of heart attacks and strokes; health monitoring.
 - Identification:
 - Apple Pay, Android Pay.
 - Computer authentication without passwords.

- Ubiquitous Computing (“Ubicomp”)
 - Introduced by Mark Weiser, 1996
 - Notions of “computing everywhere”, “calm” technology
- Ubicomp suggests computing in two forms:
 - Embedded computation, or technology that we find in the environment.
 - Personal/portable computation, or technology that travels with us as we move from environment to environment.
- Smartwatch has the potential to be as a platform for computation within a context.
 - Uniquely personal device, operating in larger context

While other forms of technology innovation have transformed and disrupted the status quo, the wrist seems more resistant to change.

- » Big problems and small spaces: How to design a smartwatch app (wareable.com)

- Small display
 - Ultimately constrained by the size of the user's wrist
- Limited input
 - Finger blocks ~25% of screen during taps
 - “Fat Finger: problem exaggerated, with few workarounds
 - Physical buttons are limited, but more important
 - Voice helps, but has issues (see last lecture)
- Wearables must accommodate *limited attention spans*
 - Watches support glance-based interactions
 - Intended to be used while users are actively engaged in other activities (otherwise, they'd just use their phones/tablets/computers!)
- Guidelines from Google and Apple, suggesting how to manage these issues, are virtually identical

“Wearable apps are relatively small in size and functionality compared to handheld apps. They contain only what makes sense on the wearable, which is usually a small subset of the corresponding handheld app. In general, you should carry out operations on the handheld when possible and send the results to the wearable.”

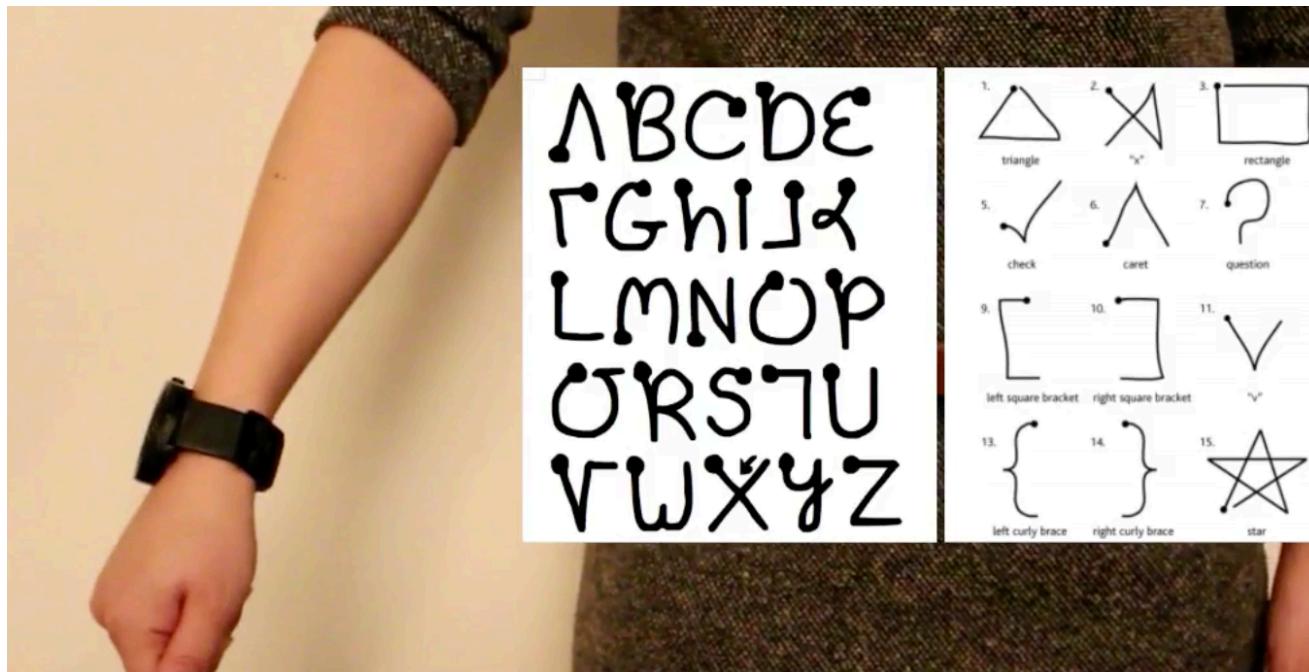
- Quick interaction while user is in motion
 - Focus on not stopping the user (< 5 seconds)
 - Design for big gestures (while walking or moving)
- Watch is always secondary to the user’s primary task
 - Design for “corner of the eye” glances
 - Show contextual information
 - Do one thing really fast



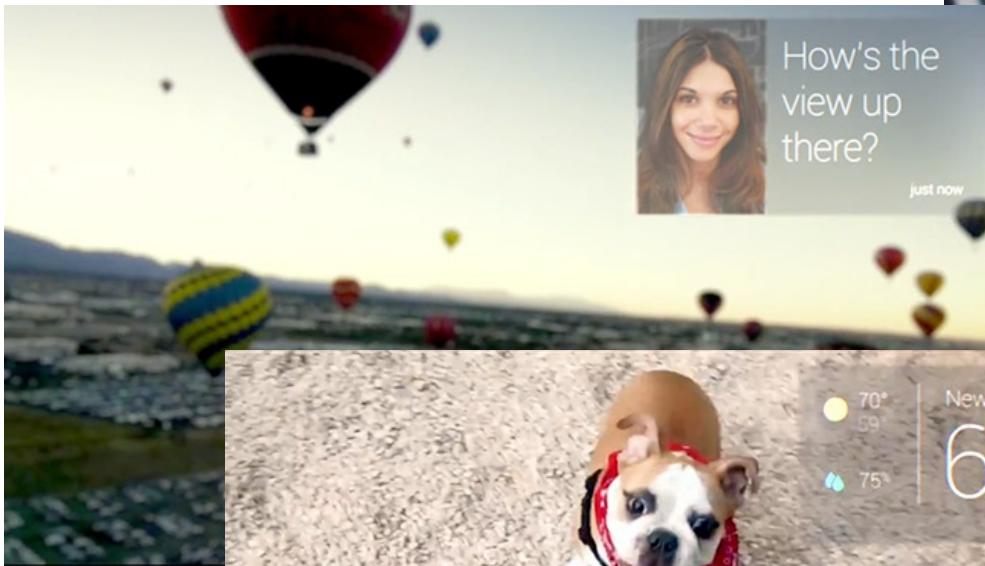
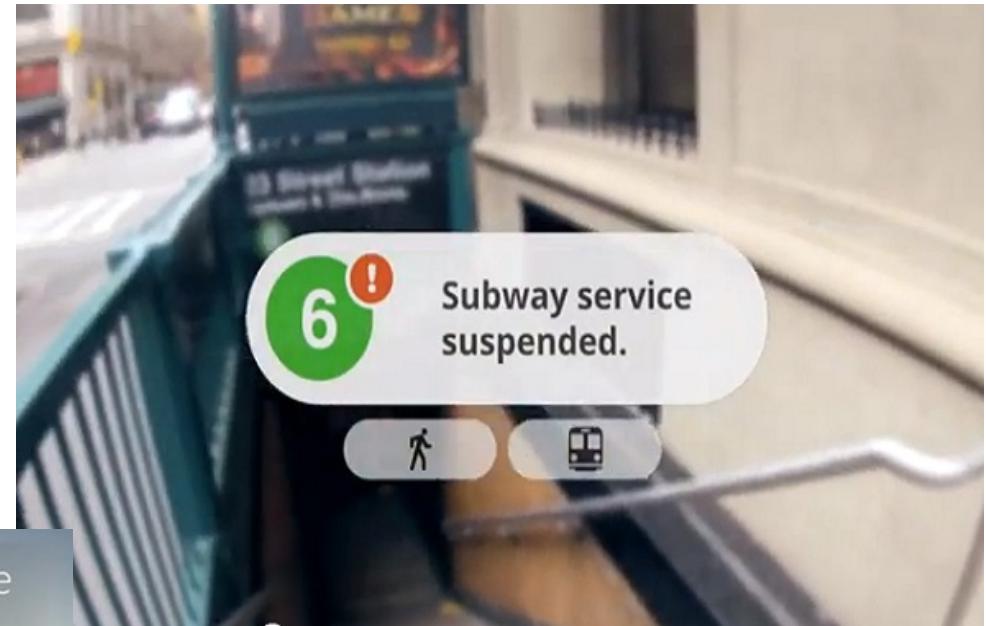
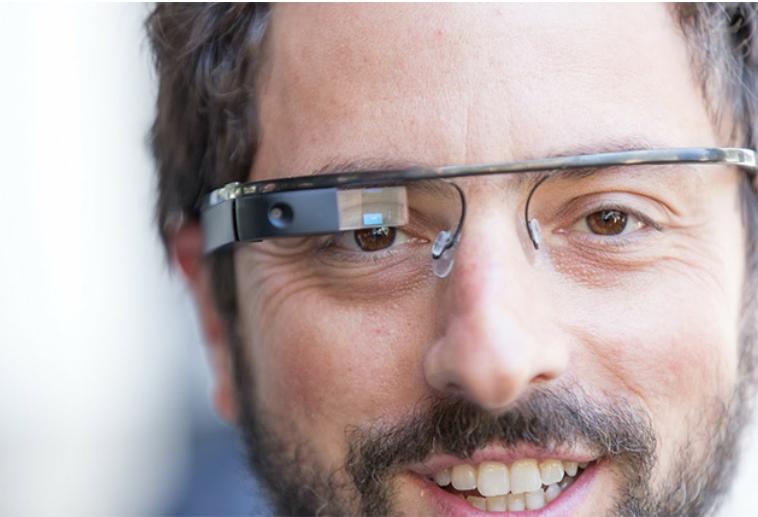
- Three principles of design:
 - Lightweight interaction
 - Holistic design (& consistency)
 - Personal communication
- Interactions occur via:
 - Gestures – up/down to scroll, left right for paging
 - Force touch – tap to activate, firm press for menu
 - Digital crown – non-obstructing scrolling and pickers
 - Side button – quick access button
- Output
 - Notifications: short looks/long looks
 - Applications, which can inject data in different ways:
 - Complications: Data that can be injected into a watch face
 - Glances: Browse “current” information, only launch apps when absolutely necessary



- Smartcasting
 - <https://youtu.be/8Mfg8P9Fguk> (OZCHI 14)
- Planecasting
 - <https://youtu.be/nq25m0vmhuM> (UIST 15)
- WRiST
 - <https://youtu.be/DNgndfR4i10> (AVI 16)



Google Glass



Introduced Feb 2013

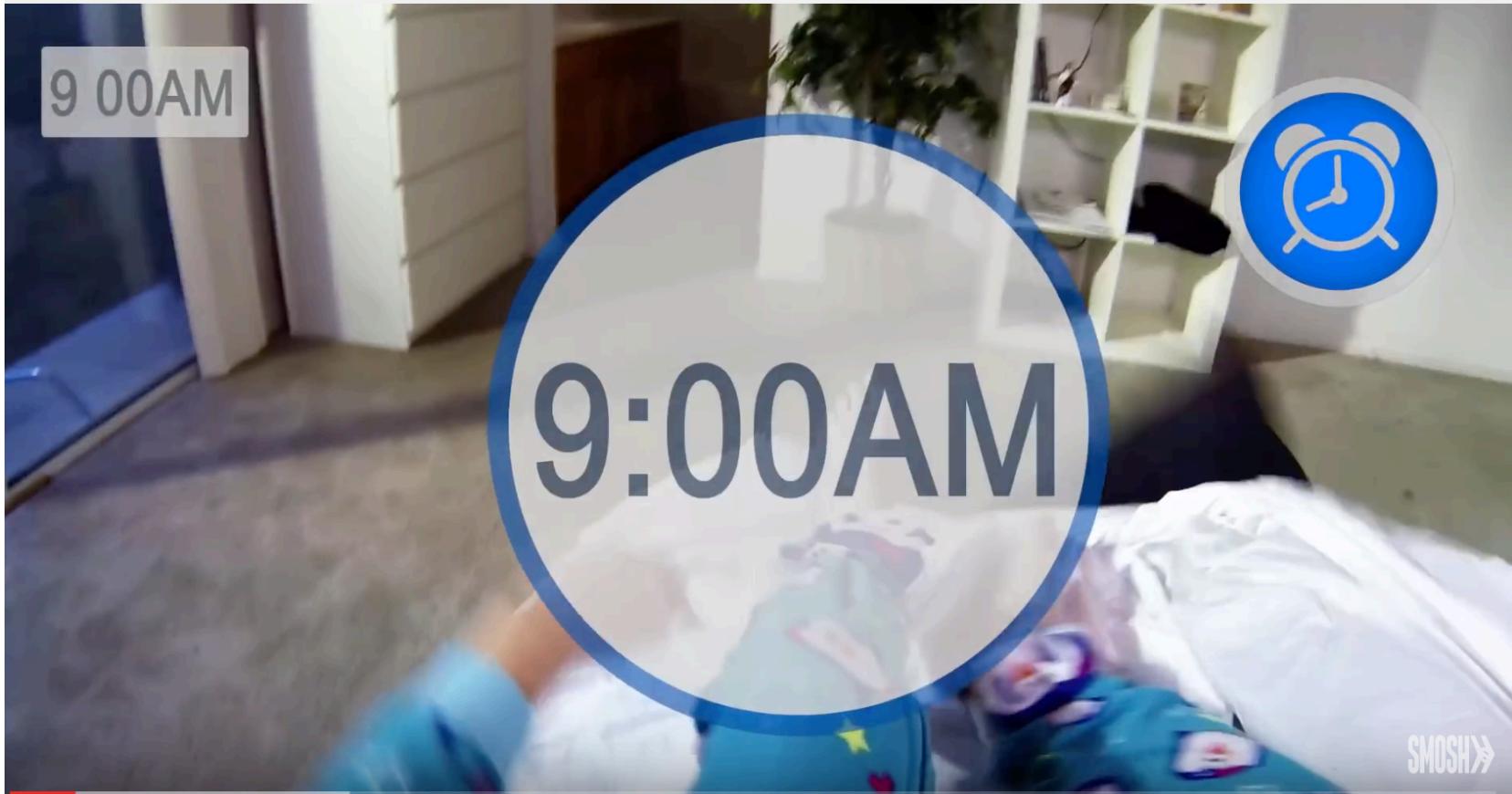
- Prism projector (640x360)
- Bone conductive transducer
- 5 MP camera, 720p video
- Interaction through voice

Google Glass Promise



<https://www.youtube.com/watch?v=JSnB06um5r4>

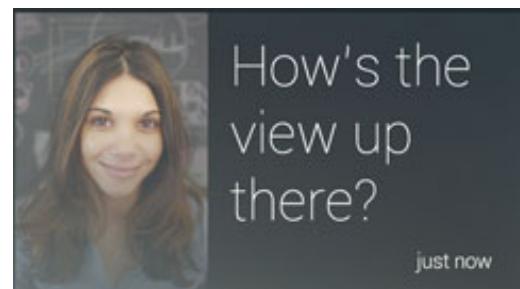
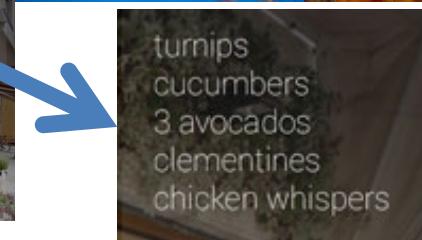
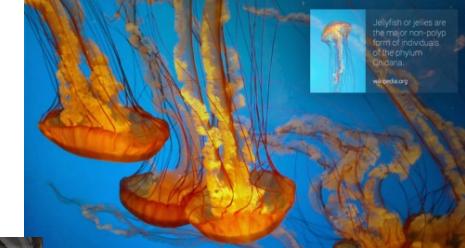
Google Glass Perception



https://youtu.be/4_X6EyqXa2s

Google Glass: Design principles

- One card per post
- Don't get in the way
- Keep it relevant
- Avoid the unexpected
- Design for people



What Happened?

- Why aren't we all wearing Google Glass?
 - Virtual reality versus augmented reality
 - Principles of ubicomp
 - Calm technology (computer as a “quiet, invisible servant”)
 - Proximal and distal elements of thought
 - Social norms
 - Considered rude, or awkward (camera always-on?)

What happened? (2)

- So ... what is Glass for?
 - “Glass’ problem is that the technology today simply doesn’t offer anything that average people really want, let alone need, in their everyday lives.” – Slate
- Is it:
 - A fashion device that you wear all the time and interact with when you wish?
 - A special purpose device that you wear for specific utilitarian functions when you need that functionality?

- Why do you need device X?
 - *“People don’t know what they want until you show it to them.”* – Steve Jobs
 - Contrast with iPod: What problem is iPod solving?
- Cool is not enough
 - Think 3D TV: Why didn’t it catch on?
- A better mousetrap is not enough
 - Think about the smartwatch ... a better mousetrap? Or is it more?

Design should be intentional.

More Generally for Wearables (2)

- CS 449 principles
 - What are the breakdowns?
 - How does it work in context?
 - What are the cultural constraints associated with its use?
- Do not judge failure harshly
 - Tablet computers – Gen 4?
 - Smartphones – Gen 3?