Designing Wearables

Embedded Interface Design

with **Bruce Montgomery**

Learning Objectives

Students will be able to…
- Understand the growth (and decline?) of wearable technology
- Recognize common concerns in wearable design
- Consider possible future directions for wearables

Designing for Wearables - Wired

- Keep it glanceable
- Don't look now
- Use other interaction modes
- Avoid a data avalanche
- Balance public/personal
- Privacy of info/states
- Design to be offline
- Reference [1]

Designing for Wearables - Weller

- Solves a recurring problem for the person
  - To be worn, the problem the wearable device purports to solve should be substantive, recurrent, and easily articulated in a sentence.
- Starts from the human, not the machine
  - Wearable technology design should start from a human problem, and then evaluate several viable technology solutions.
- Requests attention, does not demand it
  - Because it is with you everywhere, wearable tech should honor the present moment, not distract from it.
- Enhances human capabilities, does not replace them
  - It should make the wearer better able to consume and experience the world, not replace or intervene with the wearer's opportunity to experience it.
- Creates a net negative number of problems
  - In rendering a wearable solution, it should eliminate more problems than it introduces to one's life. Reference [2]

Designing for Wearables - Weller

- Enables deep and broad connectivity
  - It should enable broad networks of platforms.
- Serves the software
  - Scale and flexibility are more readily achieved when wearable hardware both serves, and is served by the software.
- Less but broader
  - Wearable hardware should strive to reduce its footprint while the wearable software platforms continue to broaden and expand.
- Capitalizes on existing behavior
  - To earn the privilege of being worn, wearable design should evoke a feeling of the device as a natural extension of the person. It should not require the person to adapt or force new behavior.
- Augments the things we love, and automates the things we don't
  - It should enhance our favorite experiences, making them richer and more memorable while using automation to create more time to do the things we love.   Reference [2]

Designing for Wearables - Sullivan

- Scott Sullivan, 2017, O'Reilly
- Types of wearables: activity trackers, smart watches, wearable cameras, glasses
- Design considerations: service designs, perception, prototyping
- "Still in the Wild West" – wearable landscape will be totally different five years from now
- Reference [3]
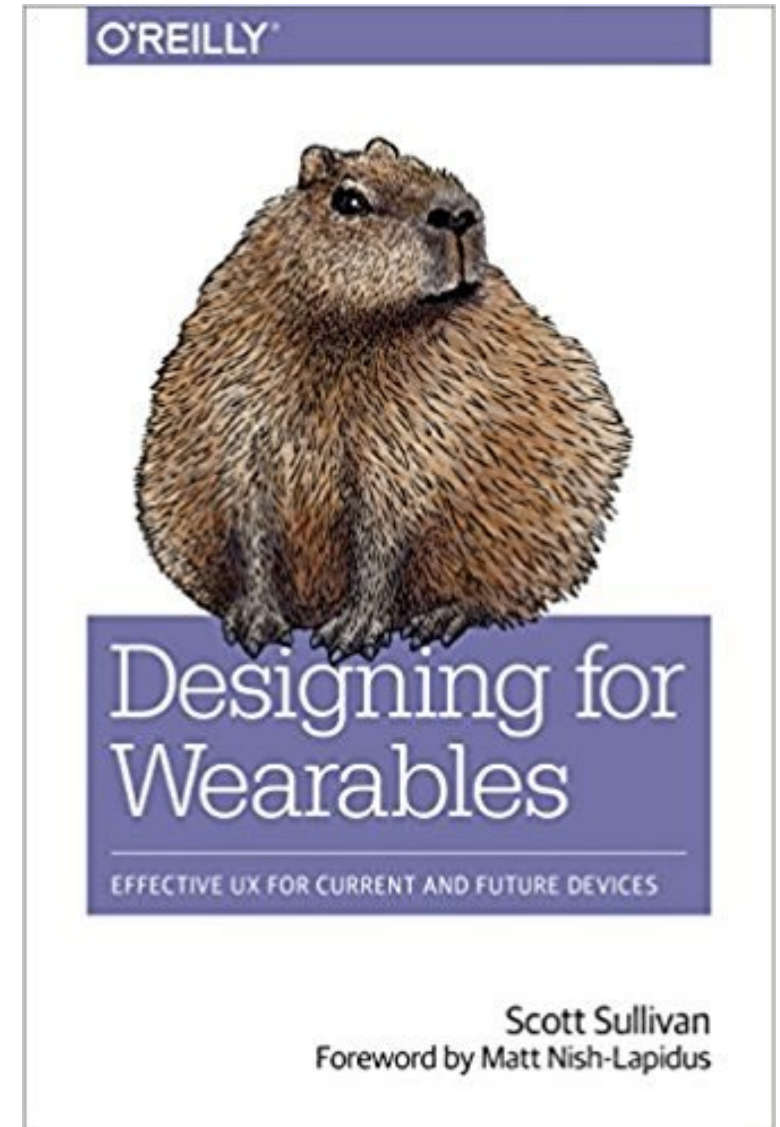
An aside, Bruce's Folly

- Lifelong quest
  for a tiny programmable computer
- Now:
  - Kindle
  - iPad
  - iPhone
  - Chromebook
  - RPis & SBCs
  - Laptops (personal and work)
- Sad
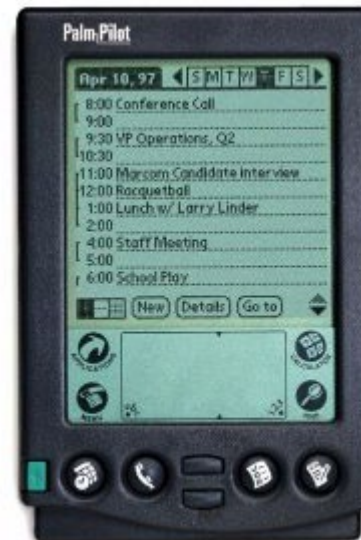
Contributors to enabling wearable devices

- Moore's Law - Shrinking size and increasing power of integrated circuits
  - In 1965, Gordon Moore wrote an article for Electronics magazine in which he predicted that the number of transistors that could fit on to a chip would double every two years
- The Internet – prevents all data from being stored locally and provides off device computation and communications
- Cellular Networks – fast bulk data transfers and maintained connectivity
- Open Source – faster pace of software development and idea exchange
- Reference [3]

Microprocessor Transistor Counts 1971-2011 & Moore's Law
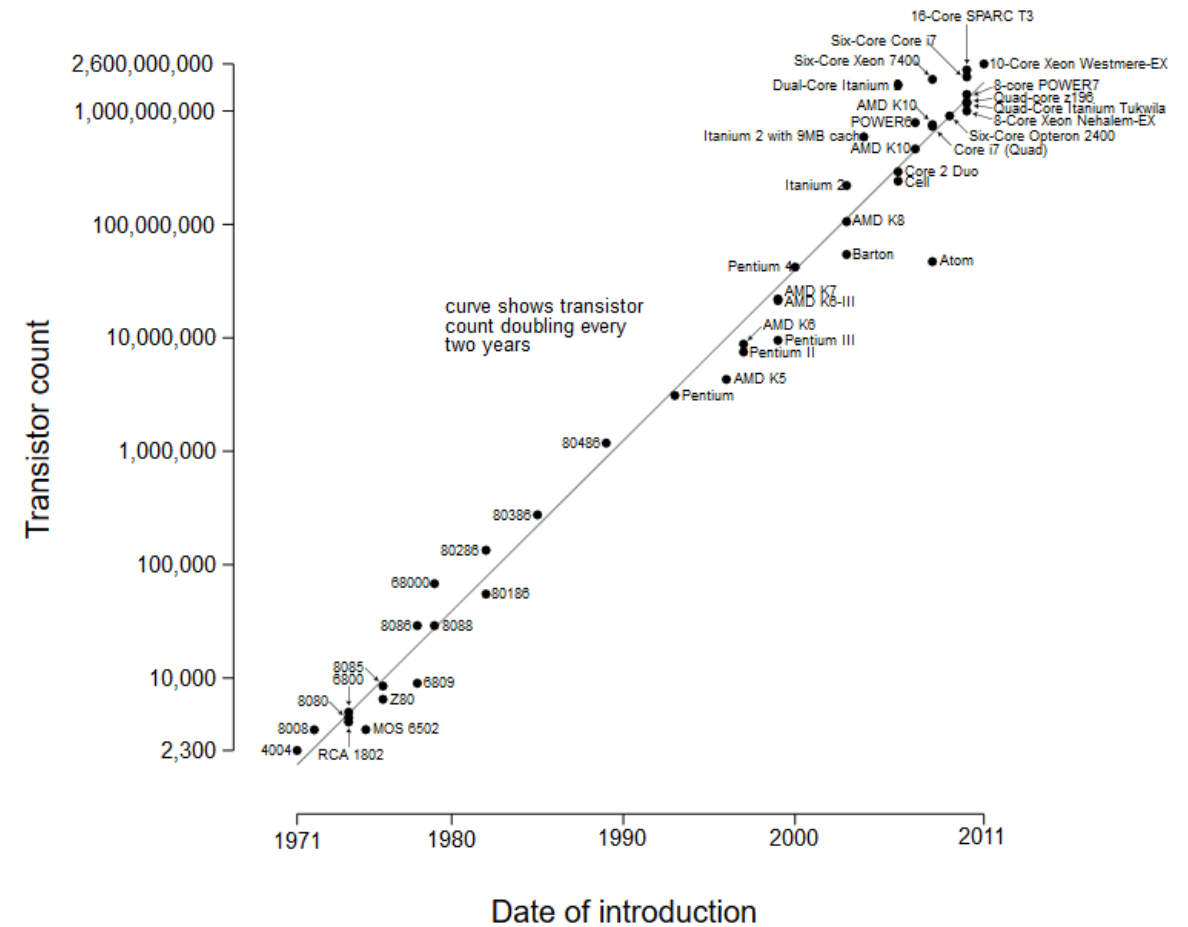
Human Factors Issues

- Input
  - Detailed input – text input, direct manipulation – possible solutions in voice and gestures, virtual keyboards
  - Complexity of input may be an issue for some users with less capability
  - Passive input – reading accelerometers or other sensors
- Output
  - Active output – More detailed traditional interactions - notifications, reminders, etc. shown on a screen or other dedicated display
  - Passive output – always on and providing information without full attention – vibration, simple light patterns, etc.
- Other?

Reference [3]

Types of Wearable Devices

- Activity/Fitness Trackers
  - Step tracking (pedometers introduced in the 1700s)
  - Connected fitness trackers (using accelerometers, gyroscope, heart rate, etc.)
- Smart Watches
  - Calculator watch
  - TV and computer watches
  - Modern smart watches
- Location Tags
- Hearables
- Medical Devices
- New! Echo Frames
- Reference [3], [4]

Types of Wearable Devices

- Smart glasses
  - Google Glass – for Augmented Reality, Echo Frames (Alexa connection)
  - Interesting initial public backlash – "stopthecyborgs.org" – "glassholes" [6]
- Wearable cameras
  - Go Pros
  - Augmented Reality – Pokemon Go
- Cognitive Wearables
  - Bioindicators – breathing, skin perspiration, heart rate, brain activity
  - Spire – tension monitor
  - Muse – EEG meditation monitor
  - Thync (pictured) – Sends electrical signals
    TO your brain to temper calm or rest
- VR Goggles
- Reference [3], [5]

Service Design – the Double Diamond

- Discover – Define – Design – Deliver
  - Produces a clear problem statement and a deliverable device
- Tools
  - Journey Maps
  - Services Blueprint
    - A Buley alternative for task flow
- Machine Learning
  - Automation, Behavioral Feedback
  - Shaping, Transparency
- Prototyping
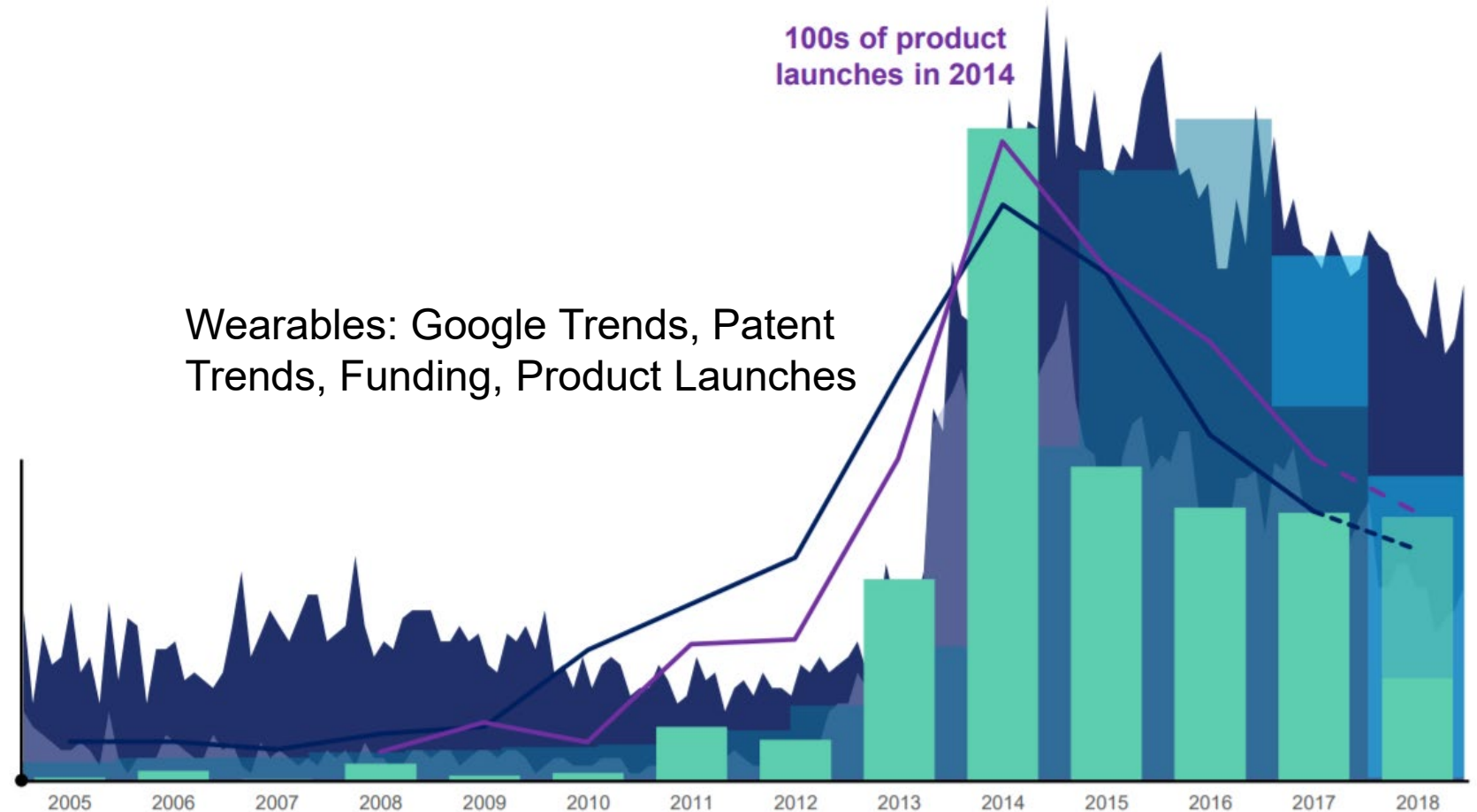 - Sketching. SBCs

Reference [3]

STAGES DISCOVER DEFINE DESIGN DELIVER

ACTIVITIES RESEARCH CONCEPTS TEST REFINE
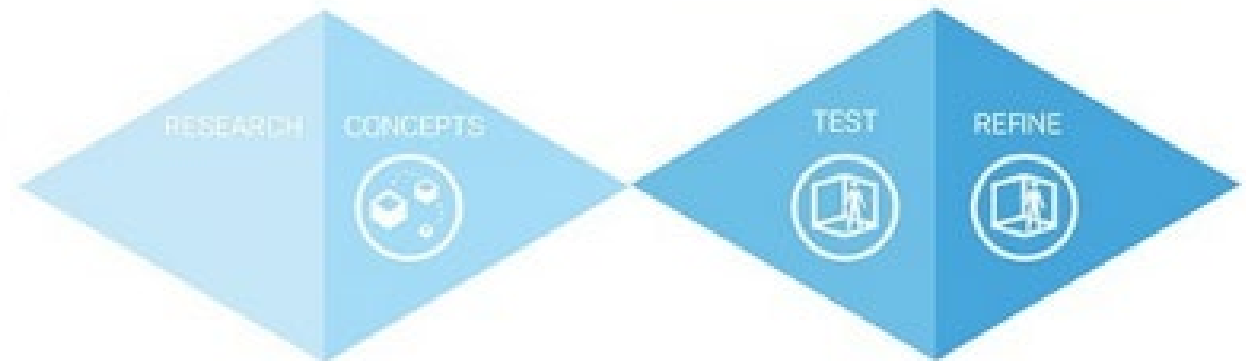
Wearable Trends: Declining?

- Attention shifting to other technology uses/products

- Decreasing use of "wearable" as parent term

- Successes in parts of wearable approaches

- Reference [7]

100s of product launches in 2014

Wearables: Google Trends, Patent Trends, Funding, Product Launches

2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018
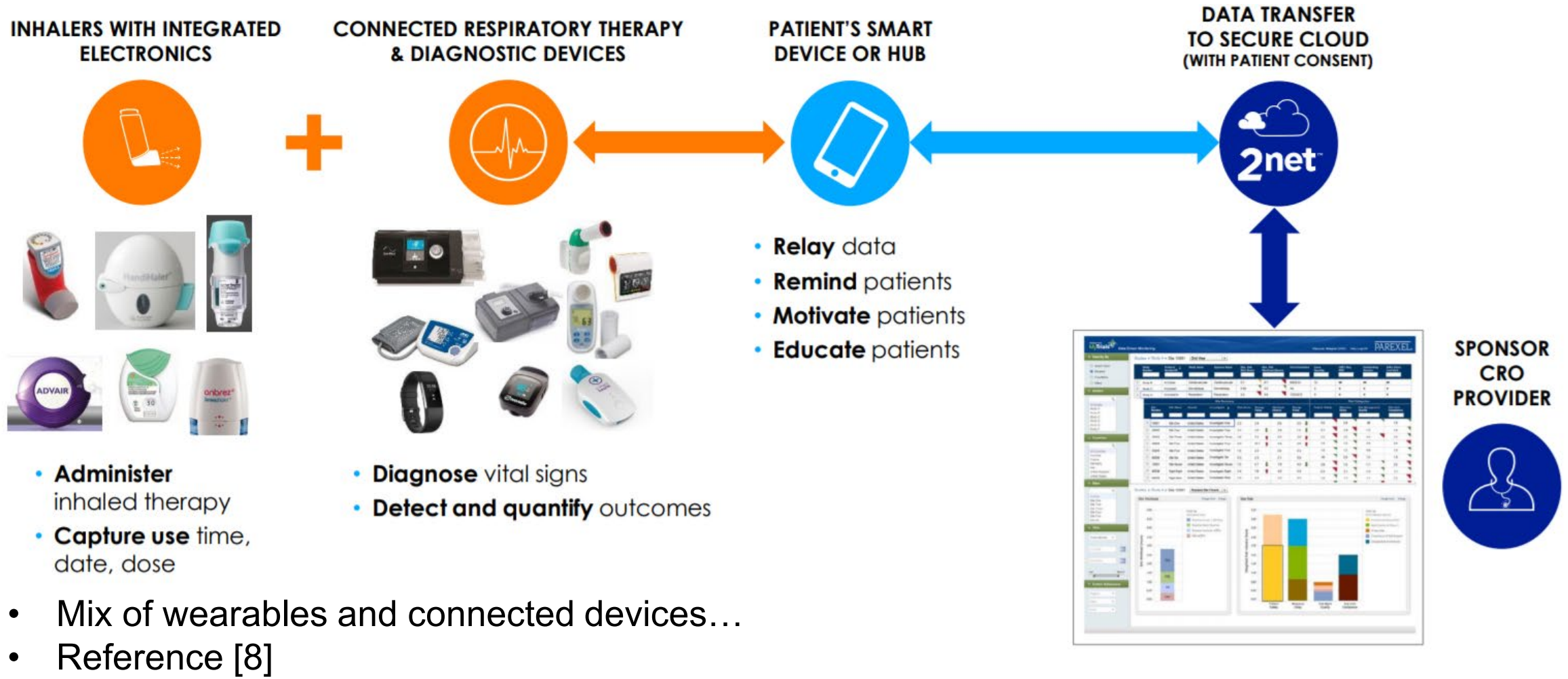
Wearable Products that are Growing

- Smartwatches and Fitness Trackers
- VR, AR, Mixed Reality devices
- Electronic textiles and smart clothing
- Electronic skin patches
- Health Care

Reference [7], [8]

- **Diagnose** vital signs
- **Detect and quantify** outcomes

Example: Respiratory Devices

INHALERS WITH INTEGRATED ELECTRONICS
- **Administer** inhaled therapy
- **Capture use** time, date, dose

CONNECTED RESPIRATORY THERAPY & DIAGNOSTIC DEVICES
- **Diagnose** vital signs
- **Detect and quantify** outcomes

PATIENT'S SMART DEVICE OR HUB
- **Relay** data
- **Remind** patients
- **Motivate** patients
- **Educate** patients

DATA TRANSFER TO SECURE CLOUD (WITH PATIENT CONSENT)

2net™

SPONSOR CRO PROVIDER

- Mix of wearables and connected devices…
- Reference [8]

University of Colorado **Boulder**

References

[1] https://www.wired.com/2015/08/5-principles-designing-wearables/

[2] http://www.designprinciplesftw.com/collections/10-top-wearable-technology-design-principles

[3] Designing for Wearables, Scott Sullivan, 2017, O'Reilly

[4] https://www.apple.com/shop/buy-watch/apple-watch

[5] https://www.thync.com/

[6] https://www.technologyreview.com/s/512541/the-meaning-of-the-google-glass-backlash/

[7] IDTechEx Wearable Technology in 2018, James Hayward, 2018 IDTechEx Show, Santa Clara 11/2018

[8] Qualcomm Life: Connected Patient and Internet of Medical Things, Gene Dantsker, 2018 IDTechEx Show, Santa Clara 11/2018

University of Colorado **Boulder**