

# Wearable Computing Solutions

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E. J. KRAUSE &  
ASSOCIATES, INC.



Promoting Accessible Technologies  
and Environments for Senior Citizens  
and Users of All Abilities



# Panelists

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# Wearable Computing Solutions Panelists



## John Morris, Ph.D.

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- Clinical Research Scientist, Shepherd Center
- Project Director for User Research & App Factory
  - Rehabilitation Engineering Research Center for Wireless Technologies (Wireless RERC)
  - Rehabilitation Engineering Research Center for Community Living Health and Function (LiveWell RERC)
- Founding Co-Chair, Technology Networking Group, American Congress of Rehabilitation Medicine
- Member, Scientific Program and Review Committee, CSUN Conference



# What is wearable technology?

## **Wearable technology, wearable devices, wearables**

- electronic technologies or computers incorporated into accessories, items of clothing which can be worn on the body
- the purpose of wearable technology is to create constant, convenient, seamless, portable, and mostly hands-free access to electronics and computers
- Examples: watches, glasses, contact lenses, e-textiles and smart fabrics, headbands, beanies and caps, jewelry such as rings, bracelets, and hearing aid-like devices that are designed to look like earrings

*Source:* <http://www.wearabledevices.com/what-is-a-wearable-device/>

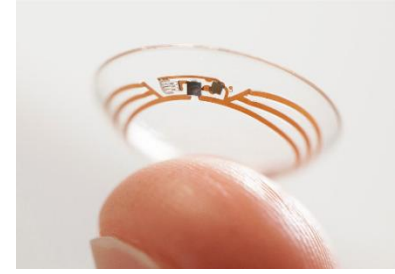


# What is wearable technology?

## **Wearable technology, wearable devices, wearables**

- Wearables can also be:
  - Controllers for other electronic or powered devices
    - e.g., Thalmic Labs Myo Band
  - Assistive technology that provides physical or other assistance
    - e.g., exoskeletons that aid standing and walking
  - Sensors that provide that capture biometric, locational, positional and/or movement data on the user

# What is wearable technology?







# Wearable Sensors

- Body Posture
- Movement
- Sleep
- Temperature
- Heart Rate
- Blood Pressure
- Skin Conductance
- Hydration
- Brain Waves/Activity
- Respiration
- Glucose
- Oxygen Level
- Eye Movement

# Ideal biosensor characteristics

- Accurate
- Repeatable
- Valid
- Reliable
- Durable
- Sufficient Range
- Timely speed of response
- Insensitive to environmental interference





# Multiple sensing



## Zenta wristband from Vinaya

Data from all aspects of life

- Biometrics – heart rate variability, electrodermal activity, blood oxygen
- How many emails are you sending? To whom?
- How much time do you spend on social media?
- How many meetings do you have a day? With whom?
- Cross reference with your location, the weather, which emojis you use.
- Build a profile of you and your own emotional responses to situations."

# Wearable Devices Worldwide Forecast (Millions of Units)



Device	2015	2016	2017
Bluetooth headset	116.32	128.50	139.23
Smartwatch	30.32	50.40	66.71
Wristband	30.15	34.97	44.10
Sports watch	21.02	23.98	26.92
Other fitness monitor	21.07	21.11	25.08
Chest strap	12.88	13.02	7.99
Head-mounted display	0.14	1.43	6.31
Smart garment	0.06	1.01	5.30
Body-worn camera	0.05	0.17	1.05
<b>Total</b>	<b>232.01</b>	<b>274.59</b>	<b>322.69</b>

Source: Gartner (January 2016)

# Abandonment rates (fitness wearables)



## WHAT CUSTOMERS LOVE

### Reporting

*"It tracks everything I want it to and nothing that I don't after a quick set up."*

### Convenience

*"I like being able to see how I am doing throughout the day in a casual manner. Looking at my step count and such."*

### Motivation

*"It motivates me to stay active and use friendly competition with my friends and family to better my health by participating in challenges."*

## WHAT CUSTOMERS HATE

### Battery Life

*"Battery life. I have always been disappointed with the battery life of all the trackers I have owned."*

### Accuracy

*"It could be more accurate; it miscounts steps and does not track activities properly."*

### Durability

*"The quality of the band needs to be improved, broke after just a few months."*

# Successful AT Adoption



	User	Caregivers	A.T. specialists	Developers
<b>Characteristics of successful adoption</b>	Desires change in what they can do.	Able to put forth effort required to learn to use and personalize the tool	Extensive knowledge of assistive technology	Comprehensive understanding of functional limitations
	Self-disciplined and has a high frustration tolerance	Support the user in using the new tool	Willingness to learn about new tools coming out on the market	Develop customizable tools
	Proud to use the device	Welcome changes use of the tool brings to the social dynamic	Facilitate a process which is collaborative rather than directive	Develop tools which are simple to set-up
	Willing to the tools use into their daily routine	Understand that customization is not a one-shot deal and may need to continue throughout the technology's life.	Offer training and support both in programming and integration	Develop tools which are durable
			Sensitivity to family values and cultural differences	Allow for customer's aesthetic preferences
				Support users with technical support and short repair times

Source: A Framework for the Adoption of Assistive Technology, 2003



# Questions for Panelists

## Technology

- What are the new and emerging form factors of wearables?
- How important is design/style for adoption and social acceptance?
- Features and functions of wearables going forward – just more data collection?
- Sensor innovation – What will be measured? How? How reliable/accurate?
- Best in class solutions today, tomorrow

**Services:** Business models (wearables + services) today, tomorrow

## Wearables as accessible/assistive/rehabilitation technology

- Are wearables for mainstream market adequate for people with disabilities?
- Are specialized solutions needed? Is accessibility a concern?
- Challenges in assessing clinical effectiveness of wearable solutions for rehabilitation or assistance