

# Human-Computer Interface

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# Today's Topics

- UI development and Trends
- NUI Discussion

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- *UI development and Trends*
  - *Development*
  - Trends
- NUI Discussion

# Importance of HCI

- Now, computers become pervasive. They are embedded in everyday things.....



# Importance of HCI

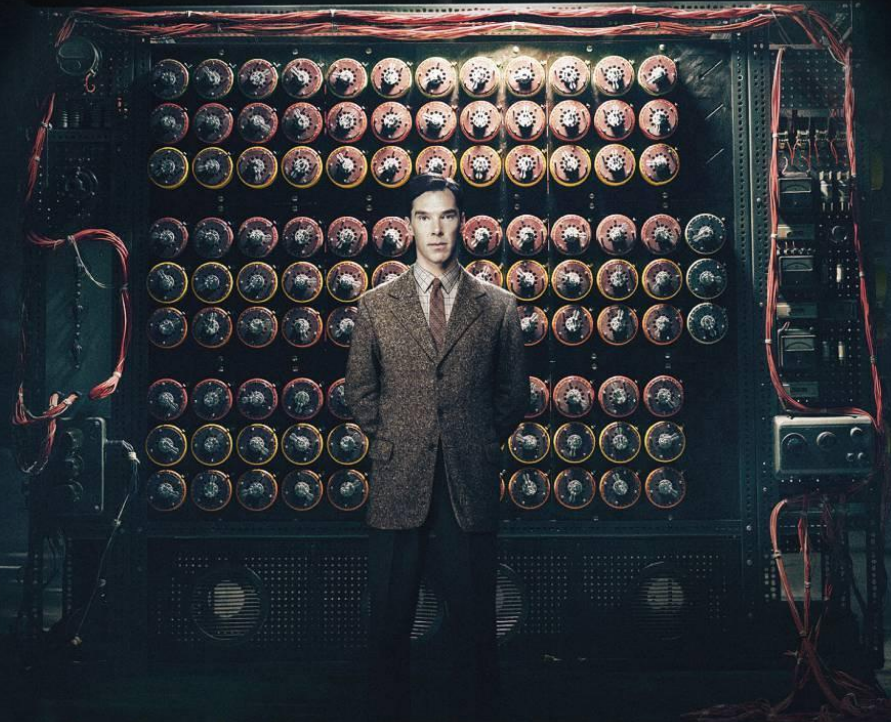
- From the user's perspective
  - Users do not care about what is inside the box, as long as the box does what they need.
  - As far as the customer is concerned, *the interface is the product*.
  - The point of interaction or communication between a computer and any other entity
- *Interaction, is with more importance*

# No Interface



NOW A MAJOR FILM STARRING  
BENEDICT CUMBERBATCH

ANDREW HODGES



# ALAN TURING: THE ENIGMA

THE BOOK THAT INSPIRED THE FILM  
THE IMITATION GAME

VINTAGE

HD 海盜網  
hdwar.net  
share for funny



# Command Line





# Mouse



# Notebook



# Pad



Pocketlint

# Touch Interface



iPod shuffle  
2GB  
\$49

iPod nano  
16GB  
\$149  
October

iPod touch  
16GB 32GB  
\$199 \$249

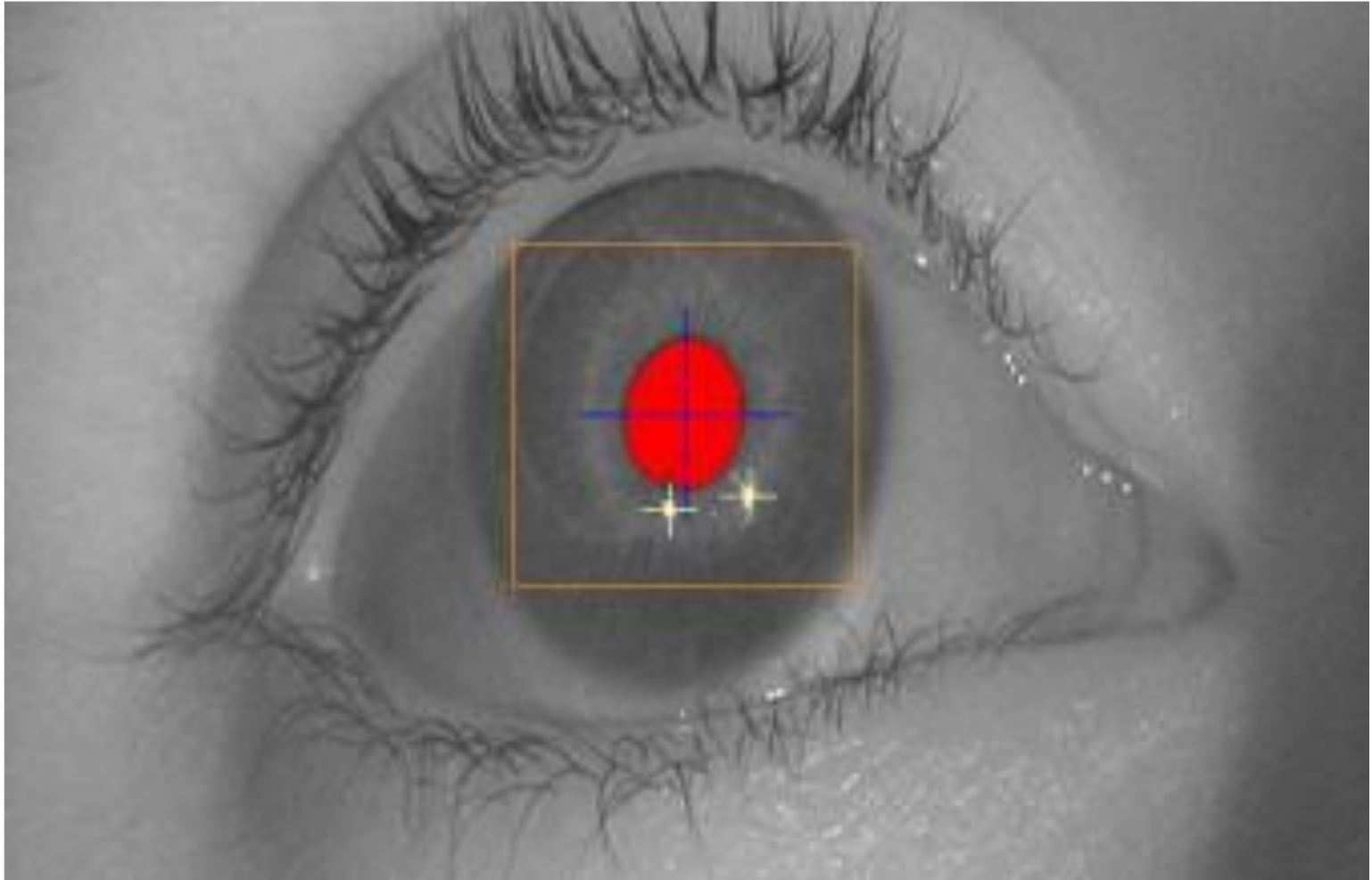
iPod touch  
32GB 64GB  
\$299 \$399  
October



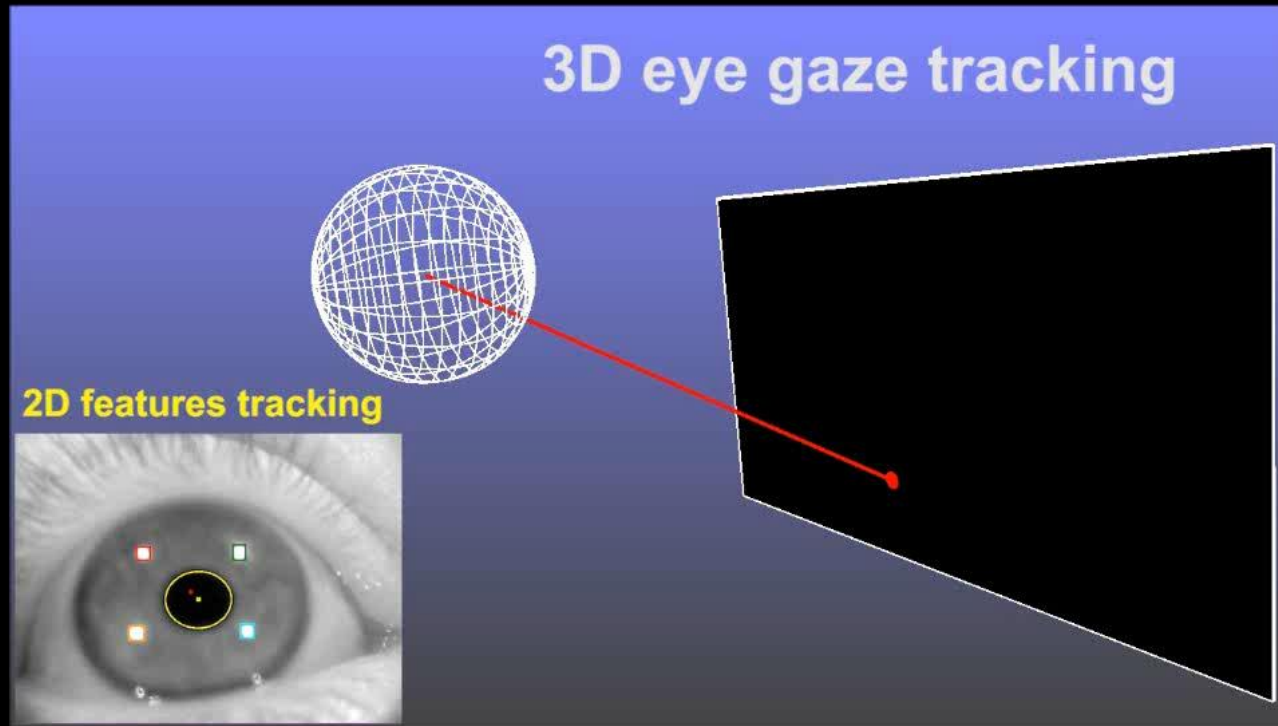
# Surface Table



# Gaze Interaction



# Gaze Interaction





# Gaze Interaction



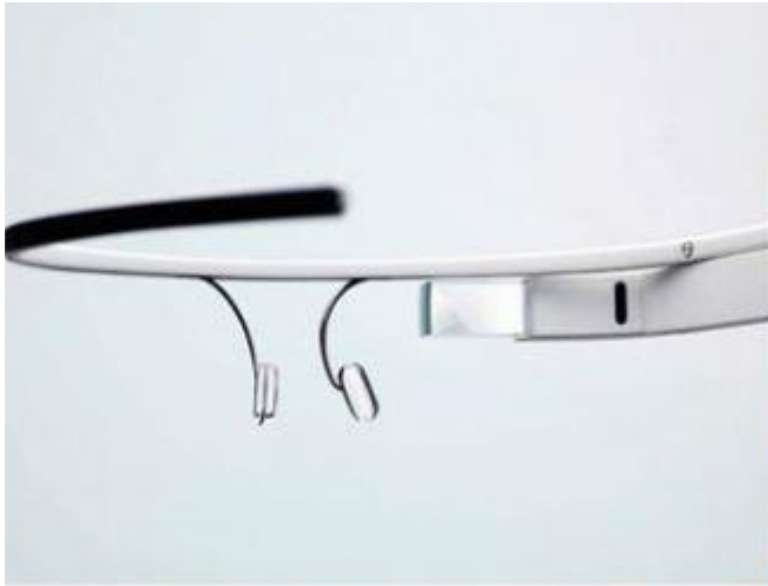
 Microsoft HoloLens

# Speech Interface



Adam Tow | AllThingsD.com

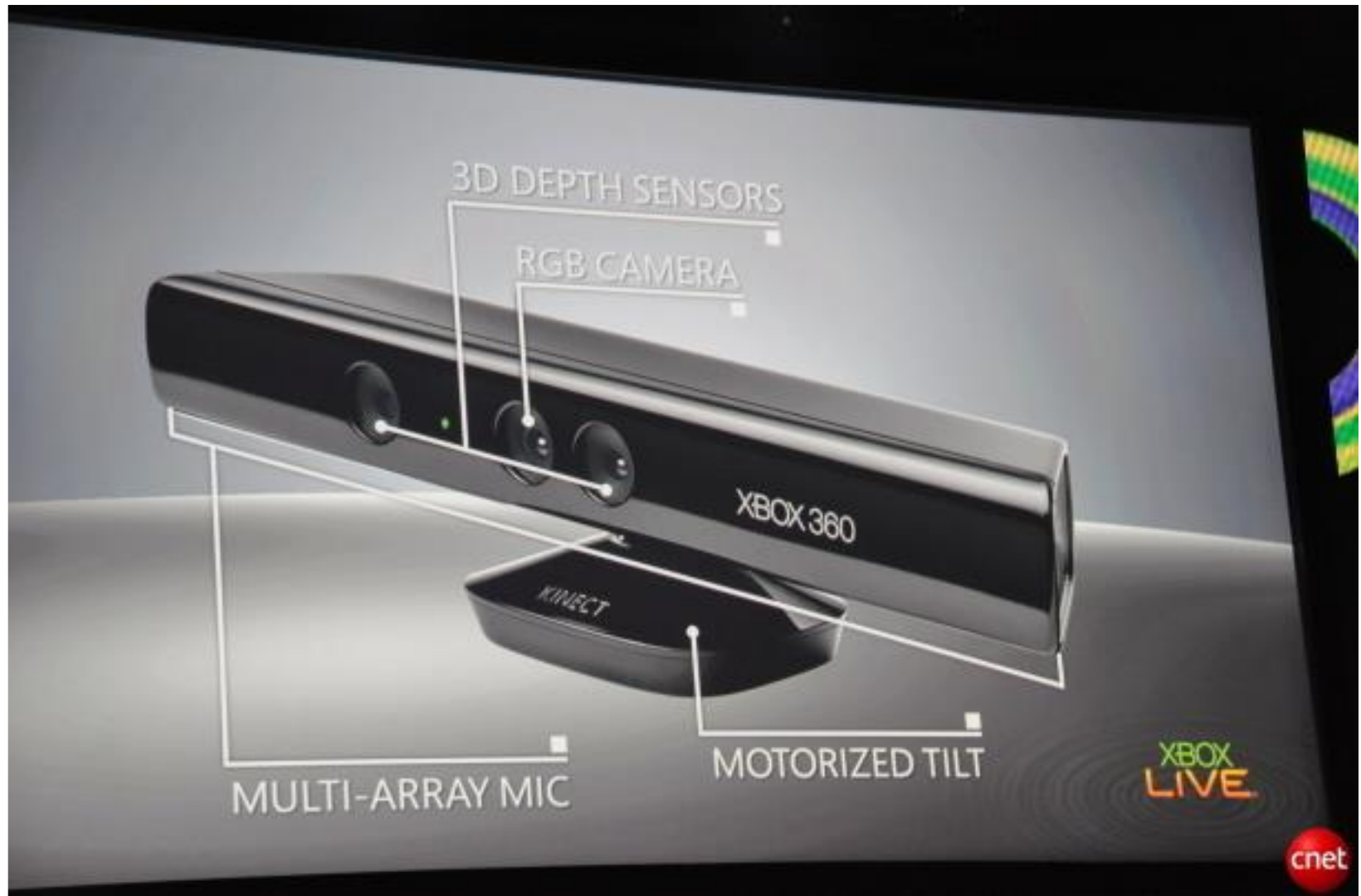
# Google Glass



# Google Glass

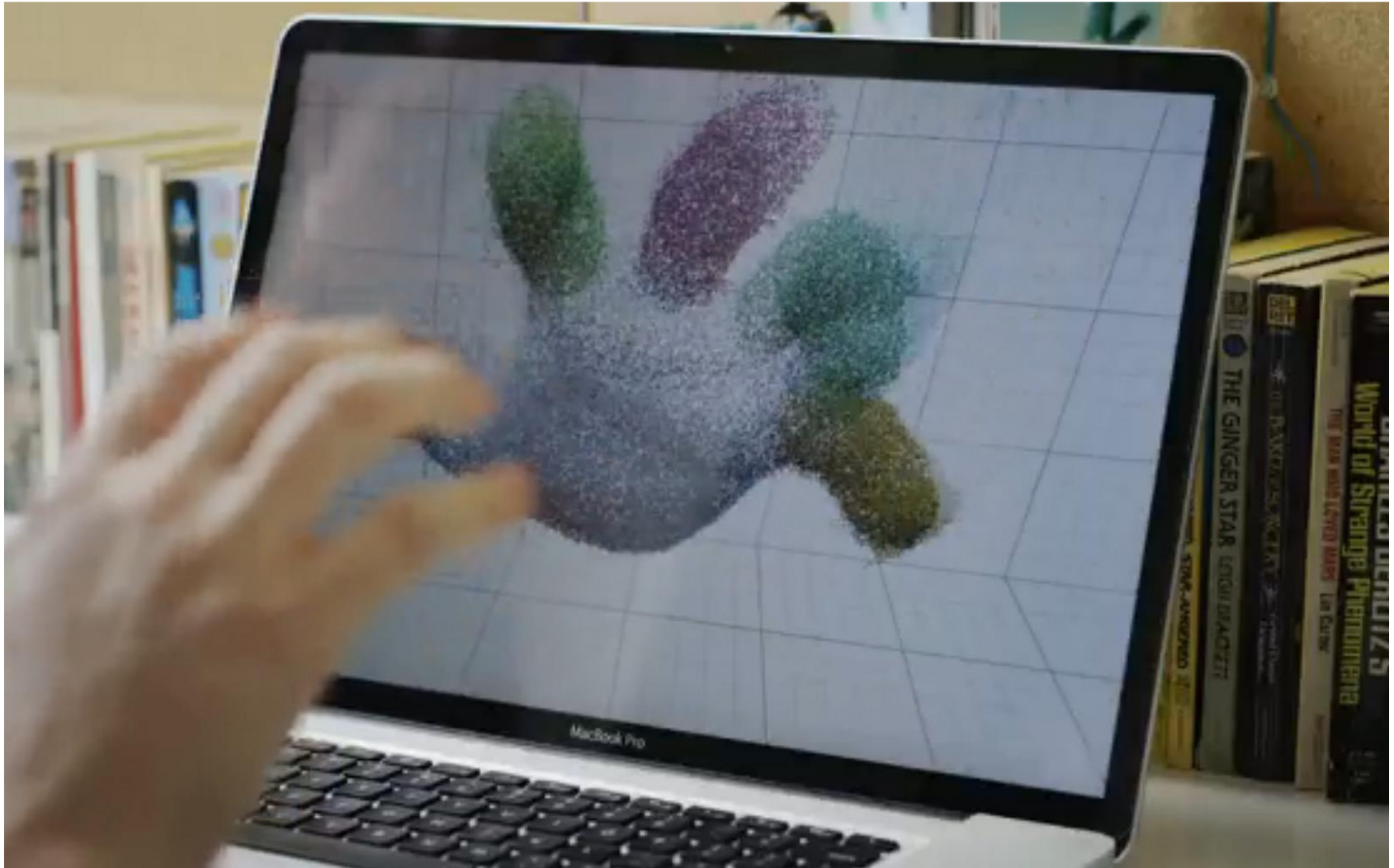


# Microsoft Kinect





# Hand Tracking

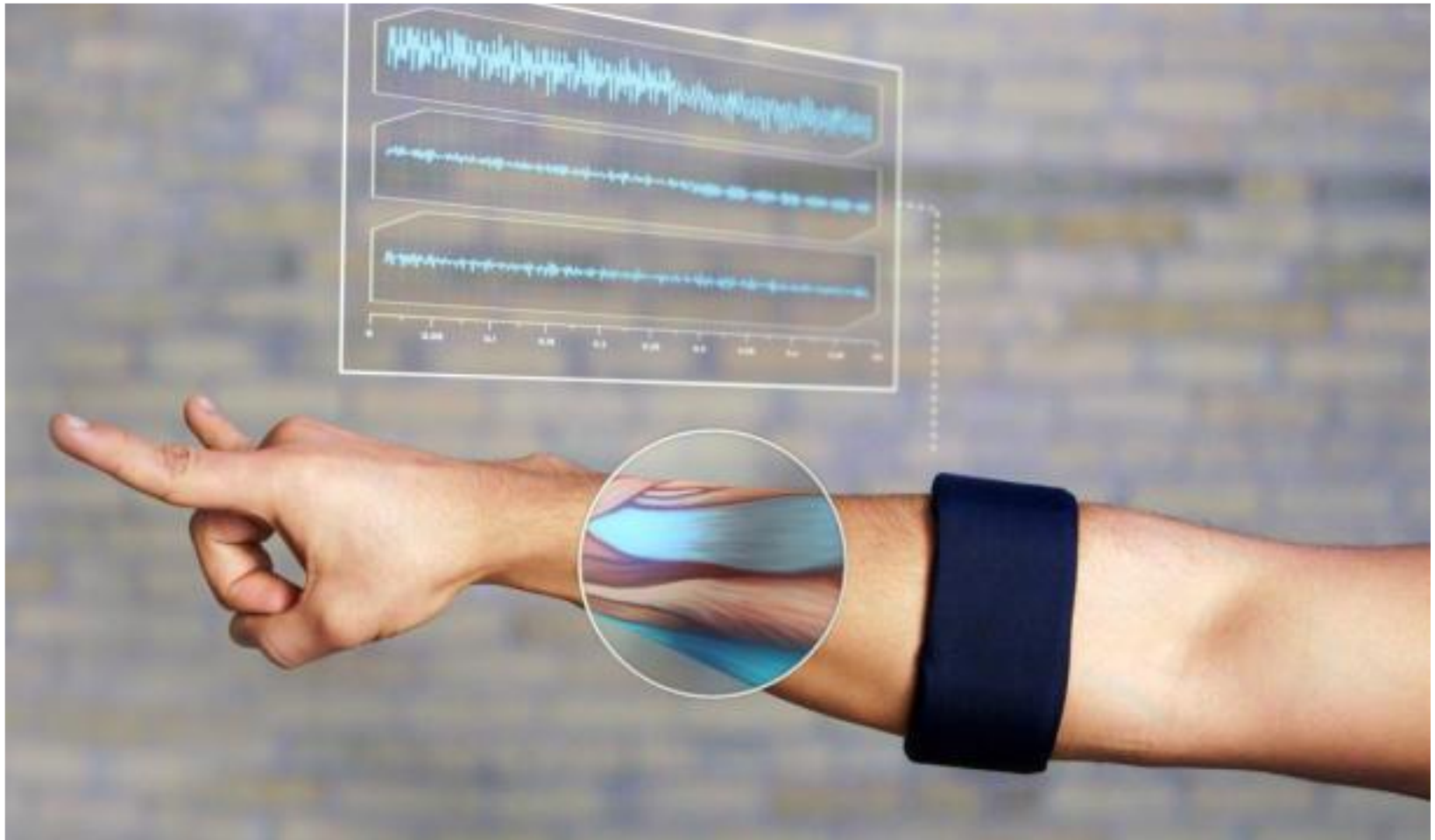


# Hand Tracking

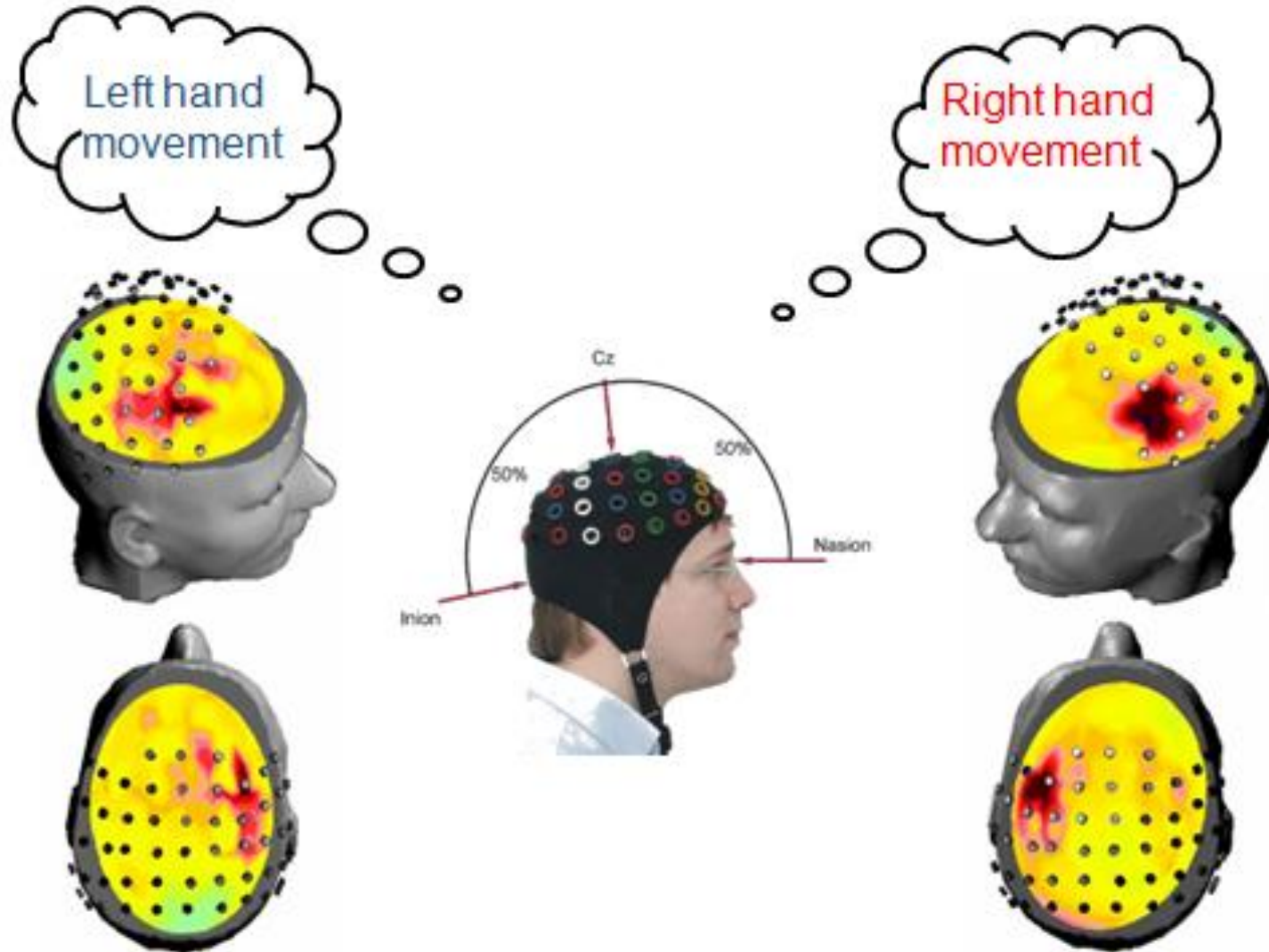




# Wearable Sensors



# Brain-Computer Interface



# Microsoft HoloLens



 Microsoft HoloLens

# Microsoft HoloLens

The image shows the Microsoft HoloLens logo, which consists of a dark, curved shape on the left and a lighter, curved shape on the right, creating a sense of depth and perspective. The text "Microsoft Holo Lens" is centered within the dark shape.

Microsoft Holo Lens

# Microsoft HoloLens

- What can be HoloLens used for?
  - Top 4: design
  - Top 3: instruction
  - Top 2: smart home
  - Top 1: game
  - .....

# HTC ViVe





# Microsoft





# Magic Leap

- Magic Leap (鲸鱼)



# VR, AR, and MR

- Reality-Virtual

以”区间)

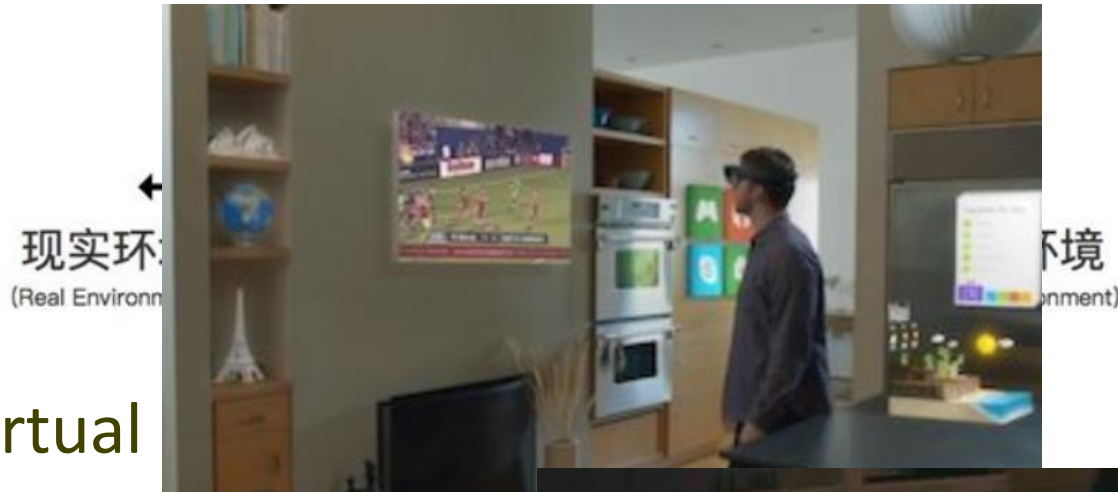
←  
现实环境  
(Real Environment)

- VR: virtual reality
  - HTC VIVE, Oculus
- AR: augmented reality
  - Google glass



# VR, AR, and MR

- Reality-Virtuality Continuum ( “现实-虚拟” 区间)



- VR: virtual
  - HTC VIVE, Oculus Rift, ...
- AR: augmented reality
  - Google glass
- MR: mixed reality
  - Hololens, Magic Leap, ...





# Self-driving Cars



# UI Development



# User Interface Development

- Q1: How does a user interact with the computer?
- Q2: What does the interface look like?

➤ *NUI*: No UI era



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- Q1: How does a user interact with the computer?
- Q2: What does the interface look like?

➤ *NUI*: No UI era

➤ *CL*: Command Languages

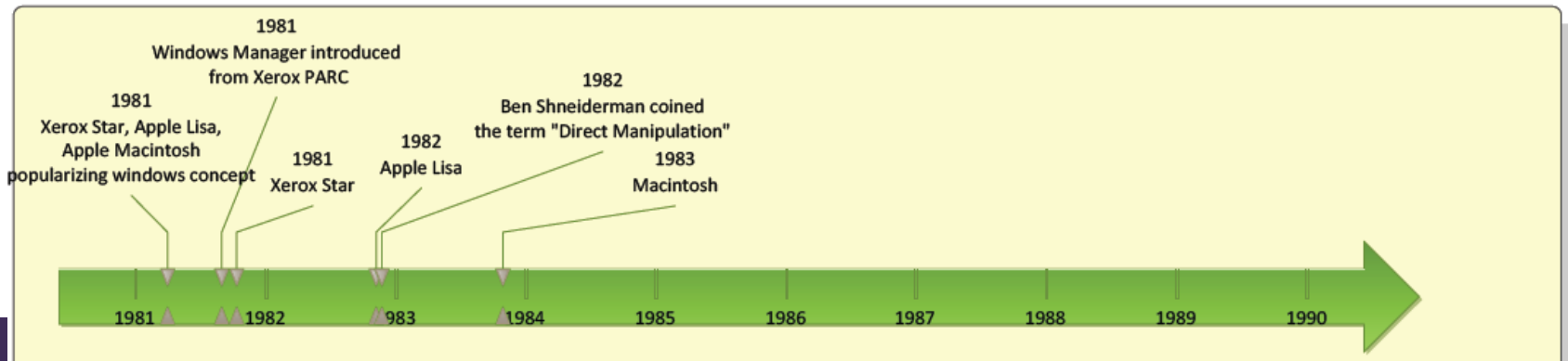
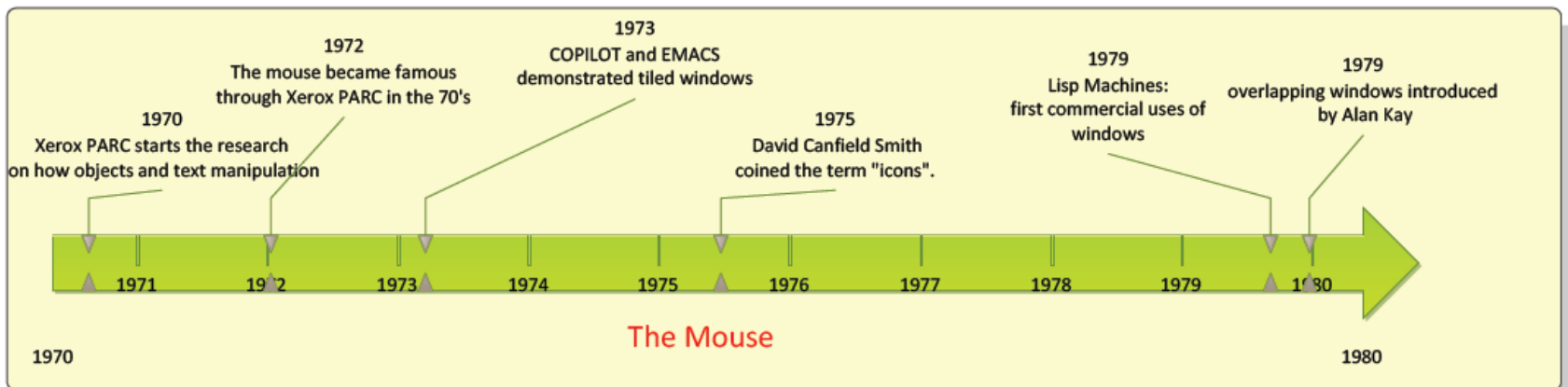
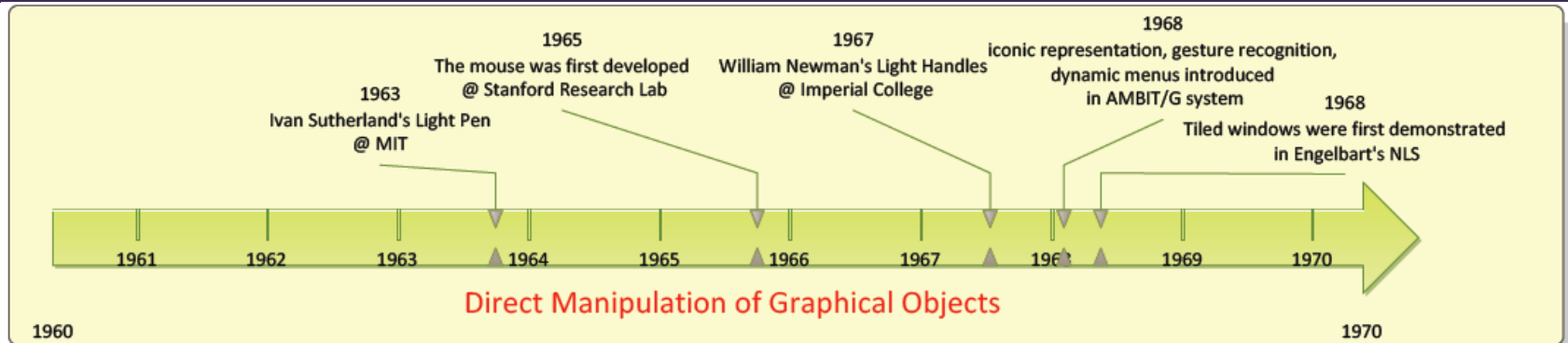




# User Interface Development

- Q1: How does a user interact with the computer?
  - Q2: What does the interface look like?
- 
- *NUI*: No UI era
  - *CL*: Command Languages
  - *GUI*: Direct Manipulation

# Birth of Graphical User Interface



# User Interface Development

- Q1: How does a user interact with the computer?
- Q2: What does the interface look like?

➤ *NUI*: No UI era

➤ *CL*: Command Languages

➤ *GUI*: Direct Manipulation

➤ *NUI*: Natural UI



# Natural UI

- *“I believe we will look back on 2010 as the year we expanded beyond the mouse and keyboard and started incorporating more natural forms of interaction such as touch, speech, gestures, handwriting, and vision--what computer scientists call the **"NUI"** or **natural user interface**.”*

--Steve Ballmer, ex-CEO Microsoft

# Today's Topics

- *UI development and Trends*
  - Development
  - *Trends*
- NUI Discussion



# Likely Future Developments

- What do we have?
  - Larger memories
  - Faster systems
  - Portability
  - Distributed computing
  - New forms of input devices
  - Wider social concerns
  - .....
- How future shapes?



# Likely Future Developments

- Ubiquitous communication
- High functionality systems
- Mass availability of computer graphics
- Mixed media
- High-bandwidth interaction
- Large and thin displays
- Embedded computation
- Group interfaces
- User Tailorability
- Information Utilities

# Natural UI – Future Vision



**Microsoft Future Vision**

# Today's Topics

- UI development and Trends
- *NUI Discussion*
  - *Habit is a second Nature*
  - Are NUI Natural?

# Formation of Habits

- Done by not giving it a glancing thought
  - Typewriter by touch
  - Strolling on a path
  - .....

1	2	3
4	5	6
7	8	9
	0	

(a) phones, remote controls

7	8	9
4	5	6
1	2	3
0		

(b) calculators, computer keypads



# Surface Interaction

## Two-finger Scroll

Brush two fingers along the Multi-Touch surface to scroll in any direction –vertically, horizontally or diagonally.



## Pinch Open & Close

Pinch to zoom in and out of photos, increase font sizes in web pages, and more.



## Rotate

With your thumb and index finger positioned on the Multi-touch surface, turn clockwise or counterclockwise to rotate an image



## Three-Finger Drag

With three-finger dragging enabled in System Preferences, position your pointer at the top of a window and brush three fingers along the Multi-Touch surface to drag it.



## Three-Finger Swipe to Navigate

Using three fingers, brush left and right along the Multi-Touch surface to swipe forward and back.



## Four-Finger Swipe Left/Right to Switch Applications

Using four fingers, brush left or right along the Multi-Touch surface to view all open applications as icons. Select the application you'd like to switch to.



Wobbrock, J.O., Morris, M.R. and Wilson, A.D. **User-defined gestures for surface computing.** (CHI '09).

# Gesture

*Select Single<sub>1</sub>: tap*



*Select Single<sub>2</sub>: lasso*



*Select Group<sub>1</sub>: hold and tap*



*Select Group<sub>2</sub> and Select Group<sub>3</sub>: Use Select Single<sub>1</sub> or Select Single<sub>2</sub> on all items in the group.*

*Move<sub>1</sub>: drag*



*Move<sub>2</sub>: jump*

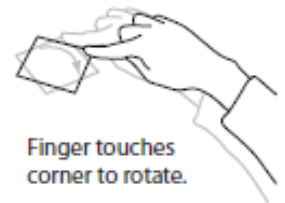


Object jumps to index finger location.

*Pan: drag hand*



*Rotate: drag corner*



Finger touches corner to rotate.

*Cut: slash*



Cuts current selection (made via *Select Single* or *Select Group*).

*Paste<sub>1</sub>: tap*



*Paste<sub>2</sub>: drag from offscreen*



*Paste<sub>3</sub>*: Use *Move<sub>2</sub>* with off-screen source and on-screen destination.

*Duplicate: tap source and destination*



After duplicating, source object is no longer selected.

# Gesture

Delete<sub>1</sub>: drag offscreen



Delete<sub>2</sub>: Use Move<sub>2</sub> with on-screen source and off-screen destination.

Accept: draw check



Help: draw '?'



Reject: draw 'X'



Reject<sub>2</sub>, Reject<sub>3</sub>: If rejecting an object/dialog with an on-screen representation, use Delete<sub>1</sub> or Delete<sub>2</sub>.

Menu: pull out



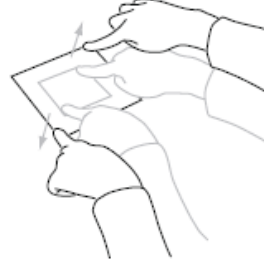
Undo: scratch out



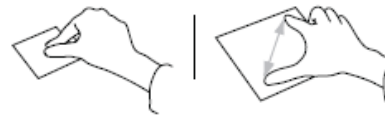
Enlarge (Shrink)<sub>1</sub>: pull apart with hands



Enlarge (Shrink)<sub>2</sub>: pull apart with fingers



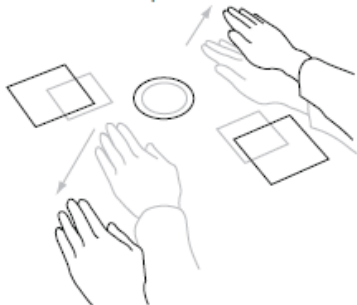
Enlarge (Shrink)<sub>3</sub>: pinch



Enlarge (Shrink)<sub>4</sub>: splay fingers



Zoom in (Zoom out)<sub>1</sub>: pull apart with hands

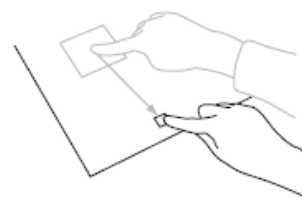


Open<sub>1</sub>: double tap



Open<sub>2-5</sub>: Use Enlarge<sub>1-4</sub> atop an "openable" object.

Minimize<sub>1</sub>: drag to bottom of surface



Minimize<sub>2</sub>: Use Move<sub>2</sub> to move object to the bottom of the surface (as defined by user's seating position).

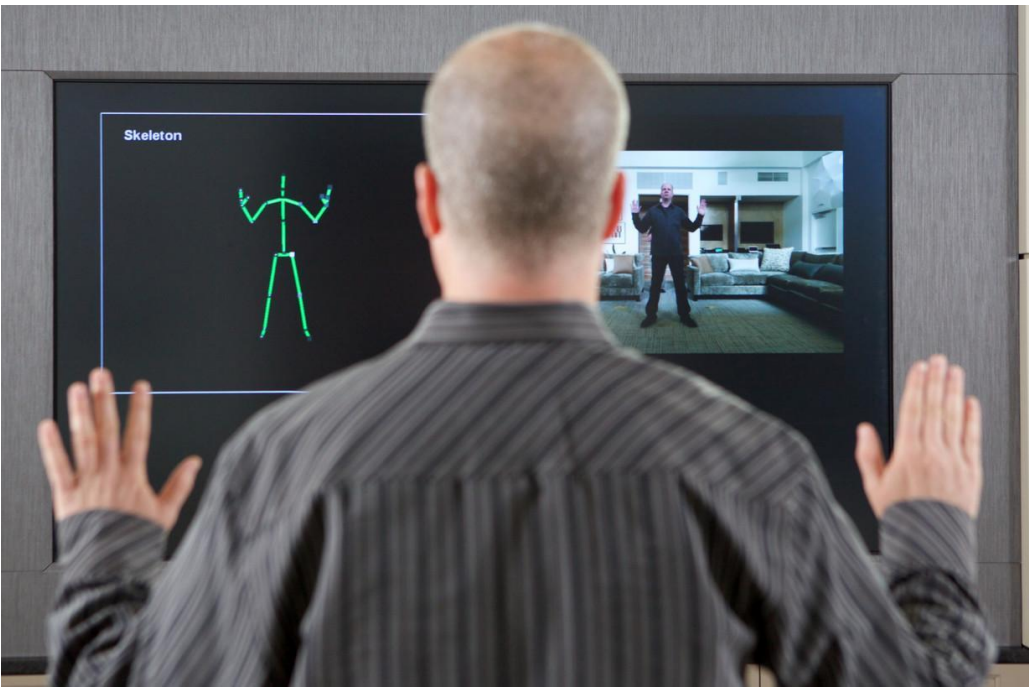
Next (Previous): draw line across object



Zoom in (Zoom out)<sub>2-4</sub>: Use Enlarge (Shrink)<sub>2-4</sub> performed on background.

# Vision

- Kinect body tracking
- HoloLens



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- *NUI Discussion*
  - Habit is a second Nature
  - *Are NUI Natural?*



# Natural UI

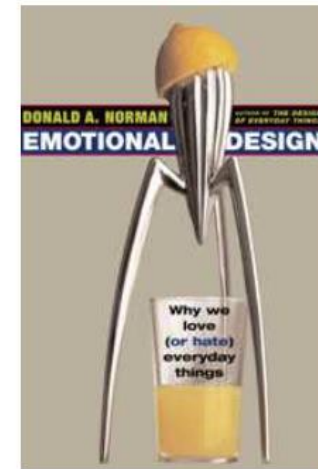
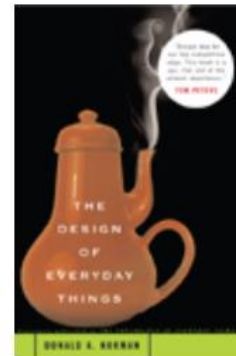
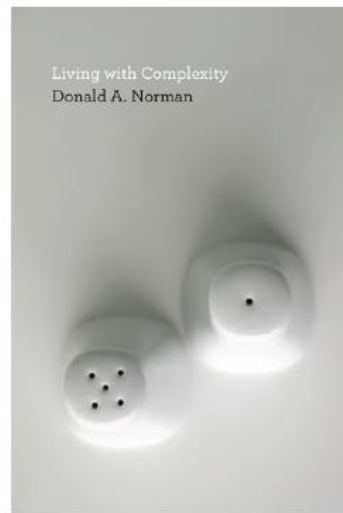
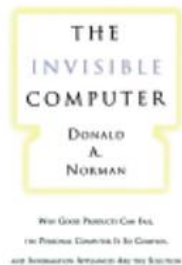
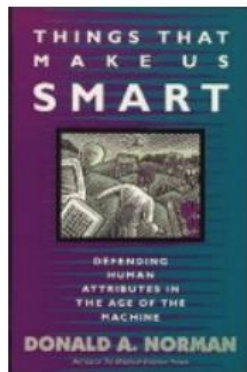
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# Are NUI Natural?

- *Natural UIs are NOT Natural*

-- Don Norman, Northwestern University  
In ACM Interactions, 2010, 17(3):6-10



# Are NUI Natural?

- *Natural UIs are NOT Natural*
  - Don Norman, Northwestern University  
In ACM Interactions, 2010, 17(3):6-10
- Gestural interaction is named as Natural. But, “As usual, marketing rhetoric is ahead of reality.”

# Is GUI Natural?

- The strength of the graphical user interface (GUI) *has little to do with its use of graphics*
  - It has to do with the *ease of remembering actions*, both in what actions are possible and how to invoke them.
  - *Visible icons and visible menus are the mechanisms*, and despite the well-known problems of scaling up to the demands of modern complex systems, they still allow one to explore and learn.
  - *The important design rule of a GUI is visibility*: Through the menus, all possible actions can be made visible and, therefore, easily discoverable.

# Is Gestural Interface Natural?

- Gestural interfaces are *not new*.
- Most gestures are *neither natural nor easy to learn or remember*.
- More important, gestures *lack critical clues* deemed essential for successful human-computer interaction.
- Gestures are ephemeral, they do not leave behind any record of their path. *The requisite feedback is lacking*. Moreover, a pure gestural system makes it difficult to discover the set of possibilities and the precise dynamics of execution.
- These problems can be overcome, of course, but only by *adding conventional interface elements*, such as menus, help systems, traces, tutorials, undo operations, and other forms of feedback and guides.



# What Makes NUI Natural?

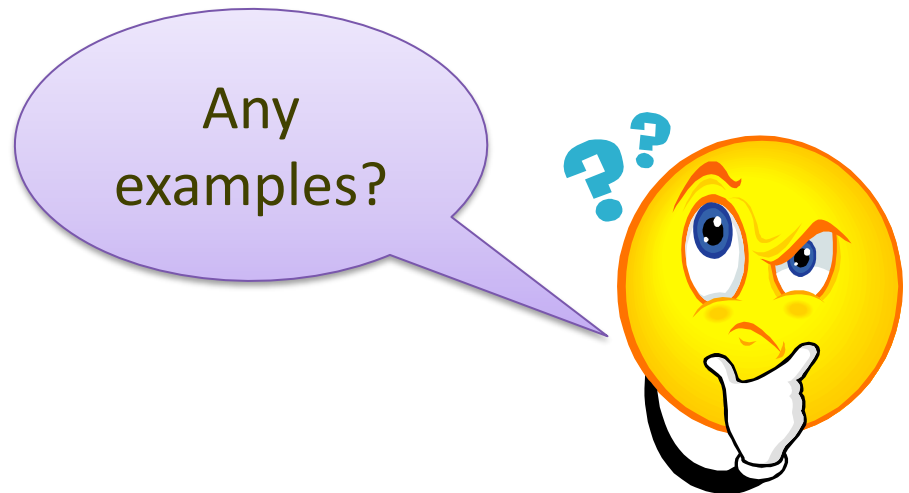
- Common misunderstandings
  - NUI=Multimodality?
  - NUI=Human-alike interface?
  - NUI=Tangible interface?
  - NUI=No interface?

***Fundamental principles of***  
- ***knowledge of results***  
- ***Feedback***  
- ***a good conceptual model***  
***still rule.***



# What Makes NUI Natural?

- Correct understanding
  - NUI is to match the existing experience or mental model of target users under expected circumstances.
- *The naturalness originates from life experiences*
- 自然来源于生活
  - Basis: *Experience*
  - Method: *Metaphor*
  - Core: *Mental Model*



# References

- Conferences
  - CHI: ACM Conference on Human Factors in Computing Systems
  - CSCW: ACM Conference on Computer Supported Cooperative Work
  - UIST: ACM Symposium on User Interface Software and Technology
  - AVI: International Working Conference on Advanced Visual Interfaces
  - Ubicomp: ACM International Conference on Ubiquitous Computing
  - MobileHCI: International Conference on Human-Computer Interaction with Mobile
  - Mobile Devices and Services
  - ITS: The ACM International Conference on Interactive Tabletops and Surfaces

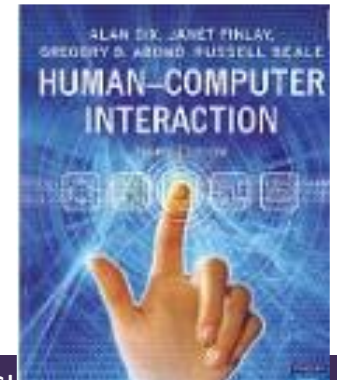
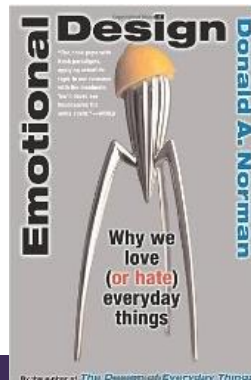
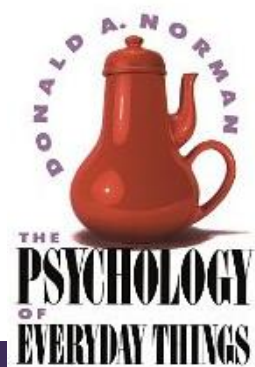
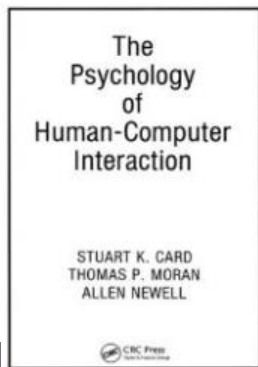
# References

- Journals
  - ACM Transactions on Computer-Human Interaction (TOCHI)
  - International Journal of Human-Computer Studies (IJHCS)
  - Interacting with Computer (IwC)
  - Human-Computer Interaction (HCI)
  - IEEE Transactions on Systems, Man, and Cybernetics
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# References

- Books

- S. K. Card, T. P. Moran, A. Newell, The Psychology of Human-Computer Interaction 1983;
- Donald. A. Norman, The Psychology of Everyday Things 1988 / Design of Everyday Things 1990, Emotional Design: Why We Love (or Hate) Everyday Things 2005;
- B. Shneiderman, Leonardo's Laptop: Human Needs and the New Computing Technologies 2003;
- Duyne, Landay, & Hong, The Design of Sites 2006; most popular UI design
- Alan Dix, et al Human-Computer Interaction 2003;
- Walter Issacson, Steve Jobs, A Biography. 2011



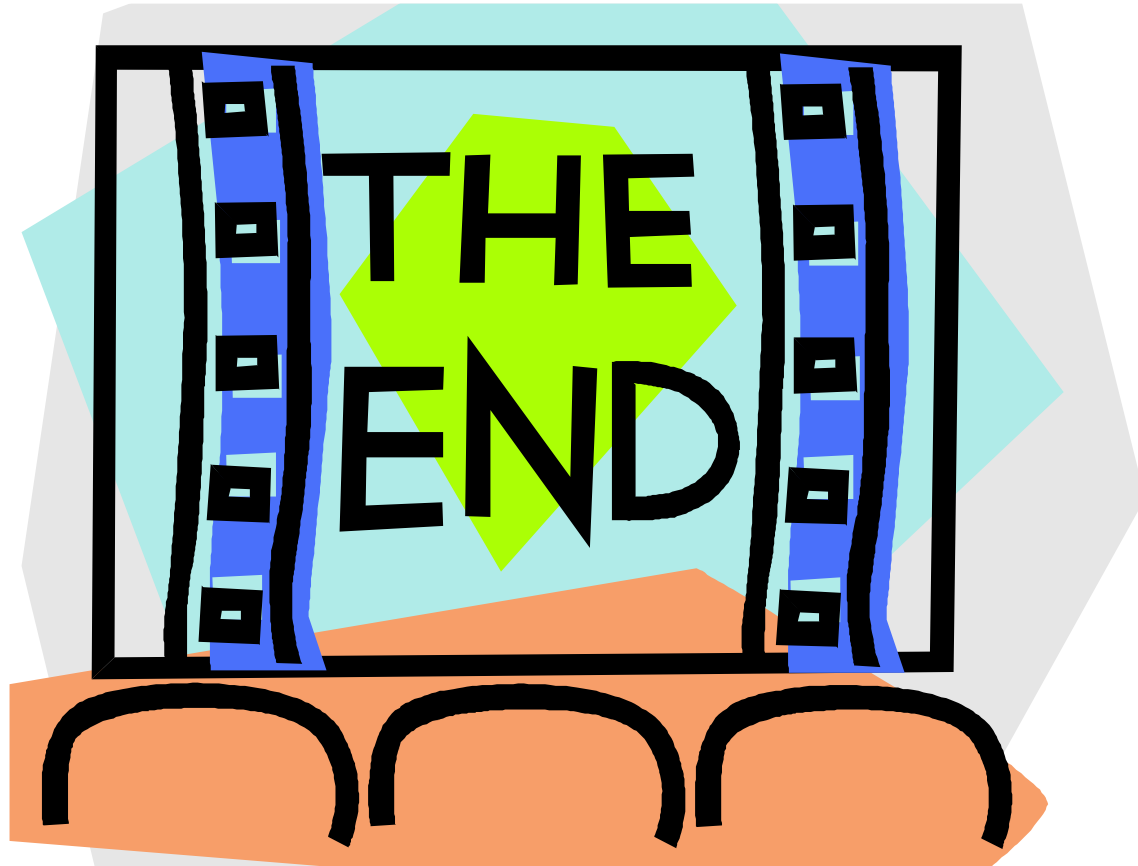
# Assignment

- Project proposal
  - Topic, Users, Tasks, Related work, Usability goals
  - Methodologies
- Presentation
  - Around 9<sup>th</sup> week
- Implementation needed
- We focus on *design, prototyping, and evaluation* aspects in this course!



# Assignment

- Example Topics (not limited to)
  - Voice recognition Apps
  - Kinect-based interactive systems
  - Leap motion-based interactive systems
  - 3D interactive systems
  - Interactive system based on gesture
  - Augmented reality
  - Web-based interactive systems
  - Mobile apps
  - .....
- 5 kinects, 1 leap motion for borrow



**Thank you for your attention!**