

Microsoft® Research

Faculty Summit

10
YEAR ANNIVERSARY

Enhancing Human-Computer Interaction with Physiological Computing

Desney Tan
Computational User Experiences
Microsoft Research

Our Goal

Create a race of cyborgs that
possess superhuman powers and
rule the earth!

Cy·borg (*n.*)

cyb(ernet)ic org(anism) [Clynes & Kline 1960]

1. A self-regulating integration of artificial and natural systems
2. A person whose functioning is aided by or dependent on a mechanical or electronic device

You and I are Cyborgs

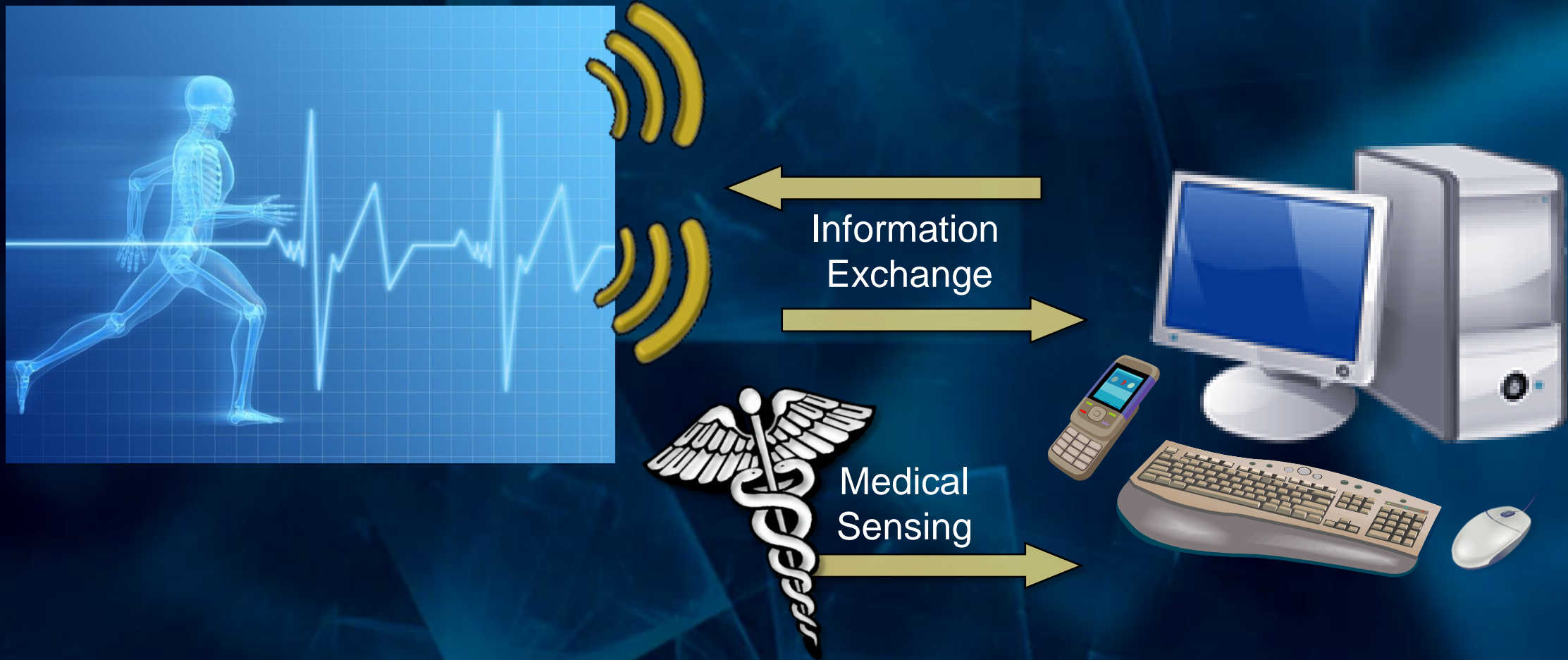
- If we give up the prejudice that the human being (or being human) is contained solely inside our “biological skin-bag” ...

We are human-technology symbionts,
cyborgs without the
invasive bodily alterations

Expanding the Information Bandwidth



Approach: Physiological Computing



Targeting Interesting Parts of the Body



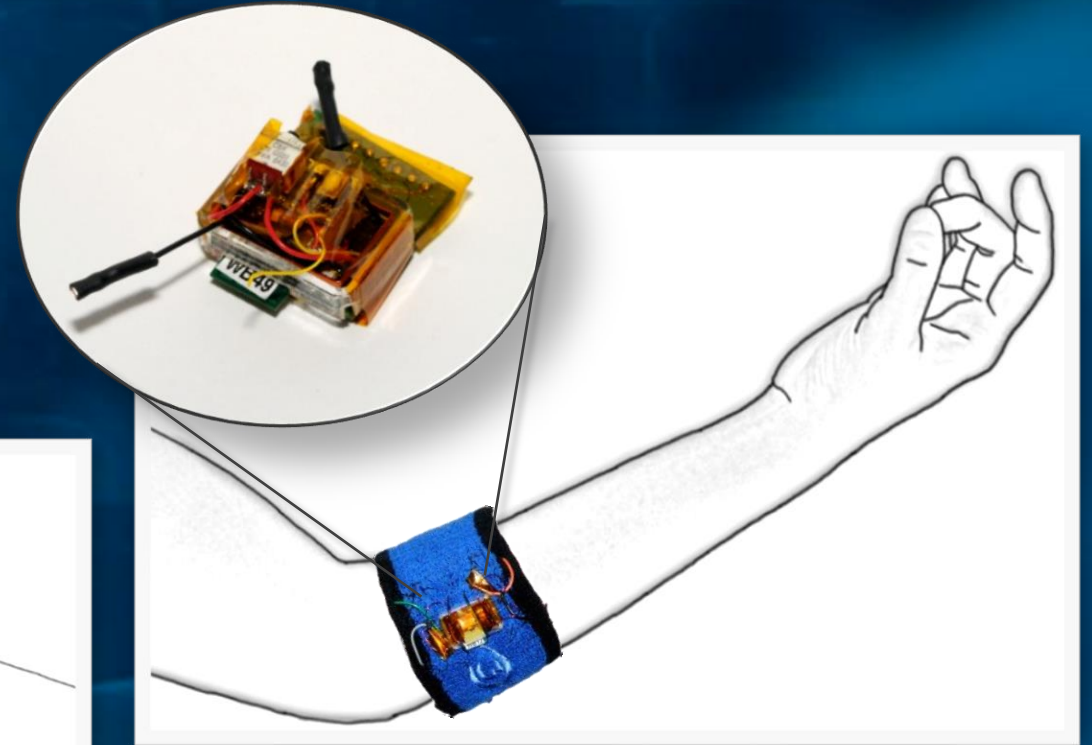
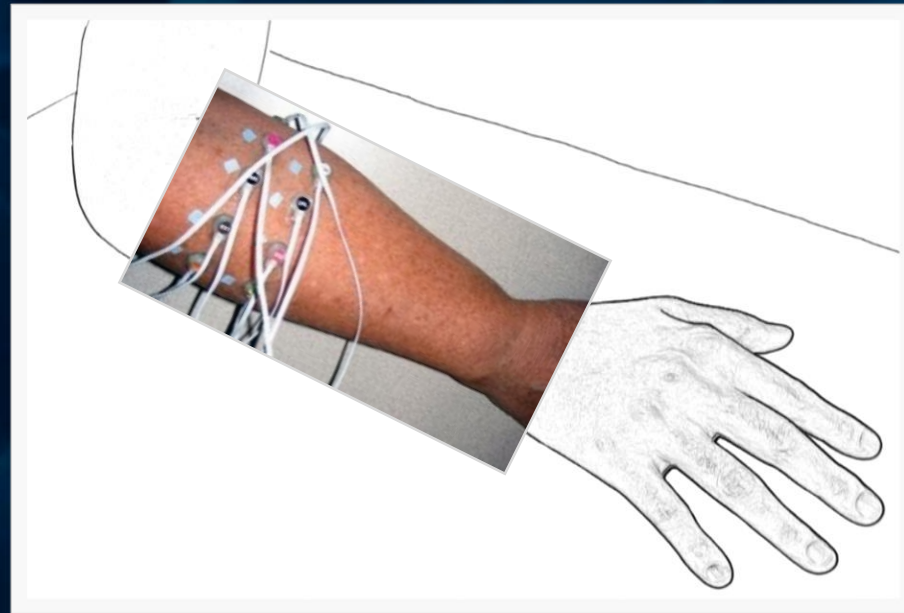
Always-Available Natural Interfaces with Muscle-Computer Input

Scott Saponas (UW) | Desney Tan | Dan Morris
Ravin Balakrishnan (Toronto) | James Landay (UW) | Jim Turner

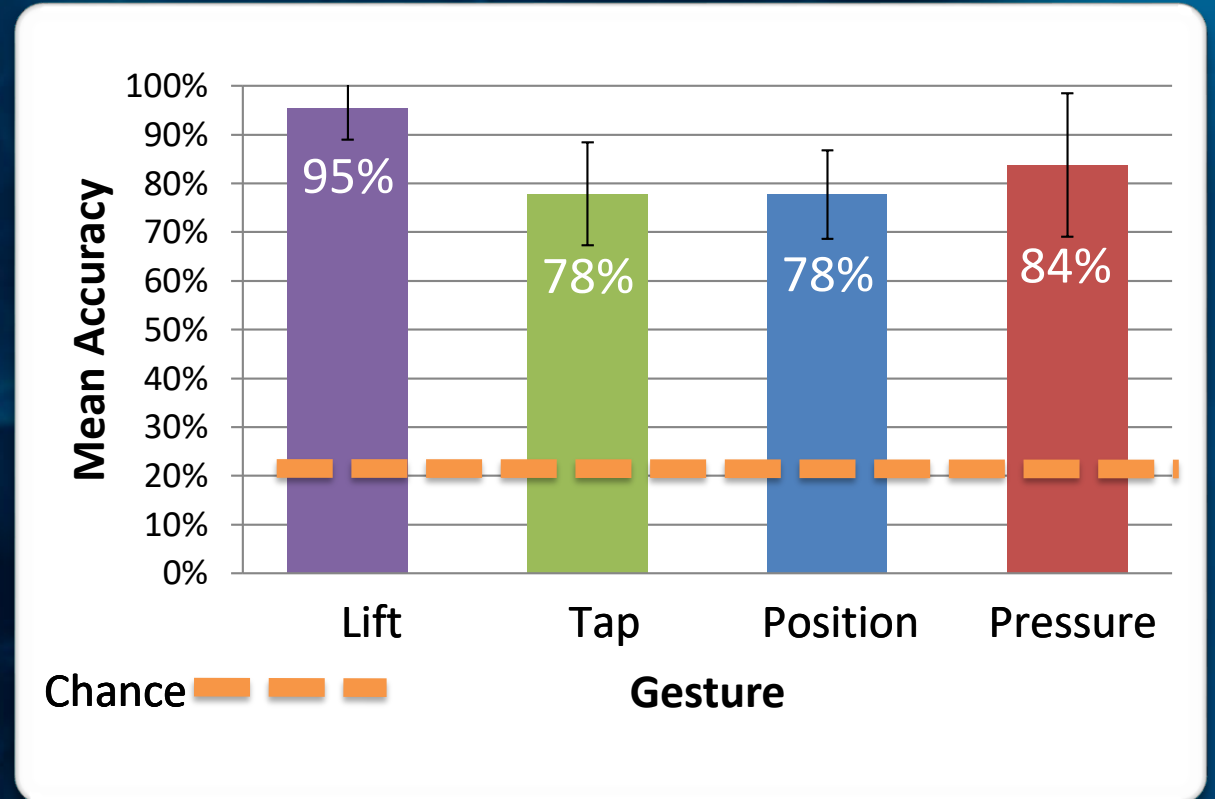
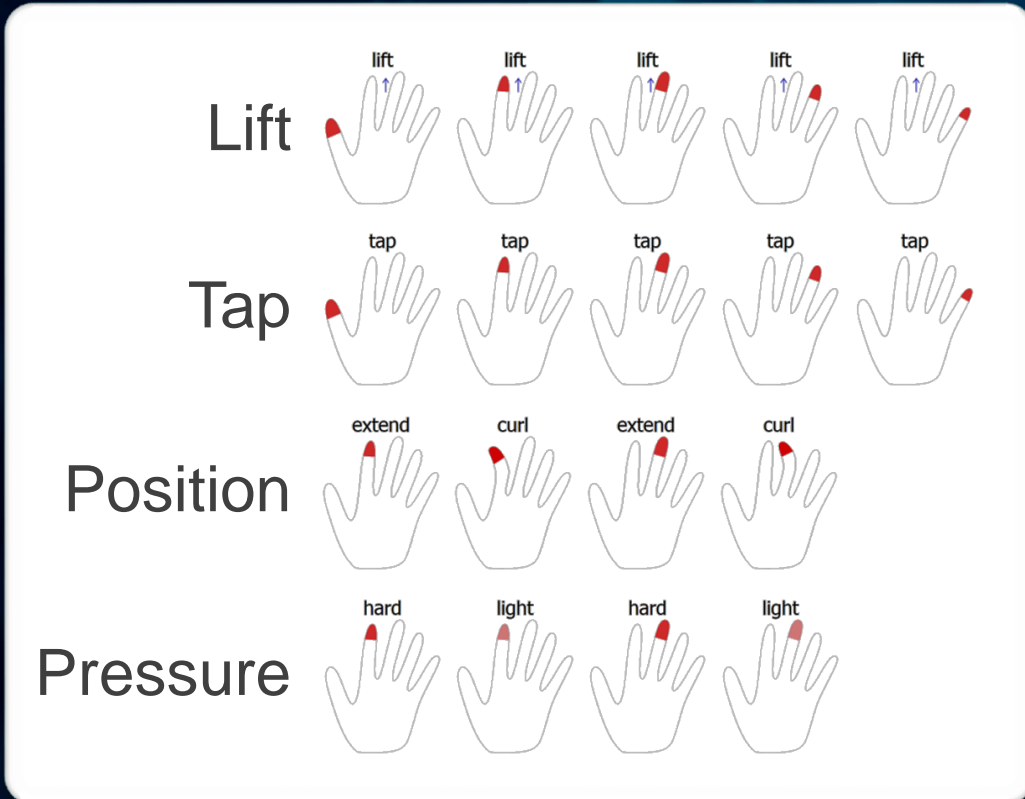
ACM CHI 2008 Conference on Human Factors in Computing Systems
Demonstrating the Feasibility of Using Forearm Electromyography for Muscle-Computer Interfaces

ACM UIST 2009 Symposium on User Interface Software and Technology
Enabling Always-Available Input with Muscle-Computer Interfaces

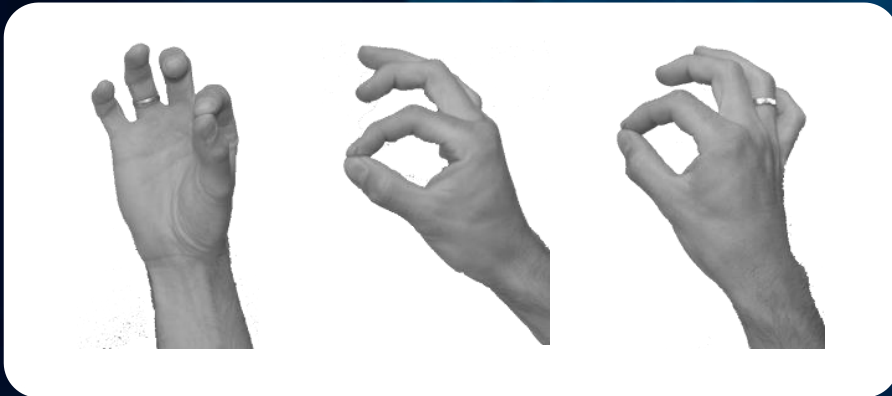
Muscle Sensing for Finger Gestures



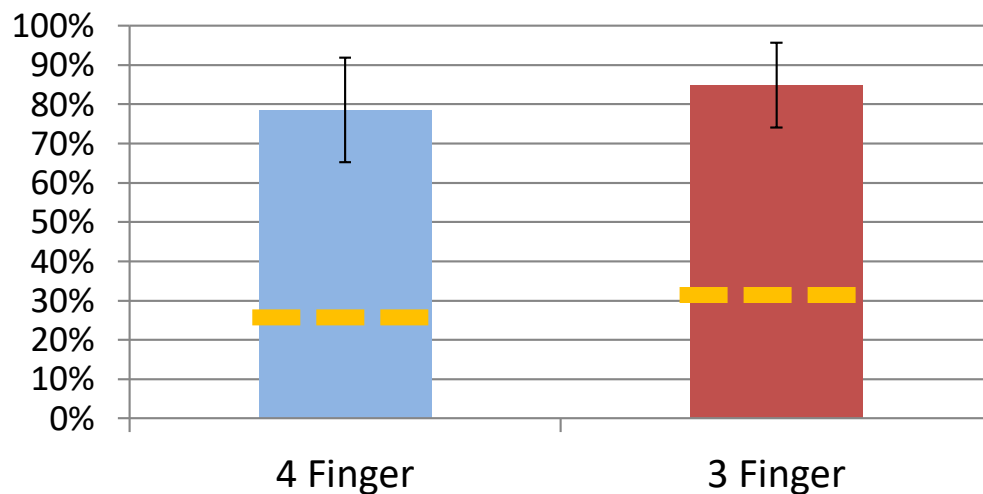
Gestures on Surfaces (e.g. table)



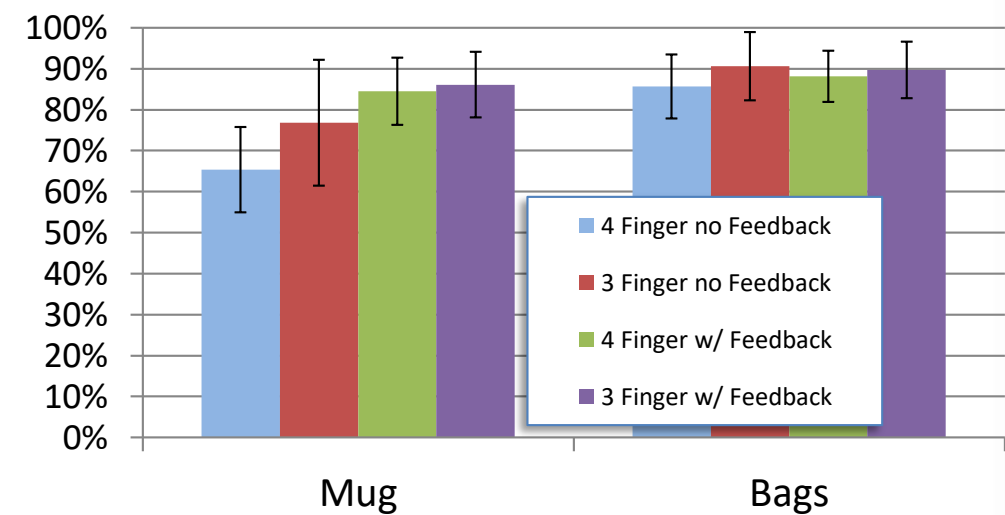
Gestures in Free Space



Hands-Free Gesture Accuracy



Hands-Busy Gesture Accuracy



Microsoft
Research Computational User Experiences - CUE group

Air
Guitar Hero[®]

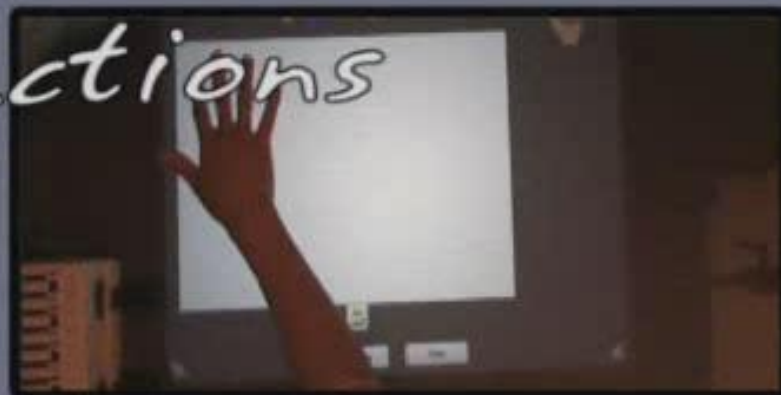
Scott Saponas

Desney Tan

Dan Morris



Pressure Sensing



Finger Identification



Off-Surface "Pinch" and "Throw"



Bimanual "Flick"

Ongoing Research

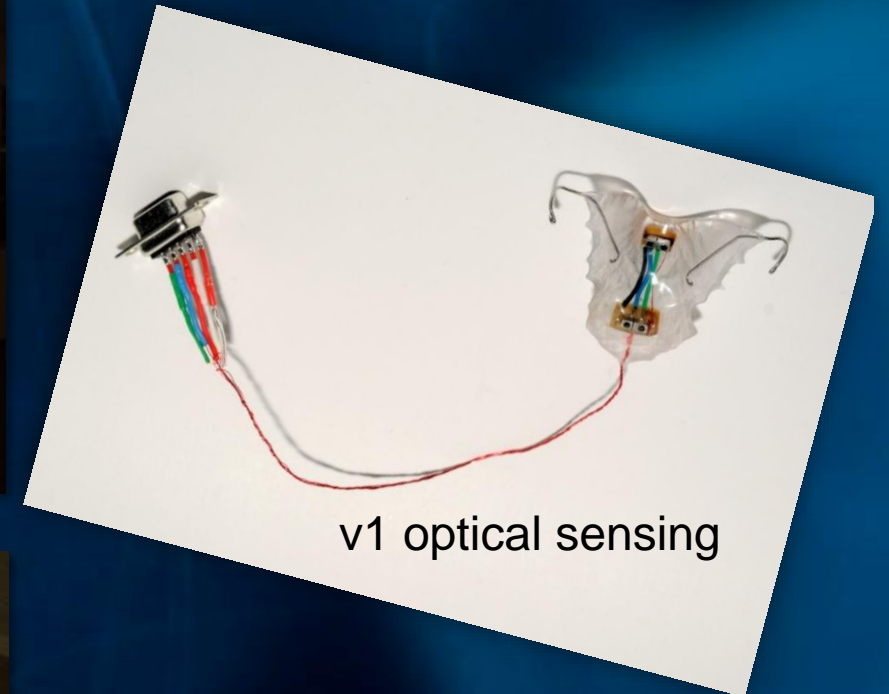
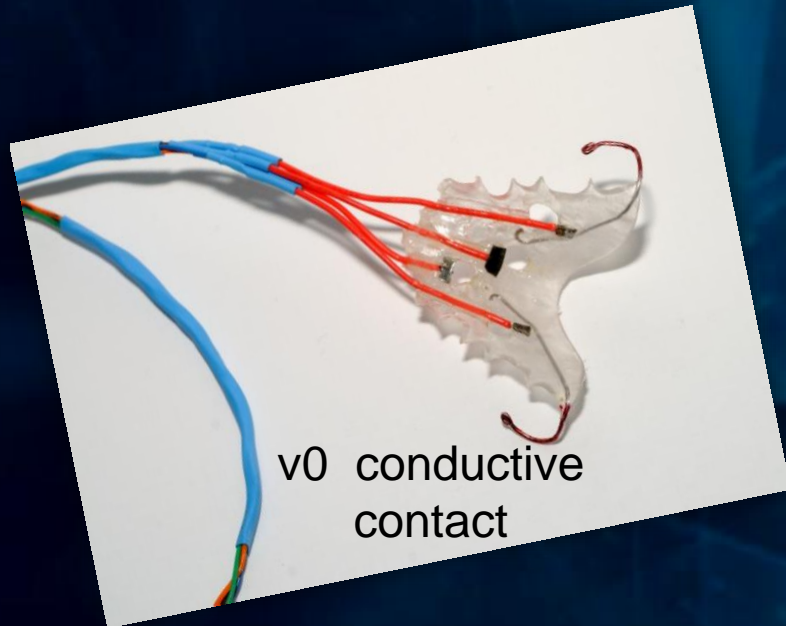
- Physical feedback for learning
- Applying to prosthetics or clinical rehabilitation
- Enabling new applications
- Defining appropriate gesture sets

Mouth-Computer Interfaces for Input, Output, and Sensing

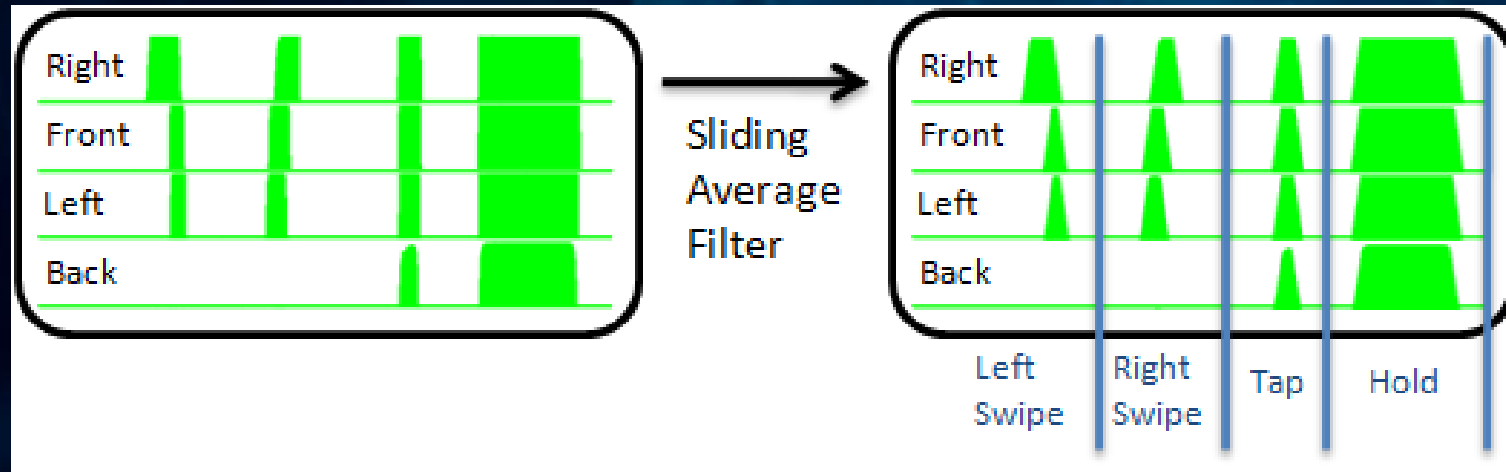
Scott Saponas (UW) | Dan Kelley (UW) |
Babak Parviz (UW) | Desney Tan
with Johnny Lee | Dodi Nov, DDS | Penn-Brookside Orthodontic Lab

ACM UIST 2009 Symposium on User Interface Software and Technology
Optically Sensing Tongue Gestures for Computer Input

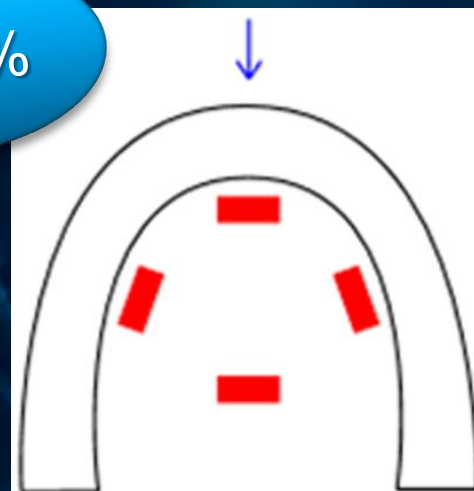
Mouth-Computer Interfaces



Simple Gesture Set Tested Well

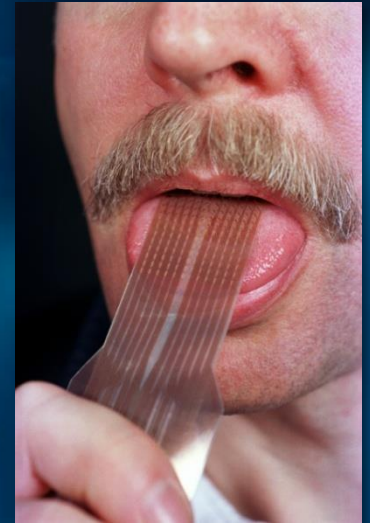


92.2%



Ongoing Research

- Input
 - Better tongue gestures
- Output:
 - Tactile stimulation
 - Bone conduction
- Medical Sensing
 - Salivary analysis
 - Food analysis



Bionic Contact Lens Interface

Babak Parviz (UW) | Brian Otis(UW) | Desney Tan
and their teams of brilliant scientists
partially supported by MSR External Research

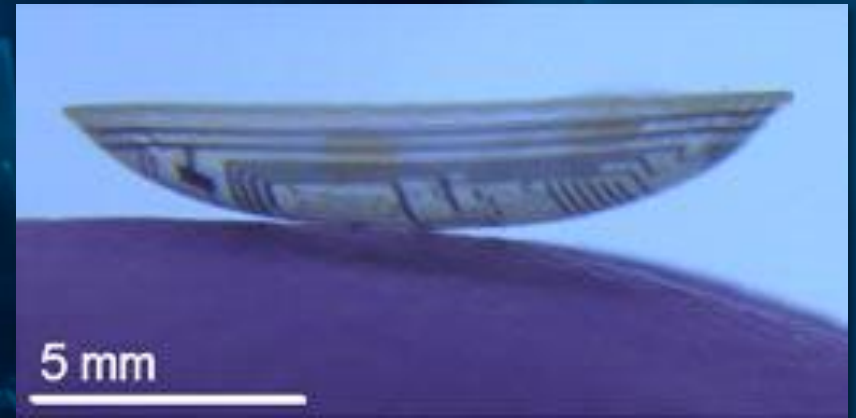
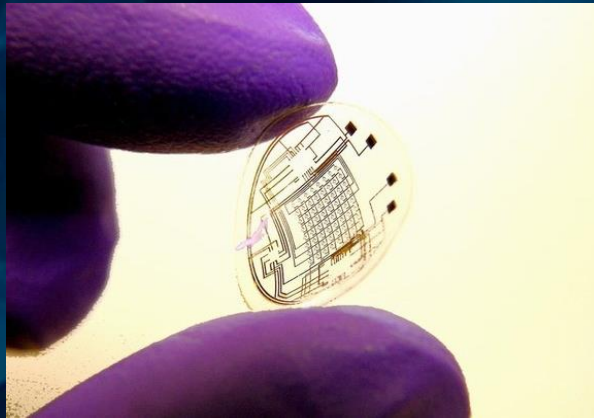
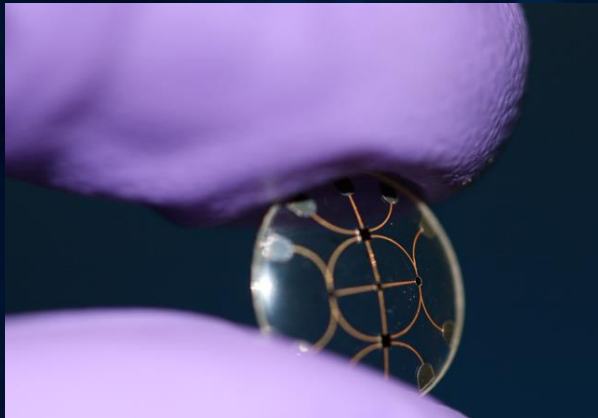
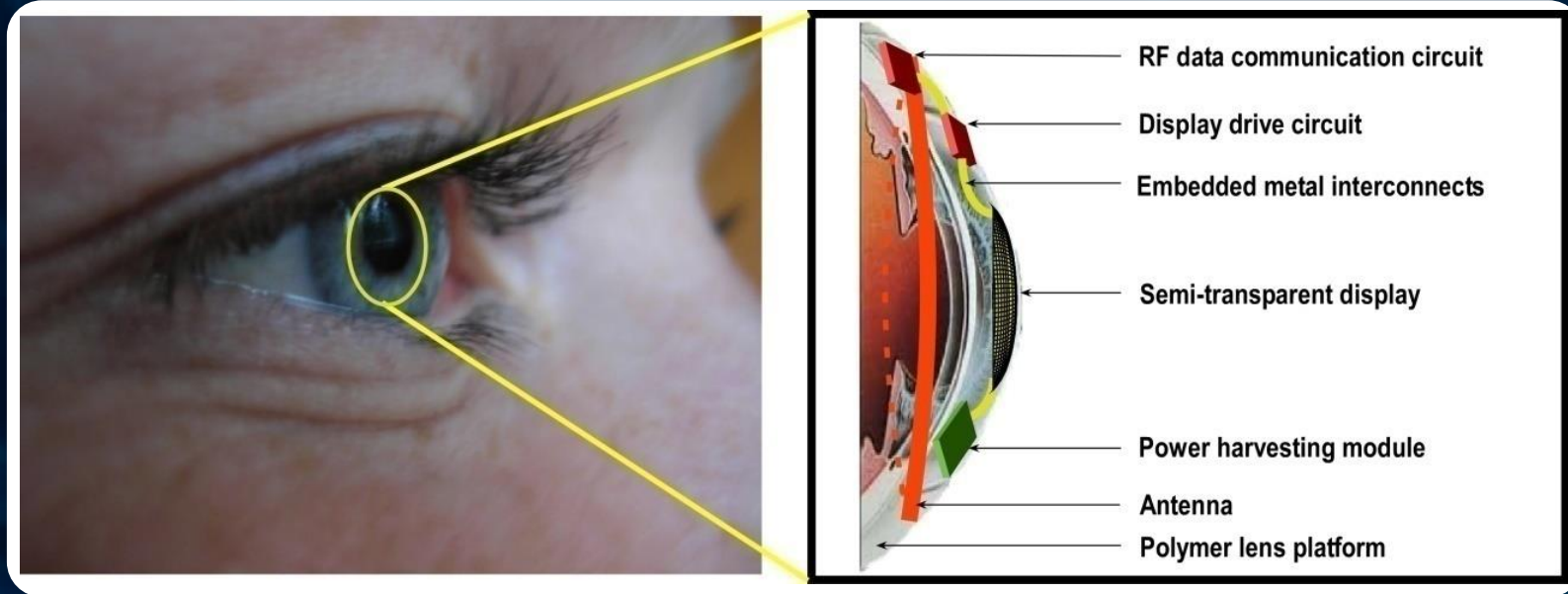
21st IEEE International Conference on MicroElectroMechanical Systems
Contact Lens with Integrated Inorganic Semiconductor Devices

SPIE Nanoscience and Engineering Conference
Functional Modular Contact Lens

2009 Euro American Workshop on Information Optics
Forming Images on a Functional Contact Lens

Annual Meeting of the Association for Research in Vision and Ophthalmology
Nanobiosensors for contact lenses and their potential uses

Bionic Contact Lenses



The Lens at Work

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Ongoing Research

- Solve the hard problems
 - Harnessing power
 - Cooling the device
 - Focus and imaging
- Medical Sensing: Glucose Sensing with the Bionic Contacts

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