Informatics 134

Software User Interfaces
Winter 2022

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Agenda

Upcoming

- T3 Presentation Order
- Today: Looking to the future
- A3: Demos
- Keep working on A4 (DUE 3/17)
- Keep working on T3 (DUE 3/11, Final Presentations Start 3/08)

User Interfaces For Tomorrow's Devices

Wearables

Augmented Reality

Virtual Reality

Augmented Reality
Virtual Reality
Wearables

What is a Wearable?
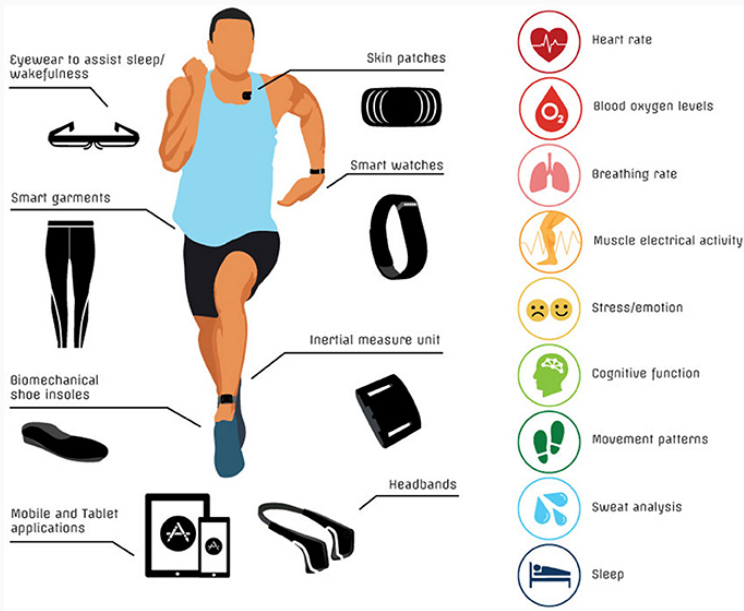
Augmented Reality
Virtual Reality
Wearables

What is a Wearable?
Smartwatch/Activity tracker
Smart glasses
Smart clothing and jewelry
Tattoos/patches/ingestibles
Medical devices

Eyewear to assist sleep/wakefulness

Skin patches

Smart watches

Smart garments

Inertial measure unit

Biomechanical shoe insoles

Headbands

Mobile and Tablet applications

Heart rate

Blood oxygen levels

Breathing rate

Muscle electrical activity

Stress/emotion

Cognitive function

Movement patterns

Sweat analysis

Sleep

source

Wearables

What to do with all the data?

How do we access?

How do we control?

Wearables

What to do without a desktop or mobile display?

How do we access?
How do we control?

Access

Advantages? Limitations?

On-device display

Haptic feedback

Speech synthesis

On-body display

LumiWatch: On-Arm Projected Graphics and Touch Input

FILTERS

CROP

SHARE

eyeHand Smartwatch Concept

Watch later

Share

0:10 / 1:06

source[Xiao et al., 2018]

User Interfaces For Tomorrow's Devices

Wearables

What to do without a desktop or mobile display?
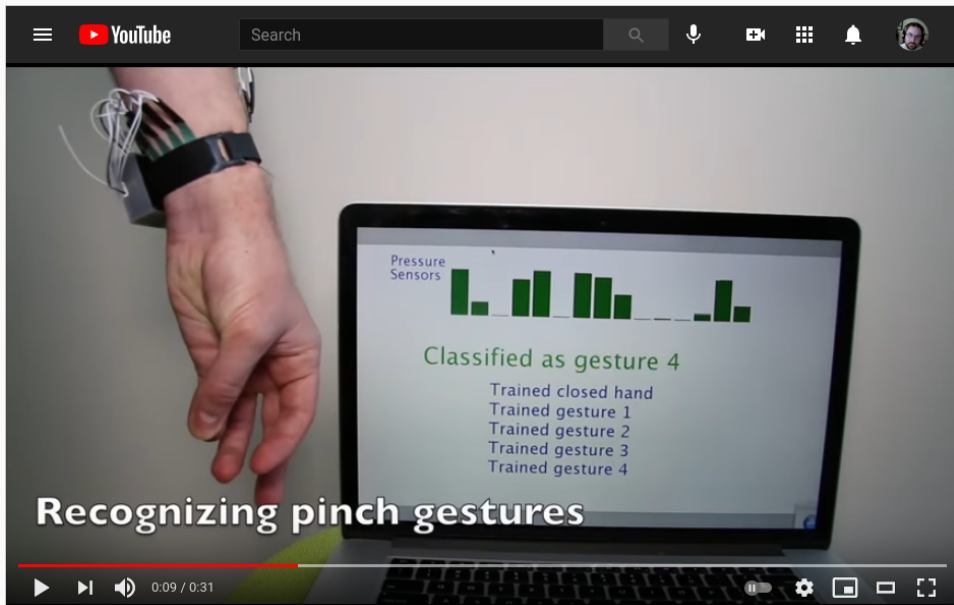
How do we access?

How do we control?

Control

On-device interactions (tap, swipe, physical buttons)

Voice

Gestures

...

source[Dementyev and Paradiso, 2014]

Wearables

What to do without a desktop or mobile display?

How do we access?

How do we control?

Control

On-device interactions (tap, swipe, physical buttons)

Voice

Gestures

Passive activity

Wearables

What to do without a desktop or mobile display?

How do we access?

How do we control?

Passive activity with biosensors

Calorimetric (chemical,thermal)

Potentiometric (chemical,electrical)

Optical (physical)

Piezo-electric (force)

Building an interaction model for wearables

Signal Processing (amplify, average, filter)
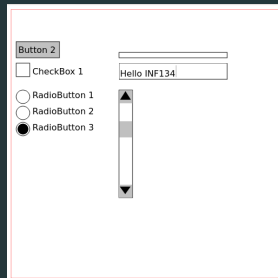
Training and Classification

Least squares

Knearest neighbors(kNN)

Hidden Markov

Artificial neural networks (ANN)

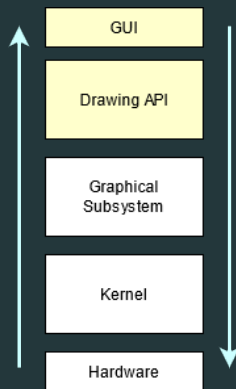Fit and Mapping (*e.g.,* gesture taxonomy)

Similarities? Anything missing?

Standard Interaction Model

Event-driven programming

Abstractions

Toolkits

| GUI |
| Drawing API |
| Graphical Subsystem |
| Kernel |
| Hardware |

We are at a confluence of novel forms of interaction and the tools required to support them

From Research to Product

Myo gesture band

User Interfaces For Tomorrow's Devices

From Research to Product

- Myo gesture band
- Google glass
- Microsoft Hololens

source

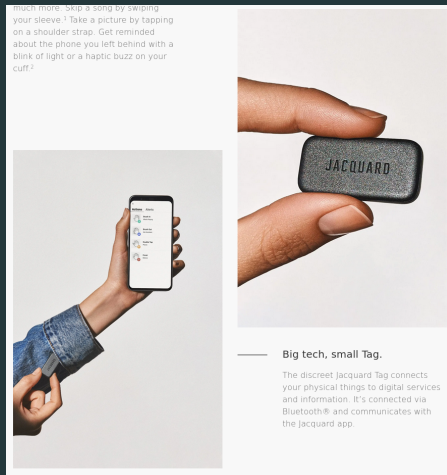**From Research to Product**

Project Jacquard

Abilities to pair gestures to actions:

- Brush in/up
- Brush out/down
- Double tap
- Cover

Interactive programmability

Perhaps not expressive enough for a body full of sensors

Still depends on mobile interface

much more. Skip a song by swiping your sleeve.[1] Take a picture by tapping on a shoulder strap. Get reminded about the phone you left behind with a blink of light or a haptic buzz on your cuff.[2]

JACQUARD

Big tech, small Tag.

The discreet Jacquard Tag connects your physical things to digital services and information. It's connected via Bluetooth® and communicates with the Jacquard app.

source

Moving away from display-based user interfaces to body-based user interfaces brings with it the opportunity for more user-driven toolkits.

What is a user-driven toolkit?

Access and control of interaction available to a user

Ability for user to define their own user experience

User-driven toolkits

A good toolkit should:

Recognize and support the unique qualities of every individual

Reduce the gulf of execution

interaction with interface should correspond to user intention
interaction with interface should correspond to user perception (of what is possible)

Reduce the gulf of evaluation

interface should support discovery (of state)
interface state should be easy to interpret and match user expectation

A3 Show an Tell

A user-driven toolkit

What are some of the obstacles you faced while building your toolkit?

A user-driven toolkit

What are some of the obstacles you faced while building your toolkit?

Design?

Abstraction?

Composability?

Debugging and problem solving?

A user-driven toolkit

How can we reduce these obstacles?

Declarative, expressive grammars
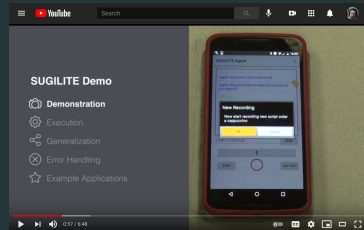
Vega-lite

source

A user-driven toolkit

How can we reduce these obstacles?

>   Declarative, expressive grammars

>   Programming By Demonstration

SUGILITE

source [Li et al., 2017]
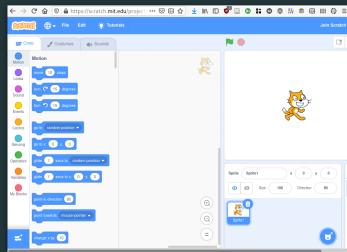
A user-driven toolkit

How can we reduce these obstacles?

> Declarative, expressive grammars
>
> Programming By Demonstration
>
> Visual programming

Scratch

source

We are at a confluence of novel forms of interaction and the tools required to support them

We navigate the confluence by building on existing innovations and leaning on the values of user-centered design.

Wrapping Up

A4?

Team feedback (con't from Tuesday) ?

References

📄 Dementyev, A. and Paradiso, J. A. (2014).
Wristflex: Low-power gesture input with wrist-worn pressure sensors.
In *Proceedings of the 27th Annual ACM Symposium on User Interface Software and Technology*, UIST '14, page 161–166, New York, NY, USA. Association for Computing Machinery.

📄 Li, T. J.-J., Azaria, A., and Myers, B. A. (2017).
Sugilite: creating multimodal smartphone automation by demonstration.
In *Proceedings of the 2017 CHI conference on human factors in computing systems*, pages 6038–6049.

📄 Xiao, R., Cao, T., Guo, N., Zhuo, J., Zhang, Y., and Harrison, C. (2018).
Lumiwatch: On-arm projected graphics and touch input.
In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems*, pages 1–11.