



# Augmenting Humans

Kai Kunze  
Professor

Keio Media Design  
Keio University, Tokyo, Japan  
<http://kaikunze.de/>

# Augmenting Humans

## Overview

Personal Background  
Physical  
Cognitive  
Augmented  
Outlook



# My Background

Professor

Graduate School of Media Design, Keio University

Research Assistant Professor

Osaka Prefecture University

Visiting Researcher at MIT Media Lab

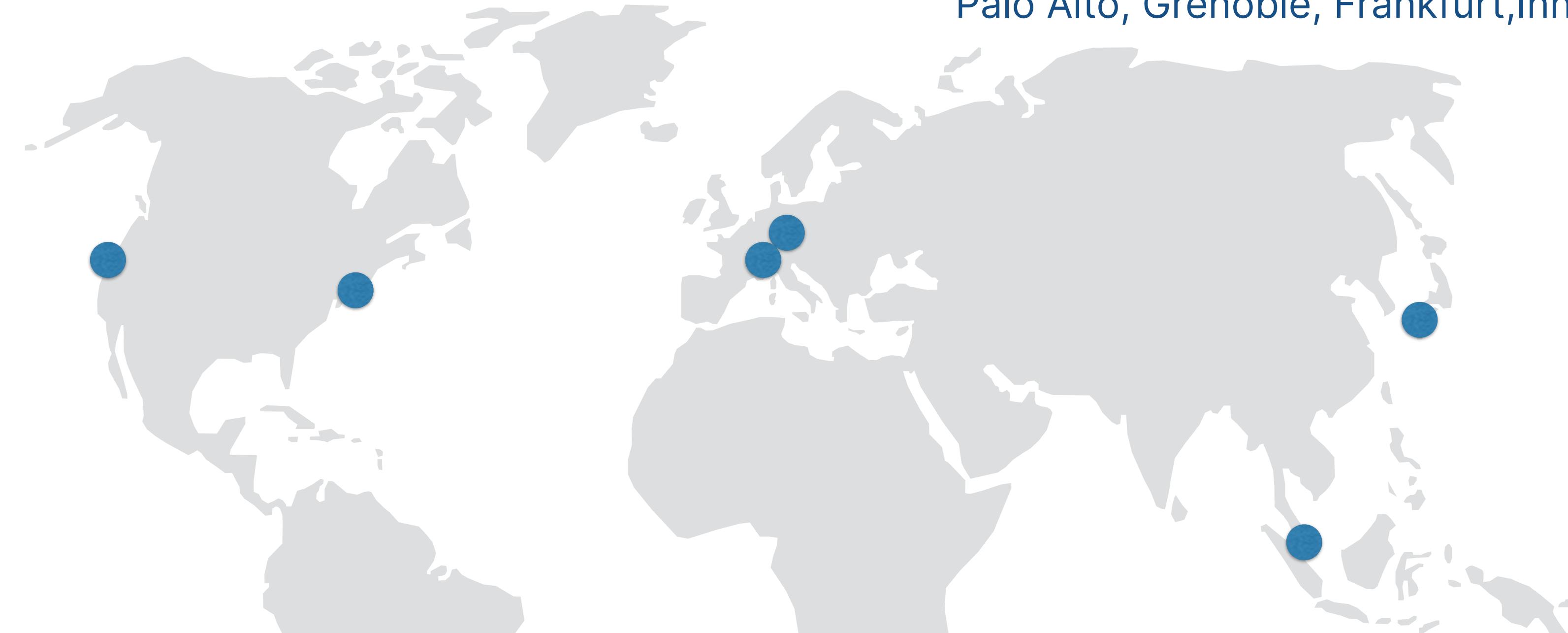
MIT, Cambridge, USA

PhD in Ubiquitous/Wearable Computing (2011)

University Passau, Germany

Collaborations with PARC, SUN, Deutsche Börse ...

Palo Alto, Grenoble, Frankfurt, Innsbruck



# Geist Lab (at Keio Media Design)



# **Physical**



With the computers surrounding us in everyday life, worn on our bodies, the performance bottle neck is  
**Human Attention.**

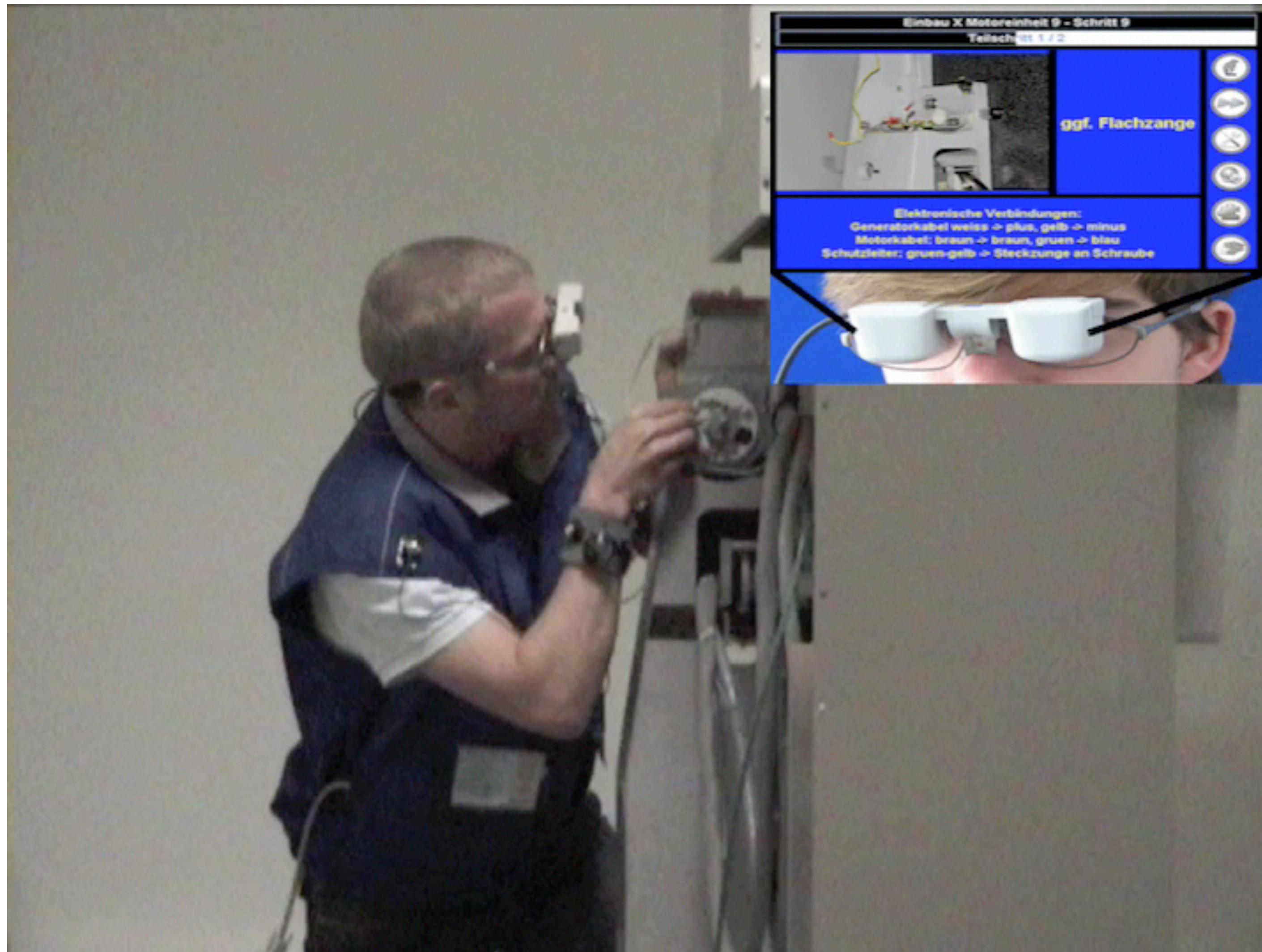
Key challenge: intuitive cooperation between humans and computers

**Activity Recognition, Context-Aware Systems**  
Using a Combination of Sensors, Signal Processing, Applied Machine Learning to Support Users in Everyday Situations



# Wearable Computing around 2005

Maintenance Scenario Collaboration with Zeiss, Oberkochen.



Kunze, Kai, et al. "Does context matter?-a quantitative evaluation in a real world maintenance scenario." *International Conference on Pervasive Computing*. Springer, Berlin, Heidelberg, 2009.

# Wearable Computing – Activity Recognition becomes Mainstream

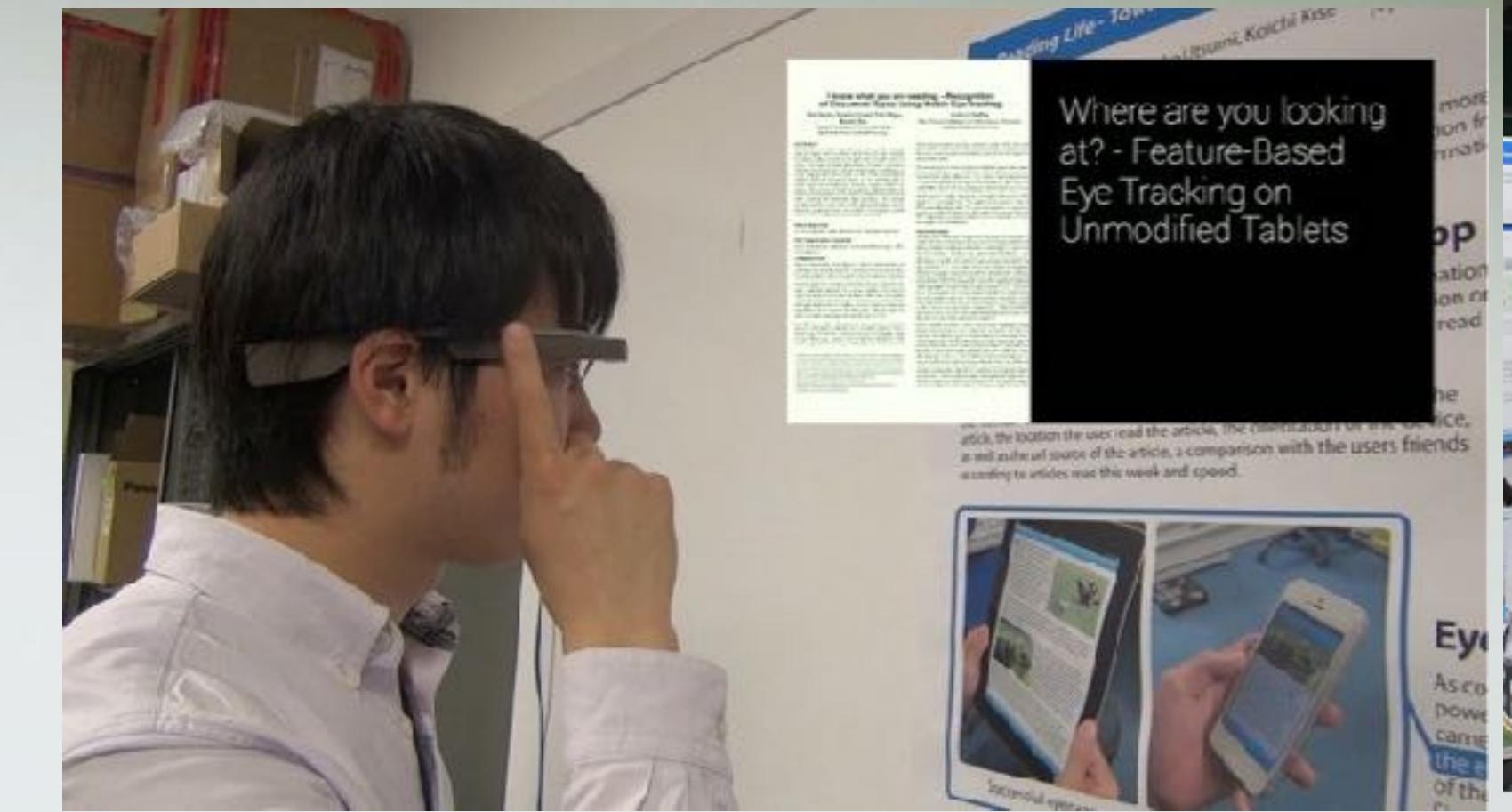


Kunze Kai. Compensating for On-Body Placement Effects in Activity Recognition, 2011.

# Cognitive

J!NS MEME: From Research to Product

# Cognitive Activity Tracking in Everyday Life



J!NS MEME



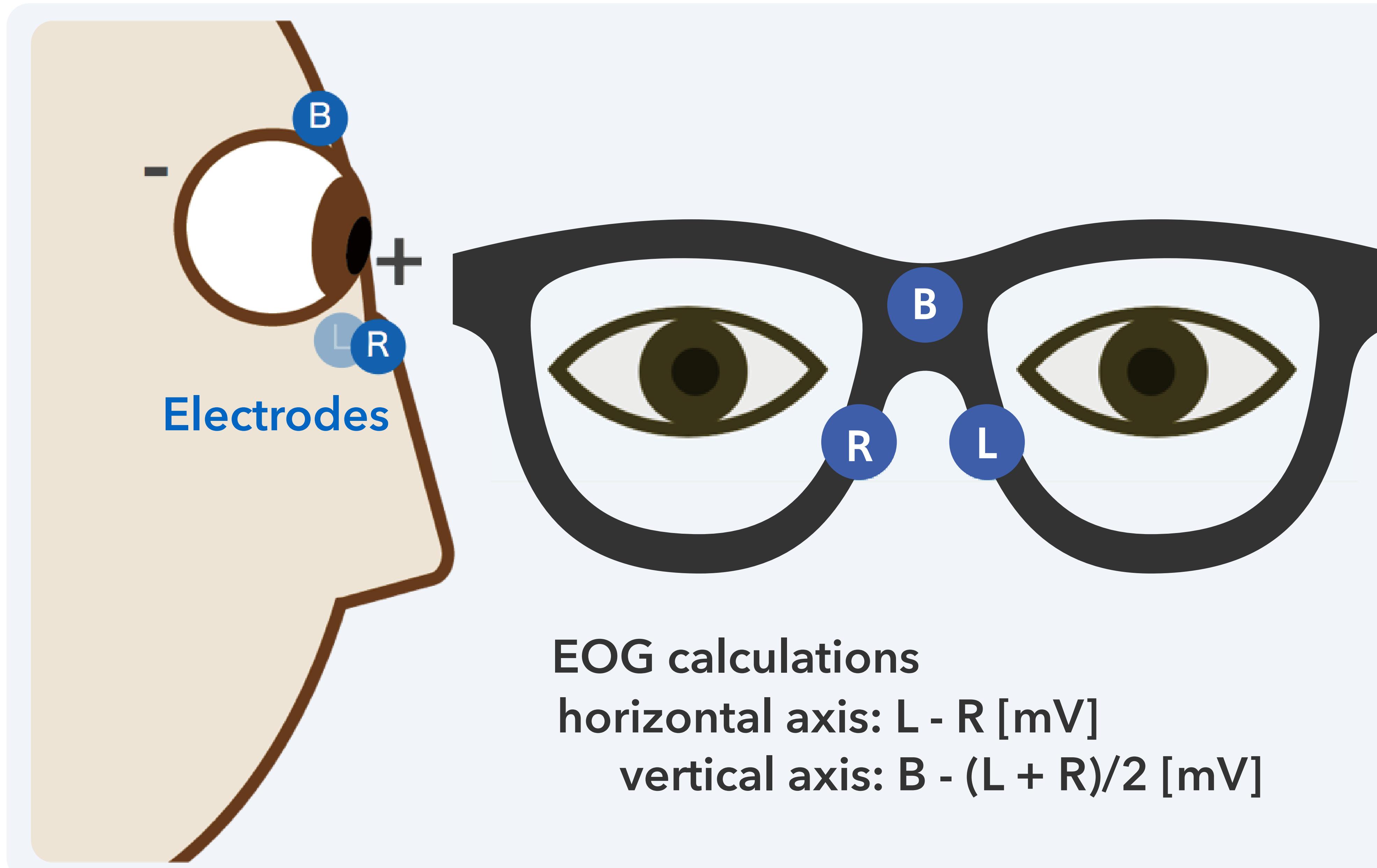
# Overview of J!NS MEME



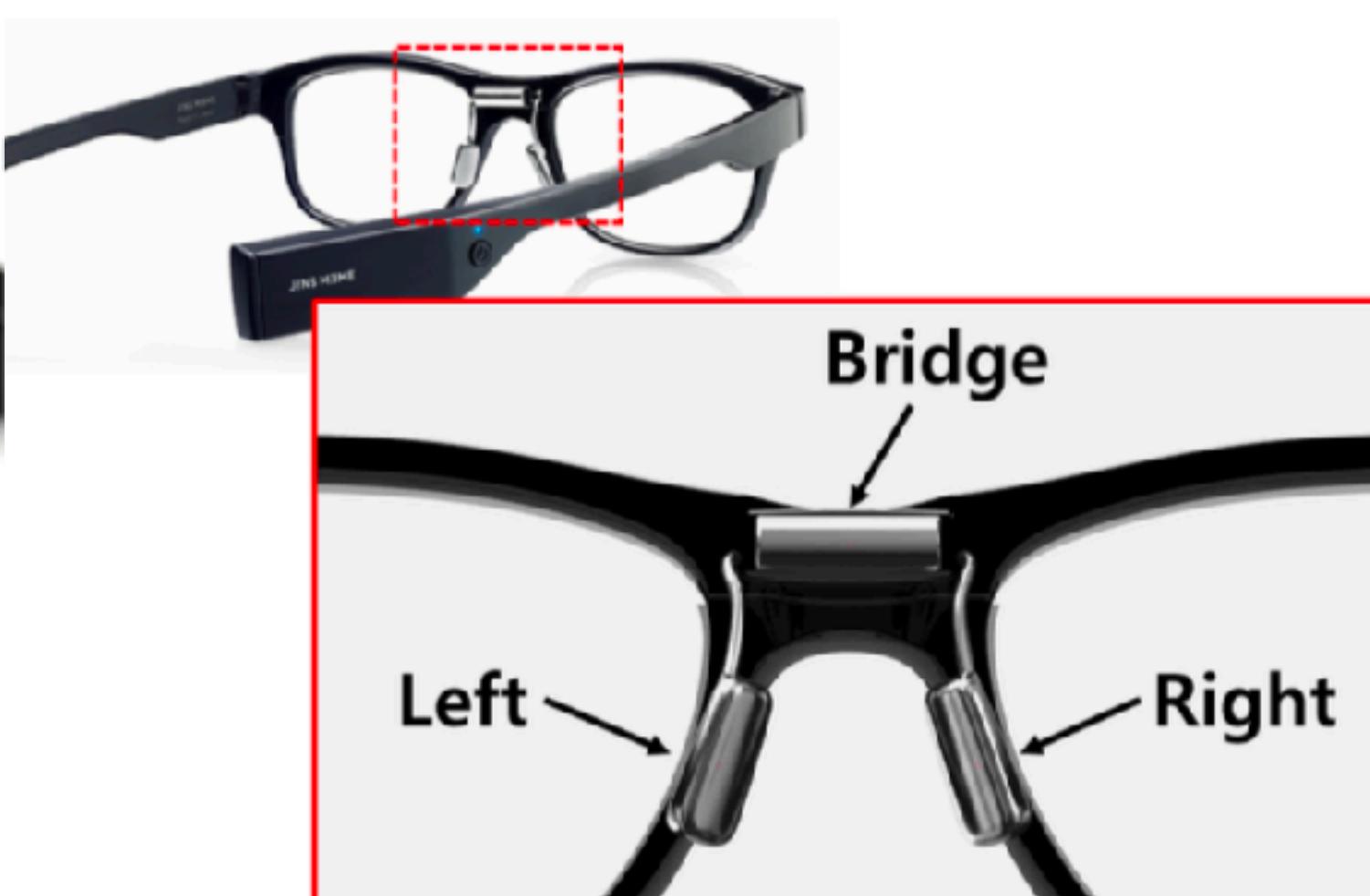
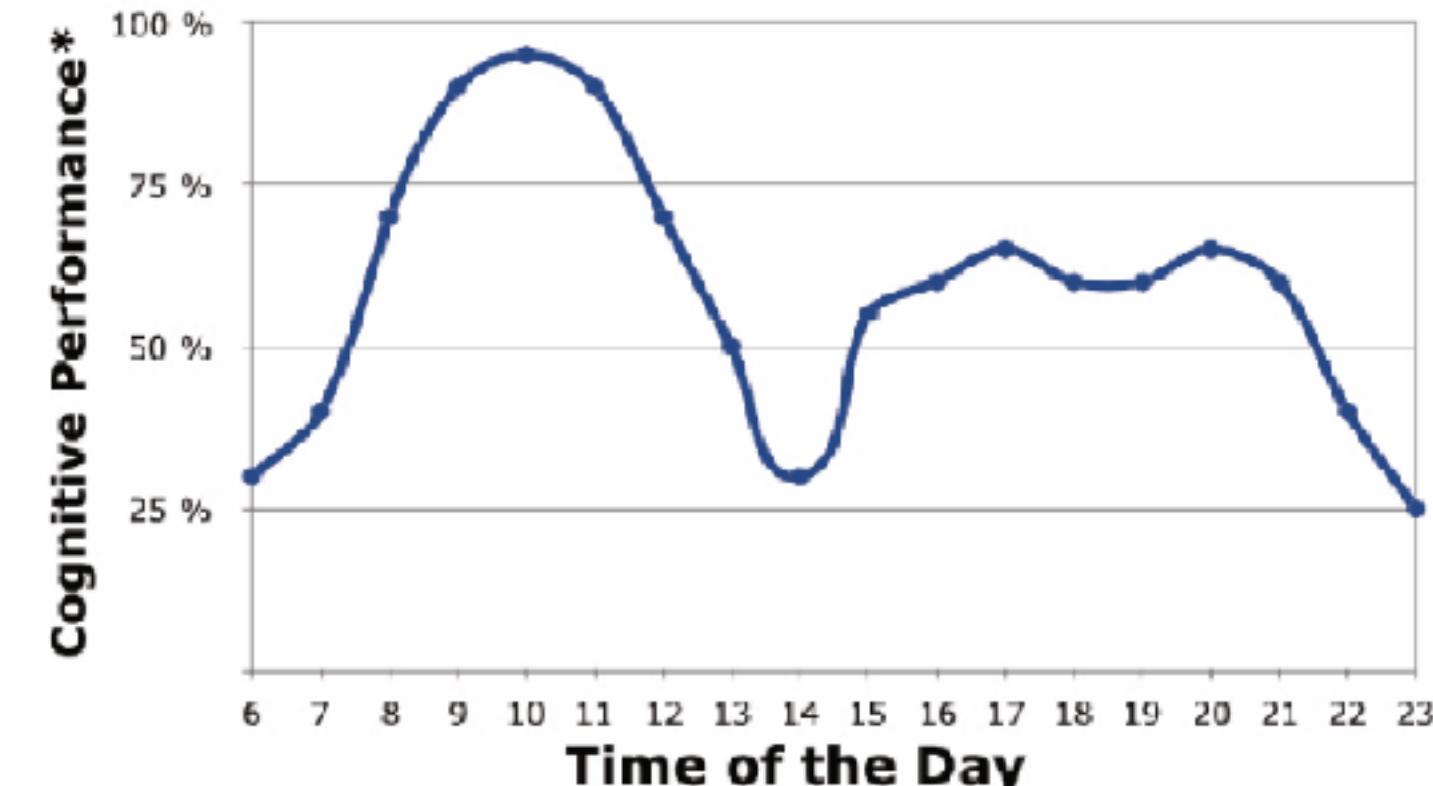
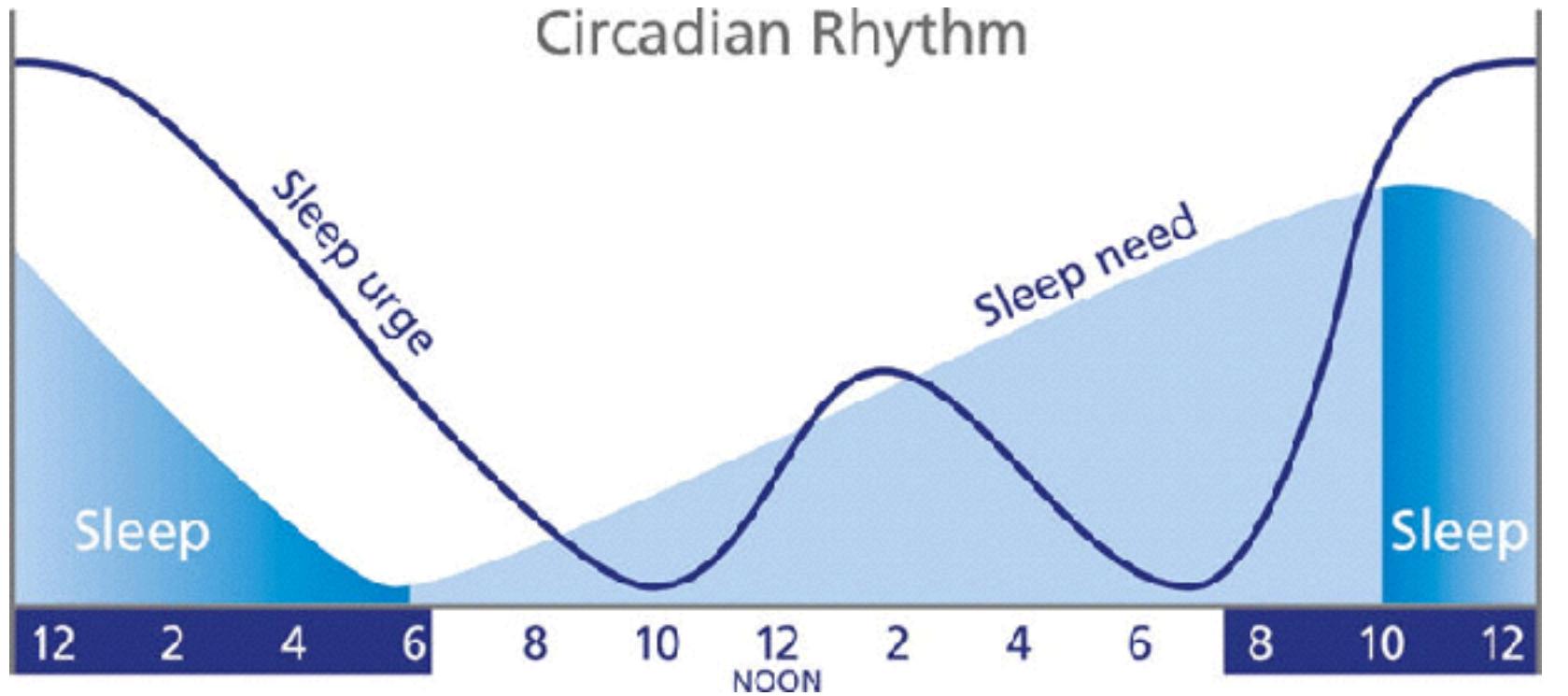
**J!NS MEME**

3-axis accelerometer  
3-axis gyroscope  
2-axis EOG

# Overview of J!NS MEME



## Circadian Rhythm



# Cognitive Fluctuation Studies

Cognitive load, Circadian Rhythm,  
Fatigue/Alertness

20 participants, 3 weeks

At least 10 hours a day: Electrooculography + Motion Sensors

“Groundtruth” every 2 hours:

Standard Cognitive Tests on the Smart Phone

Karolinska Sleepiness Scale

Psychomotor vigilance task (PVT)

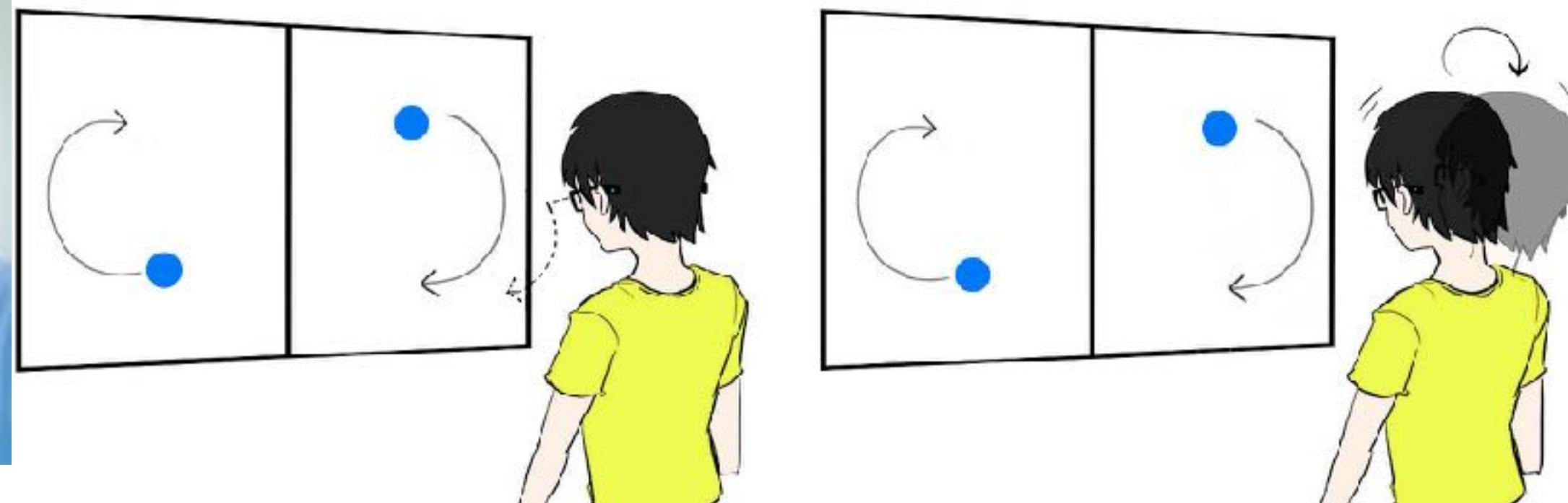
Stroop Test

Log Caffeine intake and Naps

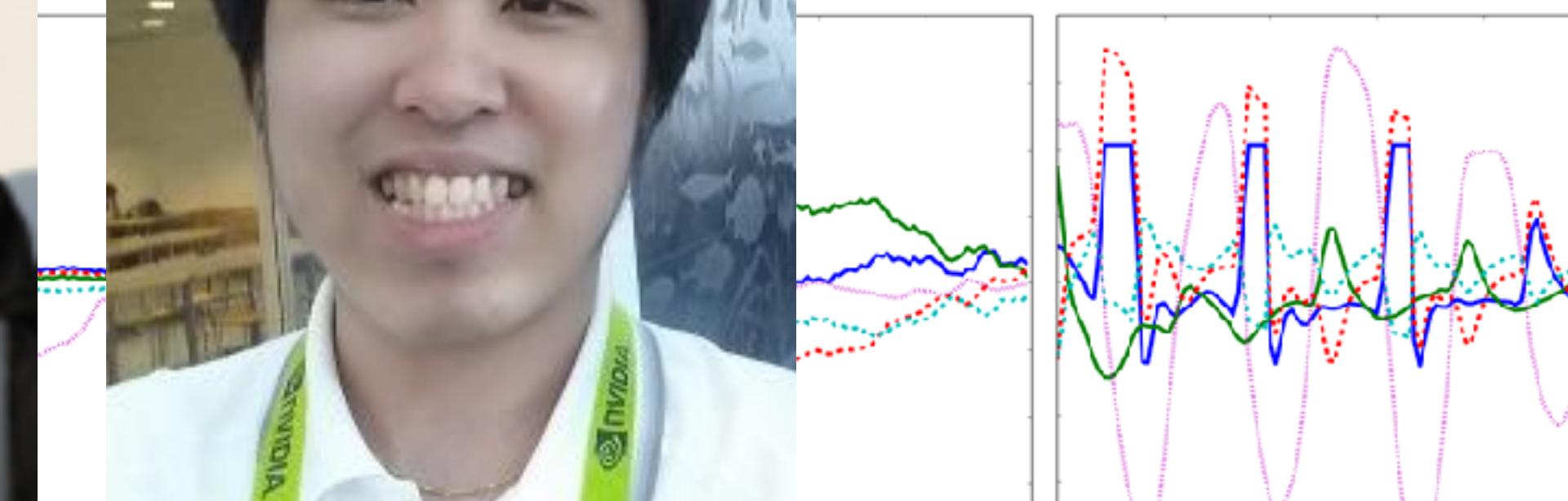
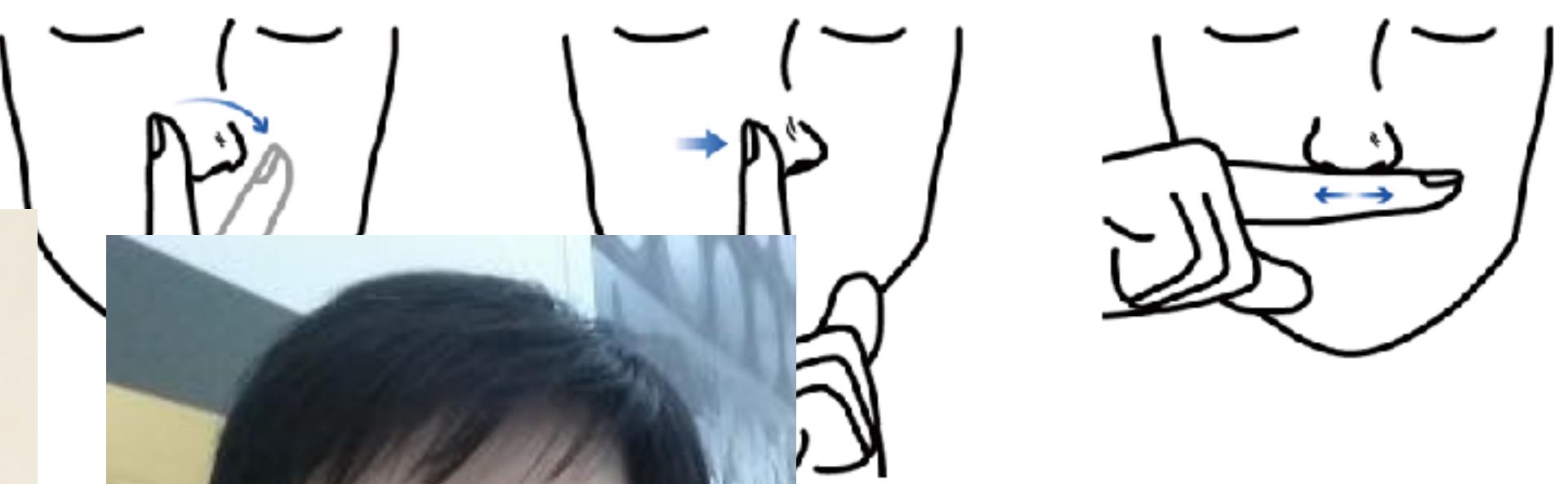
Sessions in the lab with fNIRS

Tag, Benjamin, et al. "Continuous Alertness Assessments: Using EOG Glasses to Unobtrusively Monitor Fatigue Levels In-The-Wild." *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems*. ACM, 2019.

# Subtle Interactions with Smart Eyewear



Collaboration with Woontack Woo, Thad Starner, Aaron Quigley



(a) Left Flick (Seated)

(b) Left Push (Seated)

(c) Rub (Seated)

# Project with J!NS for MEME 2.0

The longest, continuous, external  
research and development member of the team (over 5 years now)

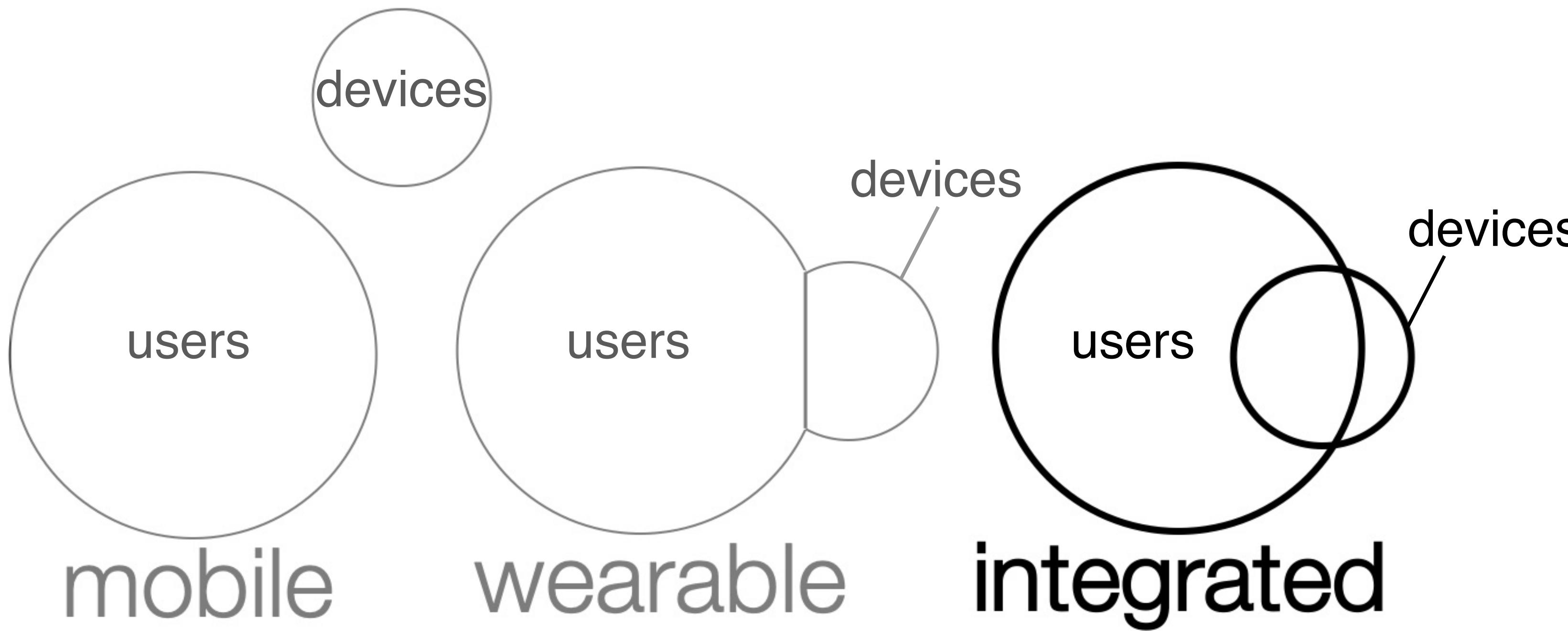
J!NS



# Augmenting

the individual

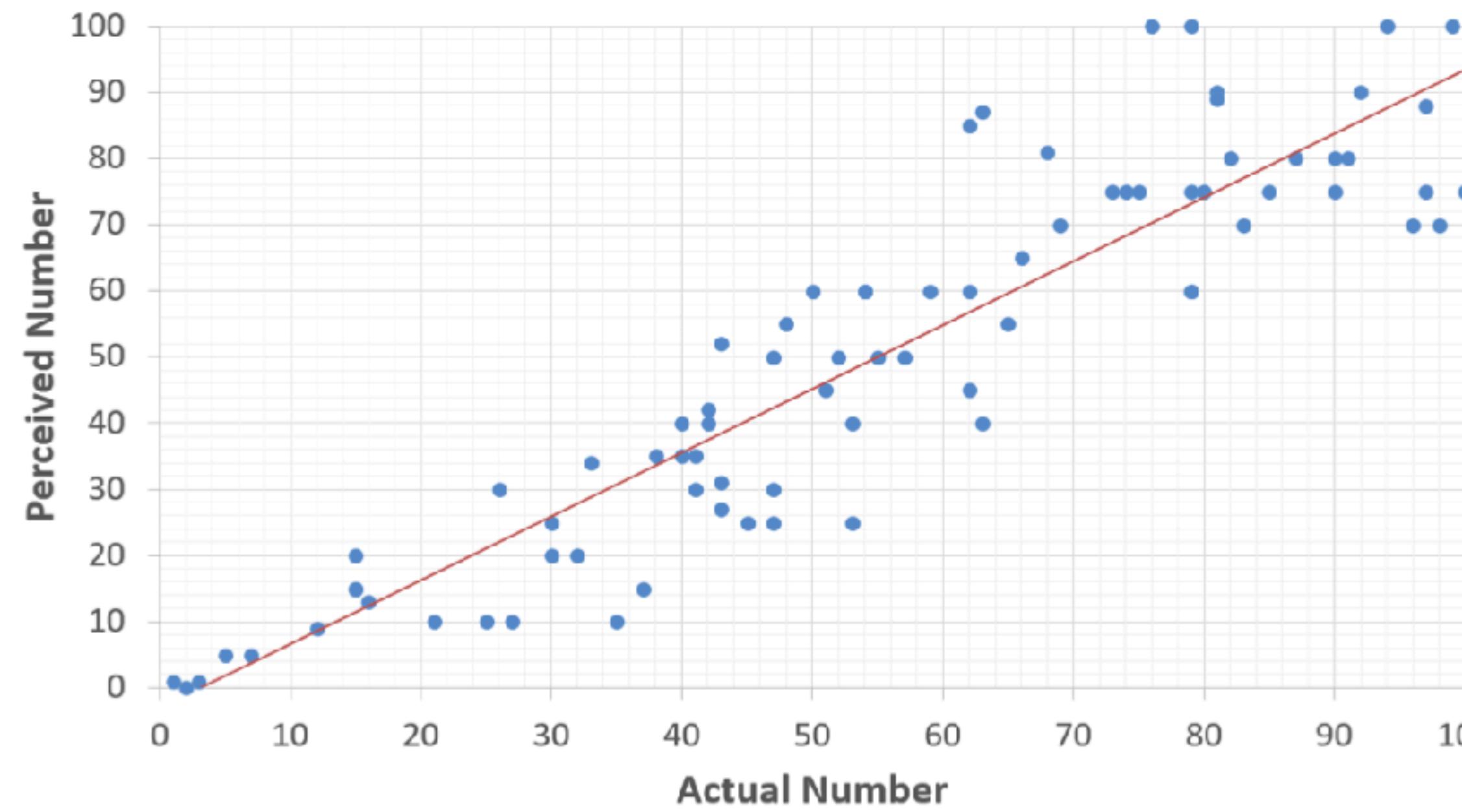
# “Next Steps in Human Computer Integration”



Novel paradigm moving away from Human Computer Interaction

Towards Human Computer Integration/Augmented Humans

# Feel a Progress Bar on Your Finger

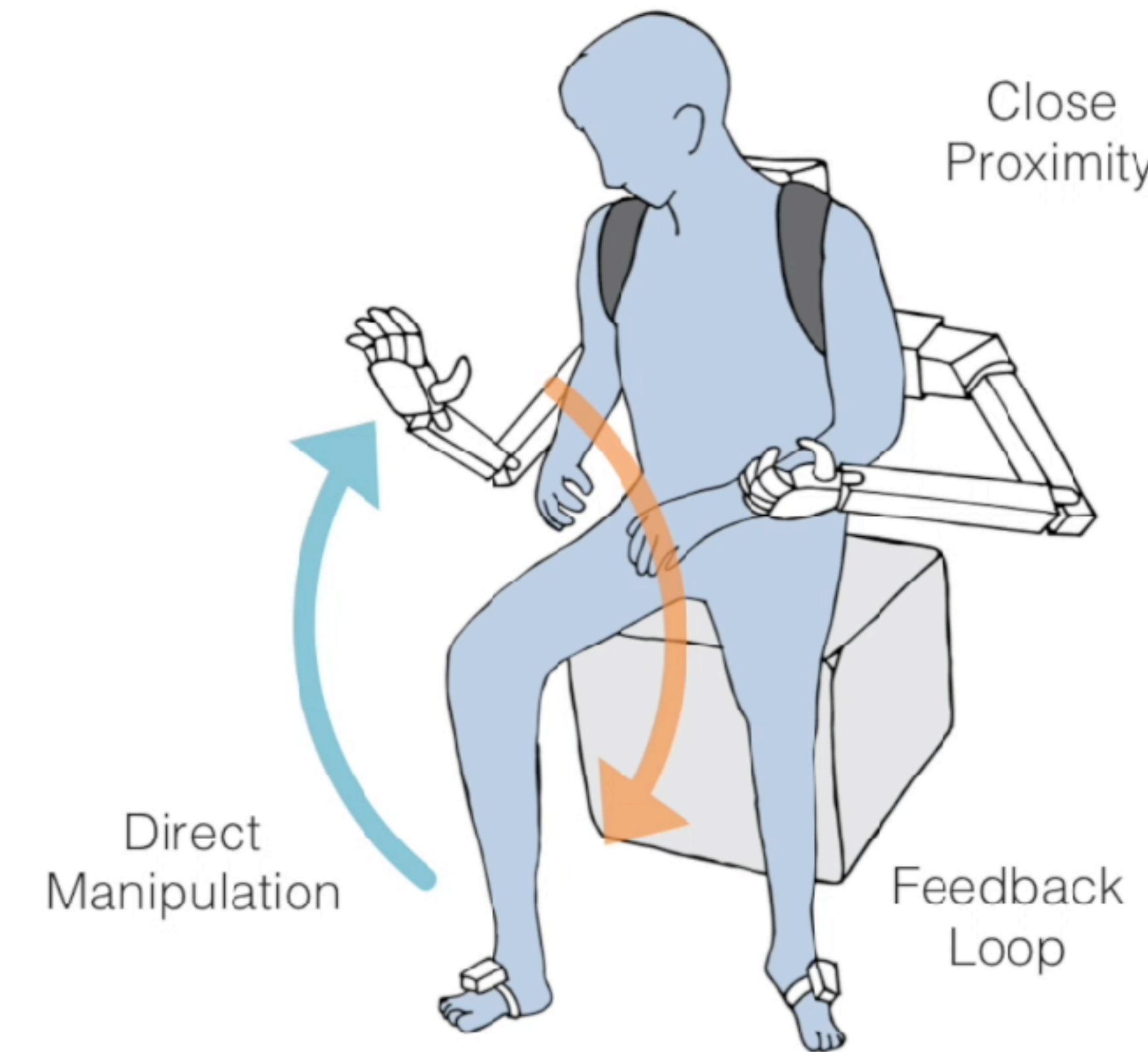


Chernyshov, George, et al. "Shape memory alloy wire actuators for soft, wearable haptic devices." *Proceedings of the 2018 ACM International Symposium on Wearable Computers*. ACM, 2018.

# Explore how can Tech overlap with our bodies

Collaboration with Inami Sensei, Minamizawa Sensei

Yamen Saraiji and Tomoya Sasaki

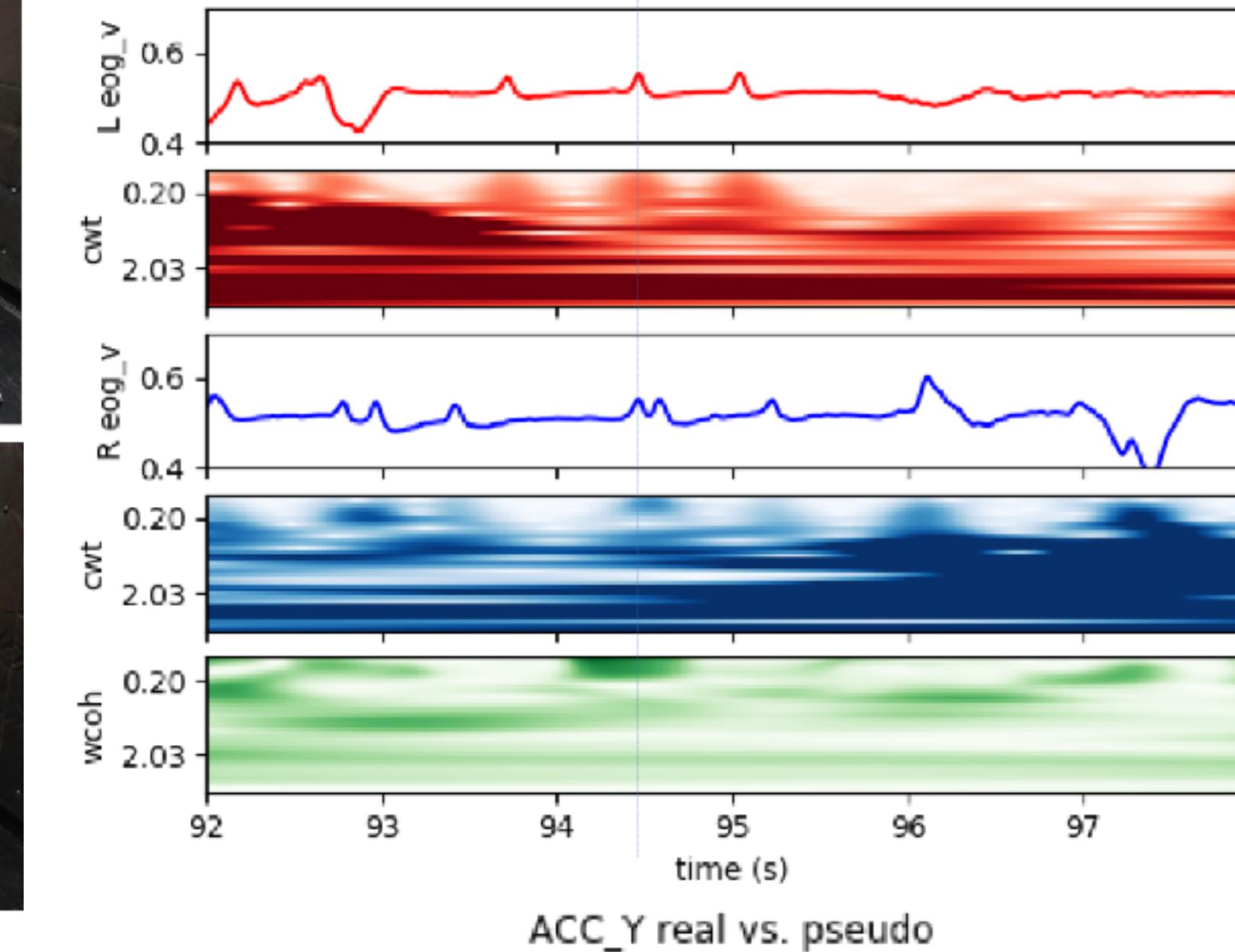
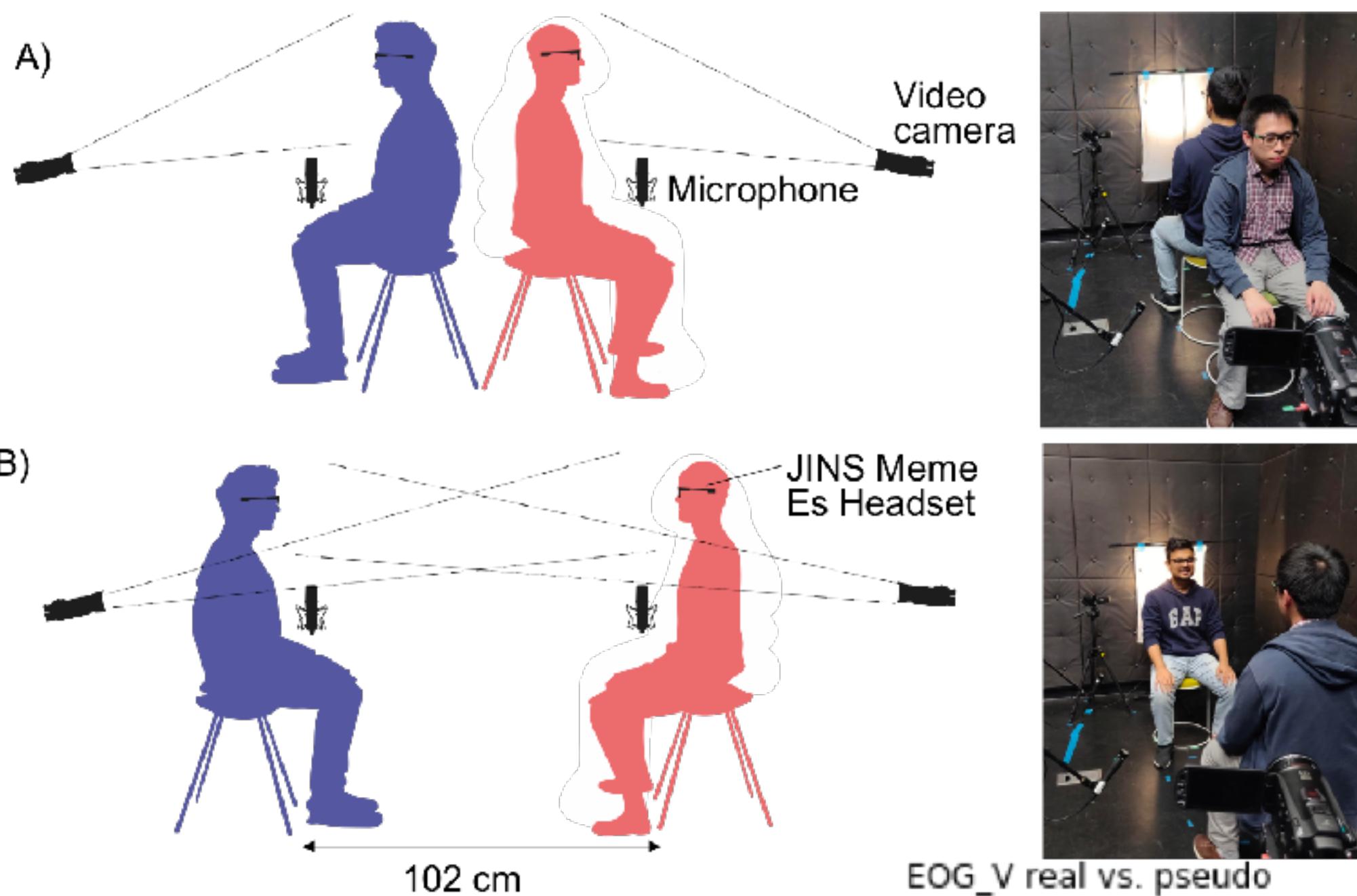


Saraiji, M. H. D., et al. "MetaArmS: Body remapping using feet-controlled artificial arms." *The 31st Annual ACM Symposium on User Interface Software and Technology*. ACM, 2018.

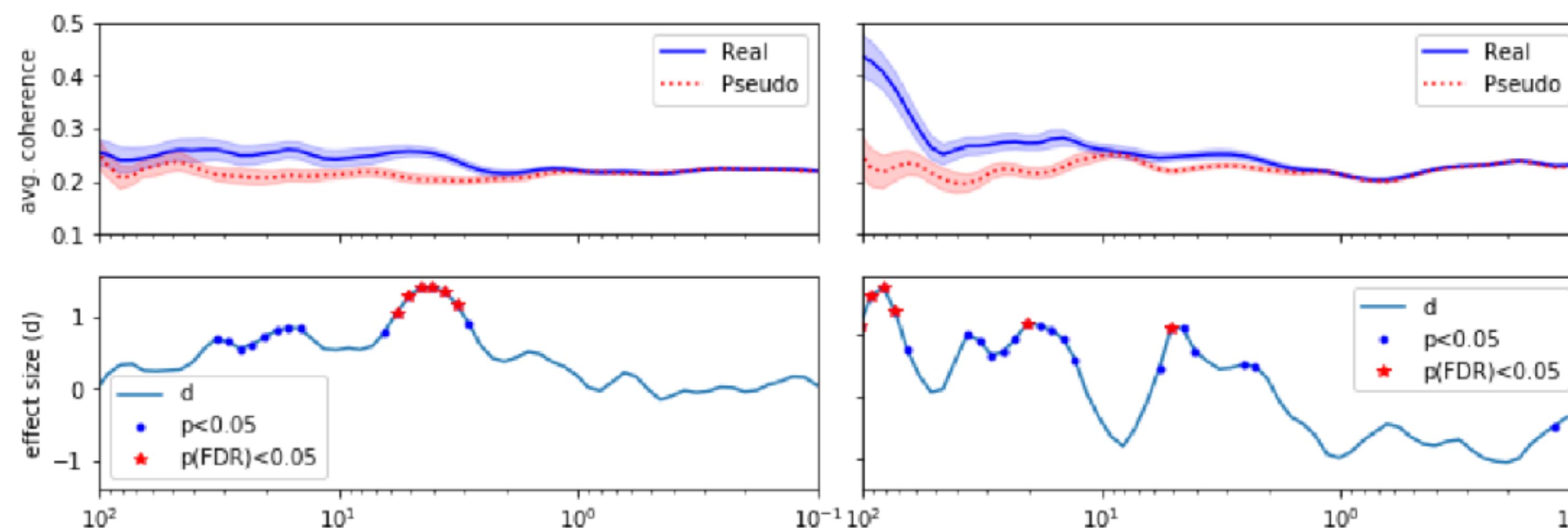
# Augmenting

the collective

# UbiComp/ISWC: Blink as You Sync: Uncovering Eye and Nod Synchrony in Conversation using Wearable Sensing



Gupta, Aman, et al. "Blink as you sync: uncovering eye and nod synchrony in conversation using wearable sensing." *Proceedings of the 23rd International Symposium on Wearable Computers*. ACM, 2019.



# Boiling Mind :: Augmenting the collective experience (collaboration with Mademoiselle Cinema and Kouta Minamizawa)



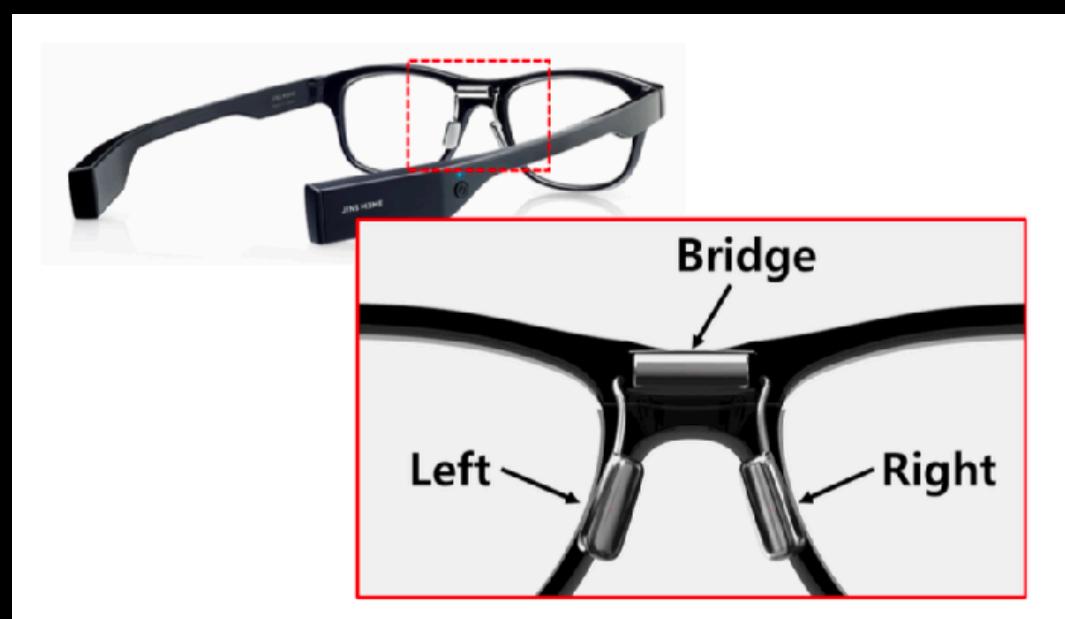
Mademoiselle  
**CINEMA**

EMBODIED MEDIA

GEIST  
Amplify the Sense of  
Wonder

# Initial Ideas

Combining Perception and Motion



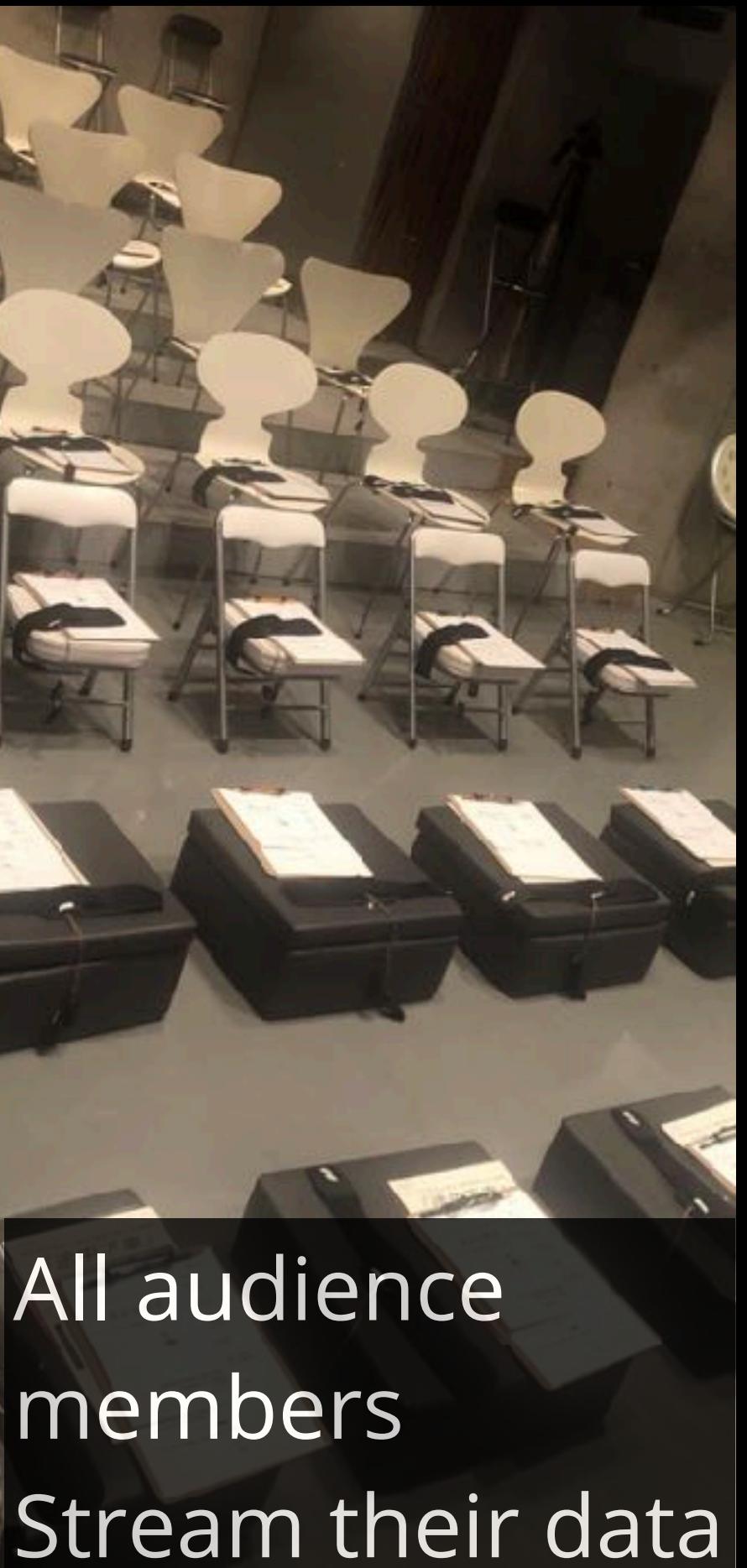
Pupil Labs Eyetracker  
EOG MEME Glasses

Zhuoqi Fu, et al. Boiling Mind - A Dataset of Physiological Signals during an Exploratory Dance Performance. Augmented Humans 2021.



# Boiling Mind :: Rationale

Why we chose the setup <http://boiling-mind.org/>



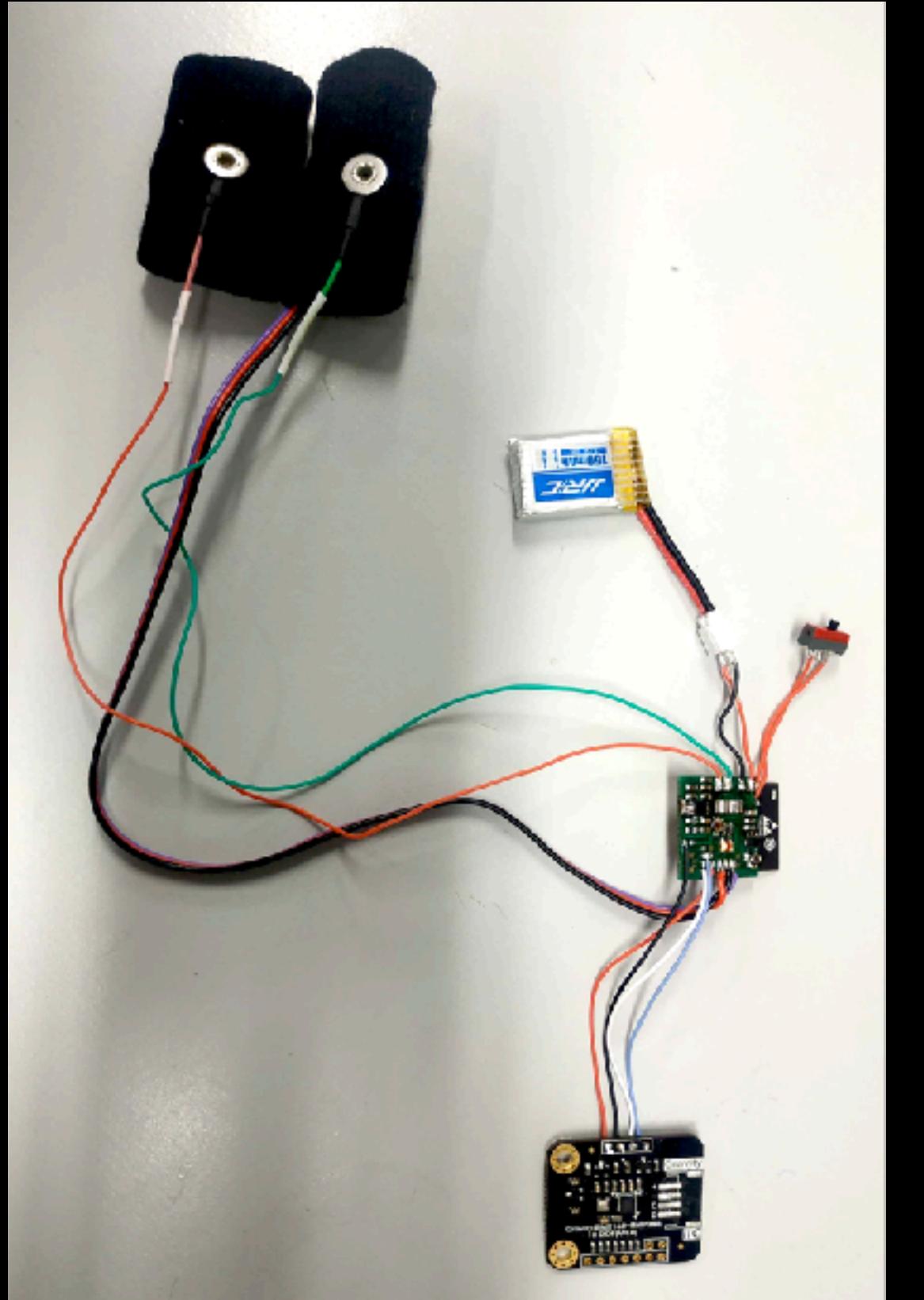


# Take Away

Soon public dataset (ping me:  
[kai@kmd.keio.ac.jp](mailto:kai@kmd.keio.ac.jp) )

3 performances around 40 -50 people in  
one performance

We have a couple of those sensors.



Moe Sugawa et al. 2021. Boiling Mind: Amplifying the Audience-Performer Connection through Sonification and Visualization of Heart and Electrodermal Activities . In Proceedings of the Fifteenth International Conference on Tangible, Embedded, and Embodied Interaction (**TEI '21**). Association for Computing Machinery New York, NY, USA, Article 34, 1–10. DOI:<https://doi.org/10.1145/3430524.3440653>

# Special Thanks to ...

to the people who actually did the work

Yun Suen Pai,

Jiawen Han,

Dinging Zheng,

George Chernyshov

Kirill Ragozin,

Junichi Shimizu,

Takuro Nakao,

Cedric Carême,

Benjamin Tag,

Shoya Ishimaru,

Taka Kazufumi.

Masai Katsutoshi,

Takashi Goto,

Kouta  
Minamizawa,

Masashi Nakatani



# Questions, Remarks, Violent Dissent?

Wearable Computing

<https://iswc.net/iswc21/> Deadline: 04 June.

Workshop at CHI 2021 Immersive Inclusivity at CHI: Design and Creation of Inclusive User Interactions

<https://sites.google.com/view/acm-chi-iicw21/home>

<http://augmented-humans.org/>



Making Waves, Combining Strengths

<http://kaikunze.de/>

@\_kai\_ku

[kai@kmd.keio.ac.jp](mailto:kai@kmd.keio.ac.jp)

[kai.kunze@gmail.com](mailto:kai.kunze@gmail.com)