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Conference 2021



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July 6-9, 2021

Affective Haptics for Enhanced XR 12 July 2021 Worldhaptics 2021

Haptics to Support the Mind

Hiroyuki Shinoda
The University of Tokyo



NTT West, September 2020

<https://xtech.nikkei.com/atcl/nxt/column/18/00138/050900792/>

Category 1: Evoking life

The life (of human or animal) exists behind the AR object.
Haptic stimulation triggers the feeling of living things.

Category 2: Direct stimulation to core affect

Haptic physical stimulation to the core affect*.

Category 3: (Almost) unconscious effect

Haptic stimulation is almost unconscious but supports the mind.

*Russell, J. A. , “Core affect and the psychological construction of emotion,” Psychological Review, 110, 1, 145-172, 2003.



inTouch
Hiroshi Ishii et al. (1998)

Haptics is an additional channel to confirm the existence



Robot phone
Tachi lab., Univ. of Tokyo, 2000

Hug Transmission

Hug over a Distance

Mueller, Florian; F. Vetere; M.R. Gibbs; J. Kjeldskov; S. Pedell; S. Howard.

Proc. of the ACM Conf. on Human Factors in Computing Systems (CHI 05), Portland, USA, ACM Press. pp. 1673–1676.

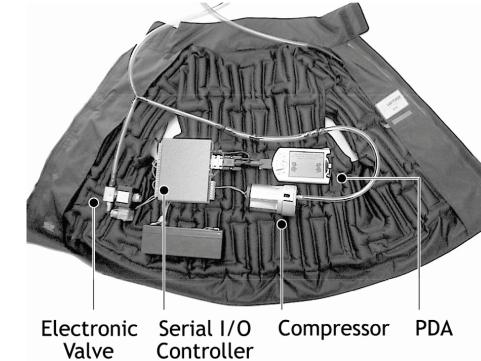


Figure 1. Rubbing the koala sends a wireless Hug over a Distance executed through the vest.

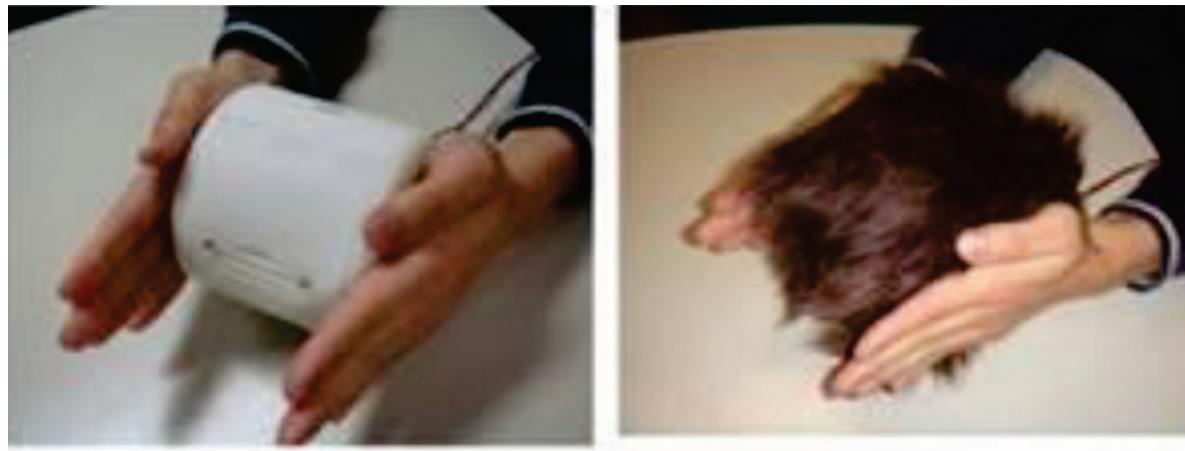
Affective haptics in emotional communication
D. Tsetserukou, A. Neviarouskaya, H. Prendinger, N. Kawakami, and S. Tachi,
Proc. 3rd Int. Conf. Affective Comput. Intell. Interact. Workshops, Sep. 2009, pp. 1-6.

iFeel_IM!

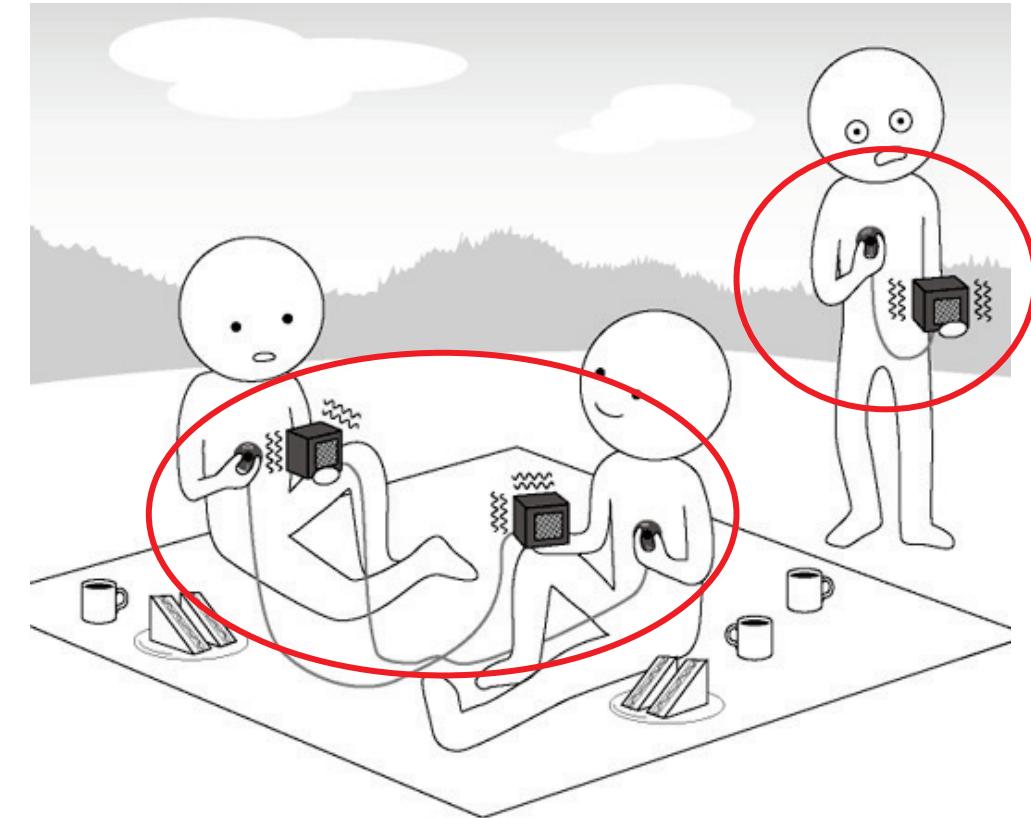


Softness, Warmth, and Responsiveness Improve Robot Hugs
Alexis Block, Katherine J. Kuchenbecker
Int. Journal of Social Robotics 11(6), 2019

Only 1D motion can transmitting
the feel of life

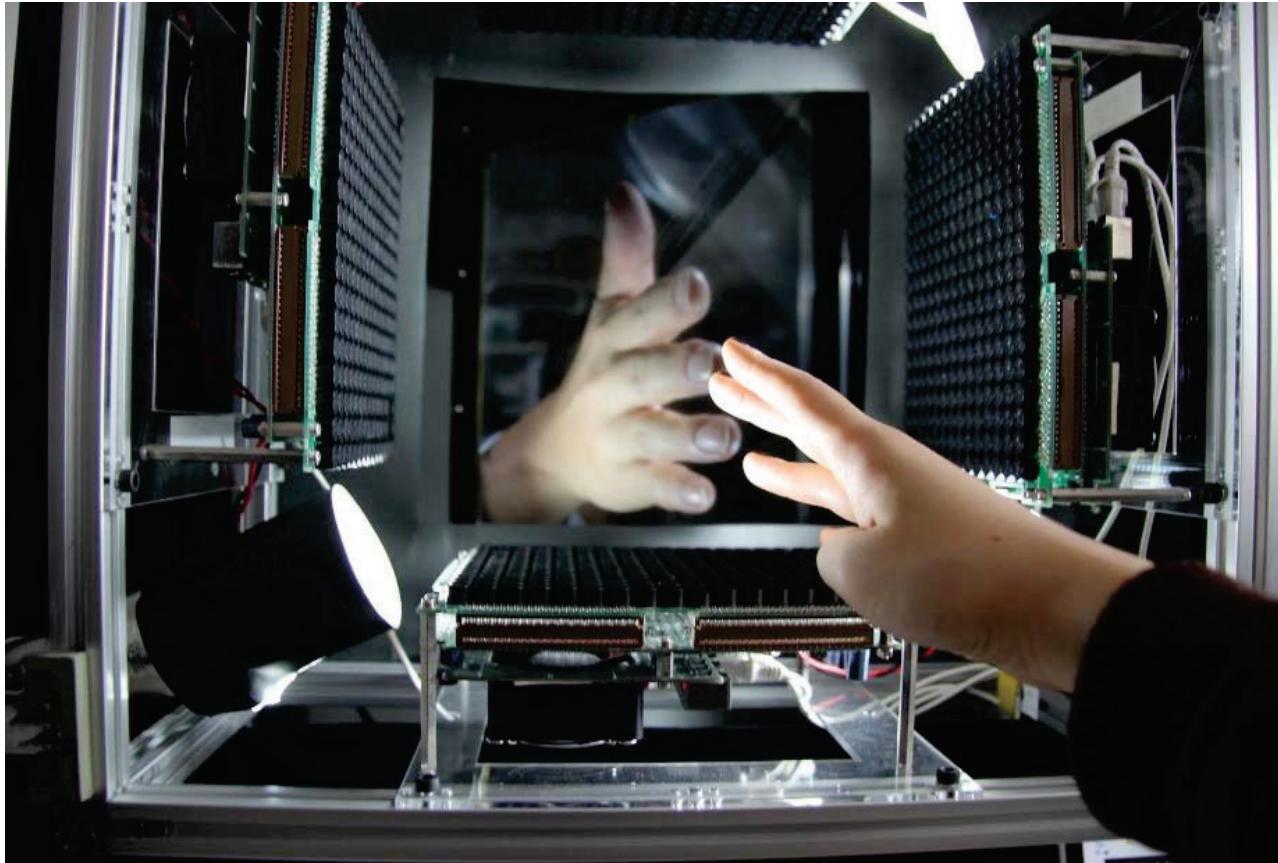


Emotional Touch
Yuki Hashimoto, Hiroyuki Kajimoto,
SIGGRAPH2008 New Tech Demos

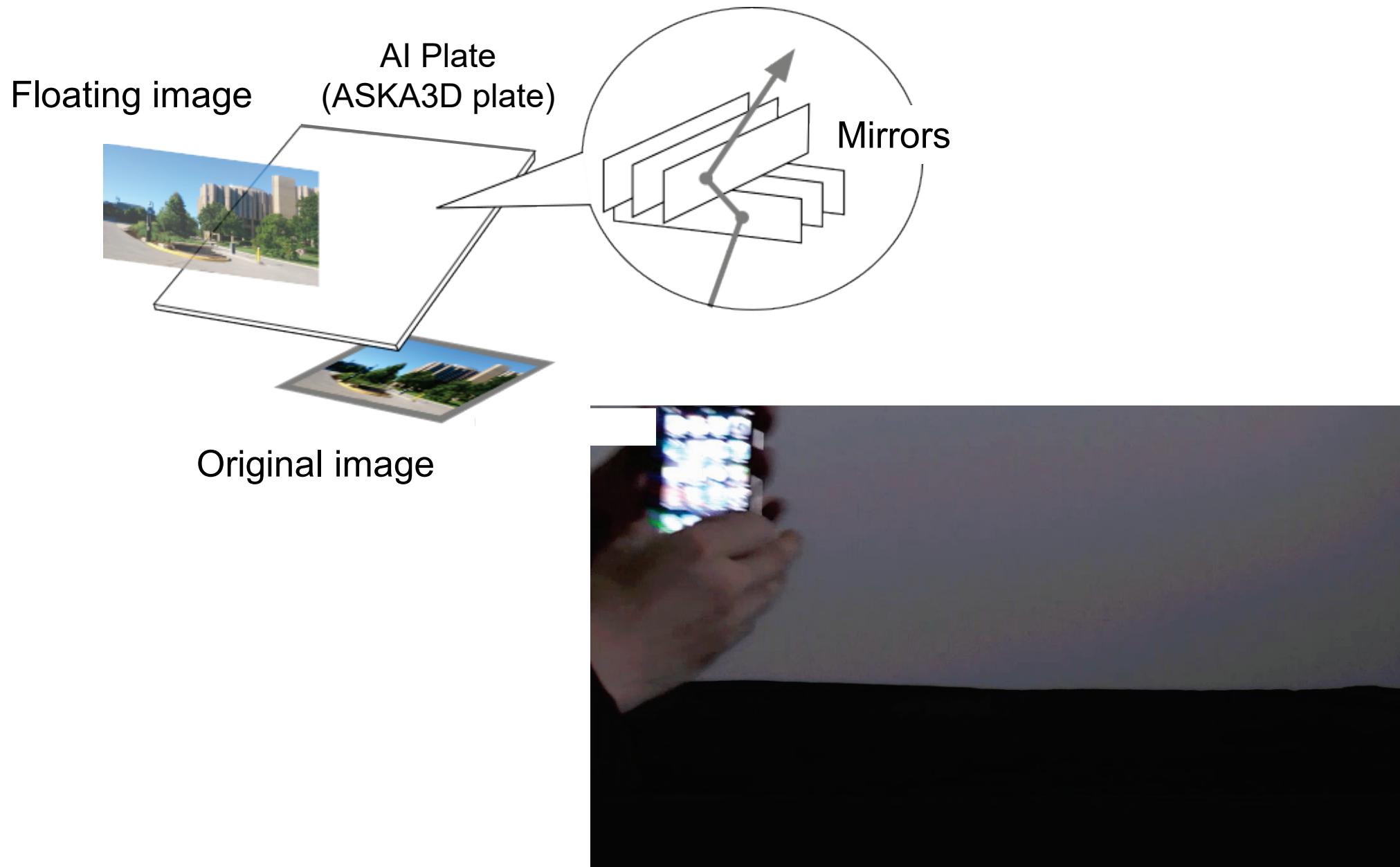


Heartbeat picnic,
Junji Watanabe (NTT) et al.
TVRSJ Vol. 16 No. 3 pp. 303-306, 2011
https://doi.org/10.18974/tvrsj.16.3_303

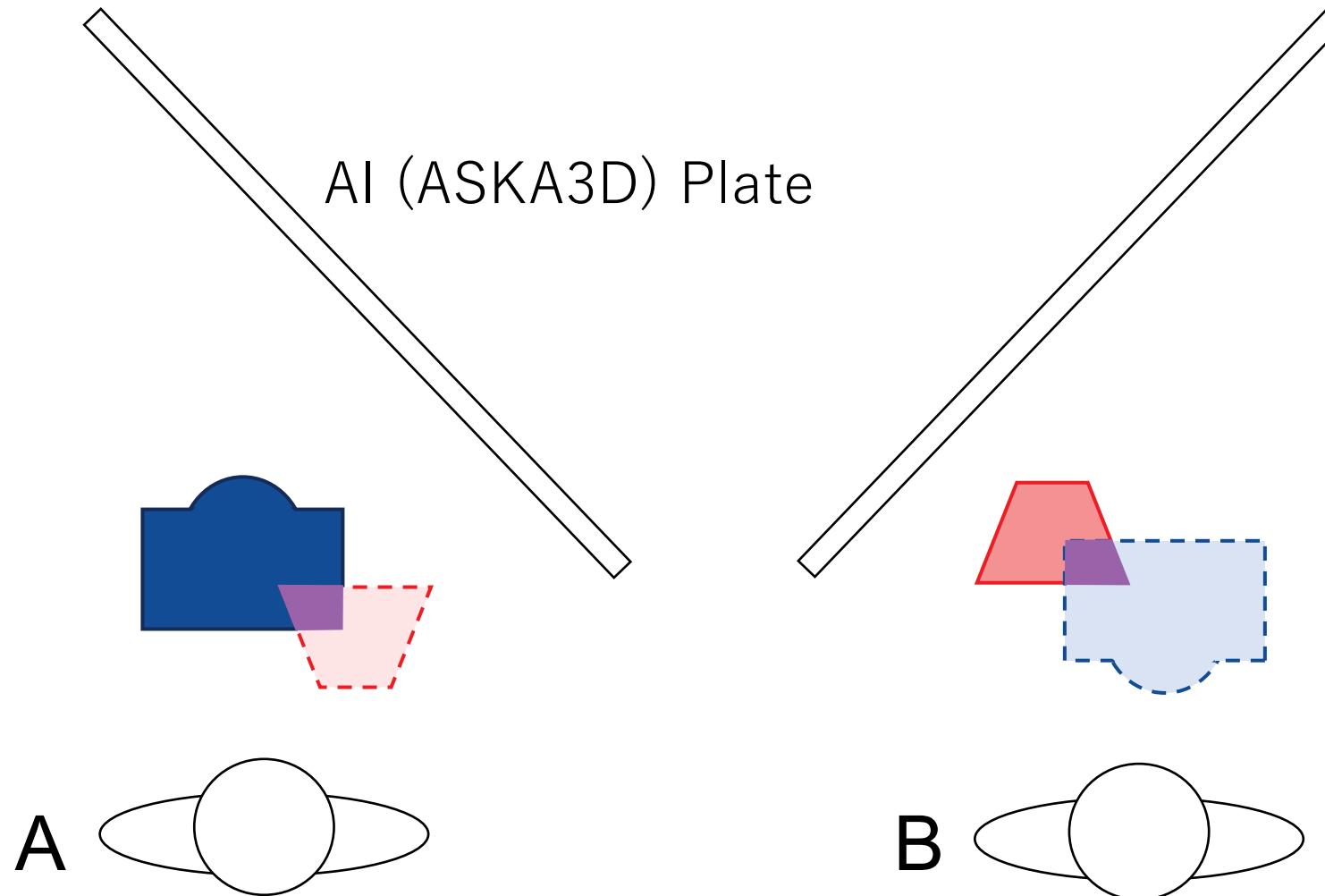
An example of haptics-in-MR (2015)

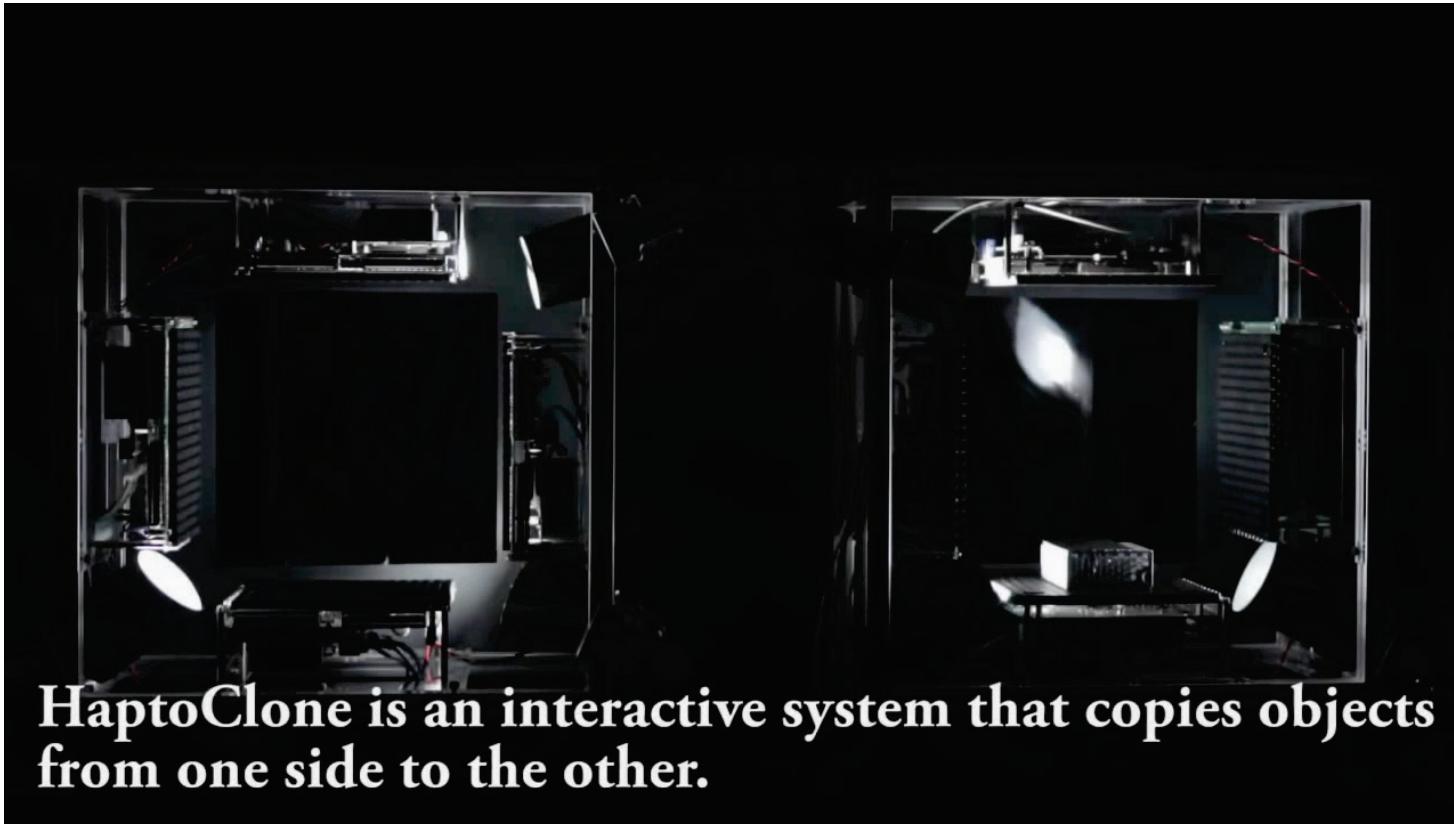


Producing realistic 3D image (2015)



Superimposing haptic stimulation on realistic 3D image





Haptocloud

Y. Makino, Y. Furuyama,
S. Inoue, H. Shinoda
2015



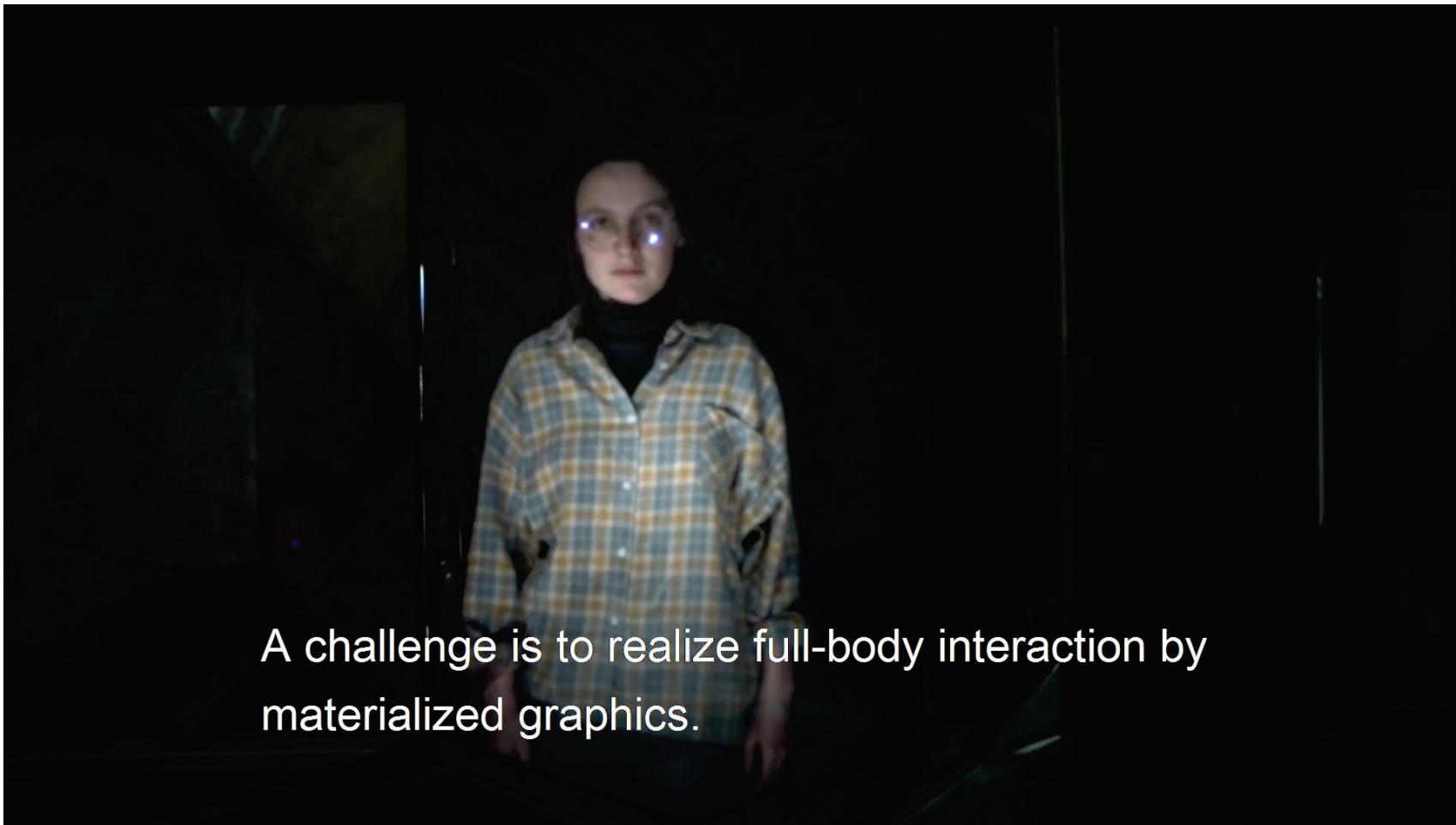
Y. Makino



Y. Furuyama



Seki Inoue



A challenge is to realize full-body interaction by materialized graphics.

K. Serizawa, T. Morisaki, C. Delfosse, M. Fujiwara,
Y. Makino, H. Shinoda,
Super Haptoclone: Upper-Body Mutual
Telexistence System with Haptic Feedback,
ACM SIGGRAPH 2020 Emerging Technologies.



K. Serizawa



T. Morisaki



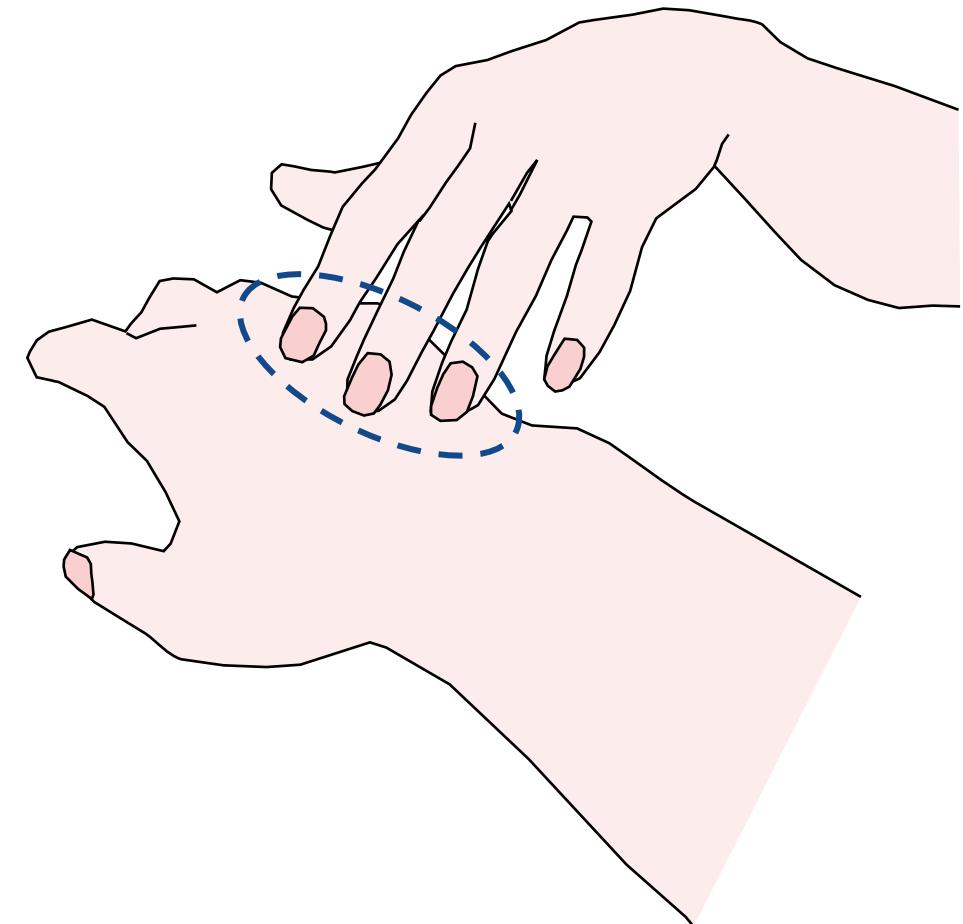
M. Fujiwara

What is the difference from the real touch?

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- Super realistic 3D image
- The partner is there
- Reality of midair tactile display has been much improved
 - Non-vibratory pressure is reproduced.
T. Morisaki et al., VRSJ 2020
 - Temperature change can be displayed.
M. Nakajima et al. ToH Early Access



“Image only” is already affective.

Haptics becomes effective when you notice
the partner feels the same.

I feel hesitation when I touch people through this system.

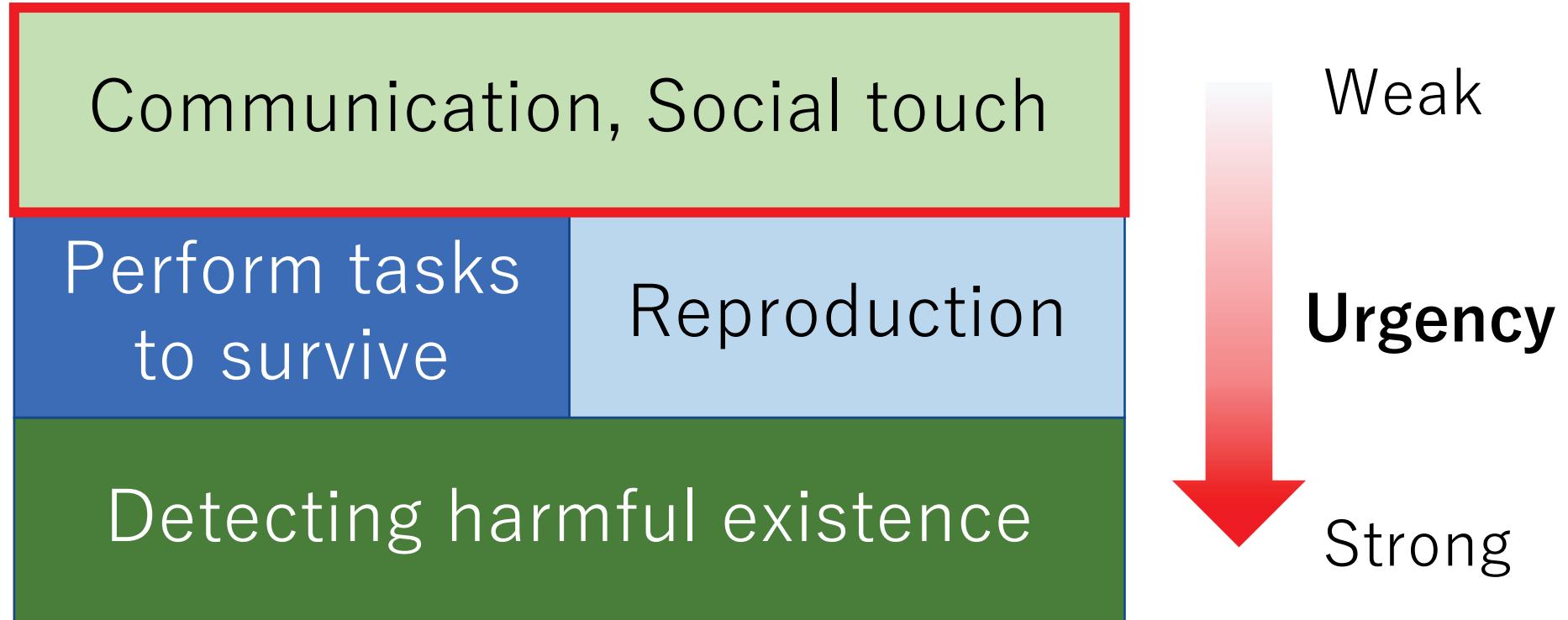
Digital touch is beneficial when you want to control (reduce) the haptic effect.

Do you want to touch?

15



If the haptic stimulation is once linked to a harmful existence, the positive effect of the haptic stimulation disappears.



If haptic sensation detects a harmful existence, the emotion is occupied to make a decision away from danger.

To enjoy communication and social touch, the haptic stimulation must be unlinked to harmful existence.

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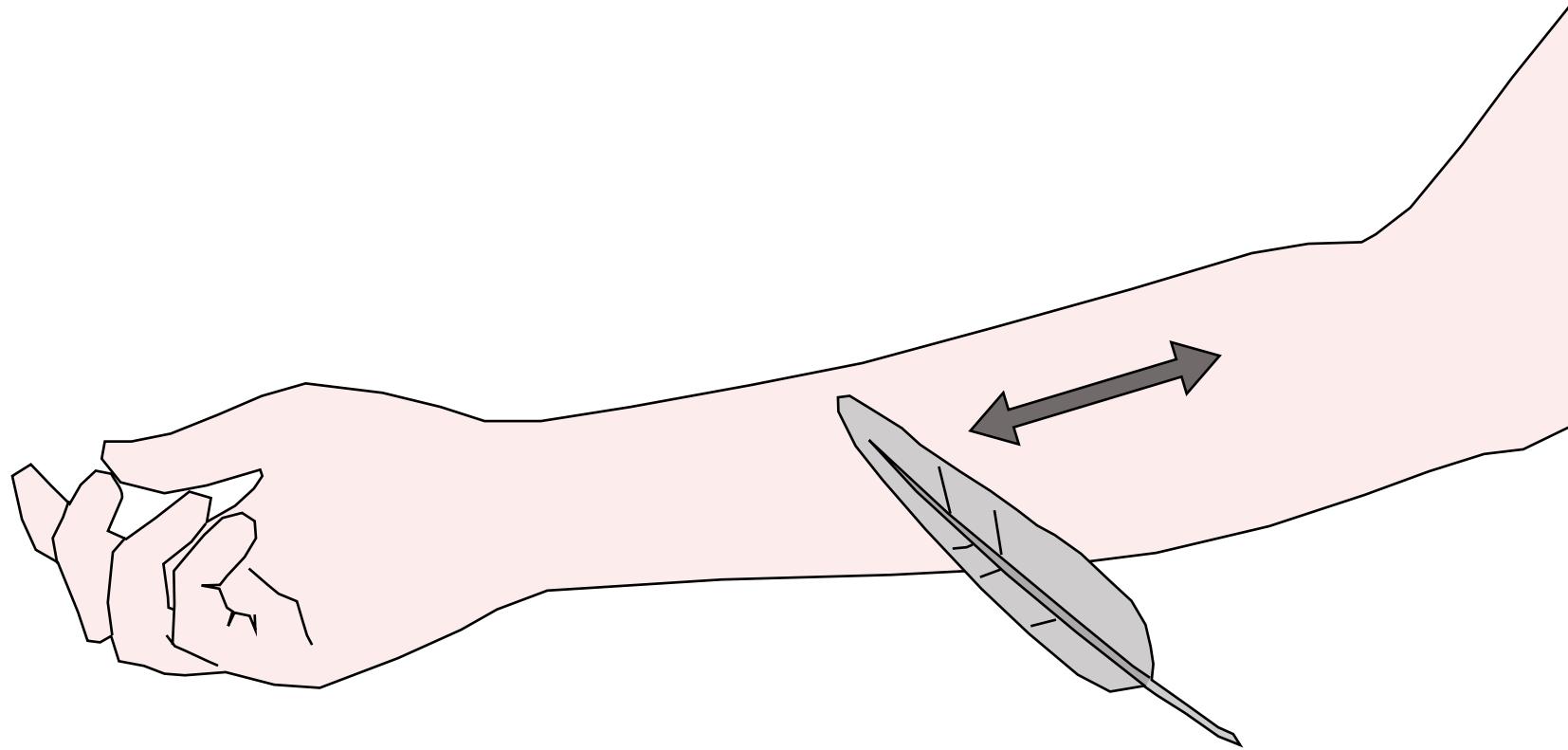
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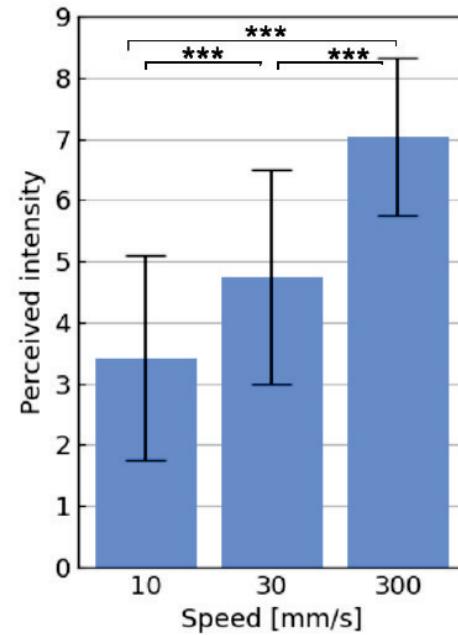
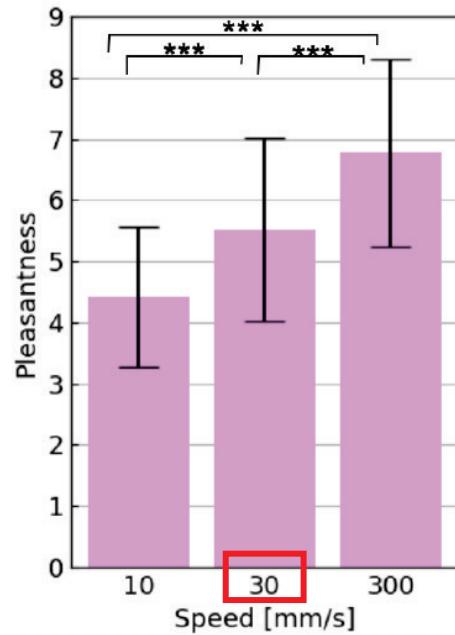
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Haptic stimulation is almost unconscious but supports the mind.

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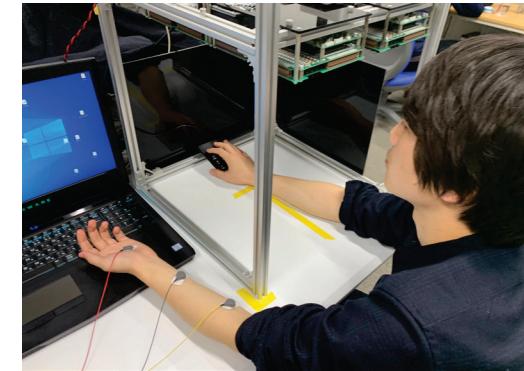


Creation of pleasant tactile stimulus

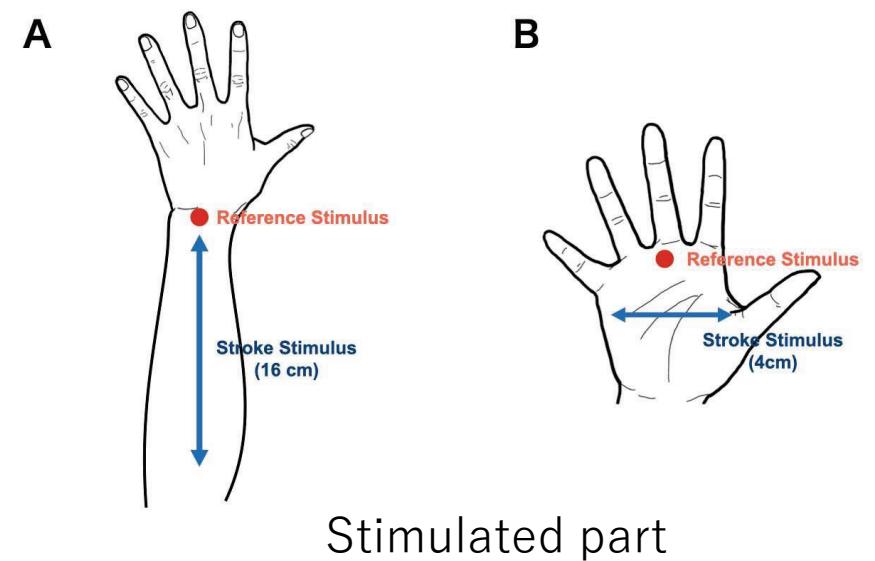


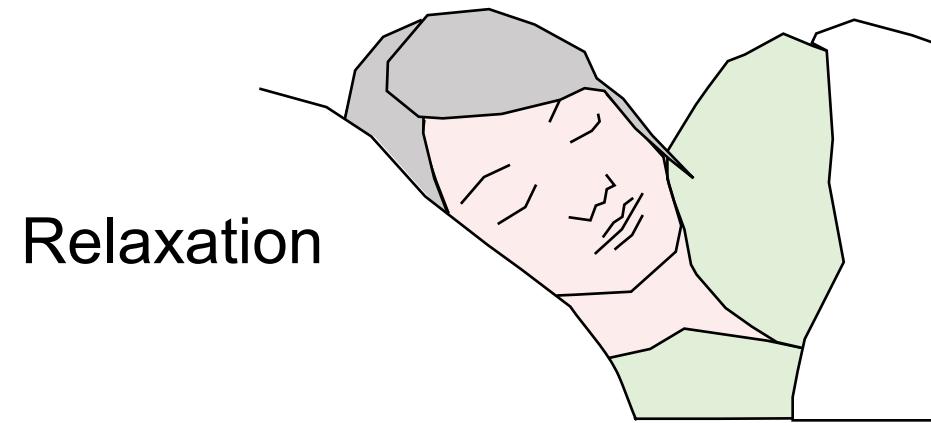
Pleasantness increased for faster motion.

Kai Tsumoto et al., "Presentation of Tactile Pleasantness Using Airborne Ultrasound," IEEE World Haptics Conference 2021.



Ultrasound focus ($\phi 8.5$ mm) moves on the right.

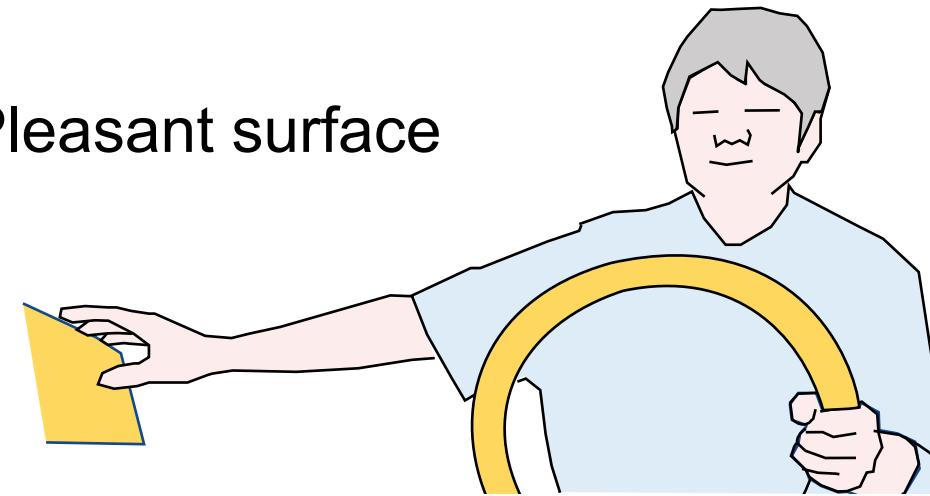




Comfortable click

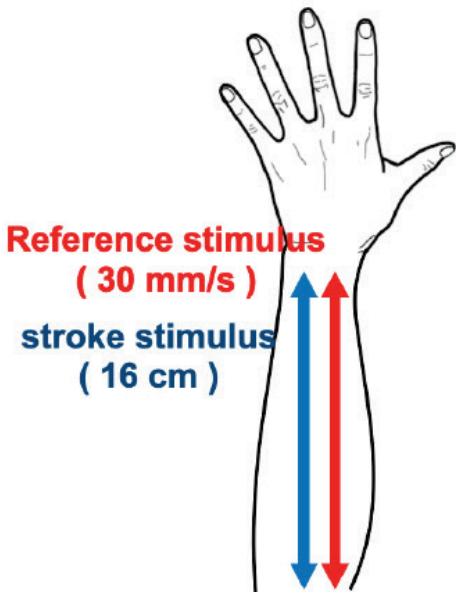


Pleasant surface



What if a visual image is displayed?

Visual stimulus	Picture1, Picture2, Picture3, Picture4
Speed	10, 30, 100, 300 [mm/s]



Pleasant picture group

Picture 1



Picture 3



Unpleasant picture group

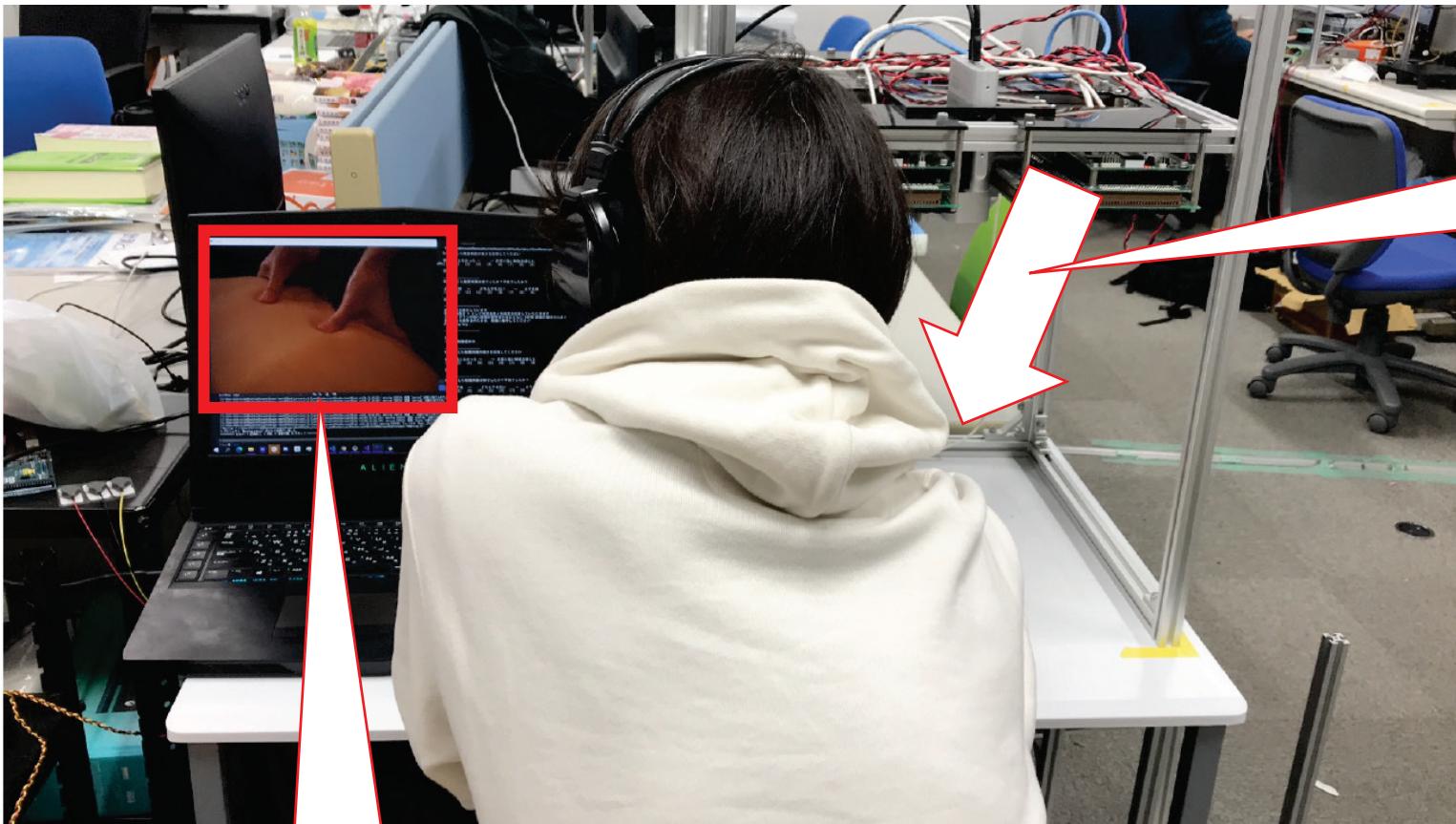
Picture 2



Picture 4



Kai Tsumoto (Shinoda & Makino lab),
Displaying pleasant sensation using airborne ultrasound
Master thesis, the Univ. of Tokyo, 2020



Image

Haptic
stimulation

Pleasant picture group

Picture 1



Picture 3



Unpleasant picture group

Picture 2



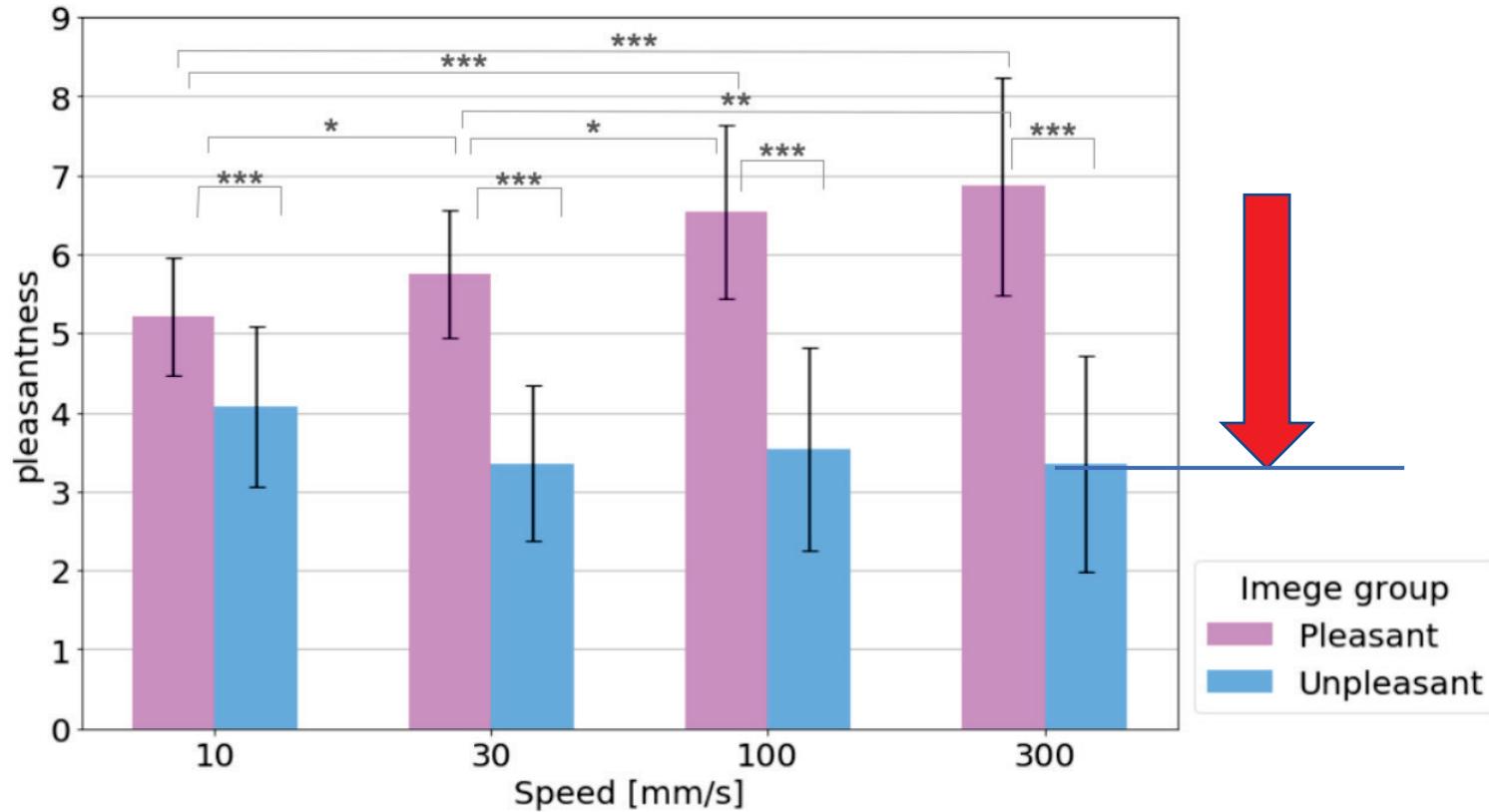
Picture 4

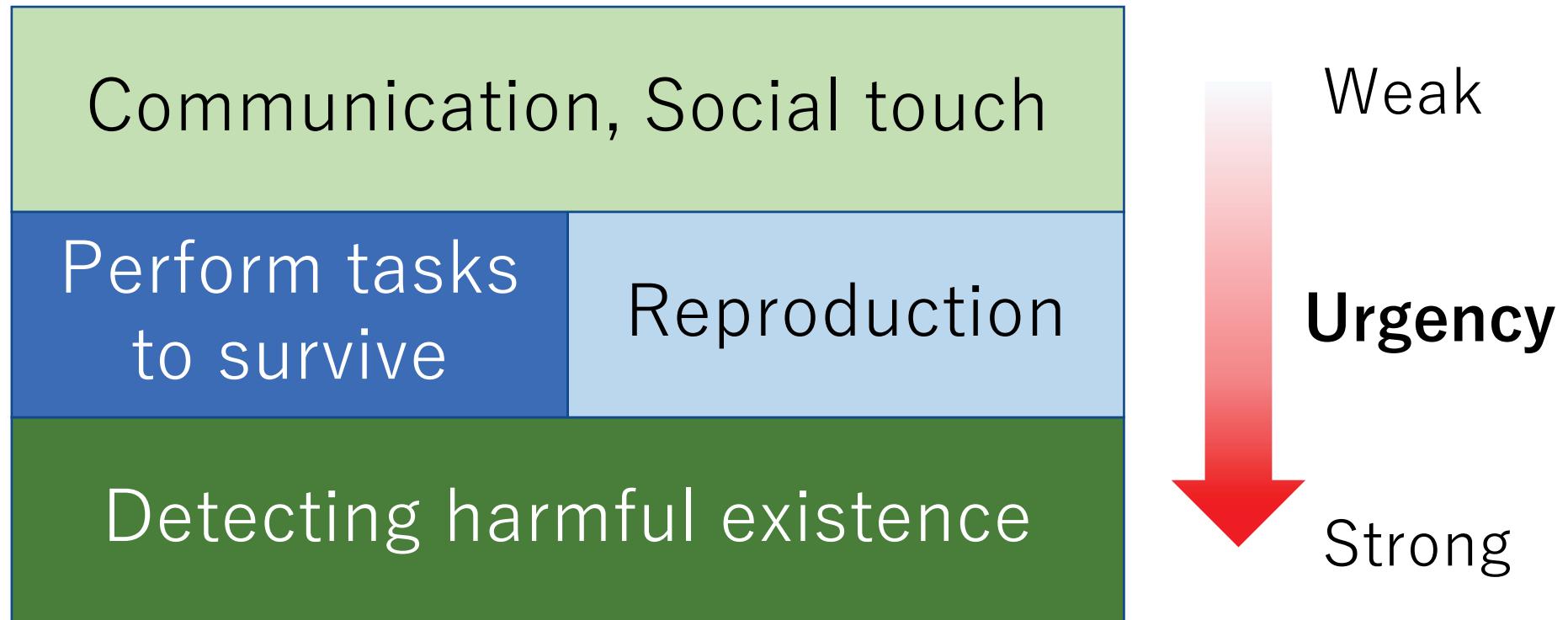


They had no choice but to say unpleasant!



Kai Tsumoto





If haptic sensation detects a harmful existence, the emotion is occupied to make a decision away from danger.

To enjoy communication and social touch, the haptic stimulation must be unlinked to harmful existence.

Moving music

- Recalling past experiences
 - The beauty of the melody
- Feeling changes by learning
- Classic music was created only about 500 years ago.



- Pleasant sounds (waterside sounds, ASMR, etc.)
Primitive feeling of sound
It also links to visual images and experiences.
- Common to ancient people and (probably) other animals
- Small changes due to learning



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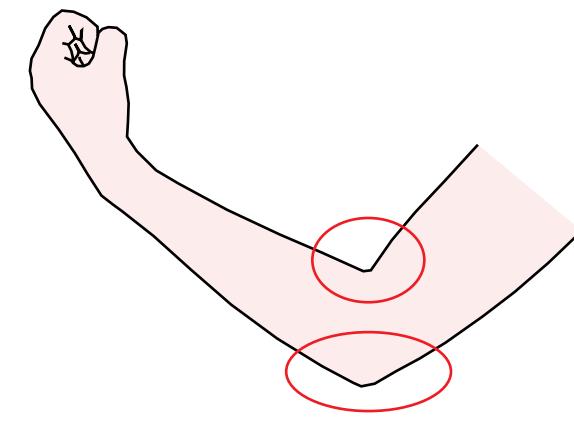
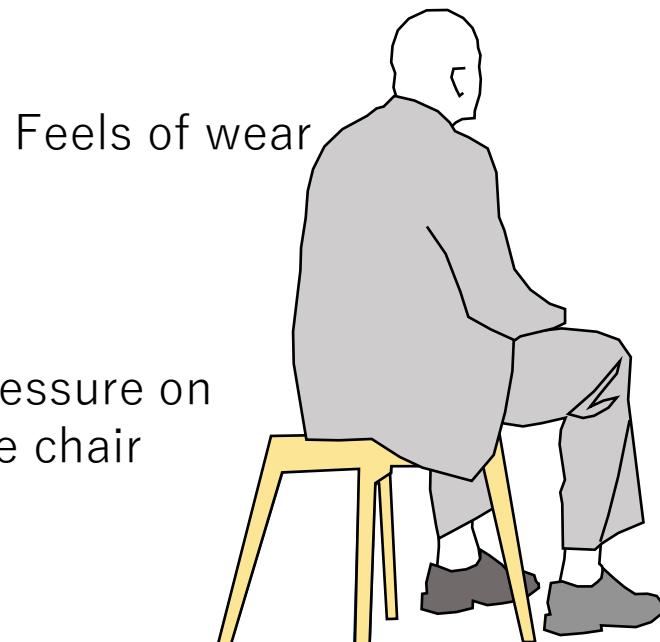
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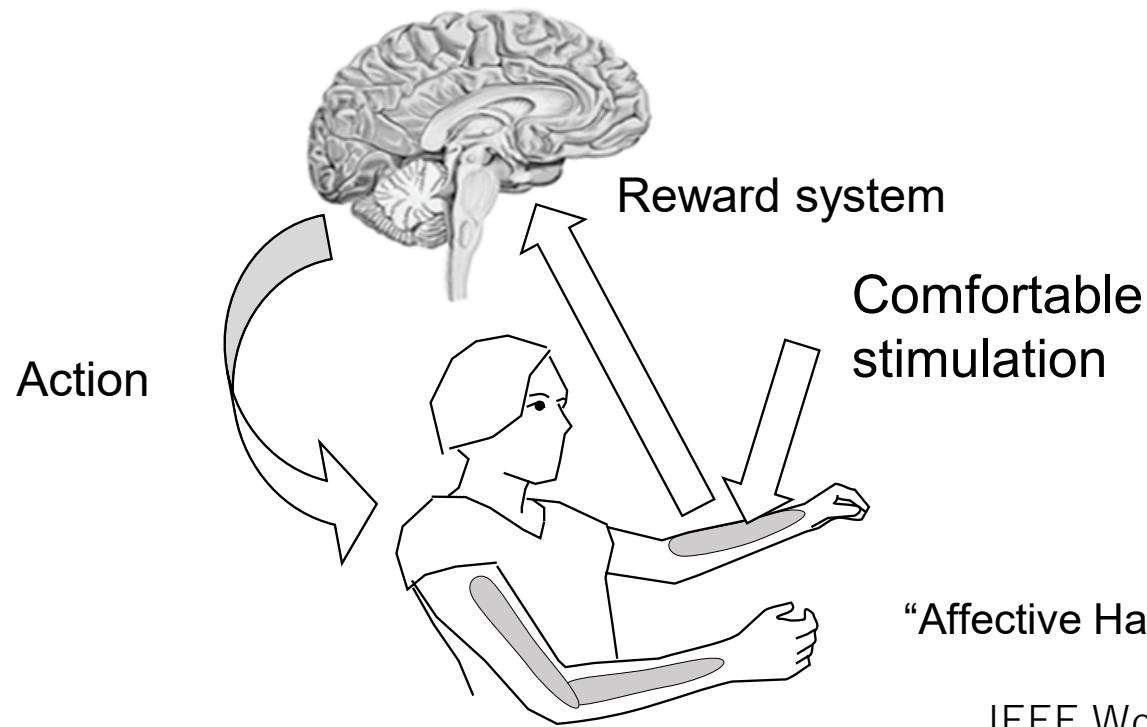
Unconsciousness of haptics

Many haptic stimulations
are unconscious / almost unconscious



Joint flexion

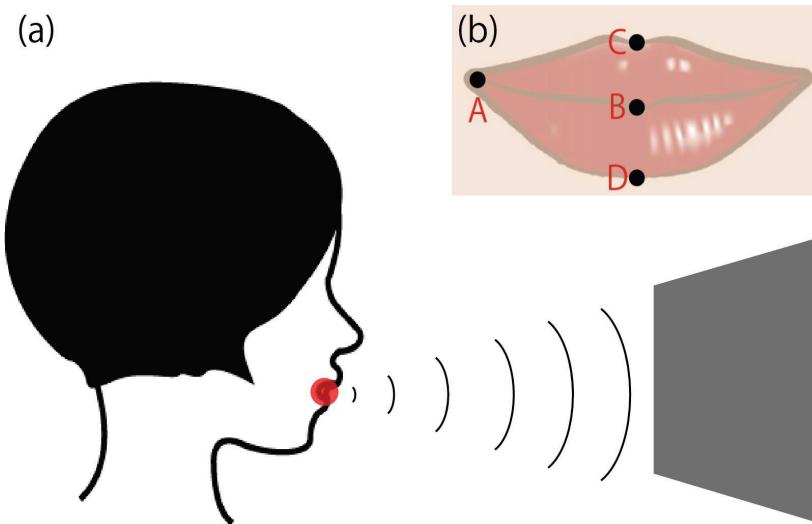
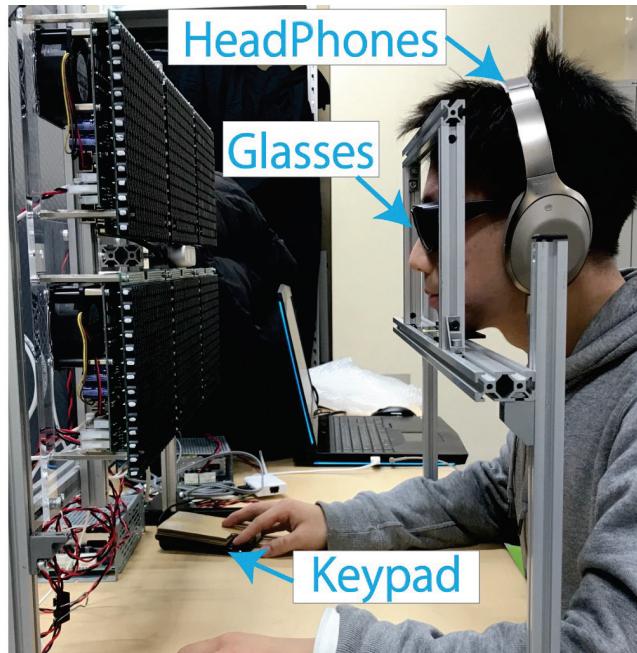
- Not disturb work
- Continuous pleasantness
- Synchronized with the mental/physical condition



Hiroyuki Shinoda
“Affective Haptics as a Direct Link to Emotion”
Workshop W5
IEEE World Haptics Conference 2019

Lip is an interesting part

Stimulation to lip



Sensory homunculus



Arata Jingu et al.,
“Tactile Perception Characteristics
of Lips Stimulated by Airborne
Ultrasound,” IEEE WHC 2021

Penfield et al., 1950

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