



TOHOKU  
UNIVERSITY



# Functional brain imaging techniques for Innovations in Next-generation Automobiles

*Kawashima Laboratory*

Takayuki Nozawa, Ryuta Kawashima  
Institute of Development, Aging and Cancer,  
Tohoku University

ICFD2013, November 26th, 2013



TOHOKU  
UNIVERSITY

# Neuroimaging techniques in our laboratory



*Basic, in laboratory*



3T-MRI for research



7T-MRI for animals



EEG for rats



200-ch MEG



192-ch EEG



Multi-channel fNIRS



Portable EEG



Portable/Compact fNIRS



*Daily, real-world*

Using almost all types of neuroimaging methods.

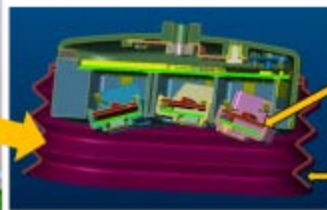
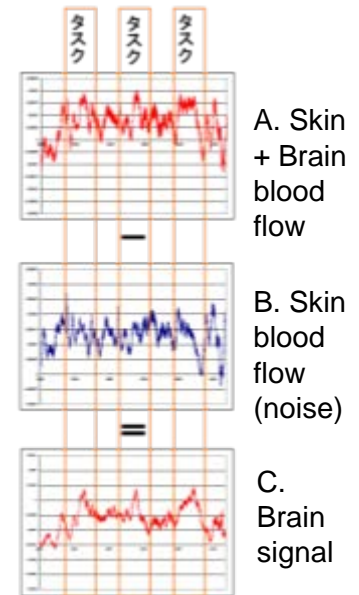
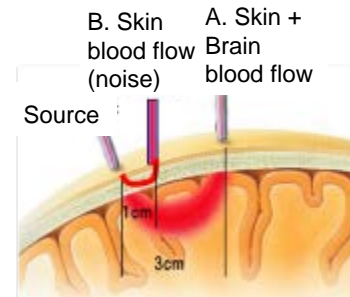


TOHOKU  
UNIVERSITY



# Ultra-compact fNIRS

- Collaborative development with Hitachi, Ltd., under the *System Development Program for Advanced Measurement and Analysis* by JST
- **Very low constraint, light weight (~100 g), wireless**
- **Simultaneous measurement of up to 20 people**
- **On-line removal of noises using skin blood flow signal**



Auto-fit by spring joint

Shield against light



TOHOKU UNIVERSITY

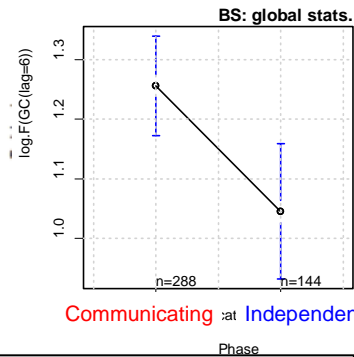
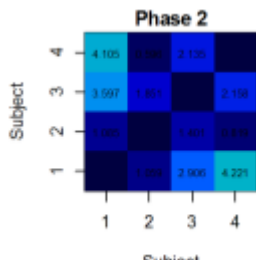
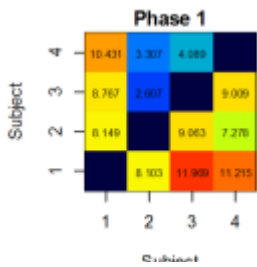
# Collective brain synchrony in social interaction



## Brain storming (verbal)



Communicating vs. Independent idea generation



Communicating

Independent

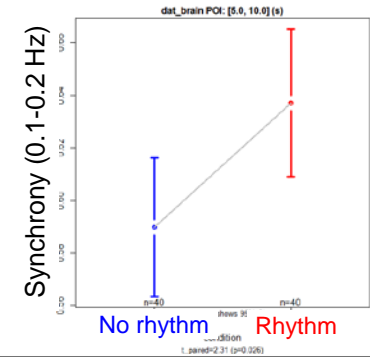
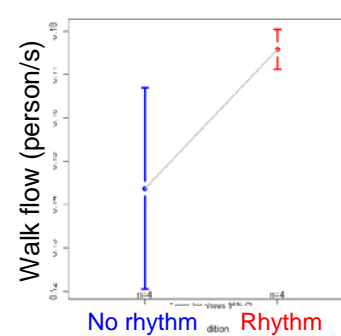
Communicating at Independent

Group-thinking enhanced collective brain synchrony among four participants.

## Congested group walking (non-verbal)



70 BPM



Slow rhythm enhanced both walk flow and brain synchrony among walkers.

Changes in verbal and non-verbal interaction can be detected in the brain synchrony among people.



# For innovative automobiles



## Evaluation/exploration of **human factors**:

- Detection of transitory risks in drivers, such as attentional lapse and sleepiness
- Better design for users' comfort / affective feelings (KANSEI/感性)
- Enhancing communication and empathy among the driver and passengers
- Brain synchrony among drivers to reduce traffic jam

We would like to discuss wide possibilities!