

### Environmental dependency in visuomotor responses

#### Abstract

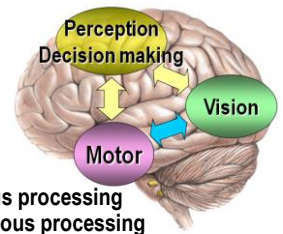
We may tend to think that human understand current states of self-body and external environments, and then consciously control our limbs according to those states. However, **dominant part of actual skilled movements are controlled unconsciously**. We are trying to reveal those implicit sensorimotor control mechanisms to understand the brain processing for skillful motor control. By inflicting different postural stability and/or noisy visual motion conditions, we investigated the adaptability of voluntary and reflexive responses to visual motion stimuli, and found **that only reflex responses can be adjusted suitably to the different situations**. This suggests that **unconscious processing would be smarter than conscious processing** for a particular condition. By understand the mechanisms of brain processing for sensorimotor control, we will be able to designe more sophisticated communication and man-machine interface, and novel training method for athletes.

#### Body and arm movement control

- In daily life, human has various physical interactions with external environments while his/her body is moving, which cannot be easily realized by current industrial robots.
- How can we realize these dexterous interactions by using the brain information processing whose transmission speed is much slower than that in current computers?

#### Implicit and explicit sensorimotor processes

It is generally considered that implicit process for sensorimotor control is faster but is less flexible than the explicit and voluntary processing.



The current study revealed that an implicit process can regulate sensorimotor response according to a particular environmental situation whereas an explicit process cannot [1].

#### Experiment: Context dependency of implicit and explicit processes for visual motion

##### Experiment

- Supply environmental context of postural fluctuation and/or random visual motion.
- Measure reflexive and voluntary visuomotor response.
  1. Reflexive response (Manual Following Response: MFR)
  2. Voluntary response (Motion Direction Discrimination)

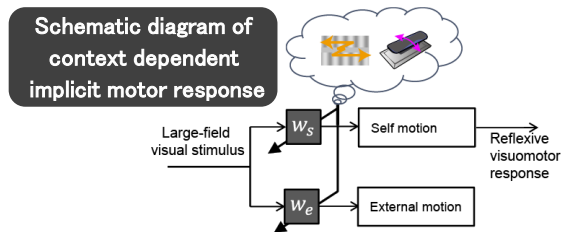
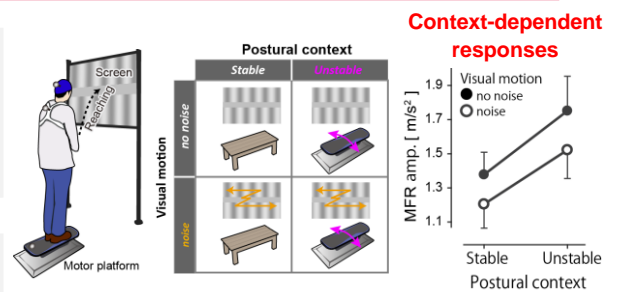
##### Results

1. Reflexive: Context dependent and rational modulation
2. Voluntary: Context independent modulation

These results suggest that reflex mechanisms properly connect the relationship between postural stability context and visual motion while voluntary motor system cannot.

**Unstable posture context ⇒ large MFR**

**Movable environment context ⇒ small MFR**



#### References

- [1] N. Abekawa, H. Gomi, "Modulation difference in visuomotor responses in implicit and explicit motor tasks depending on postural stability," *Proc. The Society for Neuroscience 47th Annual Meeting*, 2017.
- [2] H. Gomi, K. Kadota, N. Abekawa, "Dynamic reaching adjustment during continuous body perturbation is markedly improved by visual motion," *Proc. The Society for Neuroscience 40th Annual Meeting*, 2010.

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