

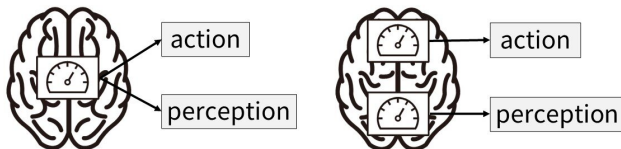
Abstract

When we walk, our brains estimate our own walking speed based on vision and regulate our steps to achieve an efficient walking speed. In this study, **we investigated whether this speed estimation for the implicit motor adjustment is the same as that used for self-motion perception**. To this end, we asked the participants to walk down a virtual hallway and measured how the walking speed changed depending on the motion of the side walls and the fineness of the spatial pattern on the walls. In another experiment, we measured the speed of self-motion the participants perceived from the same images when they were sitting down. **Our study revealed a clear dissociation** in spatial-pattern dependency between the two responses, suggesting that self-motion speed estimation for walking speed adjustments differs from that for self-motion perception. **Our brain may embed two speedometers, one for motor actions and the other for perception**.

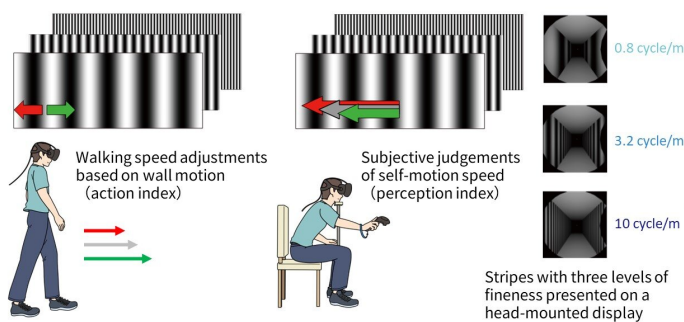
Speed estimation by the human brain

- Humans use visual information to estimate their walking speed and adjust it to the optimal speed.
- We **investigated whether this speed estimation for motor action differs from that for perception** (sense of self-motion speed).

H1. Common speedometer H2. Different speedometers

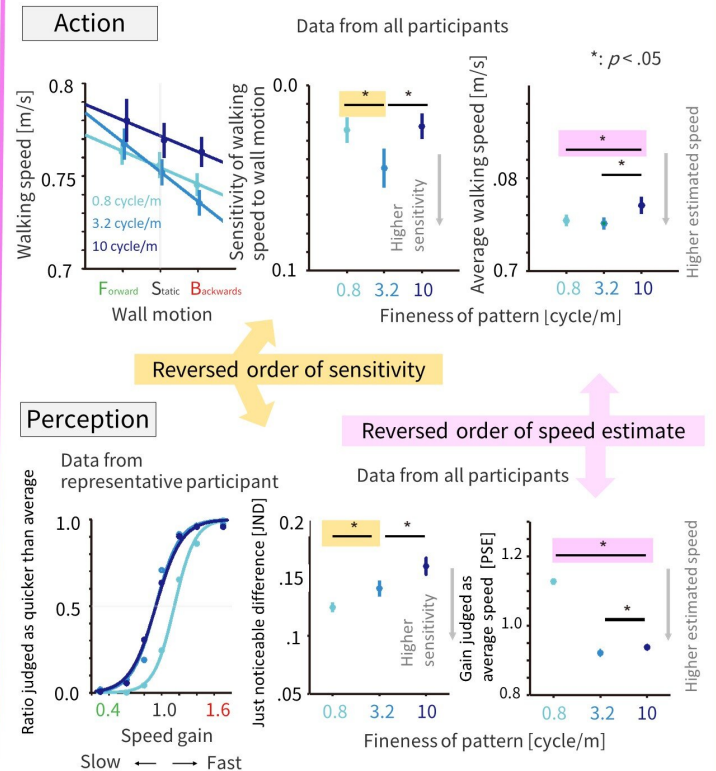


Experimental paradigm



- We examined the **impact of pattern fineness of visual information on motor and perceptual speed estimations**.
- In the action experiment, we asked the participants to walk down a virtual hallway and measured **the changes in walking speed caused by motion of the side walls**.
- In the perception experiment, we showed images of a camera moving down the hallway with various speeds and asked the participants to judge the **perceived self-motion speed**.

Different speedometers for action and perception



- The **impact of spatial fineness differed between motor and perceptual responses**.
- The finding suggests that self-motion speed estimation may differ between motor and perceptual processes (support for 2nd hypothesis of multiple speedometers)
- Further study on the speed estimation process may allow us to **develop novel technologies that efficiently navigate human behaviors (e.g., traffic control for pedestrians)**.

References

- [1] S. Takamuku, H. Gomi, "Vision-based speedometer regulates human walking," iScience, Vol. 24, No. 12, 2021.
- [2] S. Takamuku, H. Gomi, "Increase in density of optic-flow deteriorates self-motion velocity perception and decreases implicit adjustments of walking speed," in Proc. The 48th Annual Meeting of the Society for Neuroscience (Neuroscience 2018), 2018.

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