

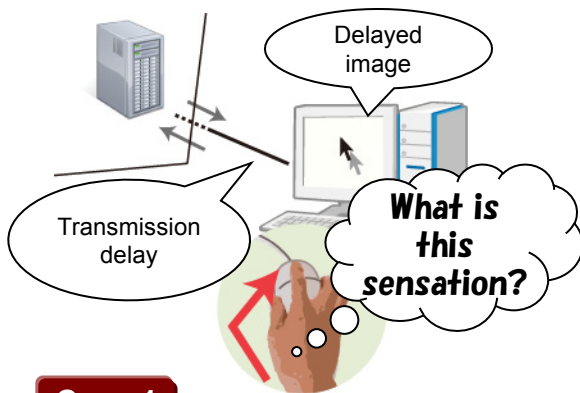


## How we feel fatigue and force

### Motor perception influenced by delayed visual feedback

**Abstract—** Sluggish sensations caused by delayed visual feedback have a critical impact on user experiences of interactive network services such as network games. Here we report that motor perception can be affected by delayed visual feedback in various ways depending on the situation. When an image of a finger was delayed compared with its actual movement, subjects reported a stronger sense of fatigue. When a cursor was delayed, subjects reported a resistive sensation as if they were pulling a mechanical load. The study sheds light on the role of vision in motor perception, and may provide an important clue regarding interface design.

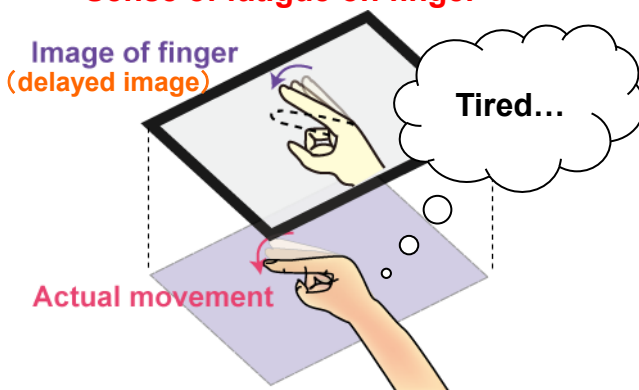
Visual delay during control  
⇒ Peculiar sensation



- ✓ Our brain comes up with different interpretations for the visual delay depending on the situation and generates a sensation associated with the interpretation.
- ✓ Understanding of the neural process of the illusory sensation may help us improve the user experience of network services.

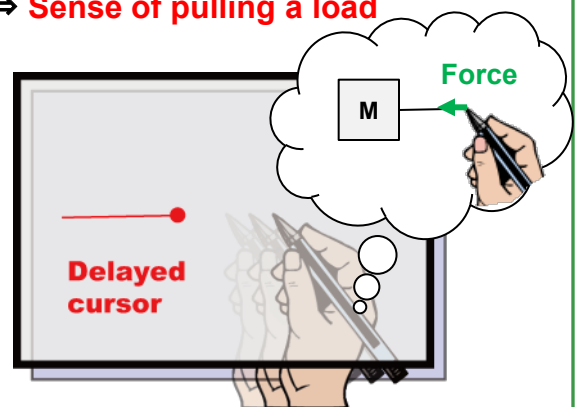
#### Case 1

When finger movement is delayed  
⇒ **Sense of fatigue on finger**



#### Case 2

When cursor is delayed  
⇒ **Sense of pulling a load**



#### Related works

- [1] S. Ito, T. Kimura, H. Gomi, "Enhancement of fatigue perception and phase lag of cyclic movement induced by delayed visual feedback," in *Proc. Society for Neuroscience 42nd Annual Meeting (SfN)*, 2012.
- [2] S. Takamuku, H. Gomi, "Principle factor yielding the sluggish sensation during movements with delayed visual feedback," in *Proc. Society for Neuroscience 42nd Annual Meeting (SfN)*, 2012.

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