

## Abstract

The eyes reflect various states of mind. It is known that gaze directed to an object of interest, but also that **microsaccades, involuntary tiny eye movements**, reflect the visual covert attention. Here, we investigated the relationship between microsaccades and spatial auditory attention. We found that **microsaccades reflect the direction of auditory attention during a dichotic selective attention task** and are also associated with task performance. Although many previous studies have already shown a link between microsaccades and visual attention, this study showed that they are also linked to auditory attention processes. We believe that **this finding will lead to the development of technology for estimating attention states** that vary spontaneously and instantaneously (e.g., estimating information such as the voice to which a person is paying attention at the party). We also hope that this result encourages future studies to elucidate the mechanisms of how our auditory system coordinates spatial attention.

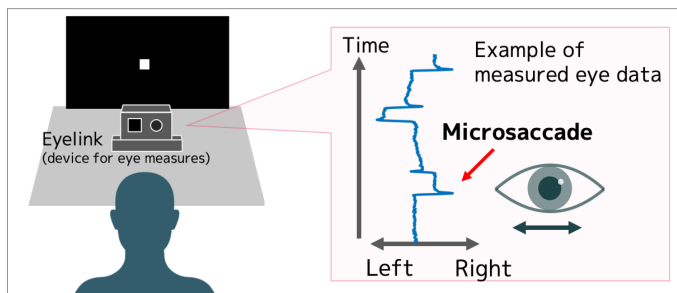
## Significance

► **Tiny saccadic eye movements, called microsaccades, reflect the direction of auditory attention.**

This study showed the possibility of tracking listener's attention states by analyzing the properties of microsaccades.

## What is a "microsaccade"?

A tiny involuntary saccadic eye movement that occurs even when fixating on one point



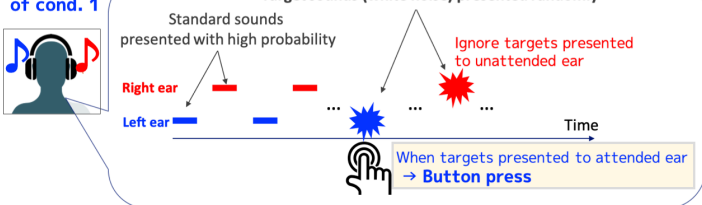
## Dichotic selective attention task

Q1: Do microsaccade reflect auditory attention direction?  
Q2: Do microsaccade reflect attention level (task performance)?

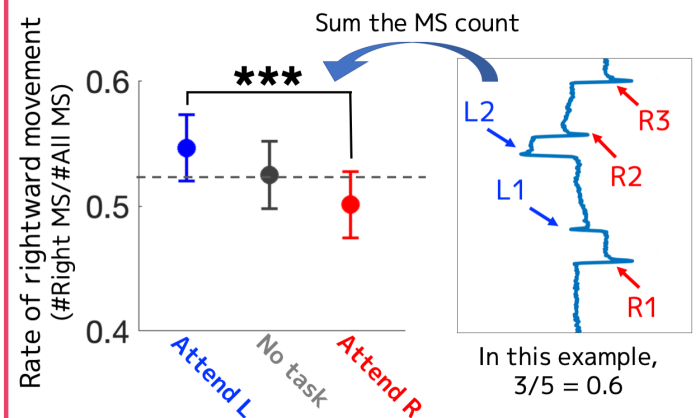
Sound sequence presented dichotically → **Three conditions:**

1. **Attend to left sound**
2. **Attend to right sound**
3. **No task**

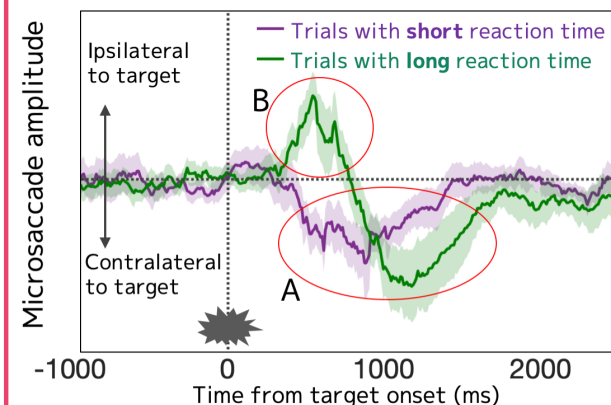
Example of cond. 1



## Microsaccade bias contralateral to attention



## Relationship between microsaccades and task performance (reaction time)



- A) For both **short** and **long** RT trials, microsaccades were biased opposite to the target.  
B) For **long** RT trials, microsaccade bias ipsilateral to the target was observed.

## References

- [1] S. Yamagishi, S. Furukawa, "Simultaneous measures of auditory brainstem frequency following response, pupillary response, and microsaccade during auditory selective attention task," in *Proc. 42nd Association for Research in Otolaryngology (ARO) Midwinter Meeting*, 2020.  
[2] S. Yamagishi, S. Furukawa, "Relationship between auditory selective attention and microsaccades," in *Proc. The Auditory Research Meeting*, 2020.

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