# Silent Communication

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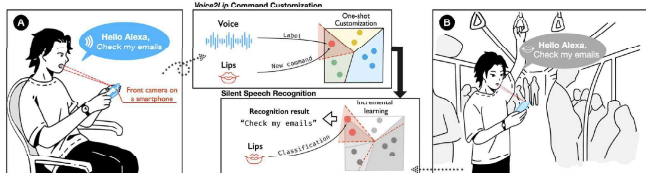
**Overview**

Voice-based communication, such as conversations with AI agents and remote communication, is becoming a major trend in next-generation HCI (Human-Computer Interaction). However, there are many situations where speaking is not possible, such as in public settings, and confidentiality cannot be guaranteed. Speech intent recognition via BCI requires invasive brain procedures and has not yet achieved recognition speeds or accuracy at normal conversational rates. This project aims to establish "Silent Communication" technology that recognizes speech from silent or near-silent, minimal vocalizations using deep learning. This technology will usher in the world of think communication, enabling users to enhance their thinking through conversation with AI anytime, anywhere. Additionally, we are researching the mechanisms of brain synchronization during remote communication and combining gaze with MLLM to enable AI to understand human advanced skills.

## LipLearner: Speaker-independent lip reading
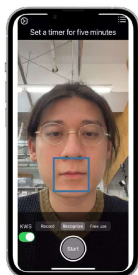
LipLearner is a silent speech technology based on lip reading. While conventional lip reading required speaker-dependent learning, this research applied the CLIP (Contrastive Language-Image Pretraining) method to lip reading, achieving speaker-independent recognition. Furthermore, by developing a mobile version that runs on smartphones, it contributed to realizing silent speech that can be used anytime, anywhere.
   (ACM CHI2023 best paper)



## WESPER: Real-time Whisper Voice Conversion

Whispered speech using minimal audio is also a promising means of silent communication. In this study, by pretraining on a large volume of whispered speech, we enable conversion from minimal audio to normal speech by extracting speech units independent of specific languages or speaking styles.
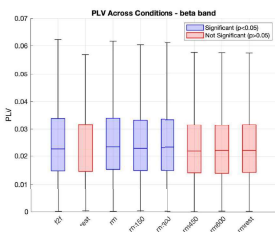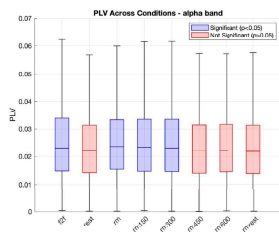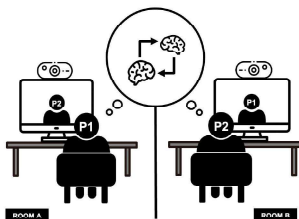   (ACM CHI2023)



## Elucidation of Remote Brain Synchronization Mechanisms

It was known that brain waves synchronize among people engaged in collaborative tasks, but whether brain synchronization occurs in remote environments remained unknown. In this study, by measuring brain synchronization in a remote environment with controlled communication delays, we confirmed that brain synchronization occurs during collaborative tasks in environments with delays of 450 milliseconds or less.
This clearly demonstrates that brain synchronization arises from interactions between brains, not external factors.
This finding is expected to be applied to metrics such as the quality of collaborative work in remote environments.
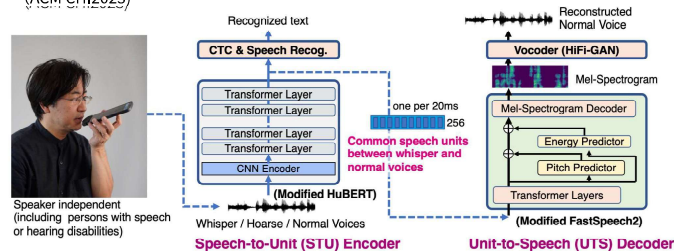(Augmented Humans 2025)



## Speech Support for Individuals with Voice Disorders

We conducted research on speech support for individuals with voice disorders using AI-based voice conversion technology. By converting the voices of people who have difficulty producing normal speech due to various factors—such as laryngectomy, vocal cord polyps, dystonia, or hearing impairment—into their natural voices, we achieved significant improvements in sound quality. We are aiming to develop technology that combines voice cloning with this approach to restore each person's original voice.
   (ACM CHI2023)
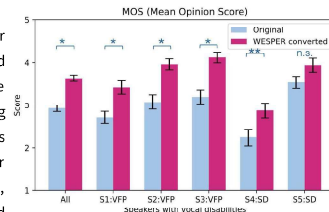


**VFP**: vocal fold polyp (声帯ポリープ)
**SD**: spasmodic dysphonia (痙攣性発声障害)

## GazeLLM: Multimodal LLM Utilizing Gaze

We are building a mechanism to directly teach first-person perspective video to MLLM (Multimodal Large Language Models) and transmit human skills to others via AI. By incorporating gaze information, we confirmed that reflecting the skilled operator's attention into the LLM improves action comprehension accuracy.
   (Augmented Humans 2025)
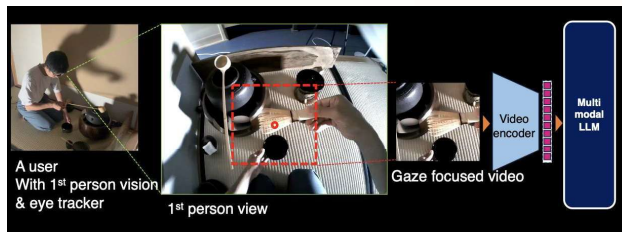


## Future Prospects

The major future trend in HCI (Human-Computer Interaction) is the fusion of humans and AI. The silent communication being advanced in this project aims to build a world where conversation with AI is possible anytime, anywhere, and where human thought is naturally enhanced by AI.

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**Internet of Brains**