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The whole-cortical ECoG reveals association cortices contribute multimodal intentional decoding

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Introduction: BCI enable patients with CNS damages, who have difficulties to move their body or to speak, to move prosthetic limbs or to communicate with other people by using their own neural activity. However most of the recent BCIs have been developed for limited tasks. For BCIs to be more widely used, it is important to decode subjects' multimodal intentions from a limited number of recording electrodes. It is little known whether there are common brain areas which highly contribute to both action and vocalization. To answer this questions, we investigated which cortical areas are suitable for multimodal decoding by a data driven manner.

Material, Methods and Results: Two common marmosets, small non-human primates, are implanted with the whole-cortical ECoG array [1], which allow us to monitor whole-cortical neural activity. We conducted wireless ECoG recordings from these animals under a free-moving condition. Then, we annotate action categories and vocalization types based on movie and audio data, which were recorded simultaneously with the ECoG signals. Then, we developed a decoder to predict multi-modal features of marmoset behaviors, and quantified spatiotemporal contributions of the whole-cortical ECoG. We found that the frontal, temporal, and parietal association cortices showed a large contribution to the decoding of both action and vocalization types.

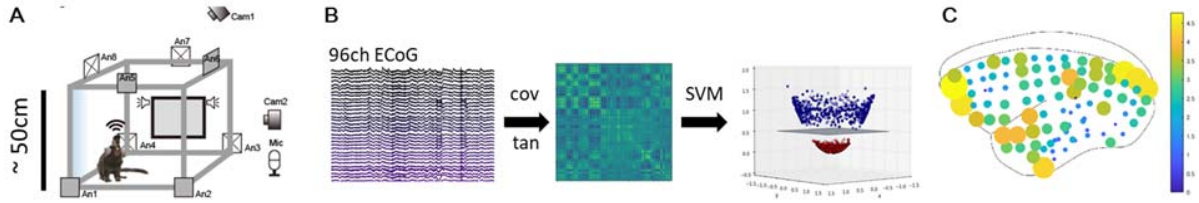

Figure 1. *A) Experimental setup for wireless ECoG recording system with a free-moving marmoset. B) Decoder construction. C) Spatial map of contribution for multi-modal decoding.*

Discussion & Significance: We decoded multi-modal features of marmoset behavior from whole-cortical ECoG, and quantified spatiotemporal contributions. The results demonstrated that association cortices contribute multimodal intentional decoding, such as actions and vocal productions. This findings may paves a new way for multimodal BCI with much higher degree-of-freedom.

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References

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