

Neural Basis Of Cognitive Intervention Via Photo-Integrated Conversation Moderated ByRobots (PICMOR) Program

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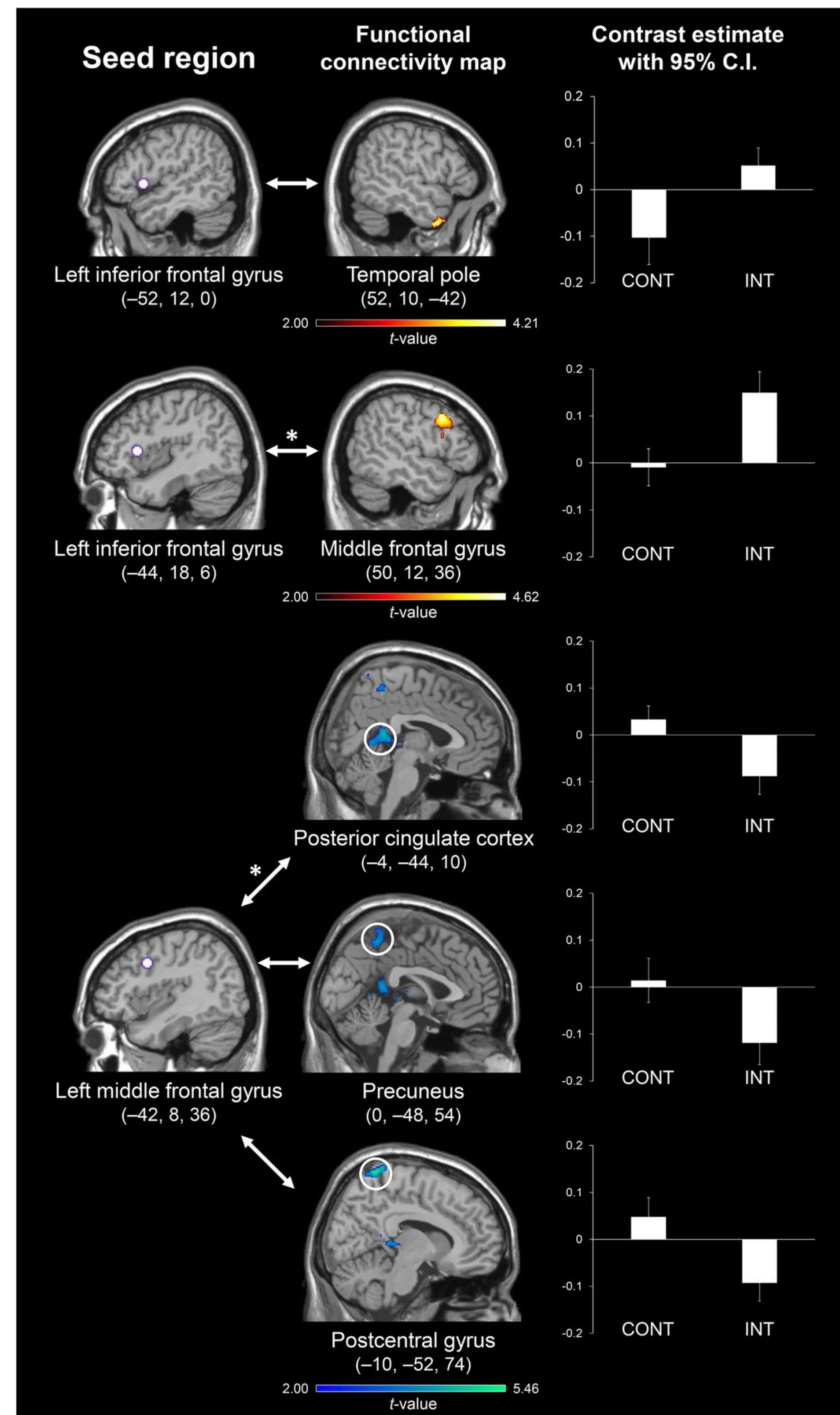
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Background The completed randomized controlled trial on PICMOR program (UMIN Clinical Trials Registry, identifier UMIN000036667), provided world-first evidence of a face-to-face topic-based structured group conversation moderated by robots on cognitive function in healthy older adults. Topline results were published in 2021. This presentation discusses neural bases of intervention found on the analysis of Magnetic resonance imaging (MRI) data.

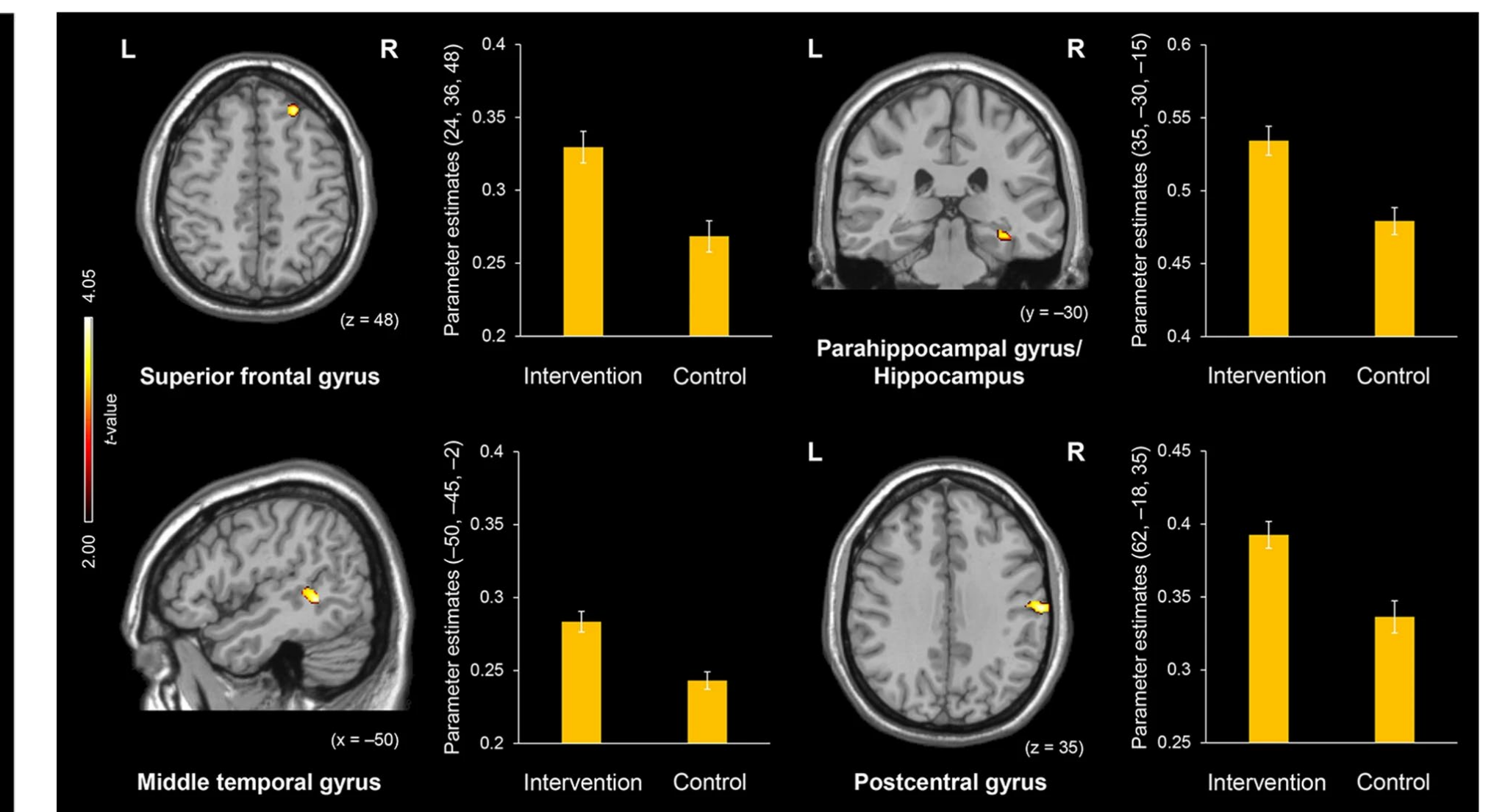
Methods In the RCT, PICMOR program was compared to an unstructured group conversation condition. The intervention was provided once a week for 12 weeks. Primary outcome measures were the cognitive functions. Baseline and post-intervention data were collected. PICMOR contains two key features: 1) photos taken by the participants are displayed and discussed sequentially; and 2) a robotic moderator manages turn-taking to make sure that participants are allocated the same amount of time. MRI data was additionally obtained from participants. A voxel-based morphometric (VBM) analysis, resting-state functional magnetic resonance imaging (rsfMRI) analysis, tract-based spatial statistics analysis of diffusion tensor imaging (DTI), were applied.

Results Sixty-five community-living older adults participated in this study. We previously reported that verbal fluency significantly improved in the intervention group. The number of words generated between pre- and post-experiment was approximately two words more than in the control group. VBM analysis revealed that the volume of the superior frontal gyrus, parahippocampal gyrus/hippocampus, posterior middle temporal gyrus, and postcentral gyrus, was greater in the intervention group than in the control group. Via rsfMRI analysis, enhanced resting state functional connectivity (rsFC) of the left inferior frontal gyrus with semantic and executive control-related regions and suppressed rsFC between the left middle frontal gyrus and posterior cortical midline structures were observed. Analysis of DTI showed that the intervention group had significantly higher fractional anisotropy values or lower mean diffusivity, axial diffusivity, and radial diffusivity values across various fiber tracts reflecting anisotropy.

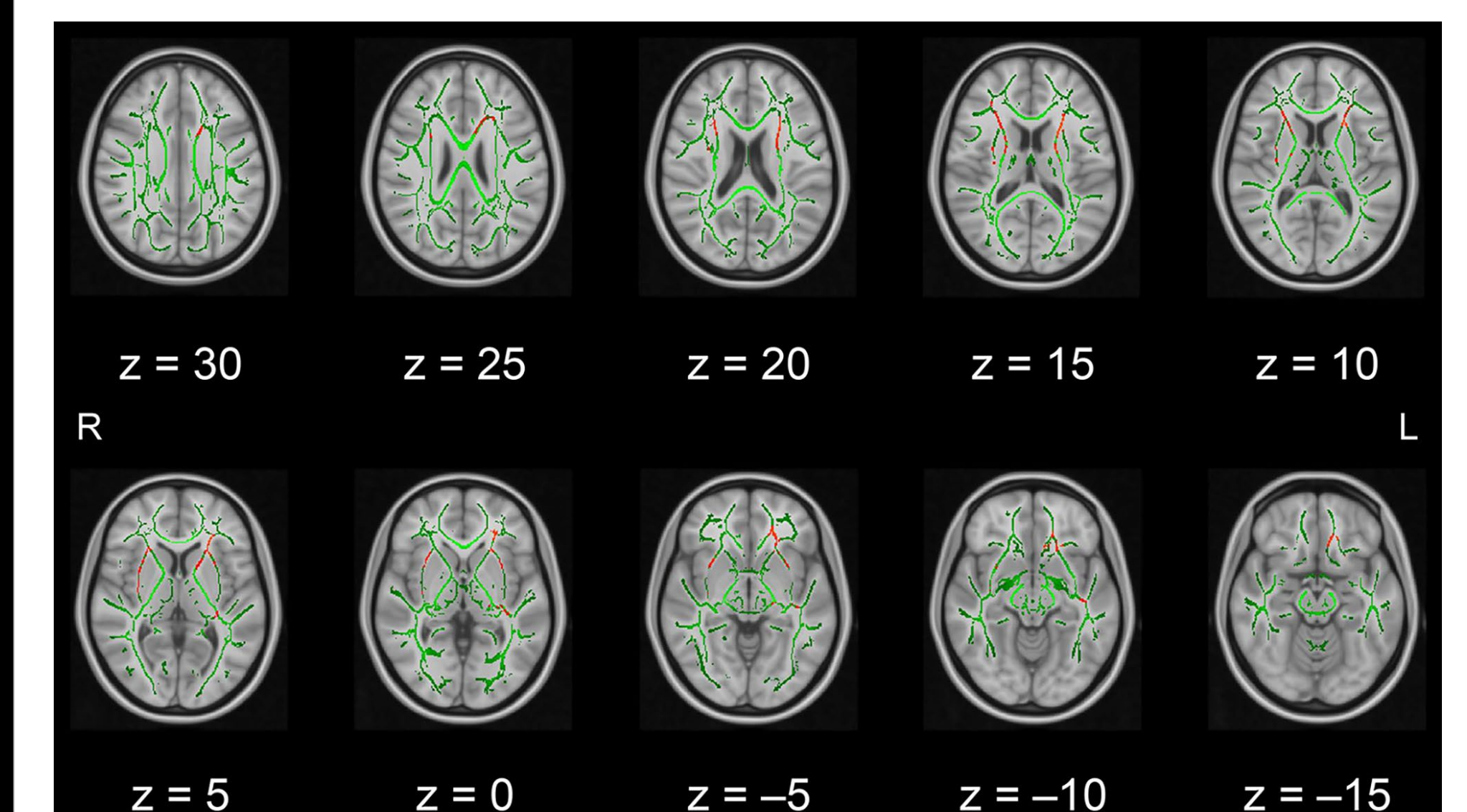
Conclusion Through comparison of these results, face-to-face group conversation has larger effect on cognitive function compared to remote group conversation. This implies the other modalities which lack in a remote setting may have additional positive effect on cognitive functions. Asking questions may contribute to positive effect on cognition among activities during conversation since positive trend was found for dialogue robot setting.



[rsfMRI analysis] The beneficial intervention effect of PICMOR on verbal fluency is characterized by enhanced rsFC of the left inferior frontal gyrus with semantic and executive control-related regions and suppressed rsFC between the left middle frontal gyrus and posterior cortical midline structures. (Fig. 1 [2])



[VBM analysis] The volume of the superior frontal gyrus was greater in the intervention group than in the control group. Greater volume in the intervention group was also identified in the parahippocampal gyrus/hippocampus, posterior middle temporal gyrus, and postcentral gyrus. No regions showed greater volume in the control group than in the intervention group. (Fig.1 [3])



[DTI analysis] Conversation-based cognitive interventions have the potential to maintain or improve white matter fiber health in adults affected by age-related alterations. Left frontal white matter structures are candidates that contribute to the intervention-induced enhancement of verbal fluency (Fig. 1 [4])

References [1] Otake-Matsuura M et al. (2021) doi: 10.3389/frobt.2021.633076.
[2] Sugimoto H, Kawagoe T, Otake-Matsuura M (2020) doi: 10.1186/s12877-020-01892-2.
[3] Sugimoto H, Otake-Matsuura M (2022) doi: 10.1186/s12877-021-02669-x.
[4] Sugimoto H, Otake-Matsuura M (2022) doi: 10.3389/fnagi.2022.867417.



[1] PICMOR
Program RCT



[2] resfMRI
Analysis



[3] VBM
Analysis



[4] DTI
Analysis

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