

Supplementary Material

Example of raw ECoG time course and HG amplitude for Subject A

Fig. 1-A shows an example of the raw ECoG time course for subject A following presentation of one stimulus, as well as the time course of the smoothed and rectified auditory stimulus (bottom trace) and the onset of the verbal response (dashed line). ECoG responses are not readily visible in these raw ECoG traces. Fig. 1-B shows the location of channels that exhibit significant HG power changes. Fig. 1-C shows the time course of ECoG HG power for these channels (i.e., channels 30, 40, 53 and 55), which were located in Brodmann's Area (BA) 21 (middle temporal gyrus, MTG), 40 (supramarginal gyrus), 44 (inferior frontal gyrus, IFG) and 6 (precentral gyrus, premotor cortex), respectively. This example shows that ECoG high gamma power in this individual trial at different cortical locations increases with the stimulus and/or with the verbal response.

Spatiotemporal Dynamics of ECoG HG Activity in Subject D

Supplementary Fig. 2 and Fig. 3 characterize the spatiotemporal dynamics of ECoG HG activity during Visual/Overt and Audio/Overt conditions, respectively, in subject D, who had electrodes on the right hemisphere.

In this subject, superior temporal lobe rapidly activates for the auditory but not the visual condition. Following these activations that reflect sensory processing, activations are mainly localized to two foci in frontal lobe in both Visual/Overt and Audio/Overt conditions. Compared with the results from the eight left-sided subjects shown in the main paper, the cortical areas related to language processing are weaker and less distributed. This difference could be explained by the different number of subjects, or by the difference in hemispheres (i.e., right hemisphere in subject D vs. left hemisphere in all others). In both cases, ECoG HG activity accurately tracked the evolution of brain dynamics corresponding to the three phases of language processing. The results shown here also demonstrate the role of the right hemisphere in acoustic processing as well as overt speech output, which is consistent with the finding that language function also involves activity on the right hemisphere (Church et al., 2008), even though it is predominantly lateralized to the left hemisphere in most people.

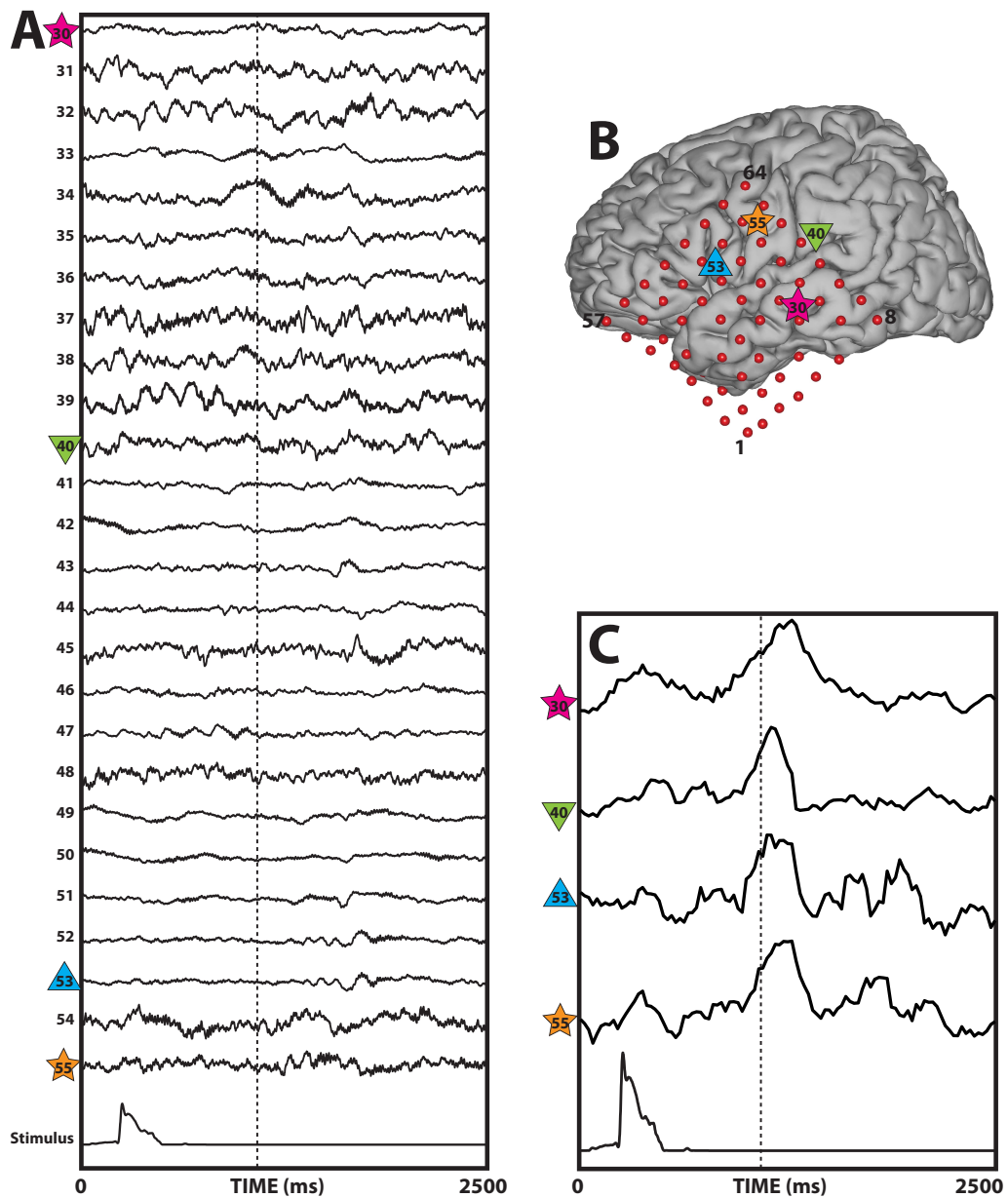


Figure 1: Example of single-trial stimulus and ECoG responses in the Audio/Overt condition in subject A. (A): Time course of the raw ECoG signals for channels 30-55 (top), the temporal envelope of the auditory stimulus (bottom), and the onset of the verbal response (dashed line). Channels that exhibit time courses that are correlated with the task are indicated with colored symbols. These channels were located in Brodmann Area 21, 40, 44, and 6 (magenta star, green triangle, blue triangle, orange star, respectively). (B): Electrode locations including channel numbers. Colored symbols indicate the locations of marked channels in (A). (C): Magnified time course of HG power of the marked channels (top), the envelope of the auditory stimulus (bottom), and the onset of the verbal response (dashed line).

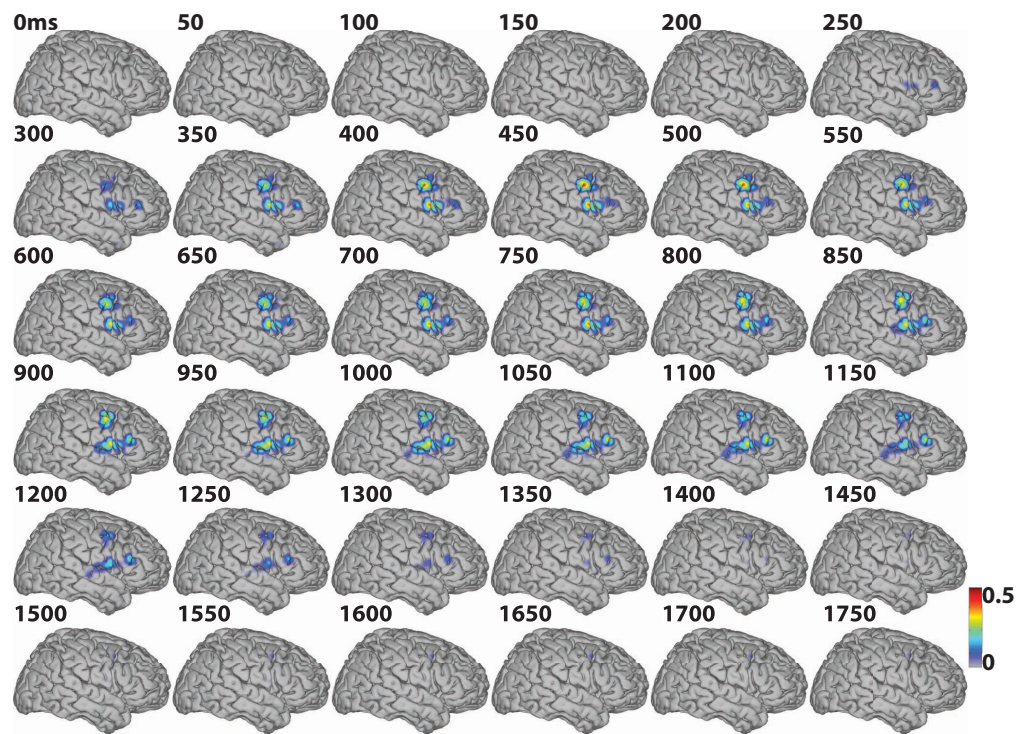


Figure 2: Spatiotemporal dynamics of language processing for the Visual/Overt condition for subject D.

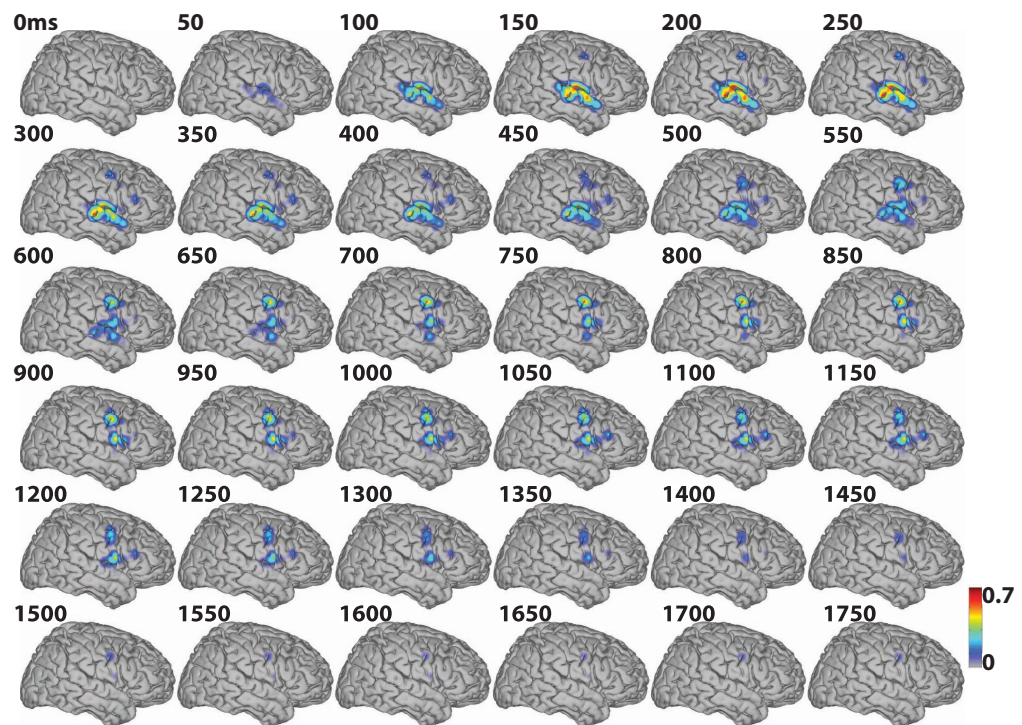


Figure 3: Spatiotemporal dynamics of language processing for the Audio/Overt condition for subject D.

References

Church JA, Coalson RS, Lugar HM, Petersen SE, Schlaggar BL (2008) A developmental fmri study of reading and repetition reveals changes in phonological and visual mechanisms over age. *Cereb Cortex* 18:2054–2065.