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Reply to 'The language network is topographically diverse and driven by rapid syntactic inferences'

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We thank Murphy and Woolnough for their comments on our recent Review (Fedorenko, E., Ivanova, A. A, & Regev, T. I. The language network as a natural kind within the broader landscape of the human brain. *Nat. Rev. Neurosci.* **25**, 289–312; 2024)[1], which we respond to below (Murphy, E. & Woolnough, O. The language network is topographically diverse and driven by rapid syntactic inferences. *Nat. Rev. Neurosci.* https://doi.org/10.1038/s41583-024-00852-8 (2024))[2].

Murphy and Woolnough raise two issues. The first is the "monolithic conception[2]" of the language network (LN). Nowhere in the Review did we argue that the LN is monolithic: the term 'natural kind' does not imply the lack of internal structure. As we discussed, the LN is an interconnected system, with similar functional responses across its component regions, and is distinct from both lower-level perceptual and motor mechanisms and higher-level systems of thought. But we acknowledged the internal complexity of, and the functional heterogeneity within, the LN (see the paragraph in the Review that starts with "Indeed, intracranial recordings have already helped uncover functional heterogeneity within the network … "[1]). In our own work[3], we found that different, spatially interleaved neural populations within the LN appear to have different temporal receptive windows: some populations process single words, others process short phrases, and yet others integrate over longer multiword spans. Such discoveries are critically enabled by intracranial recording approaches. Other temporally resolved methods can supplement intracranial recordings; however, source localization in both electroencephalography and magnetoencephalography remains a challenge[4], which makes it impossible to unambiguously attribute any effect to a particular anatomical location. More generally, different neuroscience approaches are suited for different kinds of questions: fMRI is unparalleled for identifying meaningful partitions within the brain, with different areas supporting different representations and computations — a critical stepping stone for subsequent work with (much more difficult to obtain) intracranial recordings, which are ideally suited for probing fine-grained activity patterns within each relevant brain area.

In our Review, we also discussed why past evidence for putative dissociations within the LN (such as from patient studies) is difficult to interpret as reflecting differences among the LN's components rather than between the regions of the LN and nearby functional areas or networks (see the 'Past claims about dissociations within the language network' section of our Review[1]). Murphy and Woolnough do not offer an answer to the interpretive challenges we raised.

The second issue concerns a particular way of defining the LN, but — as we discussed at length in the Review — the LN can be defined without any task contrasts, in a bottom-up fashion using intrinsic fluctuations during naturalistic cognition[5]. Empirically, the regions comprising this network respond more to stimuli that allow for syntactic structure building and semantic composition (such as sentences) compared to unstructured stimuli (such as word lists). It could, in principle, be the case that neural populations or brain regions that respond more to word lists than sentences are the true language populations or regions (which, as Murphy and Woolnough suggest, work harder to build structured linguistic representations from unstructured input), just as it could, in principle, be the case that brain regions that respond more to non-face objects than to faces are the true face-processing regions. However, in reality, brains do not work this way: brain cells and areas that respond most strongly and selectively to particular kinds of input appear to be critical for processing those inputs, as has been shown across many domains, in both human and animal neuroscience[6–8].

Finally, there is a suggestion in their comments that we argue against the hierarchical structure of language. We make no such arguments. In fact, our own work provides evidence for robust sensitivity of the language areas to hierarchical syntactic structure[9,10].

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Competing interests

The authors declare no competing interests.

Additional information

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