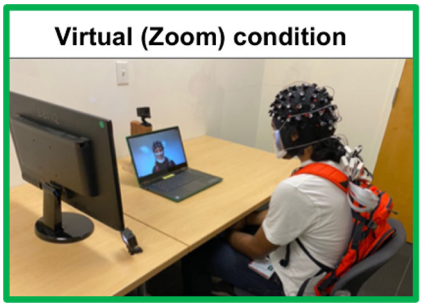
This Week in The Journal

Age-Related Overactive BOLD Signals Not Neuronal in Nature

Lars Stiernman, Filip Grill, Charlotte McNulty, Philip Bahrd, Vania Panes Lundmark, et al.

(see pages 2527–2536)

This week, Stiernman et al. tackle an enduring mystery observed with functional magnetic resonance imaging (fMRI). fMRI uses blood oxygenation level-dependent (BOLD) signals, and older adults display overactivations relative to younger adults during less demanding tasks. The underpinnings of the anomaly remain unknown. One hypothesis holds that older adults recruit additional neural resources to compensate for age-related deficits, resulting in overactivation relative to younger brains. Here, the authors imaged 23 young adults aged 20–37 years and 34 older adults aged 65–86 years. They simultaneously measured fMRI BOLD signals and positron emission tomography (PET) using a radioligand to see dynamic changes in glucose metabolism reflecting synaptic activity independent from oxygenation and blood-flow. This allowed the researchers to determine whether the overactivations arose from compensatory use of neuronal resources. Participants performed two types of working memory tasks during scanning: a less demanding maintenance task, and a more demanding manipulation task. Young and older participants performed the easier task at similar levels with high accuracy. Younger subjects outperformed older adults on the harder task, but both groups still performed with above 85% accuracy. fMRI and PET activation during working memory (WM) tasks overlapped with increased activity in multiple networks identified as core WM areas similarly in the two age groups. As expected from previous findings, BOLD signals in older adults were more widespread and significantly higher outside core WM areas compared to younger adults. Surprisingly, though, age groups did not differ significantly in their glucose metabolic signals either within or outside core WM areas, suggesting that the overactivity of BOLD signals in older adults was not due to compensatory neuronal activity. Because BOLD signals rely on neurovascular coupling, it may be that age-related changes in cerebral vasculature could affect the hemodynamic response function and thus the overactivations seen in BOLD. Changes in neurotransmitter tone may also underlie the difference. While the new findings excluded neuronal recruitment as the source of the overactivation, the mystery remains unsolved.



Experimental set up in the virtual condition of the between-subject study.

Using Brain Imaging to Understand the Downsides of Video Conferencing

Stephanie Balters, Jonas G. Miller, Rihui Li, Grace Hawthorne, and Allan L. Reiss

(see pages 2568–2578)

Three years ago, at the start of the COVID-19 global pandemic, interpersonal interactions moved online, creating a seismic shift in the way that education, business, health care, and private social gatherings were carried out. Although the pandemic has officially ended and many in-person meetings have resumed, video conferencing continues to play a crucial role in each of these sectors of society. In addition, the possibility of another global pandemic is a very real one that we should consider and plan for now. The upsides of online platforms such as Zoom are undeniable, from the sheer ability to continue endeavors in each sector in any format, to increased access to psychological treatments across state lines and to health care in rural settings, for example. But the downsides are also numerous. People throughout the world experienced the difficulties of tracking a conversation with limited or exaggerated nonverbal cues, the stress of increased self-focused attention, disrupted conversation rhythms due to transmission delays and the unnatural presentation of seeing a grid of faces with increased eye contact – all leading to a phenomenon known as Zoom fatigue. In this week's *Journal*, Balters et al. investigate the impacts of this technology with multiple measures in 72 individuals (36 dyads) tasked with performing three types of tasks including problem-solving, creative innovation, and socioeconomic tasks, either in real life or over Zoom. The authors imaged brain activity using functional near-infrared spectroscopy (fNIRS), which measures cortical oxygenation levels as a proxy for cortical activation. Recently, researchers have extended the use of fNIRS to examine interbrain coherence by "hyperscanning" interacting individuals. Here, the authors performed fNIRS hyperscanning on participants during the tasks, recorded video and audio of the performances to assess behaviors, and used questionnaires to capture subjective experiences. Not surprising to anyone who has been working over Zoom for the past several years, conversation turn-taking was reduced over video compared to in-person interactions. Pairs who took fewer turns switching between speakers reported a lower sense of cooperation and negative feelings about their subjective performance. These pairs also showed less performance on the tasks based on their behavior. Individual brain activity measured with fNIRS did not differ between virtual and in-person conditions, but interbrain coherence did vary in the virtual condition, which was associated with the reduced turn-taking. The data indicate that future technology could benefit from new features that facilitate turn-taking in virtual interaction settings.

This Week in The Journal was written by Stephani Sutherland

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