Abstract

Working memory (WM) undergoes significant changes across the lifespan, with notable differences between younger and older adults. One study explores the relationship between latent WM items and long-term memory retrieval, examining how these processes change with age. We propose a dual mechanism of control, highlighting the balance between proactive control (active maintenance of information) and reactive control (adjustments to task demands). Using advanced EEG decoding methods, we investigate the neural and behavioral patterns of WM updating across age groups. The results show that older adults display higher levels of delay-period decoding compared to younger adults, likely due to increased active maintenance, consistent with the CRUNCH model (Compensation-Related Utilization of Neural Circuits Hypothesis). According to CRUNCH, older adults compensate for cognitive decline by recruiting additional neural resources, maintaining performance under moderate demands but reaching a limit as task complexity increases. Additionally, the studies link neural activity observed during WM tasks to biomarkers of Alzheimer's disease (AD), offering valuable insights into early cognitive decline and highlighting potential for early AD detection. These findings suggest that age-related changes in WM involve both behavioral adaptations and neural shifts, with important implications for early interventions to mitigate the effects of aging and neurodegeneration on memory function.