

Embodied and Situated Cognitive Neuroscience

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We assessed performance and brain activity while cognitive work coincided with physical work in simple and complex environmental settings. Previous studies examining embodied cognition have found performance decrements in working memory with concurrent physical activity. Additionally, neuroimaging has revealed increases and decreases in prefrontal oxygenated hemoglobin. However, the effect of environment on cognitive–physical dual tasking has not been previously considered. Participants were monitored with wireless functional near-infrared spectroscopy (fNIRS) as they performed an auditory 1-back task while sitting, walking indoors, and walking outdoors. Relative to sitting and walking indoors, auditory working memory performance only declined when participants were walking outdoors. Sitting during the auditory 1-back elicited an increase in oxygenated hemoglobin along with a decrease in deoxygenated hemoglobin in the bilateral prefrontal cortex. Walking reduced the total hemoglobin available to bilateral prefrontal cortex. Finally, walking outdoors reduced oxygenated hemoglobin and increased deoxygenated hemoglobin in the bilateral prefrontal cortex. Overall, we observed that during executive processing loading of selective attention and physical work resulted in deactivation of the bilateral prefrontal cortex and degraded working-memory performance. This suggests that selective attention and physical work in certain situations compete with executive processing and may supersede executive processing in the distribution of mental resources. Further, research is needed to determine if in situations in which executive functioning is paramount precautions should be taken to eliminate competition from physical work and selective attention.