Autonomic and cognitive control in memory: Investigating the psychophysiological link using heart rate variability biofeedback

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Abstract

Vagally-mediated heart rate variability (vmHRV) at resting-state has been associated to cognitive functions dependent on cognitive control, such as memory. However, little is known about the phasic interaction between cognitive and autonomic control. In a pre-registered within-between-subject designed experiment, the potential of vmHRV biofeedback to simultaneously stimulate vmHRV during memory processing and cognitive control over memory was tested, along with investigating psychophysiological association. 71 young healthy adults completed (twice) a false memory task in virtual reality. Immediately before memory encoding and retrieval, participants practiced either vmHRV biofeedback or a control breathing exercise. Cognitive control over memory was assessed as the confidence towards false memories and the capability to discriminate them from true memories. Resting-state vmHRV before each test and phasic vmHRV during memory encoding and retrieval was measured as the root mean square differences (RMSSD) in heart period. vmHRV biofeedback had neither an immediate effect on cognitive control over memory nor on phasic RMSSD. Both metrics were associated only under consideration of the resting-state and heart rate values. Cognitive control over memory was positively predicted by parallel reactivity (i.e., change from baseline) in heart rate (ß = .333) and RMSSD (ß = .238) at memory retrieval. In consistence with previous psychophysiological models, the findings demonstrate a link between cognitive and phasic vagally-mediated autonomic control which extends to higher-level cognitive functions such as long-term memory. In this context, memory performance seems to be dependent on tonic and phasic (frequency) components of parasympathetic modulation in response to memory processing.

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