

UC Merced

Proceedings of the Annual Meeting of the Cognitive Science Society

Title

Predicting Cognitive (In)Efficiency: Heart Rate Variability as a Biomarker for Individualized Responsiveness to Aerobic exercise

Permalink

<https://escholarship.org/uc/item/81d3j920>

Journal

Proceedings of the Annual Meeting of the Cognitive Science Society, 48(0)

Authors

Olawuwo, Samuel Olutunde

Demareva, Valeriia

Publication Date

2026

Copyright Information

This work is made available under the terms of a Creative Commons Attribution License, available at <https://creativecommons.org/licenses/by/4.0/>

Peer reviewed

Predicting Cognitive (In)Efficiency: Heart Rate Variability as a Biomarker for Individualized Responsiveness to Aerobic exercise

Olawuwo Samuel

Department of Special Education & Rehabilitation Sciences, University of Jos,
Nigeria

Demareva Valerii

Department of Cyberpsychology, Lobachevsky State University of Nizhny Novgorod,
Russia

Abstract

This research investigates the psychophysiological mechanisms of cognitive regulation, specifically how aerobic exercise modulates the autonomic nervous system (ANS) to influence working memory (WM). The study employed an experimental pipeline with 33 university students (mean age = 22.4), comparing a 15-minute moderate aerobic session to a sedentary control group. Using NeuroKit2 for HRV processing, Wilcoxon signed-rank tests revealed significant reductions in RMSSD and MeanNN ($p = 0.002$), indicating acute sympathetic dominance post-exercise. Furthermore, Mann-Whitney U tests showed a significant statistical gain in WM accuracy for the experimental group ($p = 0.013$), identifying specific HRV metrics (e.g., RMSSD, SDSD) as predictors of cognitive responsiveness. These findings culminated in the UnnMindFlex mobile prototype, which utilizes real-time HRV biofeedback to personalize cognitive training, advocating for individualized pathways to cognitive optimality