

# YOU ARE INVITED TO ATTEND THE DEFENSE OF THE DOCTORAL DISSERTATION

**“The use of pupillary, cardiorespiratory, and gaze dispersion metrics to  
evaluate engagement in healthy adults and adults post-stroke during gamified  
upper extremity neurorehabilitation”**

By

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10:00 AM  
Stanley S. Bergen Building Room 920

**Join Zoom Presentation:**  
<https://rutgers.zoom.us/j/97918335702?pwd=EAEoCZl1msHXdlqCH5hT798ZnxXjeJ.1>  
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## ABSTRACT

Stroke is a leading cause of long-term disability, and high repetitions of engaging and adequately intense motor rehabilitation are essential in maximizing neuroplasticity, motor recovery, and resulting independence and quality of life. Thus, the ability to measure patient engagement to inform therapeutic task parameters and treatment plans would facilitate optimal rehabilitation outcomes, yet engagement is rarely quantified in research or clinical settings. Currently, there is no established objective method to evaluate patient engagement in real-time during rehabilitation, and existing subjective measures of engagement are intrusive to administer mid-task and subject to biases. Autonomic pupillary, respiratory, and cardiac measures, as well as behavioral measures of gaze dispersion, have been shown to be sensitive to psychological state. While existing research demonstrates the use of these measures to evaluate components of engagement in gamified and simulated activities, research is lacking in rehabilitation-specific settings with clinical populations, including individuals post-stroke. Patient engagement in motor rehabilitation is thought to be impacted by the degree of difficulty of the intervention. In this study, healthy adults and adults post-stroke participated in varying difficulty levels of a gamified upper extremity rehabilitation task in order to manipulate psychological engagement; physiological measures of engagement, specifically pupil size, heart rate, respiratory rate, and gaze dispersion, were continuously measured in order to evaluate their sensitivity to changes in subject engagement and assess for differences in autonomic responses of healthy subjects as compared to subjects post-stroke. These physiological measures were also compared to two subjective measures of engagement: the Intrinsic Motivation Inventory and the Instantaneous Self-Assessment. Results support the sensitivity of pupil size, respiratory rate, heart rate, and gaze dispersion measures to changes in engagement during a rehabilitation task in both healthy adults and adults post-stroke. In addition, physiological measures of engagement correlated with subjective measures of engagement, and results corroborate the Instantaneous Self-Assessment as a less intrusive subjective assessment of engagement. Overall, this work supports the use of physiological measures to serve as real-time, objective measures of engagement in individuals post-stroke, pointing to their potential to inform neurorehabilitation interventions and facilitate neuroplastic recovery and improved outcomes post-stroke.