University of Victoria | Graduate Studies

Notice of the Final Oral Examination
for the Degree of Master of Science

of

STEPHEN LUEHR

BSc (University of British Columbia, 2016)

"Learning Without Feedback: Detection, Quantification and Implications of Implicit Learning"

Interdisciplinary Studies

Monday, August 20th, 2018
1:30 p.m.
McKinnon Building
Room 179

Supervisory Committee:
Dr. Olav Krigolson, School of Exercise Science, Physical and Health Education, University of Victoria (Supervisor)
Dr. Adam Krawitz, Department of Psychology, UVic (Co-Supervisor)

External Examiner:
Dr. Gordon Binsted, Faculty of Health Science, University of British Columbia - Okanagan

Chair of Oral Examination:
Dr. Lisa Rosenberg, Department of Chemistry, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies

Abstract

Mounting evidence has suggested that structures such as the anterior cingulate cortex (ACC) and other areas within the medial-frontal cortex are part of a reinforcement learning system responsible for the optimization of behaviour (Holroyd & Coles, 2002). However, we also learn without reinforcement and it has been less clear what neural structures are recruited in these instances. The P300 component of the human event-related brain potential (ERP) has been intensely researched in regards to context updating and the processing of novel stimuli (Spencer, Dien, & Donchin, 2001). Here, I sought to elaborate on the role of the P300 ERP component in implicit learning of stimulus frequencies – learning driven by the stimulus itself and not reward feedback. I propose over the course of three experiments that I have provided evidence indicating that the P300 and its neural sources play a role in feedback-free learning mechanisms. Specifically, in a feedback-free paradigm participants are shown to learn stimulus frequencies. While this occurs, P300 amplitude scales in line with participant behaviour and stimulus frequency. A common trend is revealed in how quickly this amplitude scaling occurs, suggesting further mechanisms are at play. Trial-by-trial analysis ultimately shows that behavioural prediction error formula and neural correlate prediction errors utilize a nearly identical function. These trends hold even in a passive auditory task in which the participant is fully distracted.