



**University
of Victoria**

Graduate Studies

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

of

DREW HALLIDAY

BA (University of Victoria, 2011)

**“Variability in Cortical Haemodynamic Response During Executive Function
Tasks in Older Adults Using Functional Near Infrared Spectroscopy”**

Department of Psychology

Friday, July 15, 2016

1:00PM

Cornett Building

Room B316

Supervisory Committee:

Dr. Stuart MacDonald, Department of Psychology, University of Victoria (Co-Supervisor)

Dr. Mauricio Garcia-Barrera, Department of Psychology, UVic (Co-Supervisor)

Dr. Sandra Hundza, School of Exercise Science, Physical & Health Education, UVic (Outside
Member)

External Examiner:

Dr. John Walsh, Faculty of Education, UVic

Chair of Oral Examination:

Dr. Raad Nashmi, Department of Biology, UVic

Abstract

Variability in neural activity has historically been treated as noise, in favour of deriving estimates based on central tendency (e.g., mean). Recently, researchers have shown that variability and mean confer different sources of information and that increased variability in neural activity is associated with superior behavioural performance and that it decreases during late-life. Although mounting evidence suggests that neural variability is beneficial, it is less clear whether these findings are driven by within- or between-person factors and whether they are apparent during higher-order cognitive tasks. Further, variability can be derived in several different ways, drawing into question its congruence across operationalizations. The present investigation sought to separate within- and between-person sources of variance in order to ascertain what was driving any observable effects in three operationalizations of cerebral oxygenation, computed based on central tendency (mean), variability (standard deviation) and signal complexity (multivariate multiscale entropy). 25 older adults (71-81 years of age) completed two tasks of executive functions while undergoing assessment using functional near infrared spectroscopy. Time-varying covariation models were employed to estimate the effects of cerebral oxygenation on behavioural performance, as well as the moderating effects of age and fall status. Findings suggest that mean and variability are differentially associated with behavioural performance and are increased in older adults at greater fall risk. Whereas mean based computations were positively associated with more accurate and faster responding, variability based computations were primarily associated with faster responding only and occurred in non-overlapping regions of prefrontal cortex. Future studies of neural variability may consider examining within and between-person factors and operationalizing signal complexity in cerebral oxygenation over longer time periods to examine its effects over multiple time scales.