SEAN MCWHINNEY
BSc (Honours in Psychology) Saint Mary's University, 2010
MSc (Psychology & Neuroscience), Dalhousie University, 2013

DEPARTMENT OF PSYCHOLOGY AND NEUROSCIENCE

TITLE OF THESIS:	A COMPARISON OF STATISTICAL METHODS FOR RELATING INDIVIDUAL DIFFERENCES TO EVENT-RELATED POTENTIAL COMPONENTS
TIME/DATE:	9:00 am, Thursday, August 9, 2018
PLACE:	Room 3107, The Mona Campbell Building, 1459 LeMarchant Street

EXAMINING COMMITTEE:

Dr. Harold Baayen, Department of Linguistics, University of Tübingen (External Examiner)

Dr. Steven Aiken, School Communication Sciences and Disorders, Dalhousie University (Reader)

Dr. Thomas Trappenberg, Faculty of Computer Science, Dalhousie University (Reader)

Dr. Aaron Newman, Department of Psychology and Neuroscience, Dalhousie University (Supervisor)

DEPARTMENTAL REPRESENTATIVE:	Dr. Kevin Duffy, Department of Psychology and Neuroscience, Dalhousie University
CHAIR:	Dr. Katherine Fierlbeck, PhD Defence Panel, Faculty of Graduate Studies

ABSTRACT

Evidence suggests that individual differences in cognition can influence cortical processing of language violations, as differences are associated with neural recruitment. Individual differences have been found to affect two ERP components that are commonly referenced in studies of language processing. These are the N400, a negative-going deflection with a central parietal distribution, which is sensitive to violations of semantic expectation, and the P600, a positive response seen to violations of phrase structure. Despite the fact that measurable individual differences might influence the latency and topography of these responses, individual differences in cognition are rarely considered, and the ideal method to account for them in ERP studies has not been explored.

This research investigates limitations in statistical approaches for investigating the relationship between ERPs and individual differences. These analyses use three techniques. First, model selection processes are evaluated in order to circumvent problems associated with multicollinearity among numerous individual difference measures. This includes selection of the measures evaluated, depiction of interactions, and specification of random effects. Outcomes of user-specified parameters in each area are characterized to identify an ideal model selection process for a typical EEG data set. Second, by relaxing the assumption of linearity in interactions we aimed to characterize important details that may be lost when only identifying linear effects. The question of sample size required to sustain nonlinear interactions was addressed by using simulated manipulations of sample size to evaluate the propensity for over-fitting with polynomial functions. Third, a non-parametric approach was used to characterize both response topographies and individual difference measure effects through data-driven means, avoiding the requirement to specify *a priori* regions of interest or proficiency bins for significance testing.

Appropriate use cases and limitations for each technique are discussed alongside recommendations for implementing them into future investigations of individual differences in language processing. Considerations made during model specification, both in terms of effect inclusion and the complexity of nonlinear interactions, may improve sensitivity to subtle effects. Moreover, combined with data-driven selection of scalp regions or proficiency bins, the reader is presented with a means to overcome a number of limitations in hypothesis testing.