Advancing Methods and Mathematical Models of Perceptual Decision Making

by

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B.Psych (Hons I)

A thesis submitted in fulfillment of the requirements

for the degree of Doctor of Philosophy (Psychology - Science)

October 30, 2016
Declaration of Authorship

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- I hereby certify that the work embodied in this thesis contains published papers scholarly work of which I am a joint author. I have included as part of the thesis a written statement, endorsed by my supervisor, attesting to my contribution to the joint publications scholarly work.

Signed:

___________________________________________
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List of Publications

This thesis is based on the following published/submitted work. For each paper I provide the full bibliographic citations in the order they appear in the thesis:


Statement of Contribution

I attest that Research Higher Degree candidate Gabriel Tillman led the manuscripts included in this thesis. Gabriel Tillman made major contributions to each manuscript including, coordinating and supervising data collection, completing all data analyses and model fitting, and served as lead author for manuscript preparation.

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Additional Work

Listed are additional publications and presentations that have relevance to the thesis, but are not included in it:

**Invited Presentations**


**Conference Presentations**


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Abstract

In this thesis I argue that cognitive psychologists can use the combination of sequential sampling models, Bayesian estimation methods, and model comparison via predictive accuracy to investigate underlying cognitive processes of perceptual decision-making. I show that sequential sampling models of simple and choice response time allow for researchers to analyze behavioral data and translate them into the constitute components of processing, such as speed of processing, response caution, and the time needed for perceptual encoding and overt motor responses. I use these methods and models to investigate underlying mental processes related to cognitive load, speech perception, and lexical decision-making. I also show that using different sequential sampling models to analyze the same data can lead researchers to draw different conclusions about cognitive processes, which serves as a caution for carelessly using these models. I also present a novel method that researchers can use to observe cognitive processes unfold online during perceptual decision-making tasks. I then discuss a promising collaboration emerging between researchers in the field of mathematical modeling and neuroscience.
For Lucy and Willow