Statement of Purpose

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I want to pursue a Ph.D to contribute to our understanding of the human mind and how it processes information and make decisions. Through my undergraduate research, I have come to appreciate the importance of mental models and how it relates to the decision making processes and the power of computational techniques in many aspects of research ranging from coding experiments to conducting statistical analysis. During my graduate training, I hope to continue my research in human information processing and decision making, while becoming proficient in computational tools and modeling techniques (that can involve Bayesian and machine learning elements), and in the use of brain imaging tools. I aim to become a professor in this field.

Currently, I am working on my undergraduate thesis project[1] under the supervision of Dr. Britt Anderson. This project explores the relationships between changes in belief, confidence and pupil diameter. My participants were tasked to infer whether the shape or the color of the visual stimuli was relevant when making a decision to go 'up' or 'down', while they indicate how confident they feel that one of the factor is at play. After making their choice, they received a stochastic audio feedback where there was a small chance to be wrong regardless of making the correct choice. I manipulated the participants belief by alternating the relevant factor and I looked at their pupil responses when they made prediction errors. Of interest was comparing pupil response after experiencing an informative or uninformative prediction error. A secondary hypothesis I explored was whether confidence positively correlated with greater pupil response and belief change. This was done by manipulating the stochasticity of the feedback where during certain blocks the chance that the feedback will be unreliable was increased.

In the process of working on my thesis project, I developed a variety of technical skills. I learned to code in Python and use the Psychopy library to code my experiment. I became more proficient with R programming to transform, visualize and analyze data. I applied parallelization to some of my codes to run concurrently with another task or to expedite a process. I learned to use an unfamiliar eye tracker (CRS LiveTrack); familiarizing with its code library and troubleshooting its bugs. And, I became more proficient working in the Unix environment and a variety of its tools.

My research experience started during my third undergraduate year at the University of Waterloo. Before that, I was on a two years leave to fulfill the South Korean military service requirement.

[1] `https://github.com/sjp117/Undergrad_Projects/tree/master/mentalModelUpdatingPupil`

While I was certain that I wanted to continue a career path to become a scholar in cognitive science ever since high school, I used this period as an opportunity to consider my career options (both academic and non-academic) and I invested time to read about many subjects. Ultimately, I decided to return to my undergraduate study with a galvanized will to continue a path to become scholar in cognitive science. After my return, I entered Dr. Britt Anderson's lab as a research assistant and enrolled in a directed studies course on statistics, supervised by Dr. Anna Dorfman.

In the lab, I assisted in two graduate student's projects, both involving eye-trackers (SR Eyelink) and probability learning (PL). The first project investigated whether the manipulation of involuntary spatial attention can influence voluntary spatial attention. This was done by biasing participants to a region of a display with a spatial PL task and analyzing their voluntary attention tendency using a visual illusion; the Tse illusion. While we successfully biased participant to attend to one region of space using the PL task, we did could not demonstrate that this influenced their voluntary attention through the Tse illusion.

The second project investigated what eye movements can reveal about mental model updating. It involved participants learning the distribution shape of how stimuli dots appeared on the surface of an invisible circle. We monitored eye behaviors, such as dwell duration (time spent fixated on a stimulus) and saccade latency (time between stimulus onset and saccade initiation), when stimuli appeared in 'low' vs 'high' probability locations and when the stimuli distribution shape was manipulated ('wide' to 'narrow' and vice versa). We concluded that dwell duration was sensitive to mental model updating as it was longer during surprise, and we found that saccade latency was faster when looking at probable targets in learned distributions compared to unfamiliar distributions.

Through a directed studies course, I became more familiar with R programming through cleaning, mutating, visualizing and analyzing a diary data set. I learned to use packages to conduct quantitative discourse analysis, linear mixed effect modeling, and visualization. I tested my own post-hoc hypotheses on a diary data set that was originally used to explore how people internalize their experience when writing a diary in a self-immersed (first person) or a self-distanced (third person) perspective. Along side my final write up, I created a supplementary document walking through my analysis and visualization process which is openly available in a github repository[2].

[2] `https://github.com/sjp117/Undergrad_Projects/tree/master/mixedEffectModelDiary`