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 how people process information and how it informs their decision making process while becoming more proficient in computational tools and modeling techniques that can involve Bayesian and machine learning elements, and learn to apply brain imaging tools. I believe Yale University is well endowed with equipment, travel opportunities, and faculty members for me to continue my training to become a professor.

Currently, I am working on my undergraduate thesis project[1] under the supervision of Dr. Britt Anderson. My 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 were relevant when making a decision to go 'up' or 'down'. 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 expectations by alternating the relevant factor and I looked at their pupil responses when they made prediction errors. Of interest was the pupil response after experiencing an informative and uninformative prediction error. A secondary hypothesis I explored was whether confidence positively correlated with greater pupil response to informative errors. This was done by manipulating the stochasticity of the feedback during certain blocks.

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. 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 career 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. 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 be-

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

tween 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). Through a directed studies course, I developed my ability to work independently and 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. 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].

It would be my pleasure to continue my training with faculty members such as Dr. Samuel D. McDougle and Dr. Ilker Yildirim. To this point, I explored how people use prediction errors to inform what contingent to attend to when making decisions. With Dr. McDougle, I envision exploring how we can computationally model motor action in the purview of reinforcement learning or other machine learning techniques. It would be fruitful to compare models focused generally focused on cognitive tasks with those that involve motor activity. With Dr. Yildirim, I envision conducting research into how we inform our mental representations (physical or not). What mechanism is involved in differentiating one physical object from another? And what does it take to change our representation of an object? Although I am interested in the mechanism behind learning and decision making, I am not married to it. I am willing to take on a verity of projects, as I see them to be an opportunity to, 1) widen my scholarly perspective, 2) develop a diverse arsenal of tools for future research, and 3) develop an ability to relate my research to a diverse/interdisciplinary field and be able to communicate it to a variety of audiences.

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