

Statement of Purpose

Sungjoon Park (s99park@uwaterloo.ca)

I want to pursue a Ph.D to contribute to our understanding of the human mind and how it processes information and make decisions. Ultimately, I aim to become a professor. Through my undergraduate research, I have come to appreciate concepts such as mental models and how it relates to our 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 the use of computational tools and modeling techniques (that can involve Bayesian and machine learning elements), and brain imaging tools to investigate the neural substrates of these functions of interest.

Currently, I am working on my undergraduate thesis project¹ 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 an 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 of an unreliable feedback 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 Python 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 my initial desire 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 Eye-link) 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 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

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

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 changed (‘wide’ ↔ ‘narrow’). 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 repository².

It would be my pleasure to work with faculty members such as Dr. Darrell A. Worthy, and Dr. Brian Anderson during my graduate training. With Dr. Worthy, I would like to continue my research in learning, belief updating, and decision making. Of interest is how our mind is able to decide which sensory information are relevant to the task at hand. For example, when crossing a road people can rapidly attend to relevant features of the environment. We quickly focus on the movement of vehicles and the pedestrian lights, while ignore bright store signs and loud street performers. In addition, what role does confidence play in probability learning? Is there a meaningful difference between the probability of the prior belief and our confidence in the prior belief? Through my training, I hope to test a variety of learning models and explore their neural substrates.

With Dr. Anderson, I envision focusing on the attentional aspect of my interest and investigate how people narrow down on the relevant environmental features from the bombardment of sensory input. I would like to design an experiment where participants must learn which features of a rich environment are relevant in making a decision and explore how they adapt when those rules change. I would also like to model these adaptive behaviors and explore their neural substrates. While I have my general interests, I am open to investigating different aspects of cognition of devise alternative research questions.

In regards to how I can contribute to diversity and inclusion. I believe I am a fair candidate because of my international experience. Ever since I was born, I had the fortune to live in a variety of countries because of my fathers occupation. I lived in South Korea, the USA, Sweden, Canada, Italy, and the Dominican Republic. I believe I developed a world perspective where I can recognize the nuances between cultures and I lack some of the biases one would possess from living in one location for a prolonged duration. I am also aware of the difficulties experienced by those who lived in constant motion, without a stable environment to develop in; be it by choice or not. However, I admit I lack the perspective of someone who had the opportunity to live in a stable environment and I often find myself enlightened by their experiences. I find myself biased to see my environment to be in constant flux and unpredictable while others might see it as the opposite. While I cannot place a value on my perspectives, I believe it will contributes to the diversity in the institution.

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