[Prompt was removed before submission.]

U of SC personal statement:

Please submit a personal statement with emphasis on the following; why you wish to pursue a degree in Psychology at the University of South Carolina, research experience, specialized classes or coursework that prepared you for graduate studies in psychology, additional experiences and information regarding your financial status that would help us in allocation decisions for financial aid.

[Everything above was removed before submission.]

Personal Statement - University of South Carolina

Nathan Lautz

I have always been motivated by a deep curiosity and a love of learning. Questions about the fundamental nature of reality, about what it means to be human – these have been a driving force in my life. It wasn't until I came across the scientific study of the conceptual system that I had specific focus in this quest for understanding. My everyday life is filled with instances of imputing meaning to experience, yet a thorough understanding of these processes remains elusive. As an undergraduate I was introduced to the field of grounded cognition, which asserts that concepts are (at least partly) grounded in systems for perception and action. This field has captivated my interest since that introduction. Graduate training in psychology and cognitive neuroscience at the University of South Carolina will allow me to not only investigate the frontiers of understanding in this domain, but to advance them through research and theory development.

I have worked hard to attain skills and experiences which will facilitate my graduate work. As an undergraduate at Purdue University I gained a foundation in cognitive neuroscience and neuroanatomy by structuring my course-work to focus on these and related areas. Among other relevant courses, I took a graduate level neuroscience course (Neural Systems) and independent studies into both the cognitive neuroscience of concepts (Readings in Cognitive Neuroscience) and philosophical theories of concepts and mental representation (Theories of Concepts). As an undergraduate I also performed data collection and analysis as a research assistant in social psychology, investigating factors which contribute to the (dis)continuation of close, interpersonal relationships and doctor-patient relationships. In the last two years I have taken a graduate-level course at the University of Cincinnati, become a research assistant at the Center for Cognition, Action and Perception there, and begun my own research into the nature of concepts, all while maintaining my full-time job. In addition I have been independently working through the material of a graduate-level statistics course taught at the University of Cincinnati. These self-driven efforts demonstrate that I have the motivation to work long hours and manage my time effectively towards achieving my academic goals.

As a research assistant, I have primarily worked on a project examining learning in a control task. Participants were tasked with implicitly producing a difficult coordination pattern using an etch-a-sketch style controller. They independently controlled the x and y axes of motion of an onscreen cursor to follow a circling target, either as an individual controlling both

axes or as a cooperating pair, each controlling one axis. We found that relative to pairs, individuals initially showed greater interference from strong intrinsic coordination tendencies, and hence less accuracy. But individuals were able to harness those same strong coordinative abilities for greater learning, performing as well as pairs by the end of the task. I gave a talk about this project at the 2019 Guy Van Orden Student Research Conference and presented our findings as a poster at Midwest CogSci 2019. Through independently studying the literature and regular meetings with lab supervisor Colin Annand, I learned about the application of methods from dynamical systems theory (DST) in cognitive science. DST grounds behavioral explanations in physics-based models of coupled oscillators or complex networks which are context and time sensitive. In the bimanual coordination task, all the same elements, person, controller and task are present in both conditions, but the coupling varies – the neuromechanically coupled limbs of an individual yield initial interference to learning whereas the visually coupled limbs of pairs does not.

Beyond my research assistant role, I conceived and developed an experiment investigating an area of interest to me – the details of motor simulation during tool recognition. Motor simulation in this context refers to activation in action-relevant regions of the brain reflecting simulation of action and manipulation information. Based on the tenets of grounded cognition and using analytical methods from DST, the experiment will provide information about the content and temporal dynamics of the motor components of tool concepts. Participants name images of tools or animals oriented towards either the right or left while I measure the continuous grip force (GF) of both hands (throughout the experiment participants hold custom-built devices with embedded high temporal resolution force transducers). Previous research has established that tool naming induces increased activity in a network of brain areas implicated in hand action. Of interest to me was whether these activation patterns also have implications for overt motor behavior, such as the structure of GF fluctuations. Relatedly, research from the dynamical systems perspective has shown that imposing constraints on human behavior will affect the structure of that behavior, causing a decrease in measures of complexity (i.e. a decrease in measures of scale invariance, or nested self-similarity – fractality in the temporal, rather than spatial, dimension). My collaborators and I hypothesize that the longer time scale task of tool recognition will impose constraints on the shorter time scale dynamics of the GF measure through the shared involvement of hand action networks, causing a loss of complexity in the GF measure for tools relative to animals. Further, based on research establishing orientation specific effects for tool naming and other work establishing the GF sensor as an effective means of measuring motoric simulation during action verb recognition, we hypothesize that naming images of tools oriented towards a particular hand will cause a transient increase in GF in that hand, while naming images of animals will not show this orientation effect (providing evidence that, at least in some contexts, humans simulate interacting with tools in an orientation-specific manner). This experiment should also allow a window into the temporal course of motor simulation. By determining with some precision the time after stimulus presentation at which there is an increase in GF specific to tools we can infer the temporal course of activity in hand-action networks in the brain, and from this infer at what point in conceptual processing motor simulation occurs.

I am in the preliminary stages of first-authoring a paper on this experiment (which is currently in the data collection phase) with my collaborators. As project leader, I gained valuable experience in experimental design, programming, data analysis in R, and, importantly, in collaborating and seeking help as necessary.

In the lab of Dr. Rutvik Desai at the University of South Carolina I would be afforded not only training in multiple methods of cognitive neuroscience, but the opportunity to apply them to research on the nature of the conceptual system. The fact that members of the Desai Lab use methods as diverse as fMRI, tDCS, TMS, and lesion-symptom mapping is appealing for several reasons. Proficiency in these methods will be valuable in future research and career pursuits. Also, it will be fruitful to apply these methods in a complimentary fashion to approach questions in cognitive neuroscience, as they all have unique advantages and disadvantages. Also appealing, Dr. Desai's connection with Dr. Julius Fridrikkson's Aphasia Lab, which I have learned is one of the best neuropsychology labs in the world, will provide the opportunity to study impaired conceptual knowledge and language disorders. Experience in this area will be valuable in my future career, where I will have the background to conduct research with clear health implications and therefore increase my chances of securing funding.

There are several avenues of research I would like to pursue while studying in the Desai Lab. I would like to investigate the representational components of different types of abstract concepts. For example, emotion concepts rely more heavily on interoception and social context than numerical concepts. The tools used in Dr. Desai's lab offer the opportunity to better characterize what systems are involved in grounding various abstract concepts like these. I would also like to research the neurocognitive function of so-called "semantic hub" areas such as the anterior temporal lobes and angular gyri. Other areas of inquiry that I would like to pursue in graduate school are the involvement of intrinsic brain networks in semantic memory, the ways in which meditation research can inform research into the conceptual system, and the intersection of grounded cognition with affective neuroscience and predictive processing.

Coming into the Desai Lab, I will be prepared to begin contributing to research early in my graduate career. I have strong foundational knowledge of functional neuroanatomy and grounded cognition from my undergraduate studies and independent reading. I also have experience designing and conducting research. Further, I will continue to accumulate skills, experiences, and knowledge that will facilitate my contribution to research in the lab. Over the next ten months I plan to complete data-collection and analysis on my current research project and work on getting a manuscript ready to submit for publication, complete the statistics course I have started, and gain additional knowledge of principles and methods of fMRI through the completion of a two-part online course on this topic. Beyond my knowledge, skills, and experiences, I will also bring qualities like passion for the field, maturity, professionalism, dependability, tenacity, and equanimity to my graduate studies.

The University of South Carolina offers the right setting for me to pursue my academic goals. Here I will have access to and training in state of the art tools of cognitive neuroscience and the opportunity to conduct research in one of the best neuropsychology centers in the world. Also, the Experimental Psychology program is designed to explicitly prepare PhD students to be competitive applicants for funding and career opportunities by encouraging starting research early, publications, and attendance at meetings. The conjunction of the experiences, knowledge, and skills I would get in the Desai Lab and the accomplishments encouraged by the structure and quality of the Experimental Psychology program will prepare me to succeed in reaching my goal of securing a career as a researcher at an R1 university.