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**Spring 2013**  
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### **Predicting Success in Language Learning**

Though adults are generally better at learning than children in most domains, the opposite seems to be true when looking at the ability to learn a new language. Past studies have analyzed the relation of cognitive measures in learning languages in children, but little research has been done on the same topic in adults. As there is considerable variability between children and adults in their ability to learn new languages, this is a glaring lack of data that the Gabrieli Lab aims to fill, and, in the process, shed more light on human language.

This research study, titled Predicting Success in Language Learning, is supervised by Professor John Gabrieli and will take place on MIT's campus in building 46, the McGovern Institute for Brain Research. The study will include 50 adults ranging in age from 18-55, with equal numbers of both genders. 8 participants will be used for pilot data, and complete datasets will be collected for the remaining 42 participants. Each participant will complete 9 sessions, from which data will be collected. As a whole, the study will take about a year to complete.

Sessions 1 and 2 include behavioral testing and questionnaires that should take no more than 3 hours each. Session 3 is a pre-learning fMRI scan. In sessions 4-7, participants will undergo training in an artificial language. They will then take a post-learning fMRI scan in session 8 of the study. Session 9 is a follow-up appointment that will be carried out three months later to assess long-term retention.

What this study aims to understand is if and how individual differences in cognitive abilities and brain measures affect an adult's ability to learn a new language and his ability to retain it. It hopes to be able to predict language learning performance based on neural measures and to see whether cognitive measures or brain measures will be the better indicator.

This study has great potential for success for several reasons: 1.) past research has already shown a relation between brain measures and language learning abilities, 2.) a similar approach was successful in predicting video game learning, and 3.) no technical breakthroughs are required to do a thorough study, just a more targeted and optimal application of current methods.

If this study is successful, it will be possible to predict how well a person can learn a new language, and this information could be used to optimize their language training.

As a UROP for this research endeavor, I will have several responsibilities. These include: helping with experimental design; stimuli creation; administration of behavioral sessions; scoring, entering, and analyzing behavioral data; EEG and MRI data collection; and eventual data analysis. Because administering behavioral sessions involves interacting with the participants, I will need to complete CITI training in social/behavioral and biomedical areas in order to get certified to interact with human test subjects. I will also receive MRI training to get certified to assist in working the machines during brain scans and to learn how to collect MRI data. Throughout the study, I will help collect and organize various data and eventually analyze it. All in all, I will be contributing to all aspects of the study, from helping carry out the various experiments and run the different sessions to assisting in data collection and analysis.

I will commit roughly 8 hours a week to this project. Tentatively, I plan to distribute these hours throughout my Tuesdays, Thursdays, and Friday afternoons. If needed, I will also come in on weekends.

I am incredibly excited to be part of this project. I find it particularly interesting because it is a study on human language--something we all use in every day life, but also something that has evolved and has not always existed. I find language to be such a natural and familiar phenomenon that still holds many mysteries and insights into the human brain. I think there's also a lot of philosophy and thought put into language. For instance, the word "happiness" in Chinese is the conglomerate of the words "open" and "heart", which I think is fascinating, insightful, and powerfully concise. I want to better understand how the brain works in linking such words to define another, and in essence, forming a language, and how knowledge of previous languages affect the ability to learn a new one. I think it would be really interesting to explore how differences in brain and cognitive functions affect one's ability to learn a new language. I am also greatly interested in seeing what experiments are done and how they are analyzed in the effort to shed light on human language.

From this UROP, I hope to gain first-hand research experience in the field of Brain and Cognitive Sciences. This is really important to me as a freshman, as it will help me determine whether or not I would want to major in Course 9. I want to gain new insight and skills that will assist me in my future research endeavors. Particularly, this project will teach me how to carry out experiments on human test subjects, run MRI scans, collect cognitive data, and analyze the data to form convincing conclusions about the affect of brain measures on such things as language acquisition. Being involved throughout the entire study will also help me gain valuable knowledge of how research studies are designed and implemented, which, in the long run, will hopefully help me design and implement research in my own distinct interests.