Carleton University | Department of Cognitive Science

AUGUST 2024

RESEARCH SHOWCASE

CONFERENCE PRESENTATION

Canadian Society for Brain, Behavior and Cognitive Science
Edmonton, AB

Functionally localizing language-sensitive electrodes in individual participants with Electroencephalogram

NAYNA KIRUBAKAR
2ND YEAR M. COG. SCI. STUDENT

The conventional approach to EEG data analysis is to average EEG activity of the same channel (electrode) across multiple individuals. This approach is based on the assumption of similar brain anatomy and functioning across individuals and has been recognized as a serious limitation (Luck, 2005). There is ample evidence that our brains vary in their anatomy and functioning (Amunts et al., 2007). To account for this variation, researchers have more recently used the method of functional localization in fMRI studies in which the regions involved in a particular cognitive function for a particular individual are identified using a localizer task (e.g., Jouravlev et al., 2022). We have adopted the method of functional localization to the EEG modality by functionally isolating channels of interest (COI) in each participant using a language localizer task. Further, we examined whether magnitudes of 2 language-relevant ERP components (i.e., N400 and P600) vary when analyzed using the traditional approach vs. a novel functional localization approach. The findings and their implications are discussed

Kirubakar, N. & Jouravlev, O. (2024, June 25-27). Functionally localizing language-sensitive electrodes in individual participants with Electroencephalogram [Conference presentation]. Canadian Society for Brain, Behavior and Cognitive Science, Edmonton, AB, Canada.

NAYNA KIRUBAKAR

LINGUISTIC NEURODIVERSITY (L-NEURO) LAB
SUPERVISOR: OLESSIA JOURAVLEV

Her research focuses on using EEG to functionally localize language-sensitive channels, highlighting differences in the language network activation in individual participants. She loves studying the human brain and is a self-declared "neurd." Always ready to grab a pen and paper, Nayna enjoys visually explaining complex concepts. She believes science should be accessible and fun for everyone and is passionate about knowledge mobilization.

GETTING STARTED

HOW DID THE IDEA FOR THIS RESEARCH COME ABOUT?

It is Dr. Olessia Jouravlev's vision to use the localization method to account for individual differences in brain anatomy and function which results in different regions of the brain showing sensitivity to language-related stimuli. This aligned with my research interest in looking for how langauge is represented in the brain and how it is different in all individuals and hence this project was a great fit for me.

Research conducted ☐ for a class ☑ as part of thesis

IS THIS PART OF A LARGER PROJECT?

Yes! This is part of the MegaLang project. Other researchers in the L-Neuro Lab are also involved in this project which aims to look at the individual differences in how language is represented in the brain using different neuroimaging modalities. We are also interested in seeing if there are any differences in the language network between neurotypical and neurodivergent populations.

HOW WAS THIS PROJECT FUNDED?

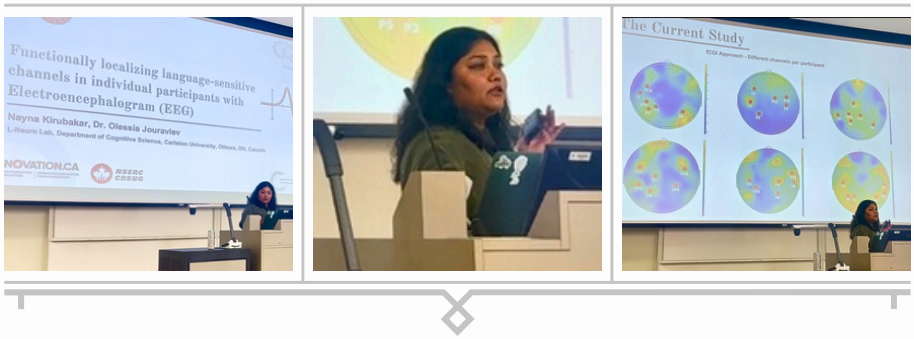
Canada Foundation for Innovation, NSERC, New Frontiers in Research Fund

WAS THIS RESEARCH CONDUCTED WITH FELLOW GRADUATE STUDENTS AT CARLETON?

Yes. Cognitive Science students from the Linguistic Neurodiversity Lab showed interest in the research. They contributed by being involved in the data collection and data analyses.

Research conducted with

- [x] supervisor
- [ ] researchers external to Carleton



DATA & CHALLENGES

HOW WAS DATA COLLECTED?

The participants were recruited through SONA and were required to come to the lab. An EEG cap and electrodes were placed on their scalp and data was collected while they completed tasks.

HOW WAS DATA ANALYZED?

EEGLab and ERPLab (both softwares integrated within MatLab) were used to process EEG data. R Statistical software was used to analyse data.

WERE THERE CHALLENGES TO CONDUCTING THIS RESEARCH?

I think the most challenging part is to make sure that the quality of the data is good and useable. Since EEG is very sensitive to artifacts, we have to take extra care in making sure that there is minimal movement from the participants and that there is no major interference from electrical sources. Our supervisor and lab members have taken every precaution to minimize these potential artifacts, however, sometimes there are motion artifacts and other sources of noise that are unavoidable. Another challenge is also data analyses. Since EEG data is quite big, cleaning the data to remove artifacts is quite a time-consuming process.

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HOW WOULD YOU DESCRIBE YOUR OVERALL EXPERIENCE?

The experience was enriching and fulfilling. It was a pleasure to meet so many other researchers doing great work in these fields. It was a great opportunity to network with researchers from across Canada. I learned a great deal about the work being done in so many different labs. It also provided a platform to represent the lab and the department which was an absolute honor.

WERE THERE CHALLENGES TO PRESENTING YOUR WORK?

I think the presentation itself went smoothly. The talks were well organised.

WILL YOU BE MAKING ANY CHANGES BASED ON FEEDBACK?

Considering that I presented preliminary findings (this is an ongoing project), the feedback was quite positive and the presentation was received with quite a lot of excitement from the audience. This is a new approach that to our knowledge, hasn't been done before. We are aware that novel approaches and projects often receive scrutiny and praise in equal measure. Keeping that in mind, we will do our best with data analyses and try to use robust statistical approaches.

Presentation format: ☐ symposium ☑ talk ☐ lightning talk ☐ poster