The Digest

LANGUAGE AND BRAIN LAB

summer 2021

This special issue of the Language and Brain Lab Digest was made to celebrate two high school seniors that joined the lab for 3 weeks this summer: Alina Vo and Laelim Jung. We were chosen as a site for the Young Scholars Senior Summit (YSSS) program and were tasked with creating a hands-on research-based curriculum to expose our Scholars to what research looks like in the speech, language, and hearing sciences. Alina and Laelim are Scholars chosen by the highly selective Jack Kent Cooke Foundation. They decided to come to our lab to learn more about what kind of science we do and gain practical writing and research skills. Over the course of 3 weeks, Alina and Laelim were introduced to the International Phonetic Alphabet, edited speech files, conducted numerous interviews, read challenging journal articles, wrote one public communication article, and presented on their experience to an audience of 25 people. All of us mentors (Dr. Emily Myers, Anne Marie Crinnion, Cristal Giorio, and Hannah Mechtenberg) were extremely impressed by their dedication, hard work, and curiosity. This Digest features snippets of the interviews they did as well as their two articles. We are so proud of their achievement, and are excited to share their incredible work.

Features

Matt Phillips

Q: What led you to double major in Speech, Language, and Hearing Sciences & Psychology?

A: I came to college planning on majoring speech sciences. I found out that speech therapy wasn't effective and that the field doesn't know much about stuttering, so I wanted to be an SLHS major to help others who stutter. I also wanted to major in Psychology because the Psych department at UConn has a lot of researchers and professors that specialize in language.

Q: Is there a particular topic that kind of blew your mind and if so, what?

A: When I was a freshman, I took a small Speech and Language seminar class. I learned that the correspondance between the acoustic speech signal and the cognitive representations of those speech signals is not 1:1, since we all make the same speech sounds in slightly different ways. Turns out, the brain is flexible enough to take different acoustic speech signals and link them to the same cognitive representations!

Q&A

Undergraduate Student

The following interviews are in order of the academic hierarchy, starting with an undergraduate research assistant and continuing, in order, to a new faculty member.

Graduate Students

David Saltzman

Q: Does a person continue to adapt to individual aggregations such as dialect and pitch even as they age, or is there a particular age or time when that becomes less capable?

A: My dissertation will be on why older adults tend to be worse at understanding accented speech. Once you get to be about 35, some of your cognitive function starts to decrease slowly, such as working memory and processing speed. Once you get to 65+, there are changes that happen in our cognitive capacities as well as the onset of hearing loss.

Nikole Giovannone

Q: Can you describe your research to someone who doesn't have a background in your field of study?

A: When you listen to someone, we contend with many variabilities such as speaking rate, accents, and individuality but we can still recognize each sound when someone speaks. I want to know how can we tell what someone is saying amidst different sources of variability, and why are some people better at understanding these accents and variabilities than others.

Postdoctoral Fellow

Phoebe Gaston

Q: What are some of your responsibilities as a postdoctoral fellow, and what does a typical day look like for you?

A: A postdoc is the last step before being fully independent. Usually there is no teaching, just research, though you still have an advisor. You also get to have a mentoring role with Ph.D students and undergraduates. Right now, I'm not able to collect data (yay pandemic) but I am pretty busy working with old data. In general, there is a lot of reading, writing, and research. I have lots of meetings with students that are helping with several projects and various research groups. Usually a good third of the day is spent on Zoom. The rest of the day is some combination of working on papers and developing new experiments.

Q: How do the fields of Linguistics and Cognitive Neuroscience overlap?

A: Both fields have a lot of variety. Linguistics is “what is the knowledge that allows me to understand when someone talks to me” or “how do we put things together” and “what is stored in people’s heads”. Cognitive Neuroscience is "what areas of the brain are responsible for different functions" and "how does the brain actually do that"? So, ultimately, the perspective of the subject is a bit different.

Q: Is there a particular discovery you made during your research that you found surprising or interesting? If so, what was it?

A: A lot of experiments play people individual words and they just have to listen. This approach is helpful for word recognition, but in the real world there aren’t just isolated words. So, we tried something different by playing audio books to simulate real life speech exposure. There’s a difference between isolated words versus words in a sentence due to coarticulation and potential strategies for word identification. In a sentence, you have no time to wait until the end of the word to start identification, which is why we think our test was closer to real life speech perception!

Q: What advice do you have for other students who are interested in pursuing research?

A: Before applying or choosing a mentor, gain hands-on experience working in a lab or some comparable kind of research experience. See what people in that area actually do all day -- it’s different from learning in a class! And, the people are important. Make sure you’re happy in that environment. Develop a balance between interest in the topic and social comfort. You collaborate on projects and work together, so make sure you like the people and are comfortable in the lab.

Q: What led you to pursue the field of Communicative Disorders and Sciences?

A: When I was in high school, I invented languages for fun in my spare time. In order to do that well, you have to learn about linguistics. So, I started reading Wikipedia articles and took an "Intro to Linguistics" course. Then, I took AP Psychology during my junior year of high school and really enjoyed the language unit. In college, I pursued linguistics and psychology and cognitive science. I then got more interested in Communication Disorders and Sciences (CDS) after reading about how aging affects speech perception and how Parkinson's Disease affects cognitive function. I began studying into CDS to learn more about speech mechanisms of the brain and to also get closer to actually helping those affected by disorders.

Q: If someone was incapable of differentiating between phonetics and dialects, would they be incapable of learning new languages?

A: Theoretically, we need to be able to distinguish sounds from each other to be able to learn new sound categories. There are, however, some things we can do subconsciously and there are experimental paradigms where we can see that people pick up on regularities without being aware of what they're doing. As a take-away, we can learn a new language without consciously differentiating between speech sounds. If someone had a disorder that prevented them from differentiating, it would be a lot harder, but not impossible, to learn a new language.

Q: I heard that you became an Assistant Professor at University at Buffalo. I imagine that you haven't been able to do much. What does your new job look like? What are some difficulties you've had? What are you most excited for?

A: Starting a lab is tough during normal times, but even tougher during the pandemic. My lab space needs renovation, but unfortunately construction has been delayed (the first design meeting was today). I have also had difficulty hiring a lab manager that will start at the beginning of the semester. Besides that, my department has many new professors that are pre-tenure -- which has given me a solid support system. I am absolutely ready to start on my own research, and dive into science outreach and communication!

Christopher Heffner

Assistant Professor at University at Buffalo

to converge or diverge?

by Laelim Jung

As I listened to my interviewer asking questions in her German accent, I found myself strangely speaking in a similar accent to theirs towards the end of the interview. Although I was born in a different country, I've lived in English-speaking communities since I was two. So why was I somehow imitating the accent of a German woman? Similar instances seemed to happen with different dialects. Once I subconsciously imitated the accent of a Polish woman. Another time I imitated the broken English of my parents. At the time, it happened so naturally that I didn't notice until my accent became obvious. For a while I thought it was just a personal quirk, but while scrolling through social media, I found something where another first generation immigrant claimed that she kept speaking in a southern accent for no reason if she was around others. So why does this happen?

When surrounded by others, our speech is affected subconsciously. When our speech becomes similar to those around us, it's called speech convergence. When our speech becomes different to those around us, it's called speech divergence.

Doise, W., Sinclair, A., & Bourhis, R.Y. (1976). Evaluation of Accent Convergence and Divergence in Cooperative and Competitive Intergroup Situations. *British Journal of Social and Clinical Psychology, 15*(3), 247–252. https://doi.org/10.1111/j.2044-8260.1976.tb00031.x

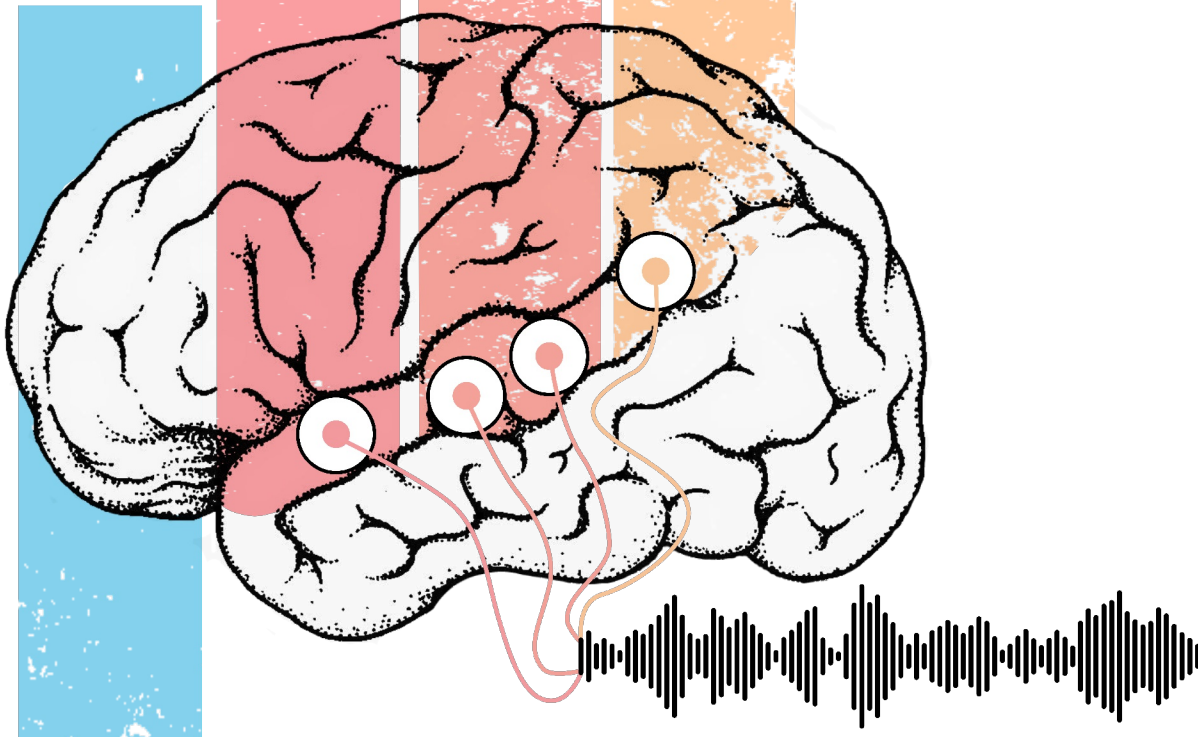
Simple enough? Not really. A huge question remains: why do we do this? Our brains are constantly analyzing words, tones, sentence context, and more in order to understand not only the conversation but also the broader context, including the environment and other surrounding people. In the process of processing this general context, our brains subconsciously make the decision of whether or not we want to differentiate ourselves from those around us.

Have you ever noticed your friend changing voices around their family? This change is another form of speech convergence or divergence. Your friend is analyzing the situation and realizing that their audience and social/power dynamic with their family is different from their dynamic with you. This is causing your friend to shift voices or tones to match what they deem appropriate. For example, your friend wouldn't use casual slang or swear words with their parents, but they might do so around you or other classmates.

In a situation where one might feel that it's beneficial to be more like someone, you might mirror their actions or mimic their speech. However, in a situation where being similar is not in your best interest, one might find themselves differentiating themselves from the other by using different words, different actions, different fashion, etc.

Researchers at the University of Geneva and the University of Bristol conducted an experiment where they recorded two people playing games. In the first game, they were told that they were competitors. In the second game, they were told that they were teammates. In the first game played, the two spoke in their respective native dialects. Their language was harsh and a bit rude, and their word choice was very different from each other. Their tones were aggressive and competitive. In the second game, however, as they worked together, their speech slowly adapted and slowly they both changed their accents to a neutral radio accent, which would be the type of accent used by an announcer or another formal speaker on television. Their speech patterns mirrored each other as well as their word choice and tone. Although this experiment does not necessarily prove to be the same for every single person, it is a good indicator that speech converges and diverges depending on the relationship and atmosphere of the speakers.

Speech convergence and divergence can be both subconscious and intentional. It is a natural response from our brains. So when I was in my interview, my brain must have subconsciously decided that it would be beneficial for me to be similar to the interviewer. My brain had picked up on their speech and made my body mimic it. So the next time you find yourself in new settings, watch your speech to see how it changes. With research and further observation, we will be able to get a better understanding of the brain, language, as well as the adaptability of people and how speech convergence and divergence affects conversation.



from brain to speech

by Alina Vo

On average, people are able to speak approximately 100-130 words per minute and convey a significant amount of information to their listeners. Those who are unable to speak lose their ability to communicate verbally, and thus have more difficulty communicating their needs and having them met. Fortunately, recent developments in speech, learning, and hearing sciences have made it possible for people who were formerly unable to talk to communicate with others.

Just a little over two weeks ago, a paralyzed man named Pancho who couldn't speak for over twenty years, was able to produce intelligible words and phrases simply by trying to say them. He was able to do so with the help of an implant in his brain that connects to a computer program.

The research behind this achievement was led by Dr. David Moses, working with Edward Chang, the chairman of neurological surgery at the University of California, San Francisco. Dr. Moses and his colleagues studied how to figure out what someone is saying just by looking at their neural signals. Some previous work has found that neural signals from the superior temporal gyrus (STG; an area of the brain known to be associated with language) can predict what people are trying to say, but the accuracy of previous techniques has been quite low.

In order to study the brain to figure out what people are trying to say, the research group placed high-density ECoG (electrocorticography) electrodes directly on the brain of three patients with epilepsy (who already needed the surface of their brains to be exposed for epilepsy treatments). They used this high-density ECoG to record neural signals while the patients were talking, and analyzed the neural signals to look for patterns that would be indicative of what the people were actually saying.

While testing these patients, researchers tried to elicit realistic speech. After conducting the experiment, researchers found that they were able to successfully decode the words their participants spoke from the data they received from the electrodes.

Because the researchers were able to use neural signals to figure out what people were saying in naturalistic speech settings (i.e., participants were answering questions as opposed to just reading a list of words), this technology can be used in a real-world setting to assist individuals with communication. The results from the study were an important step in the development of a clinically viable speech neuroprosthesis, like the one Pancho used.

This research is life changing for those like Pancho. Before the electrodes were implanted, he had to rely on a head-controlled mouse to painstakingly type words key by key. Now, simply by trying to talk, he is able to get his message across to others much faster than he was able to before. Researchers are still conducting studies to try and improve certain aspects of this technology. For example, the number of words predicted accurately by the electrode and computer system Pancho is currently using hovers at 50%. Researchers hope to develop implants with more sensitivity to increase prediction accuracy.

Though this research still has a long way to go, it is helping give a voice to those who lost their ability to speak.

Moses, D.A., Leonard, M. K., Makin, J. G., & Chang, E. F. (2019). Real-time decoding of question-and-answer speech dialogue using human cortical activity. Nature Communications, 10(1). doi:10.1038/s41467-019-10994-4

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