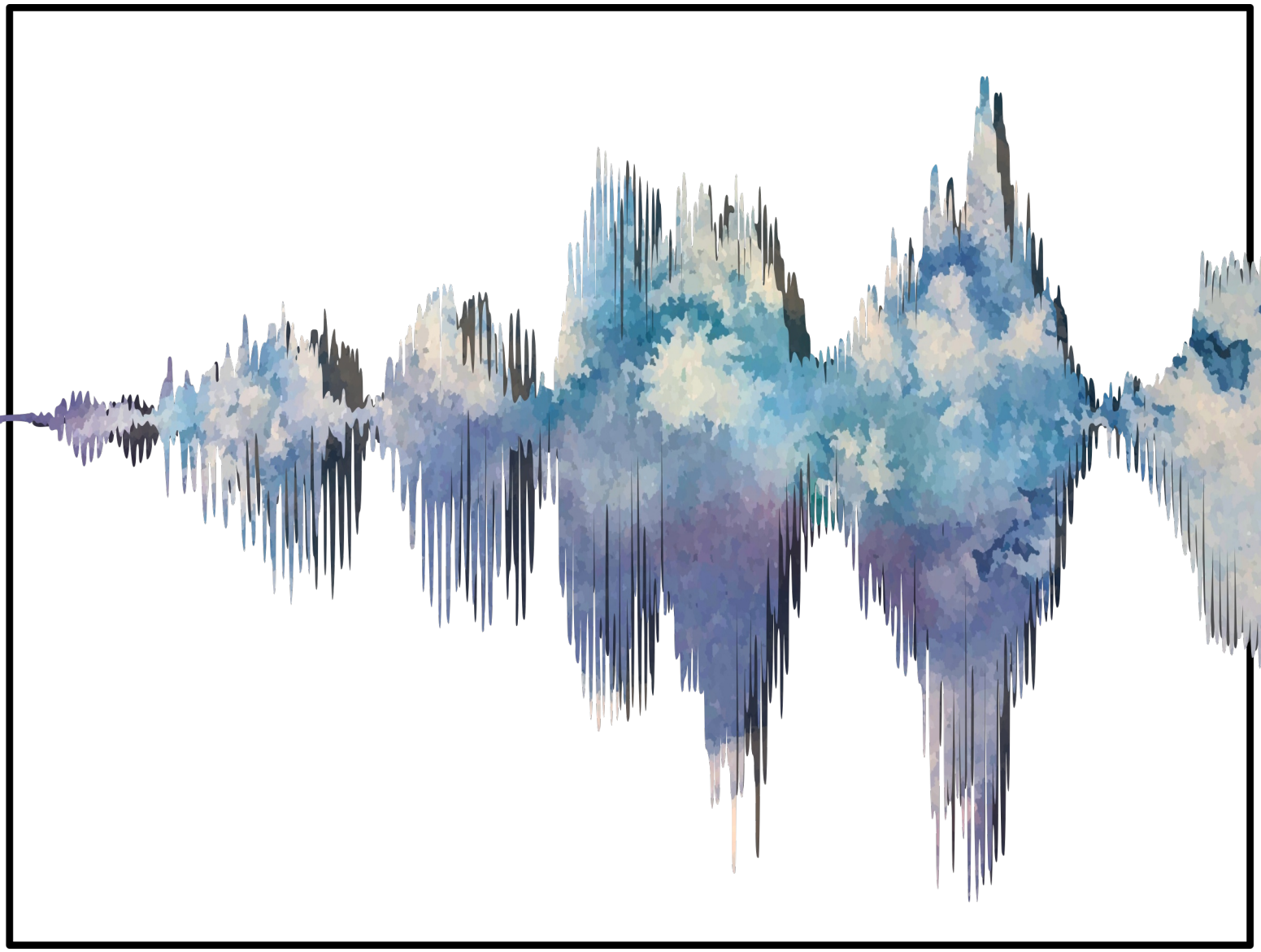
The Digest

LANGUAGE AND BRAIN LAB

spring 2020



practice makes perfect:

treating apraxia

by Triana Feliconio

Apraxia of speech is a motor speech disorder with an impairment in the planning and programming of speech that can often accompany an aphasia diagnosis. When referring to planning and programming think of something as simple as a person throwing a baseball. They need to know where the ball is going to end up so they need to plan which muscles are going to move and when. We do the same type of planning every time we speak! Successful treatment plans are few and far between, unfortunately. **Sound Production Treatment** is a type of apraxia treatment that aims to improve the ability to make difficult sounds.

A recent study led by Dr. Jennifer Mozeiko and colleagues at the University of Connectict gave patients with apraxia Sound Production Treatment for 30 hours over 2 weeks. Evidence suggests that dense, massed practices like this improves progress during aphasia treatment studies, compared to treatments over less time or over a longer span of weeks. The authors predicted that the intensive training would result in improved speech production due to speech and language brain regions being close together and highly interconnected. The goal of the study was to assess the intensive style of treatment by determining if apraxia severity decreases and examining if more repetitions result in better speech production.

One of the participants, "John" (age 51), has mild non-speech apraxia, severe verbal apraxia, and moderate-severe **Broca's aphasia** after suffering from a stroke. After hitting a plateau with speech language therapy, he enrolled in the study. Twelve sounds were selected for John, with one to three sounds given as part of treatment at a time. During treatment, the speech language pathologist says a word containing the selected sound and then John repeats the word out loud. If correct, he repeats the word five times and then moves on to the next word. If incorrect, a similar-sounding word is presented. For example, if the target word is "rat", words like "cat" or "bat" are given to help John find "rat". Additional cues are given until John correctly speaks the word.

John improved in his ability to accurately speak words during and after treatment, as there was an overall upward trend in production accuracy. His performance declined for several of the word lists at the 4-week post-treatment mark, but accuracy bounced back again at the 10-week follow-up. Potential changes in his apraxia of speech severity, were also assessed before and after treatment. Results show a clinically significant improvement in repetition, naming, and sentence completion abilities. His scores on the Communication Effectiveness Index also increased from 46 before treatment, to 78.5 at the second follow-up, with the greatest boost for responsiveness and participation. Overall, John's ratings indicated positive changes in both expressive (speaking) and receptive (listening) conversational cues. John's ability to self-correct also increased (with some variation) until he achieved greater accuracy, which remained stable at the follow-up appointments.

Oftentimes intensive treatments can be too rigorous for a patient, however, clinicians observed that with this treatment John was able to keep up and withstand the rigor. Although decreasing his aphasia severity was not a main target, clinicians observed that it overall decreased. John began treatment being unable to produce most words. He not only improved in production and self-correction, but also gained confidence in his speech.

There are multiple study limitations and additional factors to be considered, but the biggest one to note is that this treatment should be applied to a larger participant group in the future. In conclusion, Sound Production Treatment for a person with severe apraxia and aphasia improved production accuracy relating to repetition and untrained words, increased self-correction, and reduced aphasia severity. These findings are consistent with other studies following the same treatment, giving further credibility that this type of intensive treatment could be beneficial for people with apraxia of speech.

Useful Definitions

Apraxia of speech

A neurological speech disorder that results in a difficulty to perform specific actions. This is due to the impaired ability to plan and program speech sensory and motor commands properly.

Broca's aphasia

A neurological language disorder that results in difficulty in producing language (spoken and written) while the ability to comprehend language typically remains within normal limits.

Sound production treatment

A type of intensive treatment that uses repetition, placement and word cuing, practice, and verbal feedback dependent on responses from the patient.

Definition sources:

asha.org/glossary/

ncbi.nlm.nih.gov/pmc/articles/PMC5961928/

Mozeiko, J., Abolafia, V., Garneau, A., & Coelho, C. (2020). Intensive sound production treatment for severe, chronic apraxia of speech. Aphasiology, 34(9), 1164–1181. 10.1080/02687038.2019.1654083

Kacie Wittke,

M.A., CCC-SLP

speech language pathologist

by Gilian Foley

Q: This is a short background on you! The path that got you to where you are today.

A: My original undergraduate education was not in Speech Pathology; I wanted to be a developmental psychologist. I went to Brandeis University and studied developmental psychology. I taught preschool for a year before deciding what I wanted to do for graduate school. During this time is when I learned about the field of Speech Pathology. I did not know what a Speech Pathologist did, but, one of the students at my school had a repaired cleft palate and so an SLP came once a week to the classroom to work with him. I was very interested by her job! So instead of applying for PhD programs in psychology, I decided to apply for master's programs. I ended up at UConn, graduated in 2011, and worked at Connecticut Children's for a couple of years but I came back in 2014 for my PhD and I have this job too! I am still finishing my PhD but I really missed clinical practice. This position really gives me the best of both worlds, as it's part clinical practice and part teaching.

Q: What would be your biggest piece of advice for someone entering the field of Speech-Language Pathology?

A: For undergraduates, I think it was valuable that my background was not in speech. There is so much in our field that is not discipline-specific. I think majoring or minoring in another discipline is very useful in broadening your horizon. I also think that working in a job that allows you exposure to the population you think you want to work with is worth pursuing. For me, I loved children so teaching preschool was a great thing to do before going back to graduate school. Similarly, if you want to work with adults, then volunteering in a nursing home would be a great position. I am also a huge advocate for not going straight to graduate school. This is my second year supervising students here at UConn and I feel there is a huge maturity difference between those who decide to take a gap and those who go straight to graduate school. It's not required, but I think it's good to give you some real life experience!

Q: What does a typical day look like for you in the clinic?

A: My days revolve around 3 different responsibilities that take up my time from day to day. A third of my time is spent in the clinic with clients with graduate students observing with me. I have a pretty complex caseload so I am pretty hands on with that. The other third is spent meeting with my graduate students one-on-one as they prepare for their sessions and their clinical rating for weekly SOAP notes and reports, etc. The final third would be spent in meetings, classwork, teaching, etc.

Q: What is something you wish more people knew about our field of Speech-Language Pathology?

A: How the scope of our practice is really, really broad. There are a lot of misconceptions about how little people think we do. We do a lot more than people necessarily realize! I think that is why it's an exciting career to enter because you can start out doing one thing but you have the opportunity to change and grow!

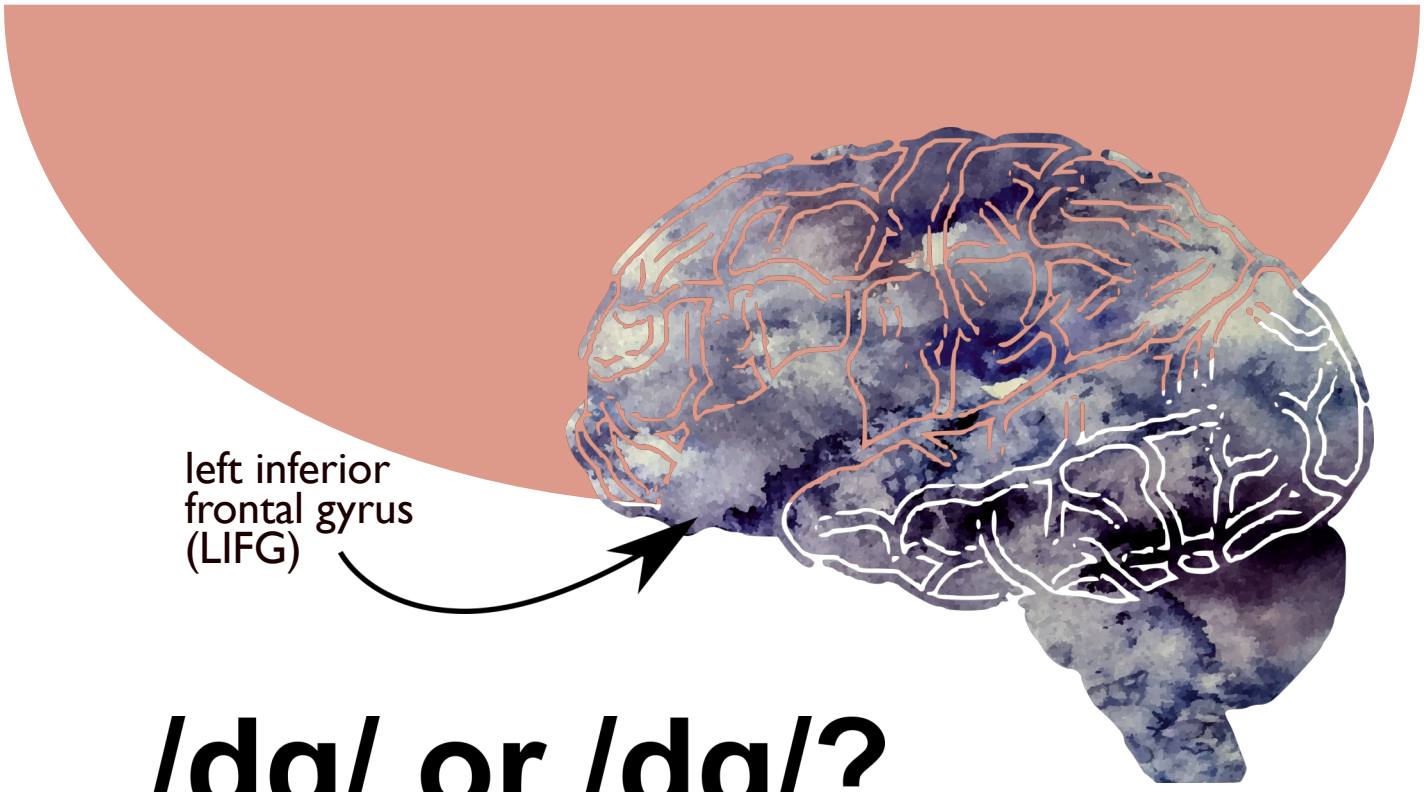
Q: What do you like most about your job?

A: The variety! That's why I picked this job rather than going back to work as a full time SLP. Also, as I was working on my PhD research, I really missed the clinical practice so I knew my next job needed to combine the best of both worlds. I still get a good dosage of both clinical practice, big component of teaching, and some time for research.

Q: If you could create an ice cream flavor based off of an emotion, what would it be and what would it taste like?

A: *laughter* ...did you make that up yourself? I would probably make a flavor of excitement. It would be fruity, a mix of mango and strawberry. A summer flavor!

Phillips Communication Sciences Building, home of the Speech and Hearing Clinic at the University of Connecticut



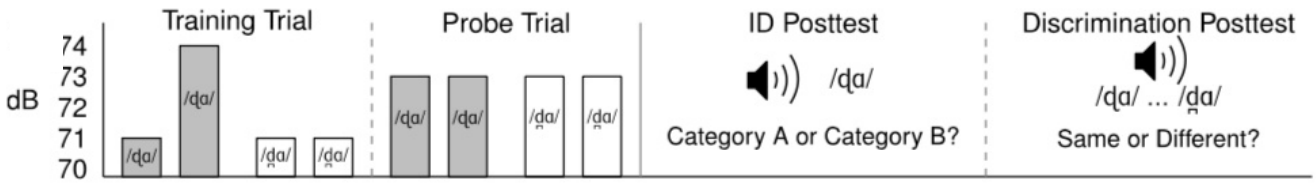
/ɖa/ or /ɖa/?

The role of the **brain** in learning non-native speech sounds

by Xinming Zhou

Globalization is how different parts of the world connect with each other through information, business, and culture. To support global cooperation and communication, it is sometimes necessary for adults to learn a second, or even a third language.

Adults tend to have greater difficulty learning a second language than kids because adults and children likely learn languages through different mechanisms. When kids are born, they are like blank pieces of paper when they start to learn their native language for the first time. They experience many different kinds of novel speech sounds that shape their understanding of language. Adults, on the other hand, are highly familiar with the sounds and patterns in their native language. They tend to



Volume difference of non-native speech sounds by trial test.

Then on the fourth day, participants completed an identification and discrimination test (right two

be anchored to one kind of sound pattern (categories of speech sounds), which makes it harder to learn the new sound pattern in a second language. While we know that there are difficulties in learning a second language in adulthood, the mechanism behind that difficulty is less well understood. Namely, what is the relationship between brain activity and non-native sound categories?

Certain brain areas are used to map the speech sounds we hear onto the categories for both native and non-native speech sounds. For example, we may hear a /ga/ or /ka/ sound. For us to determine whether the sound starts with a /k/ or a /g/, the left inferior frontal gyrus (LIFG) of the brain is likely involved (indicated on the illustration on the previous page). In other words, the LIFG is a brain region that helps us to assess speech sound category memberships. But whether LIFG activity represents access to abstract sound categories or to explicit category labels (i.e., /ka/ or /ga/) is still unknown.

A study led by Sahil Luthra investigated whether the LIFG supports non-native sound categorization when no explicit categorization labels were given to listeners with two experiments. The first experiment provided 20 native English speakers with learning examples to teach them non-native Hindi sounds. These sounds existed on a continuum between two sounds, such as from /pa/ to /ba/. Importantly, listeners were asked to categorize the sounds they heard with arbitrary labels (such as "category A" or "category B") instead of with sound labels. Additionally, participants' brain activity was measured with functional MRI before and after learning.

Results show that participants improved at the volume detection task from day to day, and participants who succeeded the volume task generally did better on the discrimination posttest. The fMRI results showed that LIFG was more sensitive to the speech sound information at phonetic categorical level, which means LIFG is more activated when comparing between category trails (whether the sound is a /k/ or /g/).

The researchers determined that it is not clear whether Experiment 1 provides justification for a strong relationship between non-native speech sound learning and brain activation or whether activation is due to just listening to the unfamiliar sounds. As such, the investigators conducted a second experiment to more specifically test the relationship between language learning and brain activation. They divided 60 participants into three groups. One group of participants completed the same task as in Experiment 1, another group did the same but the task-relevant volume changed, and the third group completed the posttest without an initial exposure to the stimuli. Results of Experiment 2 showed that the brain activation differences between the groups difference is likely due to differences in overall exposure, but not to the development of phonetic categories.

To summarize, the different activation patterns in specific brain areas, such as the LIFG, may contribute to non-native speech sound learning. However, further investigation is still needed to understand the underlying driver of brain activation to know the differences between native and non-native speech sound learning so that people may learn a second language easier.

Luthra, S., Fuhrmeister, P., Molfese, P. J., Guediche, S., Blumstein, S. E., & Myers, E. B. (2019). Brain-behavior relationships in incidental learning of non-native phonetic categories. Brain and Language, 198, 104692. 10.1016/j.bandl.2019.104692

Meet UConn's Speech Researchers

Dr. Rachel Theodore,

Professor of Speech, Language, and Hearing Sciences

Laboratory for Spoken Language Processing

Can you describe your research to someone who doesn't have a background in SLHS or cognitive science?

The specific types of problems we address in my lab are concerned with listening and learning in non-optimal environments, particularly how listeners are able to tune in to these atypical listening environments. One example of this might be having a conversation with someone who isn't a native speaker of your language. When you first start the conversation, you can probably feel yourself working to understand what they are saying, but by the end of the conversation, even if it's only 5 or 10 minutes long, it feels easier and you can almost feel yourself adapting to the unique ways the speaker is talking. This is important to study because it lays the groundwork for addressing some big real word problems, like how do we help people who might have less access to the speech signal process speech, such as those who are deaf or have language impairment.

Dr. James Magnuson,

Professor of Psychology

Computational Cognitive Neuroscience of Language Lab

Can you describe you research to someone who doesn't have a background in psychology or cognitive science?

My research is motivated by understanding how humans process speech and understanding how the typical and atypical speech processing systems work. Another motivation for studying speech processing are the potential technological implications. If you are listening to someone talk who is eating a hamburger in a noisy stairwell, you would adapt relatively quickly, whereas a smartphone's speech recognition ability would suffer right away. If your smartphone encounters a novel accent, that's going to be a huge problem, whereas human listeners usually adapt really quickly.

If we can figure out how humans are so adaptable for speech, there is the potential to make speech technology that would be a lot better and more effective.

by Matt Phillips

Erica Scarpati,

Audiology Doctoral Student
Graduate Student in the
Auditory Brain Research Lab

You are involved in research while pursuing a clinical audiology degree. Why do you think participating in research is important for future clinicians?

I think that every clinician should understand the different aspects of research since it is the foundation of our field and how we treat clients, and I think it's great that at UConn we graduate students complete research capstone projects. Not only does it give students the experience needed to pursue research in the future, but research serves as the basis for evidence-based practice, which is what clinicians value most when treating patients!

David Saltzman,

Ph.D. Student in Psychology
Graduate Student in the
Language and Brain Lab

Why did you choose to study to become a researcher?

I wasn't sure what I wanted to do as a career until I started analyzing and manipulating data in R during my master's program that I realized I had found something that I really found mentally stimulating and actually enjoyed. What I particularly like about the kind of research we do in the LAB Lab is that acoustics are a measurable, tangible quantity. That isn't a luxury all cognitive scientists have, and that grounding in a physical phenomenon is what keeps me interested in the science.

facts from speech, language, and hearing sciences

- Did you know that aphasia does not affect intelligence?
  (aphasia.org/aphasia-faqs/)
- To say a phrase, about 100 muscles of the chest, neck, jaw, tongue and lips must collaborate. This takes coordination of many more neurons than necessary for contracting the muscles in an athletes' foot.
  (wendellfoster.org/learn-some-facts-about-speech-therapy/)
- More boys than girls have a speech or language disorder: 9.6% for boys, 5.7% for girls
  (nidcd.nih.gov/health/statistics/quick-statistics-voice-speech-language)
- 40 million Americans have communication disorders & approximately 36 million Americans have some degree of hearing loss.
  (asha.org/About/news/Quick-Facts/)

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