

The Spoken Word

Language and Brain Lab Digest

2022



From the Editor

This is our seventh issue of the Language and Brain Lab Digest. When I pitched the idea to Dr. Emily Myers back in 2018, I had no idea how much it would grow. The Spoken Word's success is wholly due to the remarkable research assistants who continue to give their time and effort to develop the skill of science writing. It is no small thing to take a complicated experiment or dense academic article and transform it into something that is both accessible and truthful.

This issue also includes articles written by two guests of the Language and Brain Lab, as our lab was a site for the Young Scholars Senior Summit (YSSS) program. Two high school seniors joined us for three weeks this summer and experienced a high-speed crash course in speech science and science writing. Each were tasked

with writing an article for The Spoken Word, and they rose to the challenge. Not only is their writing compelling, but they wrote about scientific topics that were unknown to them mere weeks before.

I am grateful for these writers' willingness to listen to my passionate soapboxes on the merits of science writing for public audiences and my utter disdain of academic acronyms. I am in awe of their graceful acceptance of critique and how their writing bloomed from their first drafts to what is printed here.

I am so proud of what these writers produced for you.

Enjoy,
-Hannah Mechtenberg



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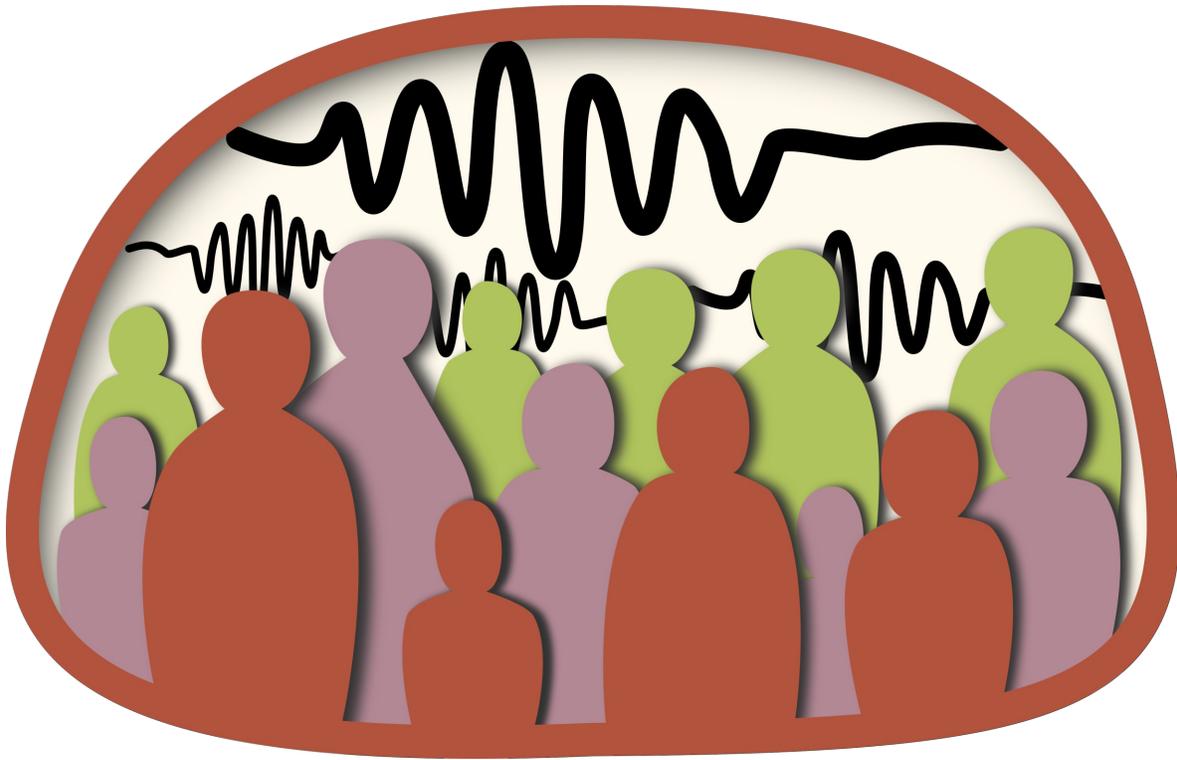
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Beyond the Clinic: Recording Everyday Conversations

by Arden Ricciardone and Cecelia Lickteig

When a person is diagnosed with aphasia, a language disorder that makes it difficult or even impossible to speak and understand others, they will typically begin working with a professional in a clinic to rehabilitate their language skills. Despite clear progress within the clinical setting they may still struggle in everyday life, including with the ability to hold a conversation with a friend. A new piece of technology offers insight into situations where patients may encounter difficulties, helping professionals optimize treatment to better benefit the patient with aphasia.

Following a brain injury or a stroke, it is crucial that a person with aphasia receives treatment to help rehabilitate their language skills. Despite how important this treatment is, it is very difficult for professionals to assess whether or not a particular treatment is actually working once the patient leaves the clinic.

Many reasons contribute to this difficulty, such as how unnatural the environment of the speech clinic is. While a patient may show major progress with their language skills in the clinic, they may still be struggling in their everyday life. This can lead to severe frustration and a feeling of hopelessness for the person with aphasia.

Dr. Jen Mozeiko and Luisa Suting at the University of Connecticut decided to tackle this gap, using a new piece of software, called the **Language Environment Analysis Pro System**. Unlike traditional aphasia assessments, this system allows clinicians to investigate aspects of recovery that involve the individual's natural language environment.

Dr. Mozeiko stated, "What we really want to know is what their environment looks like and how we can optimize that environment so that their recoveries end up being better as a result." This system allows professionals to observe a person with aphasia's language skills in the context of their natural environment, or the environment they most often communicate in.

Mozeiko and Suting tested this system on a patient, named M.M., who seemed to have reached a standstill with her progress with aphasia treatment. M.M. wore the device for two days, and the system recorded all of her speech. The speech was then



Illustration of the LENA device
by Arden Ricciardone

analyzed using software and compared to M.M.'s speech before treatment began. The feedback even took into account many of the emotional aspects of recovery that are ignored in the clinic, such as how M.M. felt after each conversation.

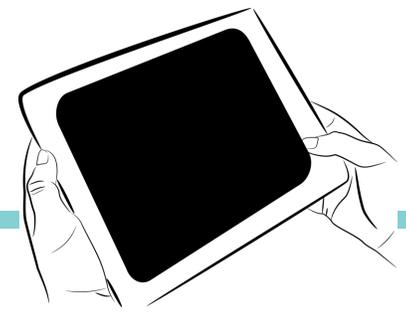
Mozeiko and Suting were able to determine that M.M. improved in many areas that are not typically assessed in the clinic, such as an increase in the number of people she talked to, an increase in small talk with those around her, and a decrease in negative emotions after conversations with others. Typically, these areas of improvement may have gone unnoticed if M.M. was only being assessed within the clinic.

Methods like these can be used in the future to test the effectiveness of rehabilitation efforts in a meaningful and quantitative way. Ultimately, they can bring awareness to how aphasia affects a person's day-to-day life and how treatment can be tailored to help them feel more comfortable and able to engage in everyday communication.



Source: Suting, L. B., & Mozeiko, J. (2021). Analysis of Real-World Language Use in a Person With Wernicke's Aphasia. *Perspectives of the ASHA Special Interest Groups*, 6(3), 553–565. doi.org/10.1044/2021_PERSP-20-00178

Treating Aphasia Remotely



by Matthew Phillips and Xinming Zhou

Treatments for aphasia are typically restorative, meaning that clinical professionals, such as speech-language pathologists, apply strategies aimed at improving or restoring patients' diminished language function. Due to the current COVID-19 pandemic and limited treatment options for aphasia patients, researchers like Michelle Braley are exploring whether remote treatment options may help patients with aphasia recover some of their lost language ability, similar to more traditional intervention approaches.

An estimated 795,000 Americans experience a stroke in their lifetime. Stroke is a chronic disorder in which a blood clot forms in our body's blood vessels and damages the brain. Among stroke patients, more than 180,000 are diagnosed with communication disorders such as aphasia, according to the Centers for Disease Control and Prevention (CDC)¹. Aphasia is a communication disorder that happens when the blood clot occurs in the brain and impacts language function.² Patients with aphasia may exhibit permanent difficulties in producing speech, understanding speech, hearing, and reading or writing. The good news is that, even in difficult conditions such as the pandemic, a recent study indicates that providing aphasia patients with remote treatment is possible and effective.

In 2021, Michelle Braley and colleagues looked into how remote treatment options might be a viable

alternative to in-person post-stroke care. Constant Therapy Research, is a digital therapeutic software program that can be used on a tablet to administer individualized intervention for people with aphasia.

Constant Therapy Research is a highly versatile therapy program, consisting of over 350 difficulty levels spanning nine speech, language, and cognitive domains. This virtual language therapy is especially important during the pandemic when clinicians are limited and in-person intervention may present health risks for both the client and clinician. Patients in Braley's study either received 10 weeks of digital treatment and quick feedback on their speech, language, and cognitive performance or, as part of the control group, completed aphasia intervention worksheets.

The results showed that aphasia severity was lower when people used Constant Therapy Research than in the group that did not receive digital treatment. This kind of treatment may be an option for many people with aphasia to alleviate barriers to treatment, including lack of transportation to in-person therapy, lack of qualified speech-language pathologists to treat aphasia, or concerns about in-person contact stemming from the COVID-19 pandemic or other health issues. 🗣️

Sources:

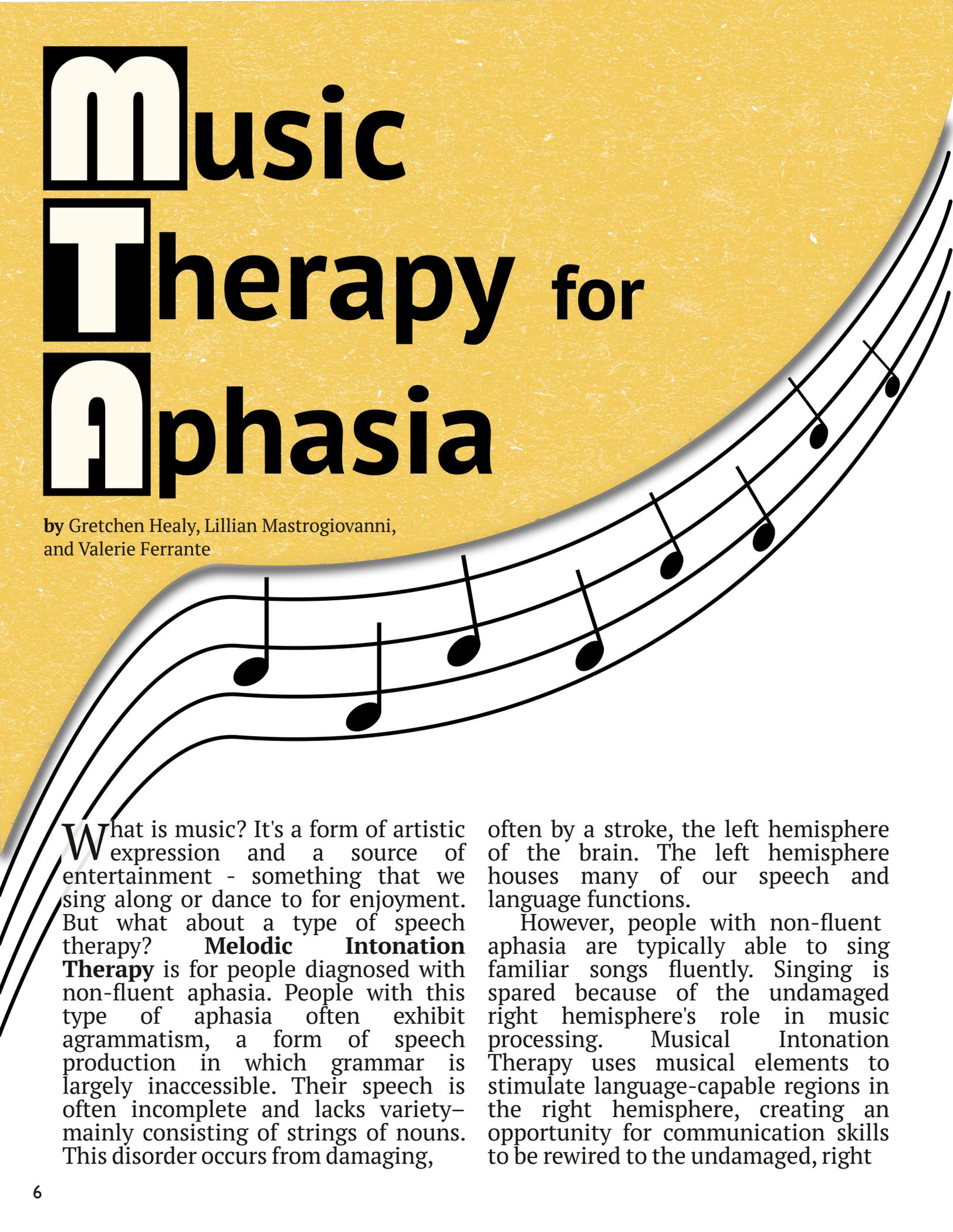
¹ Centers for Disease Control and Prevention. (2021, August 2). Stroke. From cdc.gov/stroke/index.html

² American Speech-Language-Hearing Association. Aphasia. From asha.org/practice-portal/clinical-topics/aphasia/#collapse.7

³ Braley, M., Pierce, J. S., Saxena, S., De Oliveira, E., Taraboanta, L., Anantha, V., Laxhan, S. E., & Kiran, S. (2021). A virtual, randomized, control trial of a digital therapeutic for speech, language, and cognitive intervention in post-stroke persons with aphasia. *Frontiers*.

M T A

music Therapy for Aphasia



by Gretchen Healy, Lillian Mastrogiovanni,
and Valerie Ferrante

What is music? It's a form of artistic expression and a source of entertainment - something that we sing along or dance to for enjoyment. But what about a type of speech therapy? **Melodic Intonation Therapy** is for people diagnosed with non-fluent aphasia. People with this type of aphasia often exhibit agrammatism, a form of speech production in which grammar is largely inaccessible. Their speech is often incomplete and lacks variety—mainly consisting of strings of nouns. This disorder occurs from damaging,

often by a stroke, the left hemisphere of the brain. The left hemisphere houses many of our speech and language functions.

However, people with non-fluent aphasia are typically able to sing familiar songs fluently. Singing is spared because of the undamaged right hemisphere's role in music processing. Musical Intonation Therapy uses musical elements to stimulate language-capable regions in the right hemisphere, creating an opportunity for communication skills to be rewired to the undamaged, right

side of the brain as a person relearns how to speak. But how can communication skills be shifted to the right hemisphere?

Let's start with neural plasticity, or how the brain's connections are able to change. Brains are incredibly resilient and hold the capacity to adapt—functionally and structurally. The main technique of Musical Intonation Therapy is intoned speech, a musically stylized version of normal speech. The patient uses a high pitch for stressed syllables and a low pitch for unstressed syllables, while speaking in a rhythmic pattern. Musical Intonation Therapy also involves the patient tapping out their speech rhythm with their left hand—activating the right motor cortex.¹ This essentially bridges the gap between the language processing regions and the right hemisphere, accelerating progress made during rehabilitation. Through repetition, the patient's brain will eventually use the healthy right hemisphere more in natural communication.

Recent research is focused on what the most beneficial parts of Musical Intonation Therapy are for improving speaking in people with aphasia. For example, when the patient and the clinician sing or speak in unison, there are auditory and visual speech cues that allow the patient to anticipate what comes next. Scientific findings support the benefit of singing in unison, leading to the use of singing in choirs as an effective aid during speech recovery.²

A patient's familiarity with a song also significantly boosts their ability to sing it. Researchers find that highly familiar songs have tight connections between the melody and lyrics in long-term memory.³ Have you ever

sung along to a song you hadn't heard in years and thought to yourself, "how do I remember the words to this song but not what I ate for breakfast?" We have an easier time singing songs we have listened to many times because our memory for that song is strong and our mouths can automatically form the words. Just like we don't forget how to ride a bike, we don't forget how to sing our favorite songs!

A person can develop aphasia in an instant, which changes their lives forever. Communication is an essential part of our identities and roles in society. The impact of aphasia goes far beyond difficulties with language, oftentimes resulting in a worse quality of life, depression, lack of confidence, and social isolation. It is crucial to continue to research and develop innovative therapies to create holistic treatment plans. People with aphasia may feel hesitant to participate in social situations due to fear or embarrassment, which is why those in Musical Intonation Therapy are encouraged to join aphasia choirs.

Local UConn researcher, Dr. Jennifer Mozeiko, started an aphasia choral group in 2016.⁴ These choirs provide a safe space to practice communication skills, socialize, and sing. Together, with music, we can help people recover their language and their voice. 🗣️

Sources:

¹ Kershbaum, A., Nicholas, M. L., Hunsaker, E., & Zipse, L. (2019). Speak along without the song: What promotes fluency in people with aphasia? *Aphasiology*, 33(4), 405–428. doi.org/10.1080/02687038.2017.1413487

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³ Straube, T., Schulz, A., Geipel, K., Mentzel, H.-J., & Miltner, W. H. R. (2008). Dissociation between singing and speaking in expressive aphasia: The role of song familiarity. *Neuropsychologia*, 46(5), 1505–1512. doi.org/10.1016/j.neuropsychologia.2008.01.008

⁴ Galligan, S. (2016, September 16). UConn Aphasia Choir. Department of Speech, Language and Hearing Sciences. <https://slhs.uconn.edu/2016/09/16/uconn-aphasia-choir/>

A Conversation with Dr. Adrian Garcia-Sierra: His Journey into the World of Bilingual Research



Michelle Shavnya

As someone who speaks two languages, I've always felt connected to fellow bilinguals. Although I've rarely met other bilinguals that speak Russian like I do, it appears all bilingual speakers have common experiences when it comes to language. For an undergraduate student like me, research can be both fascinating and overwhelming. This is why I was excited to chat with Dr. Adrian Garcia-Sierra, a speech scientist at UConn who studies bilingualism, and a bilingual himself. I began our conversation by asking how he first came to science...

I was born in Mexico City and lived there until I was 18. Originally, I planned to be a neurosurgeon, but the program was highly competitive and I didn't get in. So, I took a gap year after high school and traveled in the US and Europe, which gave me a new perspective on life. Working with immigrants in a restaurant was one meaningful experience that stood out to me. I was fascinated by the way they mixed English and Spanish in their speech. When I came back from my year of travel, I decided to study psychology.

Hearing about the winding path he took to get into research was fascinating, and I couldn't wait to learn how he transitioned to speech science. Luckily, I didn't have to wait long.



I applied to graduate schools in the United States with the intent of doing research about the brain. I began a Master's degree in neurobiology, [a scientific discipline that studies how cells in the brain, or neurons, work]. Here, I was exposed to speech perception, language development, and how electrical signals in the brain can study them. The idea that a person perceives sounds differently depending on their language background was fascinating. I soon moved to the University of Texas at Austin to get a PhD, where I studied speech perception in bilinguals and monolinguals [people who only speak one language]. Now I'm here at UConn, working on similar projects.

Knowing his undergraduate and graduate experiences, I was curious to hear about his current work. Since research may be regarded as quite abstract and niche, I decided to ask him about the relevance of his work to everyday life.

There are many myths behind bilingualism. A common one is that bilingualism causes language delay, [the idea that children who acquire two languages at once learn language much slower than a monolingual child]. Our research on the brain shows this is not the case. Instead, a good way to describe the situation is that we all have challenges in our lives, and one challenge bilinguals face is that they don't necessarily learn in the same way as monolinguals. They simply take a different path; but it doesn't constitute a delay. I want parents, educators, and policymakers to learn this from our work.

I was surprised so many people thought bilingualism led to a language delay, and found it relieving that Dr. Garcia Sierra's work was trying to dispel that myth. Because I work in the Language and Brain Lab, which does a lot of research on aphasia, a condition that causes individuals to lose their ability to produce or understand speech after a brain injury like stroke, I started to wonder how bilingualism and aphasia may relate. Specifically, I was curious whether aphasia for a monolingual versus bilingual differed, and if so, what those differences could be.

It's been said that when bilingual people recover from a stroke they have better outcomes [than monolinguals] because they lose one language but can still use the other language. I'm not sure that's true. Although most people think bilinguals have two separate language systems, research shows there's competition between the systems. One study looking at bilinguals recovering from aphasia found that the amount they used from the first language they learned was influenced by when they learned the second language. If they learned their second language before seven years of age, performance in both languages was comparable after stroke. If they learned their second language after seven, they mostly used their first language post-stroke. In short, I don't think you have a better chance of recovering [language after stroke] just because you're bilingual, but instead that recovery looks different based on when you learn those languages.

It fascinated me to find out that early details about a person's life could explain their prognosis after a stroke, even though it typically occurs in older adults. The answer also brought me back to the physiological psychology class I was taking at the time. In that course, we learned how the first language and the second language learned are processed in similar brain areas if they're learned relatively early, but they take up very distinct brain areas if the second language is learned much later. It can sometimes feel like the classes I take are so disconnected from each other and from real life, so it's exciting when I can connect the dots.

I thanked Dr. Garcia-Sierra for his time and detailed, insightful answers to my questions. Unfortunately, the pandemic made an in-person interview impossible but I'm grateful we could do a virtual interview. In addition to knowing more about the bilingualism research being conducted at UConn, I was now inspired to use my personal experiences to shape my future, just as Dr. Garcia-Sierra has done. 🗨️



Unfolding the listening brain

Differences in brain structure predict differences in the ability to learn the sounds of new languages.

by Lane Perkins and Kim Kabulis

Dr. Pamela Fuhrmeister and Dr. Emily Myers at the University of Connecticut recently discovered that individual differences in the ability to learn sounds from foreign languages is linked to differences in brain structure. They used magnetic resonance imaging (MRI), which allows scientists to look inside the skull and image the brain, to capture high-resolution pictures of brain areas related to speech processing and memory formation.

We already know that diligent day-to-day practice helps you learn the sounds of a new language more quickly. This study gives us a better idea of how and why some people have an easier time learning languages. Dr. Myers noted that "people vary hugely in [language learning], even when they try very hard." This new information, that the structure of specific brain regions relates to the learning of unfamiliar speech sounds, can help in the development of new methods for teaching and learning languages.

What makes languages different from one another is not only the words they use but also the basic sounds that make up these words, called phonemes. The catch is that it becomes harder to hear the sounds of other languages as you age. Hence, most adult native German speakers can no longer hear the difference between "w" and "v" sounds, in the same way that adult native Japanese speakers cannot hear the difference between "la" and "ra."

Drs. Fuhrmeister and Myers found that more surface area in the hippocampus, which is responsible for learning and memory, and the part of the brain that processes spoken words predicts your ability to learn the sounds of a new language. The surface area is the amount of space that the brain would take up if you were to lay it flat on a table. Specifically, in the part of the brain that processes spoken words (the auditory cortex), people who were quick to learn the sounds of a foreign language had more surface area in the left auditory cortex, perhaps because they were better at hearing subtle differences between sounds.

The applications for this research are exciting, especially for teachers who want to understand why some students progress faster than others when learning a new language. These findings also inform learners of a second language. Instead of feeling frustration, learners know that their differences can come from many places—even the brain.

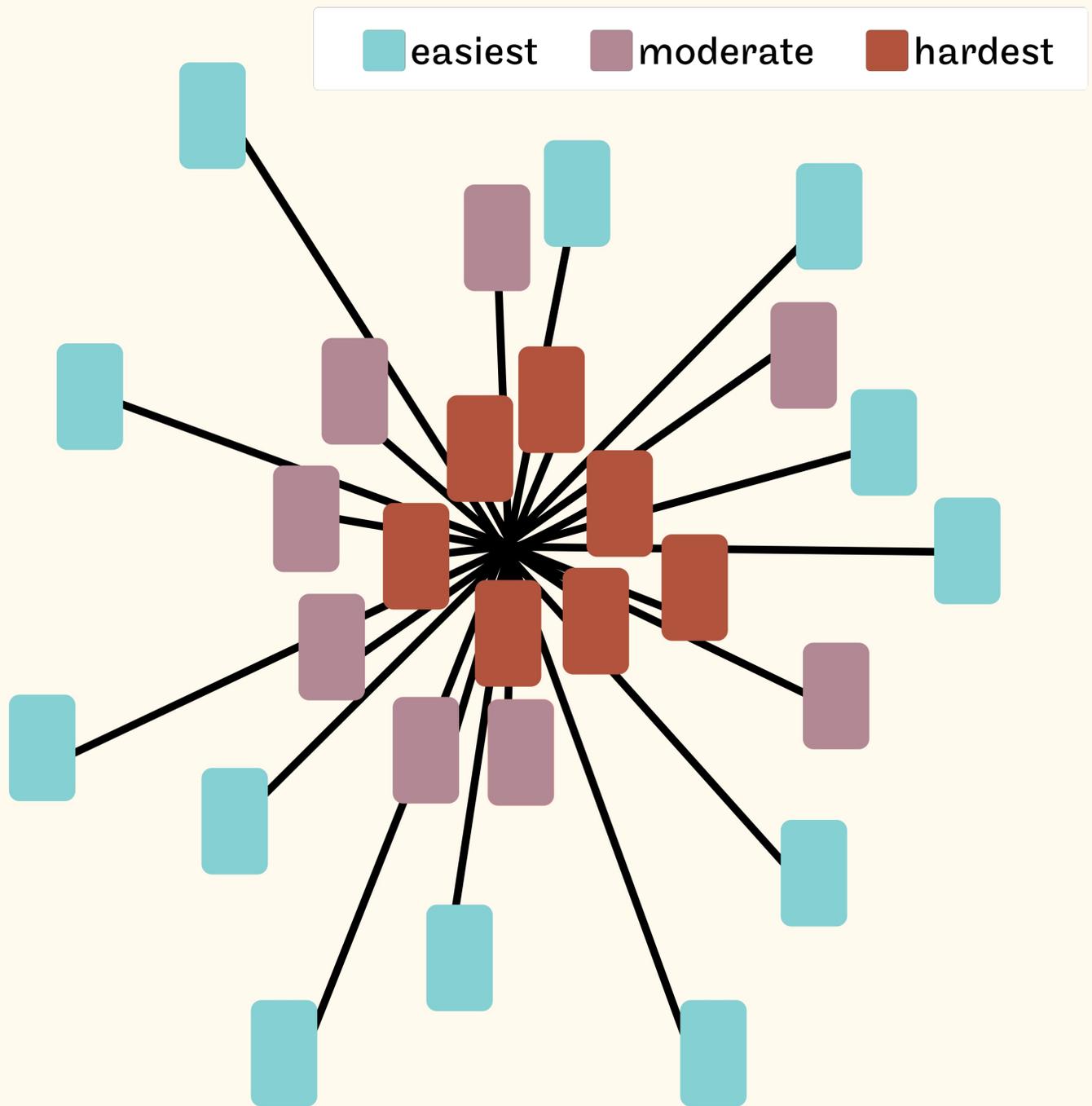
"I think it is good to understand that people come with different sensitivities to learning situations, whether it be in the classroom or the clinic," said Myers. "You may have to spend more time on different aspects of training to get them to the same level." 🗨️

Source: Fuhrmeister, P., & Myers, E. B. (2021). Structural variation in the temporal lobe predicts learning and retention of non-native speech sounds. *Language, Cognition, and Neuroscience*, 37(1), 63–79. doi.org/10.1080/23273798.2021.1944658

Top Down vs. Bottom Up

Choose Your Own Speech Adventure

by Isabel Gray



A study published by Hannah Mechtenberg, Dr. Xin Xie, and Dr. Emily Myers in 2021 at the University of Connecticut found that the easier the words in a sentence are to predict, the less the individual speech sounds matter in comprehension.

The researchers used fMRI (functional magnetic resonance imaging) to measure brain activity while people listened to spoken sentences. They wanted to explore how sentence context impacted participants' sensitivity to ambiguous speech sounds.

Phonemes are the sounds that make up words. The words "cat" (c-a-t) and "shine" (sh-i-ne) each have three phonemes because they are made up of three distinct speech sounds. Similar speech sounds (such as 'ba' and 'pa') can cause different words to "compete" for recognition. For example, the words "peach" and "beach" sound very similar. Ambiguous phonemes are more challenging to process and increase activation of parts of the brain sensitive to processing speech sounds.

Other sources of information like vocabulary and semantics (meaning) can compensate for phonetic ambiguity by filling in the gaps of garbled speech with context to supplement understanding. We can understand common phrases regardless of how clearly the individual sounds are pronounced.

We also use our knowledge of what are and are not words to guide us towards the intended word. Following the example above, if someone asked you, "do you want to go to the /?/ each?" you would understand that "beach" would make much more sense than "peach" based on the context. And, you would never guess that

someone said "keach" because it's not a word.

Ultimately, the study supports the idea that highly-predictive sentences counteract confusion caused by speech sound ambiguity. If people hear a predictive sentence like, "he put a saddle on a horse," they will easily understand the word "horse" regardless of unclear pronunciation because of the context provided by the preceding words (and not have to spend much time identifying the individual speech sounds).

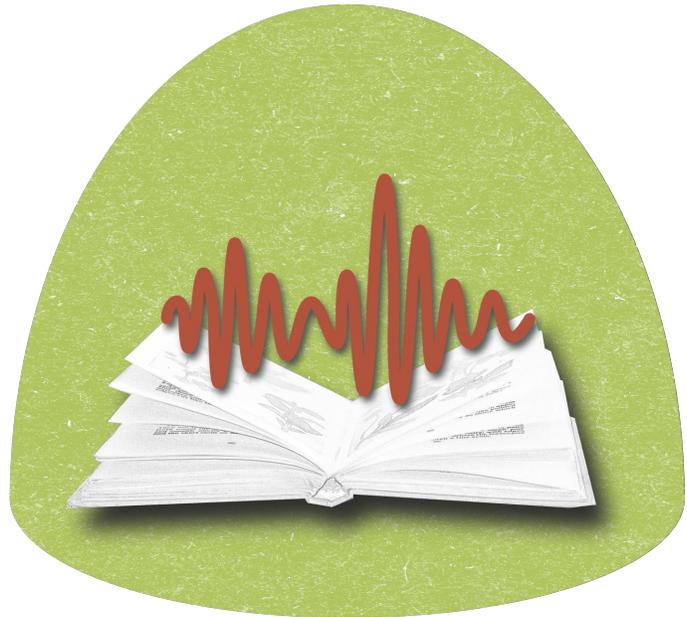
A non-predictive sentence, on the other hand, has an indiscernible pattern and cannot be interpreted as easily, especially when the speech sounds are ambiguous. An example of a non-predictive sentence is, "I broke the shed by the tree." If any one word were slurred or spoken unclearly, a participant would struggle to figure out what the word is, since sentence context isn't helpful.

Our brains are so good at recognizing patterns that individual sounds and words are sometimes less important than the main idea of a sentence. Try mixing up a similar-sounding letter or phoneme (like a "b" for a "d") and see if anyone even notices. Most of the time, a well-structured sentence can camouflage any altered sound.

Think about how you can still understand people with different accents, even though the way they produce speech sounds does not match your own pronunciation. We tend to prioritize top-down processing (context) above bottom-up processing (sound) in understanding speech and discerning meaning. 🗣️

Source: Mechtenberg, H., Xie, X., & Myers, E. B. (2021). Sentence predictability modulates cortical response to phonetic ambiguity. *Brain and Language*, 218, 104959. <https://doi.org/10.1016/j.bandl.2021.104959>.

The Healing Power of Book Clubs



by Zachary Hessler

Powerful stories bind us together. Readers everywhere are gripped by suspenseful murder mysteries and inspired by beautiful poetry. Sadly, some people are involuntarily locked out from these stories as a result of damage to the brain. To the rescue is an unassuming hero to help people regain the ability to comprehend written stories and to create supportive social groups: the book club.

According to the National Aphasia Association, over 180,000 new cases of chronic aphasia (language impairment lasting for six weeks after the initial trauma) are diagnosed per year in the United States alone.

People with aphasia often struggle with social isolation as a result of their lost language ability, slowing recovery. However, when we socialize, the learning process becomes more dynamic. Social support during recovery can improve independence and, as it turns out, the rehabilitation of language ability itself.

Following a stroke or other traumatic brain injury, patients begin working with a speech-language pathologist to

support the language recovery process. Patients typically make extraordinary progress immediately following the brain injury—known as “spontaneous recovery.” Unfortunately, despite initial leaps forward, progress typically slows and even stalls.

UConn’s Dr. Jennifer Mozeiko does social aphasia research and rehabilitation, and even hosts several aphasia bookclubs on campus. Her experience and emotional connection with people with aphasia results in a distressing but urgent reflection: **“They [people with aphasia] can be discharged, essentially abandoned, by the healthcare system after just several months of therapy, often because of their insurance.”**

While speech-language pathology is expensive and time consuming, we cannot abandon those in need. In response, some researchers are investigating the potential of group learning (e.g., book clubs) as an economical and meaningful continuation of language recovery in a social context.

Evidence supporting the efficacy of aphasia book clubs is growing. In

August of 2019, Drs. Kelly Knollman-Porter and Samantha Julian published findings illustrating the personal and language comprehension-related benefits of aphasia book clubs.

What started as a daunting task (9 out of 10 patients reported fears related to negative social stigmas) evolved to become a space for support for participating people with aphasia (half reported improved social engagement). Further, 90% of patients chose to continue meeting after the study ended.

Drs. Knollman-Porter and Julian were especially excited by how the book club benefited language recovery throughout the course of the study; six participants regained the ability to read on their own. Especially compelling, one participant reflected on how re-engaging with books renewed his interest in expanding social acceptance for people with aphasia.

Reading allows us to navigate the world and advocate for ourselves. Beyond simple rehabilitation of skills and practices, aphasia book clubs make thousands of stories accessible again. All people deserve the right to be motivated, inspired, and engaged by literature. Investing in book clubs to ignite such a purposeful recovery for people with aphasia is not only powerful but necessary. 🗣️

Sources:

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Interested in participating in language research?

At the UConn Language and Brain Lab, we're always **looking for participants** (age 18 and over). We're making a list of **adults** who may be interested in participating in our studies in the future.

You can sign up to be contacted about future studies by completing a **brief survey** on our website or contacting us directly.

There is no payment for completing the survey, but you may qualify for future studies that compensate between \$15 and \$30 an hour.

To find out more:

Visit our website: myerslab.uconn.edu

Contact us at: **860-486-0931** or uconnmyerslab@gmail.com



Follow to survey and more information

Looking for people with aphasia to help with language research!

At the UConn Language and Brain Lab, we're **looking for people** (age 18 and over) who have been diagnosed with **aphasia** and may be interested in participating in research.

You can sign up to be contacted about future studies by completing a **brief survey** on our website or contacting us directly.

There is no payment for completing the survey, but you may qualify for future studies that compensate between \$15 and \$30 an hour.

To find out more:

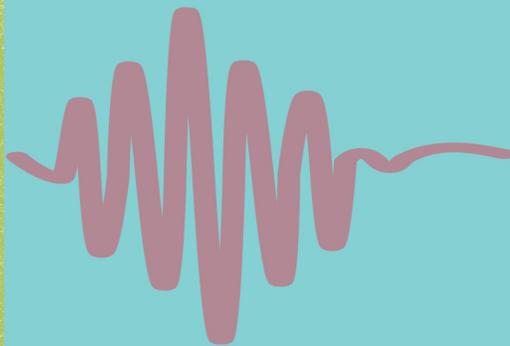
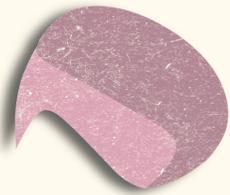
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Note from the Principal Investigator

When Hannah Mechtenberg started the Language and Brain Lab Digest in 2018, she wanted to help our lab stay in touch with participants. We wanted our research volunteers to see how their time could pay off in exciting research discoveries. Under Hannah's leadership, this publication has evolved to be so much more. Not only do we have a chance to share groundbreaking research from UConn and elsewhere, the students who work on the publication learn how to write about science in a way that inspires and educates. We're proud to share this labor of love with our UConn community and anyone who wants to learn more about speech and language.

Dr. Emily Myers, PhD
Director, Language and Brain Lab



LANGUAGE AND BRAIN
LABORATORY

