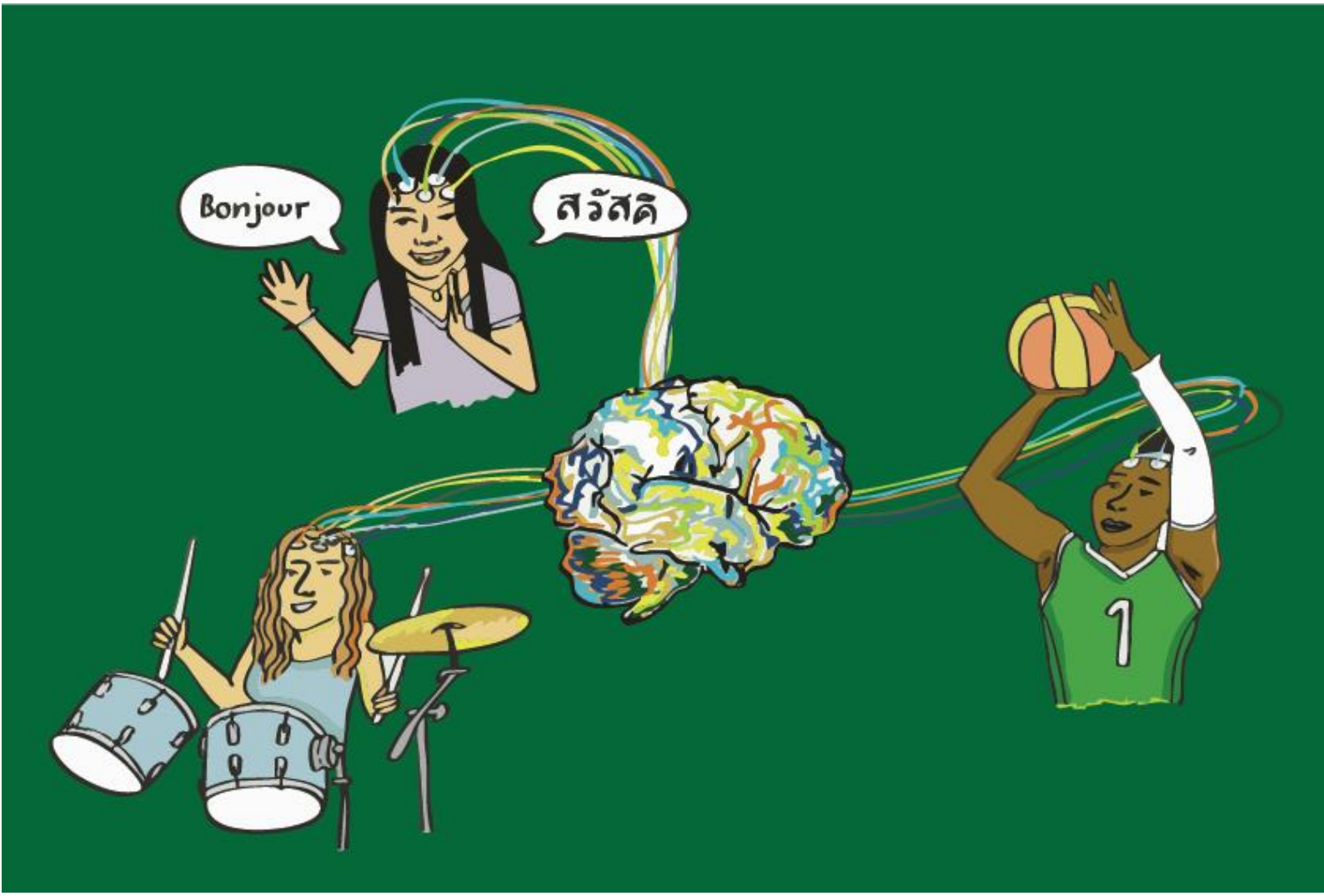
brainvolts

Auditory Neuroscience Laboratory

2025 Holiday Newsletter

brainvolts.northwestern.edu



KRAUS LAB

Dear Friends of Brainvolts,

I took some time away from Brainvolts this Fall because of a health scare. I am writing this just after Thanksgiving, realizing what I'm most grateful for are the loving, capable and devoted people around me. I'm so proud of Jen, Trent, Silvia, Joe, Charlie, and Gabriel, who have continued the lab's work apace. That the people ARE the lab is clearer to me than ever. I look forward to resuming a more active role in the new year. This experience has attuned me to music's healing force not just as a scientist, but also on a personal level.

Every year, as we settle into short days and long nights, I find myself reflecting on powerful things we cannot see. I am especially drawn to the profound spiritual role that music plays. This idea has been finding its way into the book I am now working on. Of Sound Mind was my love letter to sound. This next book is my love letter to music. Considering music as a wide-reaching and essential force in nature helps illuminate its biological roots, its healing power, and its soul.

This perspective has only deepened my commitment to understanding how listening to and making music shapes us. Toward that end, Brainvolts is launching projects that you can read more about below. In one, we observe the biological effect of music that can induce listeners to enter a trancelike state. In another, we gauge the impact of music-making on deaf and hard of hearing children.

I dream that one day the standard treatment for hearing loss will include not only a hearing aid or cochlear implant but also a music teacher. At Brainvolts, we are working to discover whether science supports this vision—and how music might become an integral part of care for people with hearing challenges.

In 2025, I joined a local choir which is accompanied by a renowned organist playing a renowned pipe-organ. This helps me understand how we listen with our entire body. As we approach the new year, I am renewing my commitment to becoming a better listener and to sharing my insights along the way.

Nina

Jennifer Krizman, Trent Nicol, Silvia Bonacina, Charlie Culbert, Jenna Cunningham

Students: Joseph Luetkehans, Gabriel McDerment, Isabelle Reynolds, Jubilee Chen, Anika Kaushikkar, Nischal Chakravarthi, Sinziana Lazar, Olivia Black, Joy Chiang

Artist collaborator: Katie Shelly

Publications

Kraus, N. & Bonacina S. (2025) La musica ed il nostro cervello: i fondamenti biologici del processamento del suono. In Rizzo A.L. & Spadolini A., Musica E Compensazione Dei DSA. *Proposte Didattiche tra Neuroscienze e Ricerca Evidence Based*. Rugginenti.

Lau, J. C. Y., Guilfoyle, J., Crawford, S., Johnson, G., Landau, E., Xing, J., Kumareswaran, M., Ethridge, S., Butler, M., Goldman, L., Martin, G. E., Zhou, L., Krizman, J., Nicol, T., Kraus, N., Berry-Kravis, E., & Losh, M. (2025) Prosodic Differences in Women with the FMR1 Premutation: Subtle Expression of Autism-Related Phenotypes Through Speech. *International Journal of Molecular Sciences*. 26(6), 2481

Nina Kraus (2026) Rhythm: Inside and Outside the Head. *In: The Rise of Rhythm Studies: Mediating Dimension, Discipline, and Scale*. Mark Lussier and Richard C. Sha (eds). (Bloomsbury, 2026)

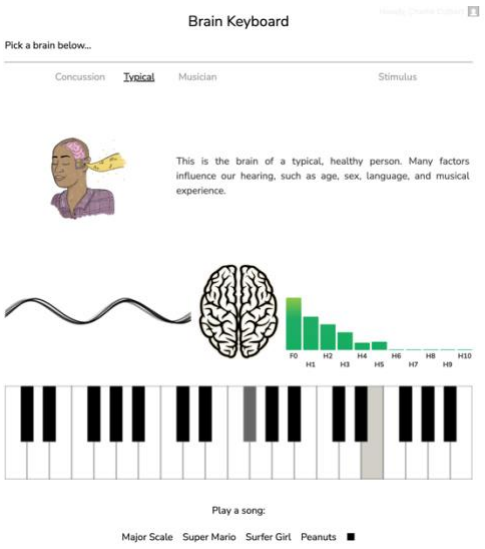
Brainvolts 2025 by the numbers

- 10 talks
- 2 keynotes
- 3 podcasts & interviews
- 3 publications
- 1 poster presentation

2025 Highlights

Play the Brain Keyboard online

The Brain Keyboard, our program that transforms neural responses to music into playable sounds, has been made public. You can access the [public version of the keyboard] on our website to play the brain yourself and to listen to a selection of typical brain responses.



Featured in this version are 2 new visualization methods we've developed this year: a segmented waveform view which displays the periodic consistency of responses (to the left of the brain), and a harmonic component analyzer which conveys the relative strengths of harmonic components in the response (to the right of the brain).

In addition to the public version of the keyboard, we continue to develop the brain keyboard as a research and demonstration tool. Looking forward, we have been experimenting with recording drum sounds in addition to our usual piano sounds. This may lead to something like a brain drum set to accompany our keyboard.

The keyboard is a great way to share our understanding of how the brain processes music and inspire audiences to think about their own brain through sound.

Investigating the York Tuba

This year, we met with Chicago Symphony Orchestra tubist Gene Pokorny. Sam Quinones, author of *The Perfect Tuba*, introduced us. The subject of our meeting was the two York tubas, on which Gene regularly performs. York tubas have been revered and copied repeatedly for their unique sound over the years — they could be considered analogous to the Stradivarius of tubas.

We made extensive recordings of one of the York tubas (the other was out of commission – they are regularly being repaired), as well as a Yamaha replica of the same tuba. We analyzed their sonic characteristics to better understand what makes them special, and how the replica compares to the original. Pokorny describes the York sound as 'grainier' -- a feature

evident in our analyses. Contrary to the harmonic purity we expected to find, both tubas were equally harmonically rich and pure, but the York sound was acoustically noisier.

We plan to make more recordings in the future and perhaps do some FFR based trials to further understand the beauty of these instruments.

Of Sound Mind Dialogues Video Series

Of Sound Mind Dialogues is a series of conversations between Nina Kraus and clinician Garrett Oyama, discussing Nina's book, *Of Sound Mind: How our Brain Constructs a Meaningful Sonic World*. Find episodes 1-6 on our YouTube playlist.

These discussions are an excellent way to continue exploring the ideas shared in *Of Sound Mind*, or to dip your toe in if you've yet to read it. Garrett Oyama is a speech-language pathologist, brain enthusiast, researcher, and musician.

The Brainvolts website grows & a renewed website tour!

We have done lots of work on our website this year. When you visit our homepage at brainvolts.northwestern.edu you may notice a few newly added areas of research, such as HIV and the Brain Keyboard. In addition to these newly published pages, we have updated our website tour. The tour is a video which takes you through every page in our site in only a few minutes. It's a great way to familiarize yourself with the layout of our site.

Take the tour here!

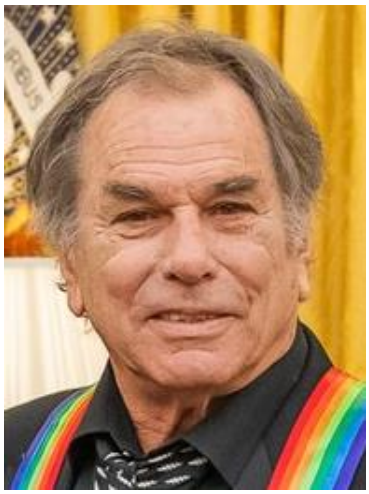
Dr. Borna Bonakdarpour: Musical benefits for people with Alzheimer's disease

This summer brought exciting news from our colleague at Northwestern Memorial Hospital, Dr. Borna Bonakdarpour. He received an NIH grant to explore how music can help reduce anxiety in people with Alzheimer's disease (AD). Anxiety affects about 40% of people with AD, lowering quality of life and adding stress for both patients and caregivers.

Brainvolts is thrilled to join this project by contributing our objective neural measure of auditory processing to complement the clinical, physiological, and neurophysiological assessments that Dr. Bonakdarpour's team will conduct. Participants will take part in eight sessions of Clinically Designed Improvisatory Music (CDIM), involving live-improvised music featuring gentle rhythms, calming silences, and flowing melodies within the range of the human voice.

A unique aspect of this study is that it will look at stress reduction and auditory processing not only in individuals with AD, but also in their caregivers. We're excited to get started soon and look forward to sharing updates as the work unfolds!

Drone Research Collaboration with Mickey Hart



Through her work with the NIH/Kennedy Center SoundHealth project, Nina has formed connections with many musicians, including Mickey Hart, best known as a drummer for the Grateful Dead. Recently, Mickey has become a passionate advocate for drone music, a minimalist style built on sustained tones and subtle harmonic shifts. He believes in the power of the drone to calm the mind and open new states of awareness.

After many lively conversations with Nina about how music shapes the brain, Mickey teamed up with Brainvolts for a new experiment exploring how listeners' brains respond to three of his original drone compositions.

To make sure the sound experience is as immersive as possible, Mickey generously outfitted the Lab with a set of high-end Meyer Sound speakers which we selected in collaboration with delightful company founders Helen and John Meyer. These have just been installed and we're currently fine-tuning the setup and getting ready to launch the study. Stay tuned for next year's newsletter where we'll share what we might discover.

Music-making collaboration with FHSR

In collaboration with the Foundation for Hearing and Speech Resources, led by director Kristen J. Van Dyke, we are launching a new project investigating the neurophysiological impact of music-making on deaf and hard of hearing children. Look for updates in next year's newsletter!

Joe represents Brainvolts at the 2025 ARO MidWinter Meeting

Graduate student Joe Luetkehans was the lab's sole representative at this year's Association for Research in Otolaryngology (ARO) MidWinter Meeting, held in February in sunny Orlando, Florida. Joe presented a poster sharing his Qualifying Research Project for doctoral candidacy, *Sex differences in young adults' Frequency Following Responses to Music*, demonstrating that female listeners encode musical sounds with subtle enhancements in the speed and consistency of their auditory processing compared to male listeners. At the meeting, he had the opportunity to share these results in his first Poster Blitz, a 3-minute speed-lecture granted to distinguished poster presenters. Be sure to check out Brainvolts' contributions to the 2026 Midwinter meeting this coming February in beautiful San Juan, Puerto Rico!

Joe's trip to Florida allowed him to explore an alternative career path in cryptozoology.

Lurie collaboration – Interactive Metronome and concussion

Over the past year, our team, in collaboration with the Sports Medicine Department at Lurie Children's Hospital led by Dr. Cynthia Labella, has been busy analyzing what is now a completed dataset.

Analyzing the data collected on over 150 children during their first post-concussion visit, we found that kids who did better on IM, a rhythm training task, had fewer concussion symptoms, fewer impairments on cognitive function, and stronger neural encoding, consistent with our hypothesis

that neural asynchrony, cognition, and rhythm abilities are tightly linked post-concussion. Our preliminary longitudinal analysis on a subset of these children suggests that IM performance improves over time, reflecting the recovery progression after a concussion.

These encouraging results motivate us to move forward with an upcoming National Endowment for the Arts-funded study exploring IM not only as an assessment tool but also as a training intervention to accelerate post-concussion recovery in young children.

Continued research collaboration with Dartmouth

Our collaboration with the Space Medicine Innovations Lab at Dartmouth, led by astronaut Jay Buckey, continues to thrive. Over the past year, we have developed a codebase to accurately and efficiently triage the thousands of FFR data collected from adults and young children in Dar es Salaam, Tanzania. Together, Brainvolts and the Dartmouth team has been meticulously reviewing the data in preparation for statistical analyses that will fully capture the richness of this unique longitudinal dataset, spanning more than eight years of data collection.

Within this project, Silvia Bonacina and Jen Krizman led an analysis exploring the predictive power of demographic and literacy variables on speech-in-noise performance using the *Triple Digit Task*—administered to young children with and without HIV. Given the scope and complexity of the dataset, the analysis employed a general linear model designed to maximize statistical power. The optimal model, which included two literacy variables, age, and HIV status, significantly predicted performance on the Triple Digit Task. This work is now being finalized in a forthcoming manuscript.

Building on this collaboration, an exciting new study, which also involves McGill University in Montreal, has recently been awarded to Dr. Buckey and is now underway. This project aims to investigate the direct links between measures of auditory function and the underlying pathophysiology of Alzheimer's disease.

Renée Fleming Receives the 2025 Knowles Prize

This spring, the Knowles Hearing Center directed by Nina and Jen, was thrilled to honor opera singer and arts advocate Renée Fleming with the 2025 Knowles Prize. For the first time, the award went to someone outside the traditional fields of hearing science and audiology, recognizing Renée's incredible work at the intersection of music, health, and neuroscience—a perfect reflection of Hugh Knowles' vision of connecting the arts and sciences. The standing-room-only event, hosted by Nina and Jen, included a public lecture,

a performance by a recent Northwestern Opera graduate hand-selected by Renée, and a lively conversation with our School's Dean E. Patrick Johnson and Bienen School of Music Dean Jonathan Holland. Faculty, students, and members of the greater Evanston and Chicago community came together to celebrate her achievements and enjoy an afternoon full of music and inspiration. Renée's visit beautifully showcased the Knowles Center's commitment to bringing people together across disciplines, blending science, the arts, and wellness in ways that inspire, educate, and celebrate the joy of hearing.

Nina, Dean Holland, Dean Johnson, Dame Renee (L to R)

Brainvolts Goes Down Under

This March, Jen joined a team from Northwestern, at the invitation of our Dean, to travel to Australia to explore collaborative research opportunities with the University of Sydney. The trip was packed with inspiring conversations, site visits, and plenty of Sydney adventures. Meetings at the Brain and Mind Centre laid the groundwork for partnerships with Brainvolts to integrate FFR testing into projects spanning social and cognitive neuroscience as well as concussion/TBI studies. A particular highlight was connecting with the University of Sydney's NeuroMusic team. Brainvolts, together with our Bienen colleagues, are working with the Sydney team to establish a Chicago arm of the study, providing a unique opportunity to expand this innovative research to the U.S. and integrate FFR measures at both sites. We're thrilled about the momentum building around this collaboration and the potential for cross-continental research.

Spurred by discussions in Sydney, Dr. Diana Chester visited our lab in July to explore creative ways to bridge art and science using sound as a medium. It was a fascinating day of idea sharing, and we're excited to see how these conversations continue to develop.
Outside of meetings, the Northwestern team explored Sydney, taking in a wild bird show at the zoo overlooking the harbor, attending a performance at the famed Sydney Opera House, taking a harbor water taxi ride, walking through the city, and even dipping their toes in the water at Bondi Beach. This trip reinforced the power of international and interdisciplinary collaboration, and we're excited for all of the partnerships and opportunities ahead for Brainvolts, Northwestern's School of Communication, and the Knowles Center.

In Memory of Zakir Hussain

We were blessed to have crossed paths with the legendary tabla player Zakir Hussain, who passed away on December 15 of last year at age 73. Hussain was renowned for his joyful virtuosity, bringing Indian classical music into dialogue with musicians across various genres through collaborations with artists like John McLaughlin and Mickey Hart. We first encountered Hussain when he and Nina shared the stage at the Kennedy Center in September 2018 for the Sound Health event "Say it with Rhythm!" — where Hussain drummed along to Nina's spoken voice to demonstrate the profound connection between rhythm, language, and the brain.

Zakir Hussain and Nina performing together on stage at the Kennedy Center, 2018.

Nina continues her exploration of the sacred side of music: meeting with Will Calhoun

Nina's continued exploration of the spirituality in music has been the impetus of many new connections with musicians, artists, and scientists. Most recently, Nina met with drummer Will Calhoun of the band Living Colour at a concert at SPACE in Evanston. Calhoun is well studied and traveled in the field of musical and drumming tradition. The culture, spiritual, and healing power of the drum was the inspiration for his album *drumwave*.

Nina and Will Calhoun at SPACE in Evanston

Welcome Gabriel

Hello everyone! My name is Gabriel, and I am the lab's new PhD student. I'm incredibly excited to join the lab and support all of the amazing work happening here. I was a musician first, beginning with a pure hatred of piano practice when I was 4. As my parents made me continue, I began to develop a love for music. I started arranging, composing, and playing with waves in Ableton. When I got to college, I designed a major in Binaural Psychophysics and Sonic Ethnography, combining music, neuroscience, and anthropology to understand how music impacts us on such a deeply human level. Research-wise, I've worked with cochlear implants, hearing aids, and novel mental health therapeutics involving music. Outside of academics, I love everything about musical theater (from writing it to seeing it)! My girlfriend is a theater major, and we see all we can. My first semester in the lab has been amazing so far, and I can't wait to continue to work on understanding music from the core principles that make it so central to everything in my life so far. Thank you all for such a warm welcome!

Welcome Georgia

With the birth of Georgia, grandbaby Julian joins the family line of wondrous big brothers. Nonna Nina has been listening to Willie Nelson on repeat.

Northwestern University provides Brainvolts with its lab space and Nina's salary as a tenured professor. Absolutely everything else - our equipment, computers, supplies, and most importantly, our people - must be funded by grants and philanthropic gifts. Please consider helping Brainvolts* this year.

*** Please be sure "Auditory Neuroscience Lab Gift" is selected for designation**
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