ANNUAL REPORT

2024

ARiEAL

Advanced Research in Experimental & Applied Linguistics

MESSAGE FROM THE DIRECTOR

DR. IVONA KUČEROVÁ
ARIEAL DIRECTOR

PHOTO CREDIT: COLIN CZERNEDA C/O MCMASTER UNIVERSITY

The year 2024 has continued to be a year of major societal and scientific transformations, challenging us to redefine our approach to research and student training. A key theme shaping our work has been the urgent need to address the growing "AI Divide" brought on by the rapid integration of AI tools into everyday life. While AI offers significant potential, its adoption remains uneven due to poor user-centered design, limited inclusivity and ethical considerations, and low technological readiness amongst users. Certain groups are especially vulnerable to exclusion, such as users with lower technological literacy (e.g., seniors), speakers of low-resource languages, including Indigenous languages, individuals with speech, hearing, or literacy challenges, and newcomers with limited proficiency in Canada's official languages. Drawing insights from engineering, natural, health, and social sciences, and the humanities, ARiEAL's interdisciplinary team is uniquely positioned to address this challenge. As language scientists, we have the skills to bridge technical and human-centred needs, develop inclusive and ethical AI applications, and contribute to evidence-based policy and regulatory frameworks. Realizing this potential is a critical mission for ARiEAL, and it has been the driving force behind several of our initiatives this year.

With this in mind, we moved forward with several training and research initiatives, alongside new academic and industry partnerships. Notably, this includes the development of a major **NSERC CREATE application**, the **first** of its kind in the **Faculty of Humanities**. This landmark training program draws on our collective strengths in Linguistics, Languages, Cognitive Science, Computer Science and Engineering, and Rehabilitation Studies. It is designed to equip trainees with interdisciplinary technical and professional skills essential to bridge these technical and human-centred needs and answer the challenges created by the "AI Divide." To ensure that our trainees are prepared to answer these challenges, we also expanded our internship and experiential learning opportunities. Leveraging our members' professional networks and connections, this initiative is supported by a broad network of collaborators across industry, government, academia, and the non-profit sector in Canada and internationally. Thanks to the enthusiastic commitment of new industry and community partners, like **All Good Speakers, Maple Leaf Sports and Entertainment**, S**R Research Ltd.**, and **Compute Ontario,** we aim to provide internships and experiential learning opportunities in a professional setting. We also furthered the development of **ARiEAL Core Research Platform (now Language Solutions),** our commercialization initiative. In collaboration with MILO and industry partners, we are refining market testing strategies that showcase our strengths in language, culture, society, clinical research, and community-based approaches, as well as our growing role in the AI landscape. Finally, with new support from the **Training, Equipment, and Renewal Fund,** we are well-positioned to provide new professionalization initiatives and expand experiential learning opportunities. These efforts will equip students with the digital skills and tools needed to address the challenges of the "AI Divide."

The engine behind these initiatives is our people and their **excellence in research**. Our researchers published **39** journal articles, **14** conference proceedings papers, **2** book chapters, and 3 technical reports. They also presented **90** academic papers, posters, and invited talks at numerous high-profile international conferences and academic institutions around the world. Many of these publications and presentations were co-authored and co-presented with our trainees. This not only highlights their importance to the knowledge mobilization and research activities at ARiEAL, but this also speaks to the quality of the training and mentoring they receive from our members. ARiEAL and ARiEAL researchers have also secured **21** grants to fund research, knowledge mobilization, and training activities, totaling more than **$15** million. These research funds will allow ARiEAL researchers to further develop their cutting-edge research and create new collaborations with academics and community partners at ARiEAL, McMaster, and around the world.

PHOTO CREDIT:DYLAN MARSHALL C/O ISTEP & MCMASTER UNIVERSITY

In 2024, we were delighted to expand our team of researcher from Humanities, Health Sciences, Science and Engineering, and their excellent, groundbreaking work, by two new members, further strengthening our community and our interdisciplinarity. **Dr. Lauren Fink** is an Assistant Professor in the Department of Psychology, Neuroscience & Behaviour at McMaster University. Her lab explores how music shapes our minds and bodies, using computational models and developing assistive devices to investigate the physiological and social effects of music. **Dr. Laurel Trainor** is a Professor in the Department of Psychology, Neuroscience & Behaviour at McMaster University and the founding and current Director of the McMaster Institute for Music and the Mind. Her research focuses on auditory development and the perception of music, including its role in social interaction and developmental disorders.

As always, our **trainees** play a vital role in ARiEAL's research, knowledge mobilization, and outreach initiatives. Members of the **ARiEAL Operational Team** have led the way in advancing professionalization and outreach activities, organizing hands-on electroencephalograms (EEG), eye-tracking, and ultrasound workshops for visitors from **Hamilton-Wentworth District School Board** and **Halton District School Board**. Moreover, we teamed up with **iStep** – a vibrant STEM enrichment program at McMaster – to bring the world of language sciences to life for high school students from racialized communities in the **Hamilton and Halton regions**. Through hands-on experiments using cutting-edge tools like EEG, eye tracking, and ultrasound technology, we showed students how language scientists at ARiEAL use STEM-based research methods to answer Humanities-focused questions. Launched in 2023, our **International Visiting Scholar Program** also officially welcomed its **first** cohort in Winter 2024. The scholars actively participated in research, networking, and learning activities, enriching both their own work and the broader ARiEAL community.

Once again, I am grateful for and impressed by the tremendous work that my colleagues and our trainees have done in 2024. Your continued contributions to the research, knowledge mobilization, and training activities at ARiEAL and commitments to our values have been inspiring and you have all played an important role in making ARiEAL a world leader in applied and experimental linguistics.
Wishing you all a safe, peaceful, healthy, and productive year.

Ivona Kučerová

RESEARCH HIGHLIGHTS 2024

ARiEAL is a research centre that brings together a collaborative and interdisciplinary community of researchers ranging from undergraduate trainees to established scholars and empowers them to excel in their problem-driven language science research across fundamental, experimental, and applied linguistics. Our work is grounded in principles of equity, diversity, and inclusion, and we are committed to rigorous, ethical scientific inquiry and to the complementarity of fundamental and applied research. This report highlights the research, knowledge mobilization, outreach, professionalization, and training activities undertaken by ARiEAL and its laboratories for the year 2024.

BRODBECK LAB

Dr. Christian Brodbeck is an Assistant Professor in the Department of Computing and Software. His research aims to understand and measure how the brain processes speech. He is particularly interested in how people comprehend speech in realistic settings, including continuous, meaningful speech and speech in noisy environments. Dr. Brodbeck primarily works with electrophysiological brain signals – electroencephalogram (EEG) and magnetoencephalogram (MEG) – and computational models. EEG and MEG allows us to measure brain activity with millisecond resolution, capturing brain responses to rapidly evolving speech signals. Computational models of speech recognition allow us to better understand the transformations necessary for recognizing speech, and they also allow us to make quantitative predictions about brain activity.

In 2024, Dr. Brodbeck published several peer-reviewed articles, many in high-impact journals, including the Journal of Neuroscience. Dr. Brodbeck also won numerous prestigious research grants, including three from the National Institutes of Health (NIH) for projects titled, "Neural Mechanisms Underlying Linguistic Context Use for Speech Processing in Aging," "User-friendly Open-Source Pipeline for Anatomically Precise Analysis of Single-Trial M/EEG," and "Predicting Intervention Outcomes in Reading Disabled Students Using In-School Cognitive Neuroscience."

DR. CHRISTIAN BRODBECK

GRAMMATICAL THEORY GROUP

DR. ALISON BIGGS

Dr. Alison Biggs is the Director of the Grammatical Theory Group. An Assistant Professor in the Department of Linguistics and Languages at McMaster University, Dr. Biggs' research focuses on the formal characterization of speaker knowledge of language. Her main area of research is syntax and its interfaces with morphology, semantics, and the lexicon. Her research also examines linguistic variation, both cross-linguistic (the possible and impossible ways in which languages and dialects can vary from each other) and inter-individual variability.

In 2024, Dr. Biggs submitted three papers for publication that were accepted, including one with ARiEAL PhD student, Braulio Lopes, titled "The Syntax of Stative Participles in Brazilian Portuguese," published in the Proceedings of the 2024 annual conference of the Canadian Linguistic Association. Dr. Biggs was also invited to present her research at l'Université du Québec à Montréal and the University of Brașov and presented her work at numerous international academic conferences, including Sinn und Bedeutung, the 55th Annual Meeting of the North East Linguistic Society at Yale University, and the Brussels Conference on Generative Linguistics. Four new trainees joined Dr. Biggs' Grammatical Theory Group in 2024: Derya Sonmez (Master's student), Jinmei Zhang (Master's student), Olivia Carstensen (Master's student), and Rankini Kulatilake (undergraduate Honours thesis student). One of Dr. Biggs' trainees – Jacob Rice – completed their Honours thesis and received their undergraduate degree in 2024. Congratulations!

LEX LAB

Dr. Phoebe Gaston is an Assistant Professor in the Department of Linguistics and Languages and the Director of the LexLab. She specializes in psycholinguistics and the cognitive neuroscience of language. Her research focuses on word recognition, lexical representation, syntactic structure-building, and the neural and cognitive mechanisms underlying top-down context effects in language comprehension. She uses behavioral, electrophysiological, and neuroimaging data, as well as computational modeling approaches.

In 2024, under the leadership of Dr. Gaston and the dedicated efforts of graduate student Simran Sandal and a team of undergraduate trainees, electroencephalogram (EEG) data collection resumed in the lab after a multi-year hiatus. Dr. Gaston also published two peer-reviewed articles: "Resolving Competing Predictions in Speech: How Qualitatively Different Cues and Cue Reliability Contribute to Phoneme Identification" in Attention, Perception, & Psychophysics and "Contra Assertions, Feedback Improves Word Recognition: How Feedback and Lateral Inhibition Sharpen Signals Over Noise" in Cognition. She also won a Collaborative Research in Computational Neuroscience U.S.-Spain Research Proposal with the National Science Foundation for a project titled, "Tracking and modeling the neurobiology of multilingual speech recognition."

DR. PHOEBE GASTON

IMAGING PHYSICS & ENGINEERING, IMAGING RESEARCH CENTER

DR. MICHAEL NOSEWORTHY

Dr. Michael Noseworthy is a Professor in the Department of Electrical and Computer Engineering and Associate Chair (Research) in the Department of Medical Imaging. He is also the Director of Medical Imaging Physics and Engineering at the Imaging Research Centre at St. Joseph's Healthcare, Hamilton. He has also played a major role in bringing the new imaging centre on campus to fruition – the Centre for Integrated and Advanced Medical Imaging (CIAMI), a joint project between McMaster University and Mohawk College. Dr. Noseworthy's research interests focus on the assessment of tissue microstructure and metabolism using multimodal medical imaging, such as magnetic resonance imaging (MRI) and in vivo nuclear magnetic resonance (NMR) spectroscopy. His work heavily involves developing imaging hardware and software, and his research team studies physiological problems and diseases using advanced medical imaging techniques.

In 2024, Dr. Noseworthy and his team published several articles, including many in high-impact journals, such as BMC Sports Science, Medicine and Rehabilitation, Alzheimer's & Dementia, Magnetic Resonance Imaging, and NMR in Biomedicine. Dr. Noseworthy also published three technical reports about medical imaging for St. Catharines General Hospital and AIM Medical Imaging, and was invited to present his research at numerous international academic institutions, conferences, and symposia, including at the University of Waterloo, the University of Ruse, the General Electric MR User Symposium, and the Ontario Association of Medical Radiation Sciences Breast Imaging Symposium. One new trainee joined the Imaging Physics and Engineering, Imaging Research Centre – Lauren Stephens (Master's student) – and one of Dr. Noseworthy's graduate students – Konrad Grala – received their Master's degree in 2024. Congratulations!

LANGUAGE, MEMORY & BRAIN LAB

The Language, Memory, and Brain (LMB) Lab is co-directed by **Drs. John Connolly** and **Elisabet Service**. Dr. Service investigates the cognitive building blocks of language development and their relationship with working memory. Her research focuses on first and second language acquisition, spoken word processing, and other related cognitive processes. Much of this work is then applied to investigations of language disorders, including dyslexia. Dr. Connolly's work uses EEG methods to study brain health and language functions.

In 2024, Dr. Service completed her term as the Chair of the Department of Linguistics and Languages. She also co-authored a paper titled "Impaired Cortical Tracking of Speech in Children with Developmental Language Disorder" in the Journal of Neuroscience and with her MSc student Fiza Ahmad, presented a paper titled "The Investigation of Foreign Word Memory Using Nursery Rhymes" at the 1st Annual Symposium of Montreal Institute for Second Language Acquisition, held in Montréal, Québec.

DR. JOHN CONNOLLY

DR. ELISABET SERVICE

Dr. Service continued research on two major funded projects: one investigating the impact of temporal patterns on short-term memory for speech and on language learning, funded by an NSERC Discovery grant; and another investigating the effects of working in a second language on strategic thinking, funded by a SSHRC Insight Grant. Finally, two of Dr. Service's trainees – Fiza Ahmad and Troy Freiburger – completed their Master's degrees, and two of her trainees – Jasmine Kwon and Shruthi Viswanathan – completed their undergraduate degrees in 2024. Congratulations!

MELD BILINGUALISM LAB

The McMaster English Language Development (MELD) Programs and the MELD Bilingualism Lab are directed by **Dr. Anna Moro**, the Associate Director of ARiEAL. The MELD programs are intended for international students whose primary language is not English but who wish to improve their English proficiency to succeed in an English-speaking higher education environment. Since 2018, the MELD Programs have expanded their services from the MELD Diploma to also include the McMaster English Readiness for Graduate Excellence (MERGE) and the McMaster Office for the Development of English Language Learners (MODEL) to offer an even more comprehensive range of services to international students of all levels. Both MELD and MODEL incorporate problem-based learning and reflective practice in their curricula.

In 2024, a new intensive seven-week undergraduate bridging program, the Summer Transition through English Prep (STEP), welcomed its inaugural class.

The MELD Bilingualism Lab investigates the underlying linguistic mechanisms of bilingual phenomena and focuses on second language development. In 2024, along with research associate Dr. Daniel Schmidtke, Dr. Moro published an article titled "Reading Experience Drives L2 Reading Speed Development: A Longitudinal Study of EAL Reading Habits" in Frontiers in Education: Educational Psychology and another titled "Bridging to Academic Success: The Impact of Reading Gains in an English Bridging Program on GPAs" in Reading and Writing.

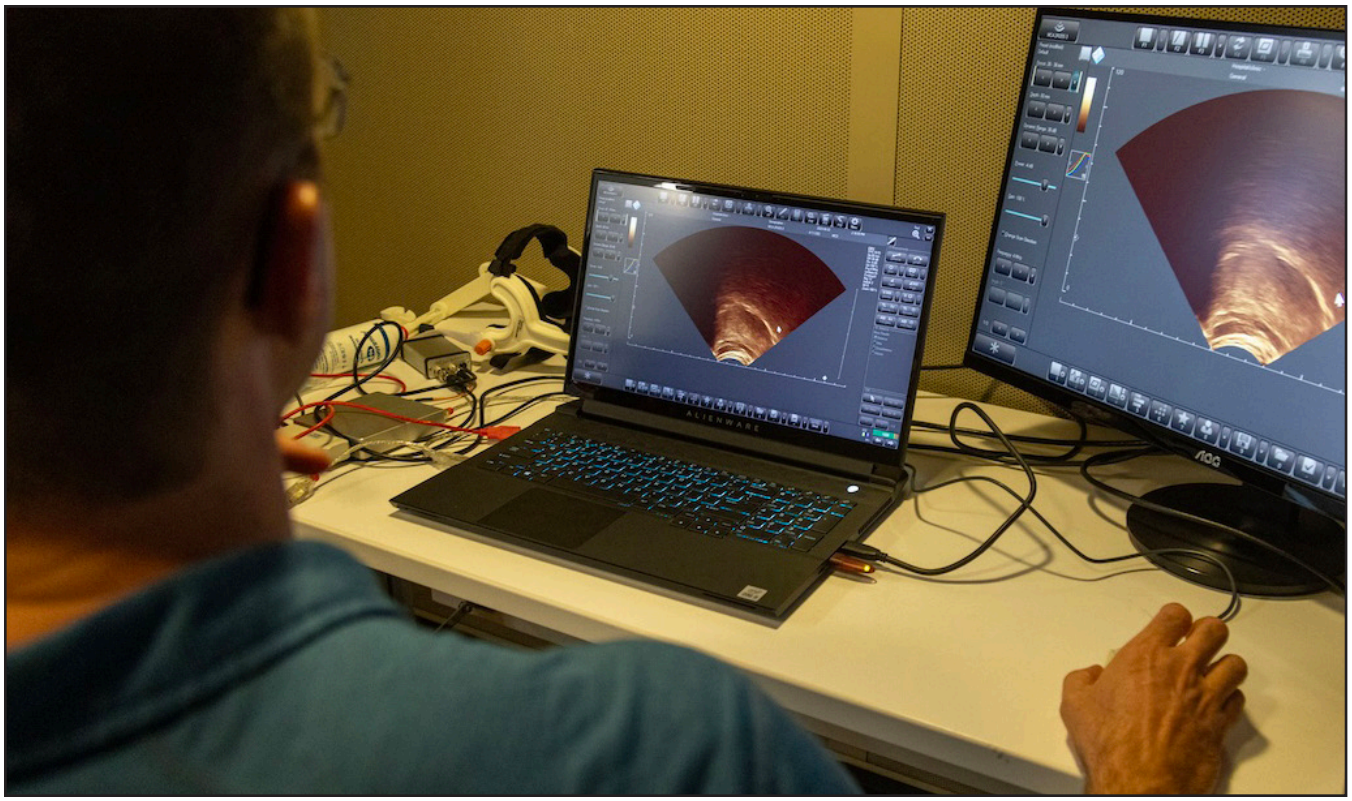
DR. ANNA MORO

PHONETICS LAB

DR. DANIEL PAPE

Dr. Daniel Pape is the Director of the Phonetics Lab. His research examines experimental phonetics and spoken speech acoustics, the link between spoken speech production and cognition, and the relationship between phonetics and neurolinguistics. A recently introduced research stream examines whether different populations produce differences in their speech patterns, and how these differences are manifested in their cognition. More specifically, the Phonetics Lab examines how (nonclinical) autism spectrum disorder differences in students manifest in their spoken speech and how that might support communication between students with varying presentations of autism spectrum disorder. A second stream examines production and perception differences among bilingual and non-native speakers with different degrees of proficiency in their respective spoken languages, using ultrasound methods and acoustics.

In 2024, Dr. Pape published several articles, including many in high-impact journals. With ARiEAL trainee Monika Krizic and ARiEAL Senior Research Associate Dr. Gemma Repiso-Puigdelliura, Dr. Pape published an article titled "Cue-weighting Under Focus: Predicting Individual Differences with Autistic Character Traits" in the Proceedings of the International Conference Speech Prosody. Dr. Pape and his team – which includes ARiEAL Senior Research Associate Dr. Gemma Repiso-Puigdelliura and ARiEAL trainees Monika Krizic, Elaina Van Abbema, Michelle Middaugh-Cifuentes, and Maiia Bulakh – also published numerous articles in journals and conference proceedings, including the Proceedings of the International Conference Ultrafest XI - Ultrasound Imaging for Speech and Language, the Proceedings of LabPhon 2024, and the Proceedings of the 13th International Seminar on Speech Production. Dr. Pape also presented his research at various international universities, including the University of Melbourne, the University of Hong Kong, National Taiwan University, and National Taipei University of Technology as well as well as at numerous conferences, including the International Conference Ultrafest XI - Ultrasound Imaging for Speech and Language, held at Aizu-Wakamatsu, Japan and LabPhon 2024, held in Seoul, South Korea. Finally, five of his trainees completed their degrees this year: Fiza Ahmad (Master's degree), Sara Pearsell (Doctoral degree), Judy Meshmesh (Undergraduate degree), Elaina Van Abbema (Undergraduate degree), and Laraib Ur-Rehman (Undergraduate degree). Congratulations!



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NEUROTECHNOLOGY & NEUROPLASTICITY LAB

Dr. Sue Becker is the Director of the Neurotechnology & Neuroplasticity Lab, which uses computational modeling and empirical studies to investigate the neural bases of learning and memory and how it serves functions such as episodic future thinking, planning, and decision-making. Dr. Becker's lab addresses research questions such as how the hippocampus codes episodic and spatial memories, and how stress, exercise, and neurofeedback affect hippocampal memory functions and intrinsic brain networks. This research can be applied to brain-computer interfaces, sensory substitution for prosthetic limbs, and furthering our understanding of memory-related disorders such as post-traumatic stress disorder.

In 2024, Dr. Becker and her team published a chapter titled "Impulsivity and Compulsivity in Bayesian Reinforcement Learning Models of Addiction: A Computational Critique of the Habit Theory" in Habits: Their Definition, Neurobiology, and Role in Addiction. They also published an article titled "A Pilot Study Examining the Impact of Lithium Treatment and Responsiveness on Mnemonic Discrimination in Bipolar Disorder" in Journal of Affective Disorders. Dr. Becker also presented her research at Queen's University, Kingston, Ontario. Finally, one of her trainees completed their doctorate this year. Congratulations, Mohammad Chaposhloo!

DR. SUE BECKER

READING LAB

DR. VICTOR KUPERMAN

The Reading Lab, directed by **Dr. Victor Kuperman**, targets a range of areas in psycholinguistics and corpus linguistics with research foci such as the cognitive and socio-demographic predictors of literacy and reading comprehension in adults across languages. The Reading Lab's research paradigms include eye-tracking, behavioural studies, large-scale norming studies, and quantitative analyses of written and spoken corpora.

In 2024, Dr. Kuperman published several articles in high-impact journals, including Psychonomic Bulletin & Review, Journal of Experimental Psychology: Learning, Memory and Cognition, Language Development and Learning, Experimental Aging Research, Scientific Reports, Journal of Memory and Language, and Language Learning. Several of these were produced with former and current trainees, including an article titled "Learning Concrete and Abstract Novel Words in Emotional Contexts: Evidence from Incidental Vocabulary Learning" with current doctoral trainee Nadia Lana and another with former trainee Dr. Daniel Schmidtke titled "A Psycholinguistic Study of Intergroup Bias and its Cultural Propagation." Dr. Kuperman was also invited to present his research at numerous international conferences, workshops, and universities, including Hanoi University of Industry in Vietnam, Guangzhou University in China, University of Macau in Macau, and Pontificia Universidad Católica de Valparaiso in Chile. In 2024, one of Dr. Kuperman's trainees – Rudaina Hamed (Doctoral) – completed their degrees. Congratulations! Dr. Kuperman's lab also welcomed two new trainees: Keerat Purewal (Master's) and Marc-Antoine Paul (Doctoral) in 2024.

SONNADARA LAB

Directed by **Dr. Ranil Sonnadara**, the Performance Science Lab aims to understand the science and art behind human performance in all its forms. More specifically, the lab investigates how individuals learn complex skills, how information flows across the motor and perceptual systems change with practice, and how feedback and assessment can be effectively implemented to support skill acquisition. Much of the lab's current work focuses on education and assessment of health professionals, musicians, and athletes.

In 2024, Dr. Sonnadara published an article titled "Survey of Perspectives on Parental Leave Policies in Canadian Surgical Training Programs" in Global Surgical Education. Dr. Sonnadara also won an Ontario Ministry of Colleges and Universities Award to extend operational funding for Compute Ontario as well as a SSHRC Insight Grant for a project titled "Joy and Pain in Observed Assessments: Improving Workplace- and sSmulation-Based Assessments in the Age of Competency-Based Medical Education." Several of Dr. Sonnadara's trainees also completed their degrees: Dr. Theotime Bakunzi completed their postdoctoral fellowship and Dr. Kestrel McNeill their PhD. Several of his undergraduate students completed their studies as well. Congratulations!

DR. RANIL SONNADARA

TURKSTRA LAB

DR. LYN TURKSTRA

Dr. Lyn Turkstra is the Director of the Turkstra Lab, which focuses on the links between cognitive function and social communication in individuals with traumatic brain injury (TBI). The lab conducts both experimental and translational research on communication in adolescents and adults, and collaborates on development of practice standards to translate research findings into improved clinical practice and long-term patient outcomes.

The past year was a busy year for clinical trials in the Turkstra Lab. Dr. Turkstra and Occupational Therapy Professor Jackie Bosch completed virtual cognitive rehabilitation trials for Canadian Armed Forces and RCMP veterans, as well as for adults with Long COVID. The Turkstra Lab also completed a pilot study of users' experience with an app designed in collaboration with colleagues at Vanderbilt University and University of Wisconsin-Madison. Dr. Turkstra's research on cognitive rehabilitation for U.S. service members and veterans with mild traumatic brain injury received the Visionary Session Award at the American Speech-Language-Hearing Annual Meeting, and the results were published in the American Journal of Speech-Language Pathology.

Her team also won several grants and awards in 2024, including a U.S. Congressionally Directed Medical Research Programs: TBI and Psychological Health Research Program contract and a CIHR Project Grant.

PhD Candidate Lisa Kakonge presented at the International Cognitive Communication Disorders Conference in Los Angeles on social media use in adolescents with acquired brain injury. Turkstra Lab member Marie-France Perrier (University of Ottawa) presented findings on cognitive and communication assessments in children with ABI. Dr. Fiona Campbell completed her thesis on augmentative and alternative communication for nonspeaking ICU patients. Undergraduates Eniola Bode-Akinboye and Jada Bernard completed their honour's theses on interactive alignment in adults with TBI and reading comprehension in children with TBI, respectively. Nnenna Utomi conducted a review of interprofessional collaboration in outpatient rehab transitions under Lisa Kakonge's mentorship. We're proud of our lab graduates who are now pursuing graduate studies in speech-language pathology, psychology, neuroscience, and undergrad medicine.

SYNTAX LAB

DR. IVONA KUČEROVÁ

Dr. Ivona Kučerová, Director of the Syntax Lab and ARiEAL, investigates syntactic structures, with a specific focus on the syntax-semantics interface. More specifically, the lab is investigating wheter and how semantic information can modulate syntactic derivation. Both traditional fieldwork and experimental methods are used to collect data from cross-linguistically diverse languages, including Indigenous languages of Canada. The goal of this research is to identify and model universal and language-specific structural properties of human languages. The primary focus of the work currently conducted in the Syntax Lab is on modeling features at the syntax-semantics interface.

In 2024, Dr. Kučerová won a Training and Equipment Fund from Ontario's Ministry of Colleges and Universities for a project titled "Experiential Digital Learning through AiREAL." Dr. Kučerová also presented her research at various international conferences and guest lectures, including at McMaster University's Indigenous Research Day, the University of Graz in Austria, Third Age Learning Linguistics, held in Guelph, Ontario, the Leiden/Bielefeld Workshop on Comparative Syntax, held at the University of Leiden in the Netherlands, and Referential Structure in Communication: International Conference on Language and Communication, held at the University of Tokyo in Japan. Dr. Kučerová also welcomed two new postdoctoral researchers – Dr. Aya Zarka and Dr. Fareeha Rana – as well as numerous doctoral and undergraduate students to her lab. Finally, Ethan Stollar and Audrey Ho completed their Master's degree, and Aya Zarka completed their PhD in 2024 under Dr. Kučerová's supervision. Congratulations!

BEAT LAB

DR. LAUREN FINK

In 2024, we welcomed **Dr. Lauren Fink** to ARiEAL Research Centre. Dr. Fink is an Assistant Professor in the Department of Psychology, Neuroscience & Behaviour and a member of the McMaster Institute for Music & the Mind, the School of Computational Science and Engineering, and the Neuroscience Graduate Program. Her research aims to understand the physiological, psychological, and interpersonal changes induced through engaging with music. Dr. Fink's lab conceives of music as multimodal (auditory, visual, tactile, motor, etc.), and often incorporates methods like eye-tracking. Currently, one big focus is on multi-person physiological monitoring to better understand attention and immersion during social, musical contexts. For example, her lab can have up to 30 audience members wearing mobile eye-tracking glasses and customized smartwatches while watching a performance. 2024 saw the first uses of these devices during LIVELab events. The lab's custom software for data acquisition and analysis is freely available on GitHub: SocialEyes (https://github.com/beatlab-mcmaster/SocialEyes) and BEATmonitor (https://github.com/beatlab-mcmaster/BEATmonitor).

In 2024, Dr. Fink published numerous articles related to eye-tracking, including "Deep Learning Models for Webcam Eye-Tracking in Online Experiments" and "From Pre-Processing to Advanced Dynamic Modeling of Pupil Data", both in Behavior Research Methods and "Eye-Blinking, Musical Processing, and Subjective States – A Methods Account" in Psychophysiology. Throughout the year, Dr. Fink was invited to present her research at numerous international universities and conferences, including at the University of Konstanz, Germany, Wellesley College, MA, and the Toronto Auditory Research Group. She won numerous research grants and awards, including a SSHRC Connection Grant for a project titled "Disseminating new modes of creativity and audience immersion at the intersection of performance and technology" and a Canadian Foundation for Innovation, John R Evans Leaders Fund & Ontario Research Fund Small Infrastructure Fund for a project titled "The role of brain-viscera coupling in shaping subjective experience and social interaction." Finally, three of Dr. Fink's undergraduate students completed their degrees in 2024: Mariyah Shaikh, Connor Horsley, and Catherine Deng. Congratulations!

TRAINOR LAB

DR. LAUREL TRAINOR

In 2024, we welcomed **Dr. Laurel Trainor** to ARiEAL Research Centre. Dr. Trainor is a Professor in the Department of Psychology, Neuroscience & Behaviour. Her research focuses on auditory development and the perception of music, including work on pitch, tonality, timing, rhythm, neuroplasticity, and the role of music in social interaction, development, and developmental disorders. As the founding and present director of the McMaster Institute for Music & the Mind, Dr. Trainor also directs a unique research-concert hall (the LIVELab) with high acoustic control that is equipped with multi-person motion capture and EEG for studying how performers and audiences interact, and how music can be used to promote health and well-being. Her research includes using motion capture, EEG, eye gaze, and physiological responses to study complex interactional dynamics, such as between musicians as they perform, between musicians and audiences, and between caregivers and infants.

In 2024, Dr. Trainor and her team published numerous articles, including several in high-impact journals, such as Attention, Perception, & Psychophysics, European Journal of Neuroscience, Developmental Science, Scientific Reports, Cognition, and Sensors. Dr. Trainor was also invited to present her research at numerous international universities and conferences, including at the Centre for Interdisciplinary Studies in Rhythm, Time, and Motion at the University of Oslo, Norway, the International Congress of Infant Studies, held in Glasgow, Scotland, and Neurosciences and Music-VIII, held in Helsinki, Finland. Dr. Trainor won numerous research and knowledge mobilization grants in 2024, including am NSERC Research Tools and Instruments grant for a project titled "Neural Measures of Caregiver-Infant Interactions During Infant-Directed Speech and Singing" and a SSHRC Insight Development Grant for a project titled "Feeling the music together: how sound and social factors drive movement dynamics on the dance floor." Finally, several of Dr. Trainor's trainees completed their degrees: Drs. Miguel Martin, Sean McWeeny, and Daniel Cameron completed their postdoctoral fellowships, Drs. Rachael Finnerty, Jesse Pazdera, Erica Flaten, and David Prete their PhDs, and several undergraduate students completed their honours theses as well. Congratulations!

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BY THE NUMBERS

Knowledge mobilization is at the core of ARiEAL's mission, values, vision, and strategic planning. We not only strive to produce interdisciplinary, collaborative, and ethical research, but we also strive to produce research that advances academic knowledge and benefits society. In 2024, our researchers were very active in disseminating their ground-breaking research by publishing articles, books, and chapters, and presenting at conferences and universities around the world. Our researchers have also secured prestigious research, knowledge mobilization, and training grants and awards.

PUBLICATIONS

In 2024, ARiEAL researchers published over **58 texts,** including **2 book chapters, 39 journal articles, 3 technical reports,** and **14 articles in conference proceedings.** These publications highlight the breadth of the research being done at ARiEAL and underscore the benefits of our interdisciplinary and collaborative approach. Many of the works listed below were co-authored by ARiEAL members and trainees, reflecting the interdisciplinary and cooperative nature of our research centre. Broadly speaking, publication topics include neurodevelopmental disorders and mental health, traumatic brain injuries, artificial intelligence, language learning, post-traumatic stress disorder, and auditory beat processing. These publications speak to the tremendous impact that our researchers have had in their respective fields.

JOURNAL ARTICLES (39)

Amador-Tejada, A., McGillivray, J., Kumbhare, D.A. & **Noseworthy, M.D.** (2024). Denoising of the Gradient Artifact Present in Simultaneous Studies of Muscle Blood Oxygen Level Dependent (BOLD) Signal and Electromyography (EMG). Magnetic Resonance Imaging, 111, 179-185.

Brodbeck, C., Kandylaki, K.D. & Scharenborg, O. (2024). Neural Representations of Non-Native Speech Reflect Proficiency and Interference from Native Language Knowledge. Journal of Neuroscience, 44(1), e0666232023.

Cahill, P.T., Ferro, M.A., Ng, S., **Turkstra, L.S.** & Campbell W.N. (2024). Core Outcomes for Speech-Language Services in Ontario Schools: A Group Concept Mapping Study and Guiding Framework. BMC Health Services Research, 24(1), 347.

Cahill, P.T., Ng, S., **Turkstra, L.S.**, Ferro, M.A. & Campbell, W.N. (2024). Exploring the Valued Outcomes of School-Based Speech-Language Therapy Services: A Sequential Iterative Design. Frontiers in Rehabilitation Sciences, 5, 1290800.

Carrillo, C., Chang, A., Armstrong, H., Cairney, J., McAuley, D. & **Trainor, L. J.** (2024). Auditory Rhythm Facilitates Perception and Action in Children with Probable Developmental Coordination Disorder. Scientific Reports, 14, 12203.

Crinnion, A.M., Luthra, S., **Gaston, P.** & Magnuson, J. (2024). Resolving Competing Predictions in Speech: How Qualitatively Different Cues and Cue Reliability Contribute to Phoneme Identification. Attention, Perception, & Psychophysics, 86, 942-961.

Cui, S., Lin, L., Shah, D., Reid, S. R., **Sonnadara, R.** & Acai, A. (2024). Survey of Perspectives on Parental Leave Policies in Canadian Surgical Training Programs. Global Surgical Education, 3(32).

Dotov, D., Motsenyat, A. & **Trainor, L. J.** (2024). Concurrent Supra-Postural Auditory-Hand Coordination Task Affects Postural Control: Using Sonification to Explore Environmental Complexity in Factors Affecting Fall Risk. Sensors, 24(6), 1994.

Edalati, M., Wallois, F., Ghostine, G., Kongolo, G., **Trainor, L.J.** & Moghimi, S. (2024). Neural Oscillations Suggest Periodicity Encoding during Auditory Beat Processing in the Premature Brain. Developmental Science, 27(6), e13550.

Esteve, D., Perea, M., Angele, B., **Kuperman, V.** & Drieghe, D. (2024). Individual Differences in Word Skipping during Reading in English as L2. Psychonomic Bulletin & Review, 31, 2823-2831.

Fink, L., Fiehn, H. & Wald-Fuhrmann, M. (2024). The Role of Audiovisual Congruence in Aesthetic Appreciation of Contemporary Music and Visual Art. Scientific Reports, 14, 20923.

Gervain, J., Kujala, T., Pena, M., **Trainor, L. J.** & Winkler, I. (2024). Editorial: Early Development of Sound Processing in the Service of Speech and Music Perception. Frontiers in Human Neuroscience, 18, 1471445.

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Kyröläinen, A.-J. & **Kuperman, V.** (2024). Emotional State of Older Adults during the COVID-19 Pandemic: Insights from the Cognitive and Social Well-Being (CoSoWELL) Corpus. Experimental Aging Research, 50(4), 482-505.

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Nave, K., Carrillo, C., Jacoby, N., **Trainor, L. J.** & Hannon, E. (2024). The Development of Rhythmic Categories as Revealed through an Interactive Production Task. Cognition, 242.

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Parshina, O., Zdorova, N. & **Kuperman, V.** Cross-Linguistic Comparison in Reading Sentences of Uniform Length: Visual-Perceptual Demands Override Readers' Experience. Quarterly Journal of Experimental Psychology, 77(8), 1694-1702.

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Pazdera, J. & **Trainor, L. J.** (2024). Pitch-Induced Illusory Percepts of Time. Attention, Perception, & Psychophysics. Attention, Perception, & Psychophysics, 87, 545-564.

Poikonen, H., Tervaniemi, M. & **Trainor, L. J.** (2024). Expertise in Dance and Music Modified Cortical EEG Oscillations during Live Dance Performance. European Journal of Neuroscience, 60(8), 6000-6014.

Schmidtke, D. & **Kuperman, V.** (2024). A Psycholinguistic Study of Intergroup Bias and its Cultural Propagation. Scientific Reports, 14, 8613.

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Sharma, B., Koelink, E., DeMatteo, C., **Noseworthy, M.D.** & Timmons, B. (2024). The Concussion, Exercise, and Brain Networks (ConExNet) study: A Cohort Study Aimed at Understanding the Effects of Sub-Maximal Aerobic Exercise on Resting State Functional Brain Activity in Pediatric Concussion. BMC Sports Science, Medicine and Rehabilitation, 16(133).

Siegelman, N., Elgort, I., Brysbaert, M., **Kuperman, V.** et al. (2024). Re-thinking L1/L2 Similarities and Differences in English Proficiency: Insights from the English Reading Online (ENRO) Project. Language Learning, 74(1), 249-294.

Tavakkoli, M., Svenningsen, S., Friedlander, Y., Konyer, N.B., Nair, P. & **Noseworthy, M.D.** (2024). Sampling Pattern Discrepancy in the Application of Compressed Sensing Hyperpolarized Xenon-129 Lung MRI. NMR in Biomedicine, 37(6), e5121.

Toma, C.L., Hwang, J., Kakonge, L., Morrow, E., **Turkstra, L.S.**, Mutlu, B. & Duff, M. (2024). Does Facebook use Provide Social Benefits to Adults with Traumatic Brain Injury? Cyberpsychology, Behavior, and Social Networking, 27(3), 214-220.

Wild, H.A. & **Kuperman, V.** (2024). Word Learning in the Wild: App-Based Evidence for Valence and Concreteness Effects. Applied Psycholinguistics, 45(5), 786-810

Van Stan, J.H., Roy, N., Stemple, J., Gartner-Schmidt, J., Gillespie, A., Whyte, J., Duffy, J. & **Turkstra, L.S.** (2024). Rehabilitation Treatment Specification System: Content and Criterion Validity Across Evidence-Based Voice Therapies for Muscle Tension Dysphonia. American Journal of Speech-Language Pathology, 33(4),1774-1791.

Xhima, K., Ramirez, J., Gibson, E., Ottoy, J., Zukotynski, K., Scott, C., Feliciano, G.J., Adamo, S., Borrie, M.J., Chertkow, H., Frayne, R., Laforce, R., Jr., **Noseworthy, M.D.** et al. (2024). Distinct Spatial Contributions of Amyloid Pathology and Cerebral Small Vessel Disease to Hippocampal Morphology. Alzheimer's & Dementia, 20(5), 3687-3695.

58 texts

02 book chapters

39 journal articles

03 technical reports

14 articles

BOOK CHAPTERS (2)

Kinley, I. & **Becker, S.** (2024). Impulsivity and Compulsivity in Bayesian Reinforcement Learning Models of Addiction: A Computational Critique of the Habit Theory. In Vandaele, Y. (Ed.) Habits: Their Definition, Neurobiology, and Role in Addiction (pp. 301-336). New York City: Springer International Publishing

Poliva, O., Venezia, J., **Brodbeck, C.** & Hickok, G. (2024). Phoneme Processing. In Grafman, J.H. (Ed.) Encyclopedia of the Human Brain (Second Edition) (pp. 315-325) Amsterdam: Elsevier.

TECHNICAL REPORTS (3)

Noseworthy, M.D. (2024). Validation of MRI Fringe Field for 1.5T Siemens Espree MRI. Prenuvo, AIM Medical Imaging.

Noseworthy, M.D. & Konyer, N.B. (2024). MRI Acceptance Test (GE Health Care 3T Architect System). Niagara Health System, St. Catharines General Hospital.

Noseworthy, M.D. & Konyer, N.B. (2024). MRI Acceptance Test (GE Health Care 1.5T Artist System). Niagara Health System, St. Catharines General Hospital.

PRESENTATIONS (90)

Researchers have presented over 90 academic papers, posters, and invited talks over the course of 2024. Our researchers have presented their cutting-edge research in numerous high profile international conferences and academic institutions around the world, which speaks to the global impact that our researchers and laboratories have on their respective fields.

Ahmad, F. & **Service, E.** (2024, May). The Investigation of Foreign Word Memory using Nursery Rhymes. 1st Annual Symposium of Montréal Institute for Second Language Acquisition (MonISLA), Montréal, Canada.

Anderson, C., Kirk, R., Miguel, M., Wood, E., Tawfik, H., Bosnyak, B. & **Trainor, L. J.** (2024, November). Highly Expressive Moments Correspond to Less Audience Synchronization during a Live Concert. 20th Annual NeuroMusic Conference, McMaster University, Hamilton, Canada.

Becker, S. (2024, January) The Autobiographical Memory Network: From Models to Mood Disorders. Centre for Neuroscience Studies Hybrid Seminar Series, Queen's University, Kingston, Canada.

Biggs, A. (2024, June). The Argument and Event Structure of Nonvolition. Canadian Linguistic Association Annual Conference, Carleton University, Ottawa, Canada.

Biggs, A. (2024, July) Argument and Event Structure. Lecture series Eastern Generative Grammar, University of Brașov, University of Brașov, Brașov, Romania.

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Biggs, A. (2024, August) Advanced Topics in Morphosyntax: Category. Lecture series on Eastern Generative Grammar, University of Brașov, Brașov, Romania.

Biggs, A. (2024, November) Structure and Root Meaning in the Interpretation of Transitive Verb Phrases. Colloquium, Université du Québec à Montréal, Montréal, Canada.

Biggs, A. & Embick, D. (2024, October) English Passive Participles: Category, Argument Introduction, and Interpretation. The 55th Annual Meeting of the North East Linguistic Society (NELS 55), Yale University, New Haven, USA.

Biggs, A. & Embick, D. (2024, December) Category in Participles: English Stative and Eventive Passives. Brussels Conference on Generative Linguistics 17: Categories & Categorization, Brussels, Belgium.

Biggs, A. & Lopes, B. (2024, June). The Syntax of Stative Participles in Brazilian Portuguese. Canadian Linguistic Association Annual Conference, Carleton University, Ottawa, Canada.

Biggs, A. & Luo, Z. (2024, September) Classifiers and Comparison Class: Evidence for Cross-Linguistic Variation in the Calculation of Standards. Sinn und Bedeutung 29, Consorzio Universitario Mediterraneo Orientale, Noto, Italy.

Cameron, D., Psaris, M., Carrillo, C. & **Trainor, L. J.** (2024, July). Assessing the Development of the Syncopation-Groove Relationship in Infants and Children. The Neurosciences and Music-VIII, Helsinki, Finland.

Carrillo, C., Dotov, D. & **Trainor, L. J.** (2024, July). Can Children with Developmental Coordination Disorder Step Clap to the Beat? Society for Music Perception and Cognition, Banff, Canada.

Carrillo, C., Marsh-Rollo, S. & **Trainor, L. J.** (2024, July). Factors Affecting the Judging of a Hip Hop Competition. Society for Music Perception and Cognition, Banff, Canada.

Carrillo, C., Marsh-Rollo, S. & **Trainor, L. J.** (2024, November). The Role of Synchrony in Hip Hop Dance Competition Judging. The 20th Annual NeuroMusic Conference, McMaster University, Hamilton, Canada.

Edalati, M., Wallois, F., Gallard, A., **Trainor, L. J.** & Moghimi, S. (2024, October). The Influence of Tempo on Neural Encoding of Rhythmic Hierarchy in Neonates. The French Association for Timing, Paris, France.

Edalati, M., Wallois, R., Ghostine, G., Kongolo, G., **Trainor, L. J.** & Moghimi, S. (July, 2024). Tempo Sensitivity Unveiled in Rhythmic Processing of Premature Newborns. The Neurosciences and Music-VIII, Helsinki, Finland.

Fink, L. (2024). The Cognitive Neuroscience of Music. Psychology of Language, Wellesley College, Wellesley, USA.

Fink, L. (2024, March). Learning Pupillometry: From Theory to Analyses. Methods Excellence Workshops, University of Konstanz, Germany.

Fink, L. (2024, March). The Neuroscience of Music. Hamilton Brain Bee, McMaster University, Hamilton, Canada.

Fink, L. (2024, July). Costs and Benefits of High-Stakes, SingleSshot, Multi-Person Data Collection Events. Society for Music Perception & Cognition, Banff Centre for Arts and Creativity, Banff, Canada.

Fink, L. (2024, September). Introduction to Advanced Analysis Techniques: Analyzing the Pupil Time Series. World Congress of Audiology, Paris, France.

Fink, L. (2024, September). Towards More Mobile, Modular, Scalable Concert Research Methodologies. Workshop on Concert Research, Centre for Interdisciplinary Studies in Rhythm, Time & Motion, University of Oslo, Olso, Norway.

Fink, L. (2024, November). Research at the Intersection of Music, Cognitive Neuroscience, Computer Science & Social Justice. Toronto Auditory Research Group, Toronto, Canada.

Fink, L. (2024, November). The Past, Present and Future of the LIVELab and Large Group Studies of Creative Human Interaction. 20th Annual Neuromusic Conference, Hamilton, Canada.

Finnerty, R. & **Trainor, L. J.** (2024, July). Group Music Therapy: A Proactive Mental Health Option. The Neurosciences and Music-VIII, Helsinki, Finland.

Finnerty, R. & **Trainor, L. J.** (2024, November). Music Therapy for Proactive Wellness. The 20th Annual NeuroMusic Conference, McMaster University, Hamilton, Canada.

Flannery, M. & **Fink, L.** (2024, November). Naturalistic Measurement of Multi-Person Cardiac Activity using Open-Source Smartwatch Technology. The 20th Annual Neuromusic Conference, Hamilton, Canada.

Flannery, M., Saxena, S., Schlichting, J. & **Fink, L.** (2024, July). Investigating the Influence of Contextual Information on Cardiac Activity in Response to Musical Performance. Society for Music Perception & Cognition, Banff Centre for Arts and Creativity, Banff, Canada.

Flaten, E. & **Trainor, L. J.** (2024, July). Infant Top-Down Representation of Meter: Investigating Generalizability. International Congress of Infant Studies, Glasgow, Scotland.

General, A.M., Maracle, J. & **Kučerová, I.** (2024, November) Teyethinorawèn:'e. Language Revitalization in the Home. Indigenous Research Day, McMaster University, Hamilton, Canada.

Gokarn, Z., Monter, L., Trainor, L. J., Bosnyak, D., Dotov, D., Witek, J. & Cameron, D. (2024, November). Investigating how Rhythm, Bass, and Social Movement Motivate Dancing at an EDM Concert. The 20th Annual NeuroMusic Conference, McMaster University, Hamilton, Canada.

He, C., Wood, E., Finnerty, R., McWeeny, S. & **Trainor, L. J.** (2024, November). The Role of Shared Music Preferences on Social Bonding during Passive Music Listening. The 20th Annual NeuroMusic Conference, McMaster University, Hamilton, Canada.

Iorio, C., Edalati, M., Georlette, B., Trainor, L. J., Moghimi, S. & Tillmann, B. (2024 October). Rhythm Processing and Production in Early Development: Drumming and Dancing to Music! The French Association for Timing, Paris, France.

Iorio, C., Edalati, M., Trainor, L. J., Fiveash, A., Caclin, A., Dalla Bella, S., Moghimi, S. & Tillmann, B. (2024, July). Rhythms of Cognition: Exploring the Links between Statistical Learning and Rhythmic. The Neurosciences and Music-VIII, Helsinki, Finland.

PRESENTATIONS (CONT)

Iorio, C., Moghimi, S., **Trainor, L. J.** & Tillmann, B. (2024, May). Sequencing Abilities in Music, Language and Movement: Focus on Rhythm. The Collectif Cognitif Conference, Paris, France.

Klein, L. & **Trainor, L. J.** (2024, November). Empirical Assessment of the Phenomenology of Peak Group Musical Experiences. The 20th Annual NeuroMusic Conference, McMaster University, Hamilton, Canada.

Klein, L., Wood, E. & **Trainor, L. J.** (2024, July). Information Flow and Synchrony in Two Auditory Representations of the Sounds of Ensemble Musicians. The Society for Music Perception and Cognition, Banff, Canada.

Kučerová, I. (2024, January). Language Preservation and Revitalization: Where we are and where we go from here. Third Age Learning Linguistics, Guelph, Canada.

Kučerová, I. (2024, March). The Syntax of Gender. Linguistics Colloquium, University of Calgary, Calgary, Canada.

Kučerová, I. (2024, May) The Syntax of Gender Features. The Leiden/Bielefeld Workshop on Comparative Syntax, University of Leiden, Leiden, Netherlands.

Kučerová, I. (2024, May). The Syntax of Gender Features. University of Graz, Graz, Austria.

Kučerová, I. & Zarka, A. (2024, March) On the Interaction of Differential Object Marking and non-default Discourse Commitments. The Referential Structure in Communication: International Conference on Language and Communication, University of Tokyo, Tokyo, Japan.

Kuperman, V. (2024, March). Highlights of the Research Program of the McMaster Reading Lab. The Pontificia Universidad Catolica de Valparaiso, Valparaiso, Chile.

Kuperman, V. (2024, March). The Pipeline of Eye-Tracking Research. The Pontificia Universidad Catolica de Valparaiso, Valparaiso, Chile.

Kuperman, V. (2024, April). Cognitive Well-Being of Seniors during the COVID-19 Pandemic. Conference on Corpora for Language and Aging Research, Tübingen University, Tübingen, Germany.

Kuperman, V. (2024, May). Linguistic Distance in the Studies of Second Language Reading. University of Macau, Macau, China.

Kuperman, V. (2024, December). Analysis of Eye-Tracking Data using R. Hanoi University of Industry, Hanoi, Vietnam.

Kuperman, V. (2024, December). New Trends in Psycholinguistic Research. Hanoi University of Industry, Hanoi, Vietnam.

Kuperman, V. (2024, December). Eye-Movement Corpora Advance Psychological Science. Symposium on Eye-Movement Corpora, Guangzhou University, Nanning, China

Mashhadi, A. R., Stamatiadis, A., Kongolo, G., Ghostine, G., Levé, F, Trainor, L. J., Wallois, R. & Moghimi, S. (2024, November). Rhythmic Versus Arrhythmic Sequences Induce Different Cortical Activity Patterns in the Premature Brain: Preliminary fNIRS Results. VIII Biennial Meeting of the Society for Functional Near-Infrared Spectroscopy (SfNIRS) 2024, Birmingham, United Kingdom.

McQueen, S., Hammond, M., McParland, A., **Sonnadara, R. R.** & Moulton, C. A. (2024, May). Cognitive Flow Redefined: Understanding the Surgeon Experience of Flow. University of Toronto Gallie Day, Toronto, Canada.

McWeeny, S., Trainor, L. J., Armstrong, S., Bosnyak, D., Tawfik, H. & Bruce, I. (2024, August). Evaluation of Assistive Listening Systems for Live music. International Hearing Aid Research Conference, Tahoe, USA.

Miguel, M., Cannon, J. & **Trainor, L. J.** (2024, November). Does Switching Partners Enhance Non-Verbal Communication in Partner Dancing. The 20th Annual NeuroMusic Conference, McMaster University, Hamilton, Canada.

Miller, H., Sakamoto, S., Wood, E. & **Trainor, L. J.** (2024, November). The Effect of Timbre Proximity on Auditory Stream Formation in Polyphonic Music: Preliminary Discussion on Behavioural Outcomes. The 20th Annual NeuroMusic Conference, McMaster University, Hamilton, Canada.

Noseworthy, M.D. (2024, March). Free Breathing Techniques, Under Sampling and Deep Learning: How Does it all Work? General Electric Healthcare, MR User Symposium 2024, Vancouver, Canada.

Noseworthy, M.D. (2024, March). The New Frontier of MRI: Free Breathing, Under-Sampling and Deep Learning Reconstruction. General Electric Healthcare, MR User Symposium 2024, Vancouver, Canada.

Noseworthy, M.D. (2024, March). Personalized Brain Injury Assessment with MRI and Machine Learning. General Electric Healthcare, MR User Symposium 2024, Vancouver, Canada.

Noseworthy, M.D. (2024, April). Current State of the Art Magnetic Resonance Imaging of Breast Cancer. Ontario Association of Medical Radiation Sciences (OAMRS) Breast Imaging Symposium, Virtual.

Noseworthy, M.D. (2024, May). Personalized Brain Injury Assessment Using Advanced MRI Approaches. University of Waterloo, Waterloo, Canada.

Noseworthy, M.D. (2024, May). Development of Magnetic Resonance Imaging (MRI) Technologies for the Non-Invasive Assessment of Human Physiology. University of Ruse, Ruse, Bulgaria.

Noseworthy, M.D. (2024, November). Using Machine Learning for Imaging Acquisition and Reconstruction. Ontario Association of Medical Radiation Sciences (OAMRS) AI Education Summit, Virtual.

Pape, D. (2024, October). Individual Versus Systematic Variation in Speech: Examining Consonant and Prosodic Contrasts. National Taiwan University, Taiwan, China.

Pape, D. (2024, October). Speech Acquisition of Fricatives and Difficult-to-Pronounce Names: Examining Individual Versus Systematic Differences. National Taiwan University, Taiwan, China.

Pape, D. (2024, November). Individual Versus Systematic Variation in Speech: Examining Prosodic and Sibilant Contrasts. University of Hong Kong, Hong Kong, China.

Pape, D. (2024, November). Examining Systematic Speech Production and Perception Variation: Acoustic Experiments in the Areas of Prosody and Fricatives. University of Melbourne, Melbourne, Australia.

Pape, D. (2024, October). Individual Versus Systematic Variation in Speech: Examining Consonant and Prosodic Contrasts. National Taiwan University, Taiwan, China.

Pape, D. (2024, October). Speech Acquisition of Fricatives and Difficult-to-Pronounce Names: Examining Individual Versus Systematic Differences. National Taipei University of Technology, Taiwan, China.

Pazdera, J. & **Trainor, L. J.** (2024, July). Pitch-Induced Illusory Percepts of Time. The Society for Music Perception and Cognition, Banff, Canada.

Psaris, M. V. & **Trainor, L. J.** (2024, November). Neural Rhythm Tracking in Prematurely-Born Infants. The 20th Annual NeuroMusic Conference, McMaster University, Hamilton, Canada.

Ray, A., **Trainor, L. J.** & Cameron, D. (2024, November). Infants have a Movement Bias for Rhythms with Moderate Syncopation. The 20th Annual NeuroMusic Conference, McMaster University, Hamilton, Canada.

Ripley, S. & **Trainor, L. J.** (2024, November). Investigating the Bidirectional Effects of Infant-Directed Singing and Speech in Caregiver-Infant Interactions: A Planned Dual Eye-Tracking Study. The 20th Annual NeuroMusic Conference, McMaster University, Hamilton, Canada.

Saadatmehr, B., Edalati, M., Wallois, R., Ghostine, G., Kongolo, G., Flaten, E., Tillmann, B., **Trainor, L. J.** & Moghimi, S. (2024, July). Auditory Rhythm Encoding during the Last Trimester of Gestation: From Tracking the Beat to Tracking Hierarchical Nested Temporal Structures. The Neurosciences and Music-VIII, Helsinki, Finland.

Sakamoto, S. & **Trainor, L. J.** (2024, April). Early Auditory Stream Formation of Simultaneous Musical Objects. The Cognitive Neuroscience Society, Toronto, Canada.

Sakamoto, S., Wood, E. & **Trainor, L. J.** (2024, July). Early Stream Formation of Simultaneous Sound: Comparing Speech and Music. The Society for Music Perception and Cognition, Banff, Canada.

Saxena, S., Schlichting, J., Flannery, M. & **Fink, L.** (2024, November). Eye Tracking for Collaborative Music Experiences: A Framework for Recording and Analysing Collective Attention in Naturalistic Concert Settings. The 20th Annual Neuromusic Conference, Hamilton, Canada.

Saxena, S., Flannery, M., Schlichting, J. & **Fink, L.** (2024, July). Gaze Behavior in Online and In-Person Concert and Film Viewing: A Large-Scale Naturalistic Eye-Tracking Study. The Society for Music Perception & Cognition, Banff Centre for Arts and Creativity, Banff, Canada.

Schlichting, J., Saxena, S., Flannery, M. & **Fink, L.** (2024, September). Musik und Sozialpolitisches Engagement: Hintergrundinformationen und Gemeinsame Anwesenheit Beeinflussen Publikumsreaktionen und Begünstigen Prosoziale Handlungen, Hochschule für Musik und Theater München, Munich, Germany.

Schlichting, J., Saxena, S., Flannery, M. & **Fink, L.** (2024, July). Social Justice Advocacy through Music Performance: Do Contextual Information and Social Co-Presence Shape Audience Reactions and Behavior? The Society for Music Perception & Cognition, Banff Centre for Arts and Creativity, Banff, Canada.

Schlichting, J., Saxena, S., Flannery, M. & **Fink, L.** (2024, November). A Multi-Method Exploration of the Impact of Music Advocacy. The 20th Annual Neuromusic Conference, Hamilton, Canada.

Segreto, M., Hove, M., Bosnyak, D., **Fink, L.**, Trainor, L. & Cameron, D. (2024, November). How does Bass Make us Move? Investigating the Sensory and Physiological Mechanisms of Very Low Frequencies' Effect on Movement. The 20th Annual Neuromusic Conference, Hamilton, Canada.

Trainor, L. J. (2024, February) Effects of Music on Early Brain Development. Child Neurology Association, Neurology through Art & Time Series, London, United Kingdom.

Trainor, L. J. (2024, September). Measuring and Understanding Audience Experiences at Concerts: Workshop on Concert Experience. RITMO Centre for Interdisciplinary Studies in Rhythm, Time and Motion, University of Oslo, Oslo, Norway.

Trainor, L. J. (2024, September). The Critical Role of Rhythm in Infants' Perceptual, Communicative and Social Development. RITMO Centre for Interdisciplinary Studies in Rhythm, Time and Motion, University of Oslo, Oslo, Norway.

Trainor, L. J. (2024, October) How Rhythm Structures Experience: From Auditory Perception to Musical Development to Social Interaction. Biology of Music Lecture Series, McGill University, Montreal, Canada.

Trainor, L. J. (2024, November). Celebrating the 10th Anniversary of the LIVELab: A Look Past. The 20th Annual NeuroMusic Conference, McMaster University, Hamilton, Canada.

Trainor, L. J. (2024, Decembre). Rhythm, Timing, and the Predictive Brain: The Biological Foundations of Music. Toronto Ravel, Hugh's Room, Toronto, Canada.

Trainor, L. J. & Carrillo, C. (2024, July). The Promise of Rhythmic Auditory-Motor Training for Children with Developmental Coordination Disorder. The Neurosciences and Music-VIII, Helsinki, Finland.

Trainor, L. J., Hunter, S., Psaris, M., Flaten, E., Werker, J. & Finlay, B. B. (2024, July). The Role of the Gut Microbiome in Neural Tracking of Rhythm: Implications for Brain Development in Premature Infants. The International Congress of Infant Studies, Glasgow, Scotland.

Wood, E., Klein, L. & **Trainor, L. J.** (2024, July). The Effect of Cannabis on Live Improvised Performances. Society for Music Perception and Cognition, Banff, Canada.

CONFERENCE PROCEEDINGS & ABSTRACTS (14)

Amador-Tejada, A., Kumbhare, D.A. & **Noseworthy, M.D.** (2024). Characterization of the Resting-State Blood Oxygen Level-dependent (BOLD) Signal from Skeletal Muscle of the Lower Leg with Resting-State Functional MRI (rs-fMRI) Metrics: Amplitude of Low-Frequency Fluctuation (ALFF), Fractional ALFF (fALFF), Approximate Entropy (AppEn) and Lyapunov Exponent. European Society for Magnetic Resonance in Medicine and Biology (ESMRMB). Magnetic Resonance Materials in Physics, Biology, and Medicine. Book of Abstracts ESMRMB 2024 Online 40th Annual Scientific Meeting 2-5 October 2024, 37, S657–S659, 403.

Bulakh, M. & **Pape, D.** (2024). Ukrainian Speakers' Articulation of Posterior Consonants Comparing Ukrainian, Russian and L2 English: An Ultrasound Study. International Conference Ultrafest XI - Ultrasound Imaging for Speech and Language: Extended Abstracts, 140-42.

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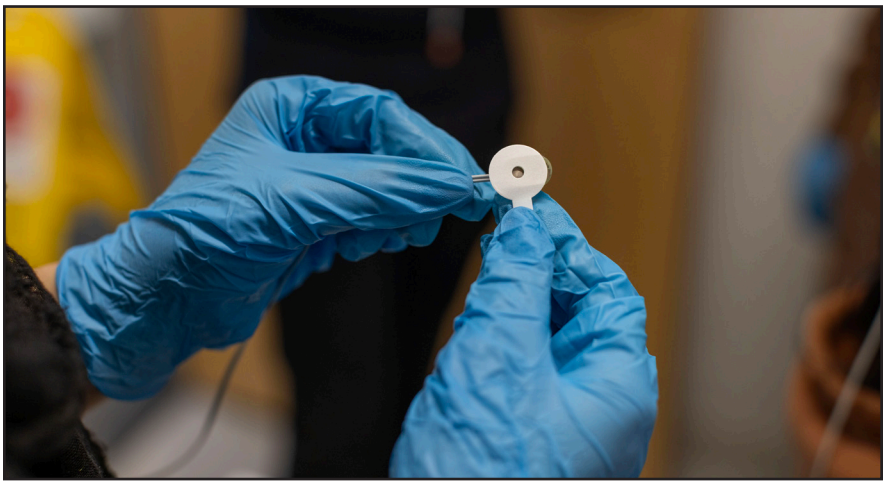

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Nowikow, C. & **Noseworthy, M.D.** (2024). Considering External Calibrant Signal Distributions when Quantifying 23Na-MRI Maps. Proceedings of the 22nd Annual Imaging Network Ontario Symposium March 19-20, 2024, 53.

Nowikow, C., Schulte, R.F., Vaeggemose, M. & **Noseworthy, M.D.** (2024). On the Effect of K-Space Trajectory on Quantification Accuracy of Sodium TSC Maps. European Society for Magnetic Resonance in Medicine and Biology (ESMRMB). Magnetic Resonance Materials in Physics, Biology, and Medicine. Book of Abstracts ESMRMB 2024 Online 40th Annual Scientific Meeting 2-5 October 2024, 37, S232–S234, P139.

Santos-Diaz, A., Sharma, B., Danielli, E., Marrufo-Melendez O.R. & **Noseworthy M.D.** (2024). Analysis of Functional Connectivity in COVID-19 Recovered Patients after Hospital Discharge using Resting State fMRI. European Society for Magnetic Resonance in Medicine and Biology (ESMRMB). Magnetic Resonance Materials in Physics, Biology, and Medicine. Book of Abstracts ESMRMB 2024 Online 40th Annual Scientific Meeting 2-5 October 2024, 37, S324–S325, P191.

Singh, S., **Becker, S.,** Khayachi, A., Trappenberg, T. & Nunes, A. (2024), Bipolar Disorder and the Dentate Gyrus: Effects of Lithium Therapy on Pattern Separation in Silico. Cosyne 2024, 29 February-3 March, 41.

Tavakkoli, M., van den Berg, D., Svenningsen, S., Konyer, N.B., Nair, P., Caan, M.W.A. & **Noseworthy, M.D.** (2024). Accelerating Hyperpolarized 129Xe Ventilation MRI using the Recurrent Inference Machine. European Society for Magnetic Resonance in Medicine and Biology (ESMRMB). Magnetic Resonance Materials in Physics, Biology, and Medicine. Book of Abstracts ESMRMB 2024 Online 40th Annual Scientific Meeting 2-5 October 2024, 37, S164–S741, P743.

Tavakkoli, M., Runderkamp, B.A, de Buck, M.H.S., **Noseworthy, M.D.,** Nederveen, A.J., Caan, M.W.A. & van der Zwaag, W. (2024) Advancing Free-Breathing Liver MRI at 7T with Pseudo-Spiral Cartesian Sampling and Phase-Shimming. International Society for Magnetic Resonance in Medicine (ISMRM) May 5-9, 2024, 33, 4012.

Thusyanthan, V., Bagheri, S., Kinley, I., Singh, S. & **Becker, S.** (2024), Frontal-Midline Cross-Frequency Coupling in Rumination: An EEG Study. NeuroEXchange Conference Abstract Book, 21.

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GRANTS

2024 was another big year for ARiEAL and ARiEAL researchers as we obtained more funding for our research, knowledge mobilization, and training activities. ARiEAL and ARiEAL researchers secured 21 new grants, totalling more than **$15 million**, as Principal Investigator and co-applicants from both internal and external sources. Funding sources include McMaster University, the Canadian Institutes of Health Research (CIHR), Natural Sciences and Engineering Research Council of Canada (NSERC), Social Sciences and Humanities Research Council (SSHRC), Mitacs, Canadian Foundation for Innovation (CFI), National Institutes of Health (NIH), Ministry of Colleges and Universities, as well as various other foundations and institutions.

Biggs, A. Evaluating Skills in Language Analysis. Paul R. MacPherson Institute for Leadership, Innovation, and Excellence in Teaching (McMaster University), Student Partners Program, $2,000, 2024-25.

Bowles, A. (PI), **Turkstra, L.** (Site PI), Cooper, D. Lu,L., Ivins, B. & Grills. Symptom-Targeted Approach to Rehabilitation for Concussion (STARC): Randomized Clinical Trial of In Person vs. Telehealth vs Waitlist Control. C. Congressionally Directed Medical Research Programs (CDMRP) Traumatic Brain Injury and Psychological Health Research Program, $2.6M USD (3.6M CAD), 2024-26.

Brodbeck, C. Neural Mechanisms Underlying Linguistic Context Use for Speech Processing in Aging. National Institutes of Health, National Institute on Deafness and Other Communication Disorders, $1,483,368 USD (2.07M CAD), 2024-29.

Brodbeck, C. User-Friendly Open-Source Pipeline for Anatomically Precise Analysis of Single-Trial M/EEG. National Institutes of Health, National Institute of Mental Health, $1,199,609 USD (1.67M CAD), 2024-27.

Cameron, D., Dotov, D., Witek, M. & **Trainor, L.** Feeling the Music Together: How Sound and Social Factors drive Movement Dynamics on the Dance Floor. Social Sciences and Humanities Research Council of Canada, Insight Development Grant, $68,684, 2024-26.

Dagenais, M. "On the Road": ARiEAL Extended Outreach Program for Underrepresented High School Students. Paul R. MacPherson Institute for Leadership, Innovation, and Excellence in Teaching (McMaster University), Student Partners Program, $2,000, 2024-25.

Dagenais, M. ARiEAL Research Magazine, Vol. 2. Paul R. MacPherson Institute for Leadership, Innovation, and Excellence in Teaching (McMaster University), Student Partners Program, $2,000, 2024.

D'Angelo, W. & **Dagenais, M.** ARiEAL-Linguistics & Languages Professionalization Preparedness Program. Paul R. MacPherson Institute for Leadership, Innovation, and Excellence in Teaching (McMaster University), Student Partners Program, $2,000, 2024-25.

Kučerová, I. & **Dagenais, M.** ARiEAL: Building Accessible and Flexible Cutting-Edge Learning through Technology. Ministry of Colleges and Universities (Ontario, Canada), Training Equipment and Renewal Fund, $24,700, 2024-25.

Iversen, J., **Fink, L.** & **Trainor, L.** J. Disseminating New Modes of Creativity and Audience Immersion at the Intersection of Performance and Technology. Social Sciences and Humanities Research Council of Canada, Connection Grant, $24,225, 2024-2025.

Fink, L. Building Intuitive Human-Computer Interactions with Eye Movements and Sound. Mitacs, Globalink Research Internship Award, $12,000, 2024.

Fink, L. The Role of Brain-Viscera Coupling in Shaping Subjective Experience and Social Interaction. Canadian Foundation for Innovation, John R Evans Leaders Fund & Ontario Research Fund Small Infrastructure Fund, $500,000, 2024-26.

CIHR IRSC
Canadian Institutes of Health Research | Instituts de recherche en santé du Canada

NSERC CRSNG

INNOVATION.CA
CANADA FOUNDATION FOR INNOVATION | FONDATION CANADIENNE POUR L'INNOVATION

Social Sciences and Humanities Research Council of Canada
Conseil de recherches en sciences humaines du Canada

Canada

Magnuson, J. (PI), Myers, E. (co-PI), **Brodbeck, C.** (co-PI) & **Gaston, P.** (co-I). Tracking and Modeling the Neurobiology of Multilingual Speech Recognition. CRCNS US-Spain Research Proposal: Collaborative Research Grant, National Science Foundation, Sub-award from University of Connecticut, $127,274 CAD, 2024.

Landi, N. (PI) & **Brodbeck, C.** (Co-I). Predicting Intervention Outcomes in Reading Disabled Students Using In-School Cognitive Neuroscience. National Institutes of Health, Eunice Kennedy Shriver National Institute of Child Health and Human Development, $2,993,249 USD (4.18M CAD), 2024-29.

McWeeny, S. & **Trainor, L.** Improving Vocal Music Experiences for Hearing-Aid Users through Hearing-Aid Integrated Assistive Listening Technology. Arts Research Board, Social Sciences and Humanities Research Council of Canada Explore Grant, $5,268, 2024-2026.

Sonnadara, R. Operating Funding Extension for Compute Ontario. Ontario Ministry of Colleges and Universities Invited Funding Call, $2,900,000, 2024-26.

Trainor, L. Neural Measures of Caregiver-Infant Interactions During Infant-Directed Speech and Singing. Natural Sciences and Engineering research Council of Canada, Research Tools and Instruments, $150,000, 2024-25.

Trainor, L. & Stafford, S. LIVELab Hybrid Concert Series. Incite Foundation for the Arts, $15,000, 2024-2025.

Trainor, L. & Stafford, S. LIVELab Youth Outreach for Underrepresented Youth. Incite Foundation for the Arts, $20,000, 2024-2025.

Zeraatkar, D. (PI), Busse, J. (PI), Agoritsas, T., Brignardello, R., Petersen, S., Chakraborty, I., Florez, G., Guyatt, A., Izcovich, L., Mbuagbaw, R., McIntyre, E., Mills, R., Morgan, S., Murthy, T., Pitre, G., Rada, S., Ritz, L., Thabane, L. **Turkstra, L.** & Turner, T. A Living Systematic Review and Network Meta-Analysis of Interventions for Long COVID. Canadian Institutes of Health Research Project Grant, $250,000, 2024-27.

Zeraatkar, D. (PI), Busse, J. (PI), Agoritsas, T., Vandvik, P.O., Guyatt, G., Brignardello Petersen, R. Mbuagbaw, L., Ritz, S., Pitre, T., G. Rada, G., Darzi, A., Morgan, R., Izcovich, A., Chakraborty, S., Turner, T., Mills, E., Murthy, S., **Turkstra, L.S.**, McIntyre. R., Kirsh, S., Jassal, T., Ling, M. & Talukdar, J. A Living Systematic Review and Network Meta-Analysis of Interventions for Post COVID-19 Condition. Long Covid Web, $50,000, 2024-2025.

IMPACT

Every year, ARiEAL strives to produce ethically conscious research that engages with a diverse global scientific community and impacts our broader society. We are also committed to producing research that harnesses the strengths of our collaborative and interdisciplinary community. Our trainees have particularly been at the forefront of ARiEAL's research output as several of our undergraduate, graduate, and postdoctoral trainees as well as senior research associates and other affiliated scholars have published articles in high-impact journals, presented their work at international conferences, and won prestigious research grants and awards. Thanks to funding from the MacPherson Institute, we published the second volume of our **ARiEAL Research Magazine** and launched the **ARiEAL Outreach Program for Underrepresented High School Students**, which allowed us to connect with local high school students from underrepresented communities and introduce them to language sciences via in-person, interactive workshops. In 2024, we also welcomed the first cohort of our International Scholar Award Program, which provided an opportunity for researchers from the Global South and other underrepresented areas to join ARiEAL and collaborate on our research projects. Finally, in 2024, we further embarked on numerous new **professionalization initiatives** to prepare our trainees for their future careers, including our **Life after ARiEAL Speaker and Video Series**. The aim of this series is to talk to ARiEAL Alumni about their post-graduate careers, how their degrees in Language Sciences helped them find their jobs, and how their academic training continues to support them in their current roles.

GLOBAL & COMMUNITY OUTREACH

ARiEAL has always been committed to expanding McMaster's community outreach and international collaborations. In 2024, we expanded our commitments to support ethical and collaborative research with marginalized and underrepresented communities and to support research that is guided by, for, and benefits marginalized and underrepresented communities around the world.

In Winter 2024, we were proud to welcome the first international visitors through our newly launched **International Scholar Award Program**. This initiative was created to support researchers from the Global South and other underrepresented regions, offering them an opportunity to collaborate with ARiEAL on cutting-edge research projects. Following a competitive selection process with over 40 applications from around the world, four scholars – **Dr. Mary Amaechi (Nigeria), Dr. Renan Ferreira (Brazil), Felix Kpogo (Ghana)**, and **Esther Vicente Manzando (Spain)** – were selected to join us. Each scholar received a stipend to support travel, accommodations, and living expenses. During their stay, they resided together in a shared house in Dundas, fostering a strong sense of community. They actively engaged with ARiEAL researchers and trainees, contributing to and benefiting from a range of research, networking, and professional development activities.

In spring and summer 2024, and in collaboration with **iStep** – a McMaster-based STEM-based Enrichment Program – we hosted three groups of grade 12 students from the Black communities of the **Hamilton-Wentworth** and **Halton District Schoolboards** and introduced them to Language Sciences. Using an experiential learning approach, we organized EEG, eye tracking, and ultrasound experiments. Students appreciated our hands-on approach and were fascinated by how language scientists at ARiEAL use STEM-based research methods to answer Humanities-focused questions. Our program was so successful that we are working with iStep again in 2025 and will host more grade 12 student from the local Black communities.

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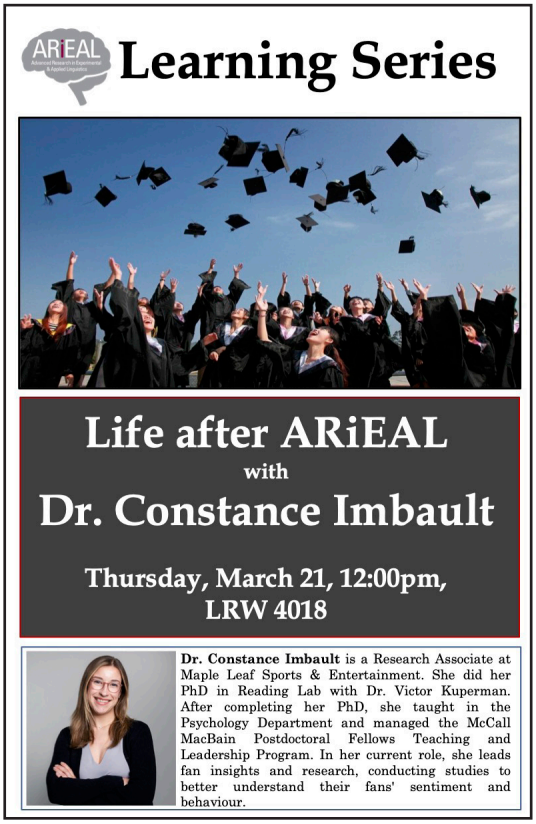
SPEAKER AND LEARNING SERIES

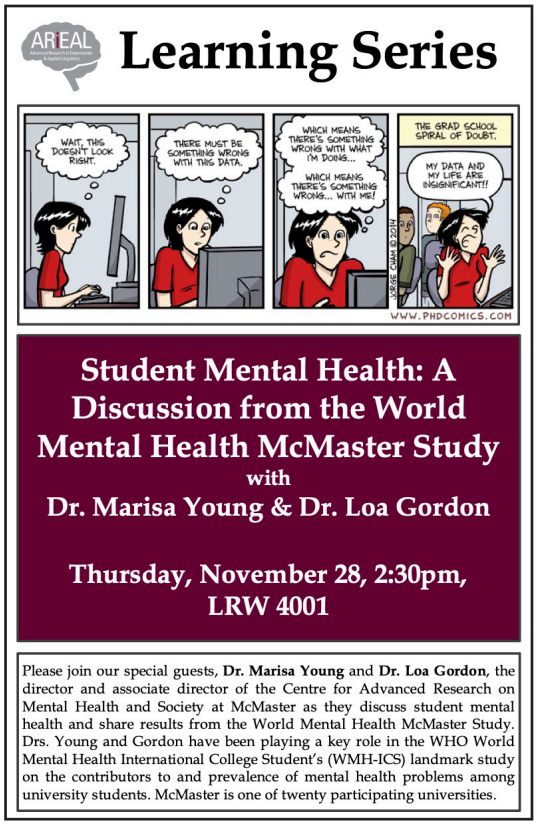
The year 2024 saw many more in-person learning and speaker events at ARiEAL. We continued our tradition of inviting world-renown researchers, such as **Dr. Serhii Zasiekin, Dr. Mary Amaechi, Dr. Renan Ferreira, Felix Kpogo**, and **Esther Vicente Manzando**. In particular, in November 2024, we hosted a special event titled "Student Mental Health: A Discussion from the World Mental Health McMaster Study." Hosted by **Dr. Marisa Young** and **Dr. Loa Gordon**, they discussed student mental health and shared results from the World Mental Health McMaster Study. Drs. Young and Gordon have been playing a key role in the WHO World Mental Health International College Students landmark study on the contributors to and prevalence of mental health problems among university students. McMaster is one of twenty participating universities.

Through our **Brown Bag series**, we also encouraged our own community of researchers and trainees to share their work-in-progress, allowing all to workshop their work for some constructive feedback from our team. In particular, **Dr. Renan Castro Ferreira** presented his research on bilingual minds and conceptual transfer in the use of English as a foreign language. Throughout, he demonstrated how the journey of learning a new language is more than just assimilating new vocabulary and grammar; it involves a fascinating process of reorganizing our mental frameworks, especially when faced with concepts that do not entirely match across our languages. **Dr. Mary Amaechi** presented her research on sluicing-like constructions in Igbo, demonstrating that while Igbo seems to exhibit genuine English-type sluicing only in matrix clauses, the relevant movement is focus movement rather than wh-movement. She proposed that in Igbo, it is not only the interrogative complementizer but also the focus head that can license clausal ellipsis.

In 2024, we also continued to organize and host learning series events for our trainees, with a further emphasis on their professionalization and career growth. Particularly, we hosted a **Life after ARiEAL Networking Series**. The goal was to invite ARiEAL Alumni that have been doing great things since graduating to talk to our trainees. Throughout this series, our guests talked about their current jobs, how their degree in Language Sciences helped them find their job and is helping them in their current role. Many also discussed their struggles on the job market and how they overcame them.

One of our goals was to normalize the struggle that some of us have on the job market after graduating but also demonstrate how we have tools and skills to succeed and that can help us transition between academia and the non-academic job market. As part of this series, we were pleased to welcome back four former ARiEAL trainees who have gone on to build impactful careers in diverse sectors. **Diane Doran**, now the Delivery Operations Director at BenchSci, contributes to accelerating drug discovery through AI-driven solutions. **Dr. Cassandra Chapman** serves as the Headmaster for Halton and Peel at Brain Power Enrichment Programs, an academic initiative supporting high-achieving students in Grades 1–12. **Dr. Constance Imbault** is a Research Associate at Maple Leaf Sports & Entertainment (MLSE), where she leads fan insights and research to deepen understanding of audience sentiment and behaviour. Finally, **Tess Hudson** is the Research, Training, and Knowledge Mobilization Manager at the Canadian Research Data Centre Network (CRDCN), based at McMaster University.





AI-BASED RESEARCH & PARTNERSHIPS

2024 was an important year for ARiEAL research and partnerships, particularly in the realm of **responsible Artificial Intelligence (AI)**. There is no doubt that AI is one of the next big emerging areas of research in language sciences. While academic institutions still debate how to best ensure that AI tools are ethically used by students, staff, and faculty, and explore how to utilize it as an effective and productive teaching and research tool, some researchers have warned that Indigenous and racialized peoples that already suffer from unequal access to information and communication technologies, known as the "Digital Divide," may suffer the same fate with AI. This "AI Divide" will have disastrous consequences for equity-seeking groups that are already struggling with access to modern technologies.

AI technology is not only here to stay, but it is projected to grow and become a central component of our lives. At ARiEAL, we fully anticipated this growth and recognized that, as language scientists, we have an important role to play in further developing this technology and understanding its societal/human implications. As such, in 2024, members of our team collaborated (and continue to collaborate) on two large-scale projects that tackle the issue of responsible AI and equity. The first is an **NSERC CREATE** proposal titled "Skills Translation in Language Technologies and Sciences (STILTS)" and the second a **Horizon Europe** proposal titled "Closing the AI Divide: Accessibility, Employability, and Safety." With the support of our numerous academic, industry, and community partners around the world, our programs will train a workforce that is able to push the potential of language technologies to develop engineering products and solutions that are cognitively, psychologically, and culturally informed, equitable and inclusive.

TRAINEE PROFESSIONALIZATION INITIATIVES

Training undergraduate, graduate, and post-graduate students remains a core tenet of our priorities. In 2024, we embarked on numerous new professionalization initiatives to further prepare our trainees for their future careers. Along with our **Life after ARiEAL Networking Series**, we secured additional support from the **Training, Equipment, and Renewal Fund** to enhance equipment, technology, and software across several of our labs. These upgrades are designed to give undergraduate and graduate students more opportunities to develop practical, hands-on skills that are essential in both academic research and industry settings. By incorporating these new technologies, we are expanding experiential learning opportunities and helping students build the digital competencies needed for their future careers.

In 2024, we also embarked on a large-scale, interdisciplinary, and collaborative training initiative that will provide our students with the skills to thrive on the job market and benefit society more generally: our proposed **NSERC CREATE** for "Skills Translation in Language Technologies and Sciences (STILTS)," **a first for the Faculty of Humanities**. As AI becomes rapidly integrated into all aspects of life, an urgent need has emerged to address the growing "AI Divide." This divide disproportionately affects vulnerable populations, including users with lower technological literacy (e.g., seniors), speakers of low-resource languages, including Indigenous languages, individuals with speech, hearing, or literacy challenges, and newcomers with limited proficiency in Canada's official languages. Our program directly addresses this challenge by equipping trainees with interdisciplinary technical and professional skills to bridge both the technological and human-centred gaps created by the AI Divide. With strong support from our industry and community partners, this initiative offers students valuable internships and hands-on learning experiences in professional environments to develop these important skills. Importantly, even if external funding is not secured, our partners – which include **Lingvist, All Good Speakers, Maple Leaf Sports and Entertainment, SR Research Ltd., the Brain Injury Association of Peel and Halton**, and **Compute Ontario** – are eager to host interns and contribute to these vital skills-development efforts.

COLLABORATIVE RESEARCH & TRAINING INITIATIVES

The year 2024 once again highlighted the value of our collaborative model. This approach continues to generate impactful research, while also playing a vital role in enhancing the academic and professional development of our students. First, our researchers and trainees co-authored numerous journal articles and conference papers, which resulted from years of collaborative research efforts between our various labs. For example, **Dr. Daniel Pape** worked closely with Senior Research Associate **Dr. Gemma Repiso Puigdelliura** and several trainees on a series of publications and presentations exploring speech perception, production, and Autistic traits. Similarly, **Dr. Victor Kuperman** collaborated with **Dr. Daniel Schmidtke**, a Research Associate in the MELD Bilingualism Lab, on several research projects published in Scientific Reports and Behavior Research Methods. Leveraging our centre's expertise in both theoretical and applied linguistics, our research team also launched a new initiative at ARiEAL: our **Experimental and Theoretical Reading Groups**. More than just reading sessions, they provide a space for discussing upcoming projects and research ideas, with the goal of fostering collaboration and encouraging co-publication by bringing researchers and trainees together in our shared environment. This collaborative model also led to the Faculty of Humanities' first **NSERC CREATE** application (discussed later in this report). ARiEAL's collaborative environment supports research and training that pushes beyond traditional disciplinary boundaries and draws on the strengths of our many labs.

OUR TRAINEES' AND AFFILIATED RESEARCHERS' IMPACT ON ACADEMIA

Our core members are not the only ones that are producing ground-breaking and innovative research, but our trainees and affiliated researchers are as well. In 2024, several of our trainees, from undergraduate students to postdoctoral researchers, research associates, and visiting researchers have published their research in several high-impact journals, presented at numerous local and international conferences and community events, and won several prestigious awards. The following is a portion of this research.

CONFERENCE PROCEEDINGS & ABSTRACTS

Amador-Tejada, A., Kumbhare, D.A. & Noseworthy, M.D. (2024). Characterization of the Resting-State Blood Oxygen Level-dependent (BOLD) Signal from Skeletal Muscle of the Lower Leg with Resting-State Functional MRI (rs-fMRI) Metrics: Amplitude of Low-Frequency Fluctuation (ALFF), Fractional ALFF (fALFF), Approximate Entropy (AppEn) and Lyapunov Exponent. European Society for Magnetic Resonance in Medicine and Biology (ESMRMB). Magnetic Resonance Materials in Physics, Biology, and Medicine. Book of Abstracts ESMRMB 2024 Online 40th Annual Scientific Meeting 2-5 October 2024, 37, S657–S659, P403.

Bulakh, M. & Pape, D. (2024). Ukrainian Speakers' Articulation of Posterior Consonants Comparing Ukrainian, Russian and L2 English: An Ultrasound Study. International Conference Ultrafest XI-Ultrasound Imaging for Speech and Language: Extended Abstracts, 140-42.

Dochu, A. (2024). Revitalization of the Crimean Tatar Language (with Reference to the Opinions of Crimean Tatars Living in Ukraine, Canada and the US). Conference Abstract Book for the International Scientific Conference Beyond Words: Persuasive Narratives and Multimodal Discourse 24-25 October 2024.

Hu, Y., Lim, J., **Kakonge, L.**, Mitchell, J.T., Johnson, H.L., Turkstra, L.S., Duff, M.C., Toma, C.L. & Mutlu B. (2024), SMART-TBI: Design and Evaluation of the Social Media Accessibility and Rehabilitation Toolkit for Users with Traumatic Brain Injury. Assets' 24: Proceedings of the 26th International ACM SIGACCESS Conference on Computers and Accessibility, 37, 1-19.

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Thusyanthan, V., Bagheri, S., Kinley, I., **Singh, S.** & Becker, S. (2024), Frontal-Midline Cross-Frequency Coupling in Rumination: An EEG Study. NeuroEXchange Conference Abstract Book, 21.
The following is a fragment of this research.

Van Abbema, E., Pape, D. & **Repiso-Puigdelliura, G.** (2024). The Role of Foreign Accents in Humor Appreciation: An Exploratory Perception Study. Proceedings of the Nineteenth Australasian International Conference on Speech Science and Technology, 3-5 December 2024.

JOURNAL ARTICLES & BOOK CHAPTERS:

Amador-Tejada, A., McGillivray, J., Kumbhare, D.A. & Noseworthy, M.D. (2024). Denoising of the Gradient Artifact Present in Simultaneous Studies of Muscle Blood Oxygen Level Dependent (BOLD) Signal and Electromyography (EMG). Magnetic Resonance Imaging, 111, 179-185.

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Lana, N. & Kuperman, V. (2024). Learning Concrete and Abstract Novel Words in Emotional Contexts: Evidence from Incidental Vocabulary Learning. Language Development and Learning, 20(2), 158-173.

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Madanlal, D., Guinard, C., Pardo Nuñez, V., Becker, S., Garnham, J., Khayachi, A., Léger, S., O'Donovan, C., **Singh, S.**, Stern, S., Slaney, C., Trappenberg, T., Alda, M. & Nunes, A. (2024), A Pilot Study Examining the Impact of Lithium Treatment and Responsiveness on Mnemonic Discrimination in Bipolar Disorder. Journal of Affective Disorders, 351, 49-57

McWeeny, S., Luoma, A. C., Al-Saleem, Y. & Trainor, L. J. (2024). Synchronous and Anti-Phase Drumming Elicit Similar Prosocial Behaviour. Frontiers in Cognition, 3.

Pazdera, J. & Trainor, L. J. (2024). Pitch-Induced Illusory Percepts of Time. Attention, Perception, & Psychophysics. Attention, Perception, & Psychophysics, 87, 545-564.

Schmidtke, D. & Kuperman, V. (2024). A Psycholinguistic Study of Intergroup Bias and its Cultural Propagation. Scientific Reports, 14, 8613.

Schmidtke, D., Van Dyke, J.A. & Kuperman, V. (2024). DerLex: An Eye-Movement Database of Derived Word Reading in English. Behavior Research Methods, 57, 11.

Tavakkoli, M., Svenningsen, S., Friedlander, Y., Konyer, N.B., Nair, P. & Noseworthy, M.D. (2024). Sampling Pattern Discrepancy in the Application of Compressed Sensing Hyperpolarized Xenon-129 Lung MRI. NMR in Biomedicine, 37(6), e5121.

Toma, C.L., Hwang, J., **Kakonge, L.,** Morrow, E., Turkstra, L.S., Mutlu, B. & Duff, M (2024). Does Facebook Use Provide Social Benefits to Adults with Traumatic Brain Injury? Cyberpsychology, Behavior, and Social Networking, 27(3), 214-220.

PRESENTATIONS:

Ahmad, F. & Service, E. (2024, May). The Investigation of Foreign Word Memory using Nursery Rhymes. 1st Annual Symposium of Montréal Institute for Second Language Acquisition (MonISLA), Montr´´al, Canada.

Anderson, C., Kirk, R., **Miguel, M., Wood, E.,** Tawfik, H., Bosnyak, B. & Trainor, L. J. (2024, November). Highly Expressive Moments Correspond to Less Audience Synchronization during a Live Concert. 20th Annual NeuroMusic Conference, McMaster University, Hamilton, Canada.

Bulakh, M. & Pape, D. (2024). Ukrainian Speakers' Articulation of Posterior Consonants Comparing Ukrainian, Russian and L2 English: An Ultrasound Study. International Conference Ultrafest XI-Ultrasound Imaging for Speech and Language, University of Aizu, Japan.

Bao, Y. & Kuperman, V. (2024, August). Comparative Analysis of Saccadic Main Sequence in Horizontal and Vertical Reading. European Conference on Eye Movements, Maynooth University, Ireland.

Biggs, A. & **Lopes, B.** (2024, June). The Syntax of Stative Participles in Brazilian Portuguese. Canadian Linguistic Association Annual Conference, Carleton University, Ottawa, Canada.

Cameron, D., Psaris, M., Carrillo, C. & Trainor, L. J. (2024, July). Assessing the Development of the Syncopation-Groove Relationship in Infants and Children. The Neurosciences and Music-VIII, Helsinki, Finland.

Dochu, A. (2024, October). Revitalization of the Crimean Tatar Language (with Reference to the Opinions of Crimean Tatars Living in Ukraine, Canada and the US). Beyond Words: Persuasive Narratives and Multimodal Discourse, Vilnius University, Lithuania.

Finnerty, R. & Trainor, L. J. (2024, July). Group Music Therapy: A Proactive Mental Health Option. The Neurosciences and Music-VIII, Helsinki, Finland.

Finnerty, R. & Trainor, L. J. (2024, November). Music Therapy for Proactive Wellness. The 20th Annual NeuroMusic Conference, McMaster University, Hamilton, Canada.

Flannery, M. & Fink, L. (2024, November). Naturalistic Measurement of Multi-Person Cardiac Activity using Open Source Smartwatch Technology. The 20th Annual Neuromusic Conference, Hamilton, Canada.

Flannery, M., Saxena, S., Schlichting, J. & Fink, L. (2024, July). Investigating the Influence of Contextual Information on Cardiac Activity in Response to Musical Performance. Society for Music Perception & Cognition, Banff Centre for Arts and Creativity, Banff, Canada.

Flaten, E. & Trainor, L. J. (2024, July). Infant Top-Down Representation of Meter: Investigating Generalizability. Poster presented at the International Congress of Infant Studies, Glasgow, Scotland.

Gallant, J. & Libben, G. (2024, July). Effects of Stress Shift on the Typed Production of Derived Word Forms. MoProc 2024: International Word Processing Conference, University of Belgrade, Belgrade, Serbia.

He, C., **Wood, E., Finnerty, R., McWeeny, S.** & Trainor, L. J. (2024, November). The Role of Shared Music Preferences on Social Bonding during Passive Music Listening. The 20th Annual NeuroMusic Conference, McMaster University, Hamilton, Canada.

Klein, L. & Trainor, L. J. (2024, November). Empirical Assessment of the Phenomenology of Peak Group Musical Experiences. The 20th Annual NeuroMusic Conference, McMaster University, Hamilton, Canada.

Klein, L., Wood, E. & Trainor, L. J. (2024, July). Information Flow and Synchrony in Two Auditory Representations of the Sounds of Ensemble Musicians. The Society for Music Perception and Cognition, Banff, Canada.

Kučerová, I. & **Zarka, A.** (2024, March) On the Interaction of Differential Object Marking and non-default Discourse Commitments. The Referential Structure in Communication: International Conference on Language and Communication, University of Tokyo, Tokyo, Japan.

McWeeny, S., Trainor, L. J., Armstrong, S., Bosnyak, D., Tawfik, H. & Bruce, I. (2024, August). Evaluation of Assistive Listening Systems for Live Music. International Hearing Aid Research Conference, Tahoe, USA.

Miguel, M., Cannon, J. & Trainor, L. J. (2024, November). Does Switching Partners Enhance Non-Verbal Communication in Partner Dancing. The 20th Annual NeuroMusic Conference, McMaster University, Hamilton, Canada.

Miller, H., **Sakamoto, S., Wood, E.** & Trainor, L. J. (2024, November). The Effect of Timbre Proximity on Auditory Stream Formation in Polyphonic Music: Preliminary Discussion on Behavioural Outcomes. The 20th Annual NeuroMusic Conference, McMaster University, Hamilton, Canada.

Pazdera, J. & Trainor, L. J. (2024, July). Pitch-Induced Illusory Percepts of Time. The Society for Music Perception and Cognition, Banff, Canada.

Psaris, M. V. & Trainor, L. J. (2024, November). Neural Rhythm Tracking in Prematurely-Born Infants. The 20th Annual NeuroMusic Conference, McMaster University, Hamilton, Canada.

Ripley, S. & Trainor, L. J. (2024, November). Investigating the Bidirectional Effects of Infant-Directed Singing and Speech in Caregiver–Infant Interactions: A Planned Dual Eye-Tracking Study. The 20th Annual NeuroMusic Conference, McMaster University, Hamilton, Canada.

Saadatmehr, B., Edalati, M., Wallois, R., Ghostine, G., Kongolo, G., **Flaten, E.,** Tillmann, B., Trainor, L. J. & Moghimi, S. (2024, July). Auditory Rhythm Encoding during the Last Trimester of Gestation: From Tracking the Beat to Tracking Hierarchical Nested Temporal Structures. The Neurosciences and Music-VIII, Helsinki, Finland.

Sakamoto, S. & Trainor, L. J. (2024, April). Early Auditory Stream Formation of Simultaneous Musical Objects. The Cognitive Neuroscience Society, Toronto, Canada.

Sakamoto, S., Wood, E. & Trainor, L. J. (2024, July). Early Stream Formation of Simultaneous Sound: Comparing Speech and Music. The Society for Music Perception and Cognition, Banff, Canada.

Saxena, S., Schlichting, J., Flannery, M. & Fink, L. (2024, November). Eye Tracking for Collaborative Music Experiences: A Framework for Recording and Analysing Collective Attention in Naturalistic Concert Settings. The 20th Annual Neuromusic Conference, Hamilton, Canada.

Saxena, S., Flannery, M., Schlichting, J. & Fink, L. (2024, July). Gaze Behavior in Online and In-Person Concert and Film Viewing: A Large-Scale Naturalistic Eye-Tracking Study. The Society for Music Perception & Cognition, Banff Centre for Arts and Creativity, Banff, Canada.

Schlichting, J., Saxena, S., Flannery, M. & Fink, L. (2024, September). Musik und Sozialpolitisches Engagement: Hintergrundinformationen und Gemeinsame Anwesenheit Beeinflussen Publikumsreaktionen und Begünstigen Prosoziale Handlungen, Hochschule für Musik und Theater München, Munich, Germany.

Schlichting, J., Saxena, S., Flannery, M. & Fink, L. (2024, July). Social Justice Advocacy through Music Performance: Do Contextual Information and Social Co-Presence Shape Audience Reactions and Behavior? The Society for Music Perception & Cognition, Banff Centre for Arts and Creativity, Banff, Canada.

Schlichting, J., Saxena, S., Flannery, M. & Fink, L. (2024, November). A Multi-Method Exploration of the Impact of Music Advocacy. The 20th Annual Neuromusic Conference, Hamilton, Canada.

Schmidtke, D. (2024). Reading Development as a Pathway to International Student Success: A Focus on Academic Bridging Programs textquotedbl. Inaugural CSSIC Research Fellow Research Talk, Mohawk College, Hamilton, Canada.

Trainor, L. J., Hunter, S., **Psaris, M., Flaten, E.,** Werker, J. & Finlay, B. B. (2024, July). The Role of the Gut Microbiome in Neural Tracking of Rhythm: Implications for Brain Development in Premature Infants. The International Congress of Infant Studies, Glasgow, Scotland.

Wood, E., Klein, L. & Trainor, L. J. (2024, July). The Effect of Cannabis on Live Improvised Performances. Society for Music Perception and Cognition, Banff, Canada.

GRANTS & AWARDS:

Bao, Y. Keith Rayner Memorial Award for Best Oral Presentation, European Conference on Eye Movements, Ireland, 2024.

Lotlikar, I. Dean's Honour List, McMaster University, 2024.

Lotlikar, I. JEC General Scholarship Program, McMaster University, 2024.

McWeeny, S. & **Trainor, L.** Improving Vocal Music Experiences for Hearing-Aid Users through Hearing-Aid Integrated Assistive Listening Technology. Arts Research Board, Social Sciences and Humanities Research Council of Canada Explore Grant, $5,268, 2024-2026.

Schmidtke, D. Reading Development as a Pathway to International Student Success: A Targeted Reading Intervention on EAP Program Students at Mohawk College. 2024 Mohawk College Student Success Innovation Centre (CSSIC) Research Fellowship, $99,471.84 CAD, 2024.

OPERATIONS TEAM

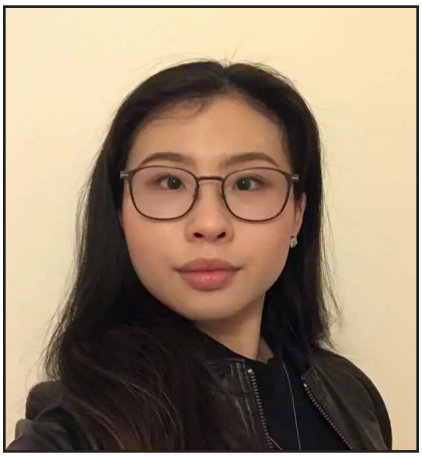
In 2020, ARiEAL established a trainee-based operations team known as the ARiEAL Operations Team (AOT). Working collaboratively with ARiEAL Manager **Dr. Maxime Dagenais,** the AOT supports our centre's knowledge mobilization and learning activities, social media engagement, and event planning. The AOT operates on a one-year renewable term and provides hands-on opportunities for undergraduate and graduate trainees to participate in and lead various training and knowledge mobilization activities. With the leadership and creativity demonstrated by our AOT Team, ARiEAL expanded its reach through our social media platforms, organized valuable networking, professionalization, and mental health events and organized some much-needed, light-hearted breaks from our research and work, including our **Second Annual ARiEAL Cup Games Night** that was won by the Reading-Raymond Lab. A rematch is coming soon!

Along with the AOT Team, ARiEAL also benefited from a team of MacPherson Student Partners who helped develop and guide various projects to fruition. Thanks to the hard work of **Fiza Ahmad, Simranpreet Sandal,** and **Brianna Griska-Macphee,** the second volume of our ARiEAL Research Magazine was published and showcased our trainees' research. Volume 2 includes five items: two long-form articles, two academic posters, and a short-form think piece. Once again, we were amazed by the research our trainees are producing at ARiEAL. For this issue, two of our recent undergraduate students produced articles on 1. the roles of prosody during language acquisition and 2. code-switching in language sciences. Additionally, two of our graduate students produced an article on perceptual differences among traumatic brain injury patients and a poster where they propose an experimental design for speech perception and production in autism spectrum disorder. Finally, one of our graduating Master's students explored the challenges surrounding inclusivity and current research methods in the language sciences. MacPherson Student Partner and ARiEAL AOT member, **Fiza Ahmad,** also spearheaded an important K-12 student outreach program. Working in collaboration with iStep and using an experiential learning approach, Fiza organized EEG, eye tracking, and ultrasound experiments for three groups of Grade 12 students from the Black communities of the **Hamilton-Wentworth** and **Halton District School Boards**.

DR. MAXIME DAGENAIS

BRIANNA GRISKA-MACPHEE

SIMRAN SANDAL



AUDREY HO

BRAULIO LOPES

SCIENTIFIC ADVISORY COMMITTEE

In 2024, we made significant progress toward establishing a new, EDI-conscious Scientific Advisory Committee (SAC). Guided by recommendations from our EDI taskforce, we developed clear guidelines regarding the committee's composition, mandate, and size. However, with our evolving emphasis on commercialization and industry partnerships, we are re-evaluating the SAC's structure to ensure that it aligns with the vision and strategic objectives of the ARiEAL Research Centre and the ARiEAL Language Solutions. We are currently considering next steps in this transition.

THE CENTRE

Founded in late 2016, ARiEAL celebrated its eight full calendar year since its inception in 2024. We are proud of the mentorship demonstrated by our researchers and our amazing trainees of all levels and the incredible and important research that they are creating.

POSTDOCTORAL FELLOWS:

Dr. Theotime Bakunzi
*(Supervised by Dr. Ranil Sonnadara)**

Dr. Maiia Bulakh
(Supervised by Dr. Daniel Pape)

Dr. Cameron Daniel
*(Supervised by Dr. Laurel Trainor)**

Dr. Alina Dochu
(Supervised by Dr. Ivona Kučerová)

Dr. Mary Edward
*(Supervised by Dr. Elisabet Service)**

Dr. Martin Miguel
*(Supervised by Dr. Laurel Trainor)**

Dr. Sean McWeeny
*(Supervised by Dr. Laurel Trainor)**

Dr. Rafael Román Caballero
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Dr. Bhanu Sharma
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*Completed Program in 2024

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Lesya Ukrainka Volyn National University, Lutsk, Ukraine

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Centro de Ciencia Cognitiva (C3), Madrid, Spain

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Words in the World (WoW), Partnership Grant funded by the Social Sciences and Humanities Research Council of Canada (SSHRC), Canada

University of Turku (Department of Psychology and Speech-Language Pathology), Turku, Finland

Tilburg University, Tilburg, Netherlands

Xi'an Jiaotong – Liverpool University, Suzhou, China

University of Alberta

McGill University

Ontario Tech University

University of Waterloo

Montclair State University

University of Cambridge

University of Oxford

NON-ACADEMIC COLLABORATORS:

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Onkwawenna Kentyohkwa, Ohsweken, ON, Canada

Twatati Oneida Language Committee, Southwold, ON, Canada

VoxNeuro, Hamilton, On, Canada

CBC Kids/CanChild

Lingvist

Ministry of Advanced Education, Alberta

All Good Speakers, Denmark

Maple Leaf Sports and Entertainment

SR Research LtD, Ottawa

Brain Injury Association of Peel and Halton

Compute Ontario

Six Nations Language Commission

Centre de recherche interdisciplinaire de réadaptation du Montréal Métropolitain

iStep Program, McMaster University

PHOTO CREDIT: COLIN CZERNEDA C/O MCMASTERUNIVERSITY

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RESEARCH PROGRAM MANAGER
Dr. Maxime Dagenais

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(January-May 2024)

Brianna Griska-Macphee
(January-December 2024)

Audrey Ho
(August-December 2024)

Braulio Lopes
(August-December 2024)

Simran Sandal
(August-December 2024)

ARIEAL IS GRATEFUL TO OUR PARTNERS FOR THEIR FINANCIAL AND RESOURCE SUPPORT

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Produced & Designed by Dr. Maxime Dagenais & MSU Underground

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