MUSICAL LEARNING ACROSS THE LIFESPAN

A PUBLIC SYMPOSIUM ON MUSIC, LEARNING & THE BRAIN

Western
UNIVERSITY · CANADA

Saturday, October 17, 2015
Paul Davenport Theatre

SCHEDULE

10.00 **Welcome Addresses**
Katie Overy, Don Wright Faculty of Music (DWFoM)
Representative from Research Western

10.10 Session 1 (Chair: Jonathan De Souza, DWFoM)

Keynote Lecture: Music for the Brain?
Psyche Loui, Wesleyan University

Keynote Lecture: Tone Deafness and Other Myths
Steven Demorest, Northwestern University

11.30 Session 2 (Chair: Betty Anne Younker, DWFoM)

Crossing the Borders: Working with Marginalized Communities in Scotland and West Africa
Dee Isaacs, University of Edinburgh

Rhythm Processing, the Brain, and Parkinson's Disease
Jessica Grahn, The Brain and Mind Institute (BMI)

12.15 Lunch break
Open Rehearsals of the **New Horizons Adult Band** in Music Building, Rooms 27 and 227

A map showing on-campus lunch options is available at the registration desk.

1.10 **The Intergenerational Choir**
The Alzheimer Society London and Middlesex

1.30 Session 3 (Chair: Ruth Wright, DWFoM)

The Intergenerational Choir Project: Mapping the Journeys of Singers with Alzheimer's Disease, their Caregivers, and Students
Carol Beynon, Faculty of Education

Opera Programs with Adults who have Experienced Homelessness
Matthew Peacock, Streetwise Opera, UK

Movement Responses to Music in Early Childhood
Ana Almeida, IMHSD, University of Edinburgh

2.30 Coffee break

3.00 Session 4 (Chair: Kevin Watson, DWFoM)

What Can We Learn from Cognitive Neuroscience about Development and Learning?
Daniel Ansari, BMI

Musically Cued Motor Training & Neuroplasticity
Emma Moore, IMHSD, University of Edinburgh

Pianos, Hands, Ears & Minds
Jonathan De Souza, DWFoM

4.00 **Panel Discussion** (Chair: Katie Overy, DWFoM)

4.30 Close & Wine Reception

ABSTRACTS & BIOS

SESSION 1 •

Music for the Brain?

Where does musical knowledge come from, and how can we use it? Although music is ubiquitous and implicitly learned by human beings of all ages and cultures, it requires complex interactions of multiple brain networks. I will provide an overview of the brain processes that enable music perception, production, and enjoyment, drawing from research using convergent behavioral and neuroimaging methods in normal and disordered populations. Results from several lines of studies show that the neural networks that enable music perception and action are also involved in generating emotional responses to music, and overlap in part with brain networks for language. Having described a model of how we perceive, learn, and derive pleasure from music, I will then describe ways in which we can apply the principles of music cognition to aid in sound design for those with abnormal brain activity, specifically in patients with epilepsy.

Psyche Loui *is an Assistant Professor in Psychology and in Neuroscience and Behavior at Wesleyan University. She directs the MIND (Music, Imaging, and Neural Dynamics) Lab at Wesleyan. Psyche received her B.S. in Psychology and Music from Duke University in 2003 and her Ph.D. in Psychology from the University of California at Berkeley in 2007. She then was Instructor in Neurology at the Harvard Medical School, with a hospital appointment in the Department of Neurology at Beth Israel Deaconess Medical Center (BIDMC). Her research aims to understand and apply the network of brain functions that enable subjective experiences such as the*

perception, cognition, and production of music. Ongoing projects tackle problems in auditory perception, auditory-motor interaction, and emotion and cognition, using tools from psychophysics and cognitive neuroscience as appropriate. Psyche is a recipient of Young Investigator Awards from the Templeton Foundation for Positive Neuroscience and the European Society for the Cognitive Sciences of Music and has held grants to date from the Grammy Foundation, Templeton Foundation, and NIH. Her research has been published in journals such as the Journal of Neuroscience, Current Biology, and Music Perception, and her work has been featured in the BBC, WGBH, Boston Globe, New York Times, MSNBC, Science Daily, and other news sources.

Tone Deafness and Other Myths

Singing is one of the earliest developing and most fundamental musical skills. Despite its importance, we don't know as much as we should about how accurate singing develops and, more importantly, why it never develops for some people. Though the phenomenon of "tone deafness" has been researched for decades, a clear picture of the problems of inaccurate singing has yet to emerge. Recently, a number of researchers from music education, psychology, and neuroscience have begun to explore systematically the prevalence of accurate singing in the general population and how it is influenced by age, music training, perceptual skills, and type of singing task. I will review some of what we know and don't know about so-called "tone deafness", review recent efforts to develop an online measure of singing accuracy, and share some results from a study of singing accuracy across the lifespan.

Steven M. Demorest *is a Professor of Music Education at Northwestern University where he teaches graduate and undergraduate courses in choral music methods, philosophy,*

research methods, and music cognition. His research interests include singing development through the lifespan, music cognition, sight-singing pedagogy, and the application of neuro-imaging techniques to music research.

Dr. Demorest has lectured at the American Choral Directors Association National Conference, The Music Educators National Conference and at many state and regional ACDA and MENC conferences. He coauthored the second edition of Choral Music Methods and Materials (Cengage, 2013) with Barbara Brinson and is the author of Building Choral Excellence: Teaching Sight-singing in the Choral Rehearsal, published by Oxford University Press. Most recently he coedited a special edition of Music Perception dealing with the development of singing accuracy. Reports of his singing research have appeared recently in the media (e.g. "Study: Singing more of learned skill than natural talent," Chicago Tribune, 02/18/2015). In 2007 he received the Weston H. Noble award for outstanding contributions to choral music from Luther College, his alma mater.

SESSION 2 •

Session Chair: ***Betty Anne Younker***, *Ph.D. (Northwestern University), is Dean of the Don Wright Faculty and Professor of Music Education. She was on faculty at Western from 1997 to 2000, during which time she was awarded the Dr. Pedro Goldman Award by the Faculty of Music Students' Council. In addition, she was awarded the distinguished Alumnus of the Year by Pennsylvania State University College of Arts and Architecture (2008). Before returning to Western, Younker was Associate Dean for Academic Affairs and Associate Professor of Music Education at the University of Michigan.*

Her research interests include critical and creative thinking within the disciplines of philosophy and psychology. Publications include articles in national and international journals and chapters in several books. Paper presentations have occurred at state, national and international conferences.

Before appointments at the university level, Younker taught in band, choral, and general music settings in the public school system, and taught flute students from beginning to university levels of performance. Presently she serves as President of the College Music Society (CMS) and as President of the London Arts Council (LAC), and serves on editorial boards and committees for several professional organizations.

Crossing the Borders: Working with Marginalized Communities in Scotland and West Africa

For the last fifteen years, I have devised and implemented a series of fully immersive performance projects for primary school children and undergraduate community musicians in collaboration with the Royal Botanic Garden Edinburgh. These projects integrate music with visual and performing arts to provide active learning that fosters children's own creativity, in line with the principles of an integrated curriculum and the goals of local teachers. The projects specifically work with children and their families from areas of multi deprivation.

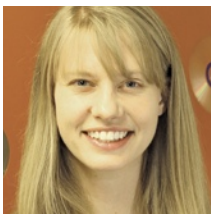
Beginning in 2012, the same model has been taken to the market town of Serekunda, in The Gambia, West Africa. University of Edinburgh staff and Community Music students work with local teachers and up to one hundred fifty primary children in a school serving this large urban community. In a region with low levels of literacy, this project makes use of the educational and social potential of music as a tool for the transferring of knowledge. The project also involves an exchange of skills whereby team members from Scotland are trained in traditional Gambian musical techniques.

The exchange that the projects facilitate benefits everyone involved. In Scotland, the projects can enhance existing arts provision and facilitate school agendas to engage disadvantaged or socially excluded children in education and personal development. In Serekunda, the projects provide a contrast to the traditional approach of rote learning that characterizes existing teaching at the school, helping children instead to engage in an imaginative world. Ultimately, these projects explore a question that is vital to the development of the next generation of community musicians: How we do we create a feeling of community, of shared understanding, that allows creativity to flourish and for each individual to develop, grow and thrive?

Dee Isaacs *is Lecturer in Music in the Community at the University of Edinburgh. For the past twenty years she has worked predominantly in the area of Community Music throughout Scotland and the UK. She has been commissioned by a wide range of professional arts bodies including Opera North, London Symphony Orchestra, Northern Sinfonia, Scottish Chamber Orchestra, Scottish Ballet, Magnetic North, Scottish Ensemble, Live Music Now, The Scottish Executive, and Creative Scotland. In 2003 and 2006 she was nominated by the British Academy of Composers for her compositions Festus and Suppose Life. In 2012 she was awarded the Principal's Medal by the University of Edinburgh for her work in music education and within communities both locally and internationally. Dee has worked for War Child as UK co-ordinator for War Child in the Caucasus working with refugee communities and psychologists, specifically using music to help children suffering from trauma. Dee continues to work across cultures and within communities and is currently working with primary school children in The Gambia, West Africa.*

Rhythm Processing, the Brain, and Parkinson's Disease

Moving to music is a spontaneous and natural activity for most of us. Much of our movement is synchronized to an underlying pulse, or "beat" that we sense in the musical rhythm. Here I will discuss how areas of the brain that control movement also respond when we hear rhythm or feel the beat, and the exciting potential held by musical therapies for helping those with degenerative neurological diseases such as Parkinson's disease.



Jessica Grahn *investigates how music affects our brain and our behavior. Her topics include: how music makes us move, how musical training changes brain structure, and whether music can benefit patients with neurological disorders, including patients with Parkinson's disease. Her lab is also investigating how music affects cognitive abilities, such as memory or reasoning.*

Dr. Grahn has degrees in Neuroscience and Piano Performance from Northwestern University, as well as a Ph.D. from Cambridge, England, in the Neuroscience of Music. She joined the Psychology department and Brain and Mind Institute at Western in 2011. Jessica has received the Charles Darwin Award in Public Communication of Science from the British Science Association. She also has an Early Researcher Award from the Ontario government, a New Investigator Award from Canadian Institutes for Health Research, and a Scholar Award from the James S. McDonnell Foundation. Her research is currently funded by the National Sciences and Engineering Council, Parkinson Society Canada, the Grammy foundation, and the Canadian Foundation for Innovation. She also plays electric cello in a local band.

Session Chair: ***Ruth Wright*** *is Associate Professor in the Don Wright Faculty of Music. She has also served as Chair of Music Education and Assistant Dean Research at this institution. Prior to moving to Canada in 2009, she lectured in music education at the University of Wales Institute Cardiff and was Director of the Graduate Continuing Professional Development Framework in education. Wright's earlier career involved teaching high school music and maintaining a large private piano studio. She studied music at the Royal Academy of Music, London, UK and music education at the University of Wales Institute, Cardiff. She received her Ph.D. in Education in 2006. She is passionate about the rights of all young people to a rewarding and personally meaningful experience of music in education and has developed programs that bridge the gap between experiences of music outside school and school music. In 2012, in collaboration with colleagues Dr. Betty Anne Younker and Dr. Carol Beynon at Western University, she launched Musical Futures Canada, a music program aimed at addressing these issues. Dr. Wright publishes regularly in books and refereed journals on the subject of music education and is a speaker at national and international conferences. Her edited book Sociology and Music Education was published by Ashgate Press in September 2010.*

The Intergenerational Choir Project: Mapping the Journeys of Singers with Alzheimer's Disease, their Caregivers, Music Educators, and Students

There is a body of evidence that musical interventions have the temporary capacity to evoke emotions, influence mood, reduce emotional and behavioural disturbances, relieve pain, and improve

quality of life in person with dementia. While there is literature that describes the role of music listening, sing-alongs, and other activities as therapies for persons with Alzheimer's Disease, there is little in the literature about the role of new learning through singing. In this paper we report on a study of an intergenerational choral program that brings together persons with AD, their caregivers, high school students, and their music teachers; we articulate the role that the choir plays in providing: new learning opportunities for persons with AD; music and health education for adolescent students; respite, reunion, and learning opportunities for caregivers; and, professional and personal development for music educators. Grounded in themes of Learning: i) About self, about singing; ii) Personhood & Identity; iii) Defining and Rekindling Relationships; iv) Health & Well-being; and, v) Affective and Aesthetic Engagement & Agency in Response to Singing, we map and describe the learning outcomes.

*Dr. **Carol Beynon**, currently on a research sabbatical, serves as Associate Vice Provost of the School of Graduate & Postdoctoral Studies, is former acting Dean of the Faculty of Education, and Associate Professor in Music Education at Western University. She is also the senior artistic director of the award-winning Amabile Boys & Men's Choirs of London, Canada.*

Carol's research focuses on teacher development and identity, gender issues in music education, and intergenerational singing. She has authored two books: Learning to Teach (2001) and Critical Perspectives in Canadian Music Education (2012). She also has numerous scholarly articles in several peer-reviewed journals. Carol is currently a co-investigator on two SSHRC funded projects related to engagement in music education and singing.

Carol is an authority in vocal and choral development and serves as a guest speaker, clinician, and adjudicator for conferences and

music festivals in Canada and globally. With the Amabile Boys & Men's Choirs, she has conducted invited and reviewed performances and recordings for the World Choral Symposium VI, American Choral Directors' Association, Choral Canada, ISME, TIFF, and Alliance Atlantis, with numerous broadcasts on CBC, BBC, Minnesota Public Radio, Bravo, and Czech National Radio. She has received several awards for outstanding teaching, has been named Woman of Excellence in Arts, Culture and Heritage in London, and was inducted into the "Wall of Fame" at the Don Wright Faculty of Music.

Opera Programmes with Adults who have Experienced Homelessness

Homelessness is not just about housing—in the UK and most countries around the world, people who have experienced homelessness suffer trauma, mental health issues and isolation as well as the practical challenges of not having a roof over their heads. The arts sector has developed strongly in the last 30 years where there are now an estimated 50 projects around the world using the arts to improve well-being and social inclusion and to promote positive attitudes for homeless people. Streetwise Opera has been part of this sector for 13 years and was founded when I was a support worker in a busy nightshelter in London, England. A resident read out a quote from a politician in the newspaper who said that, "the homeless are the people you step over coming out of the Opera House." The residents from the nightshelter wanted to prove to the politician and the public that they had skills and achievements that were overlooked. What would it be like if they were in an opera? Since then, Streetwise Opera has built an opera programme which takes place in 10 locations around England and a thriving international programme linking arts and homeless groups around the world. In this talk I will present the methodology of Streetwise Opera (including the importance of regularity, a safe space and changing identity) and how

we measure whether we are meeting our aims of helping to improve well-being and social inclusion for people who have experienced homelessness.

Matt Peacock *founded Streetwise Opera in 2002, a charity that uses music to help people who have experienced homelessness make positive changes in their lives. Streetwise runs an award-winning music programme in five cities across England every week with more than five hundred people each year. The company's opera productions seek to be of equal artistic and social merit, focusing on the achievements of the performers not their needs; every production has received four- and five-star reviews in the national press. Streetwise's international programme, With One Voice, seeks to help build the capacity of the international arts and homelessness sector through exchanges between projects across different countries. Matt is a former homeless support worker, opera critic, Clore Leadership Fellow, and Paul Hamlyn Foundation Breakthrough Fund recipient. He is one of thirty social activists profiled in Former Prime Minister Gordon Brown's book Britain's Everyday Heroes and was one of the Evening Standard's Most Influential Londoners in 2013. He was awarded an MBE for services to music and homelessness in 2011 by the Queen and is a Trustee of the arts and kindness charity, People United.*

Movement Responses to Music in Early Childhood

Embodied accounts of music cognition focus on the coupling between perception and action, supported by evidence from psychology and neuroscience research. This line of thought includes the proposition that body specificities and sensorimotor capabilities can shape the way in which an individual perceives and understands music. Such a body-as-constraint hypothesis becomes especially pertinent when

considering cognitive agents undergoing significant physical and motor developmental changes, such as young children. In other words, the repertoire of body movements freely performed by a young child in response to specific structural features of music is likely to reflect his/her unique way of understanding and dynamically interacting with those features.

Within his framework, I will discuss a recent observation study in which 4- and 5-year-old children (n=47) were invited to move-as-they-wish to rhythmic music with a strong and steady beat. The study adopted a process-oriented approach, attentive to the children's free movement repertoire and how these varied, rather than an outcome-oriented approach, often used to measure the accuracy of prescribed movements. Results revealed a large variability in the young participants' movement choices, possibly reflecting developmental stages and prior experience, but with strong similarities across all children regarding the physical and spatial components of their individual movement signatures, most of which showed a periodic, biphasic structure. This evidence suggests that, rather than using prescribed movements with young children, self-regulated movement experiences might encourage them to freely explore their unique preferences and consequently to interact with rhythmic music (and in particular with the beat) in a more meaningful way.

Ana Almeida *graduated from the Department of Musical Sciences, Faculty of Social and Human Sciences (FCSH), New University of Lisbon in 1998. She then undertook a Postgraduate degree in Teacher Training in the same department specifically focusing on Edwin Gordon's Music Learning Theory for Newborn and Young Children. In 2006 Ana completed a Master's degree in Contemporary Art History at FCSH and her dissertation The Universe of Sound in the Plastic Arts was published as a book by Ediçõe Colibri. In 2015 she was awarded a*

Ph.D. in Music under the supervision of Dr. Katie Overy and Prof. Dorothy Miell at the Institute for Music in Human and Social Development, University of Edinburgh, supported by a doctoral grant from the Portuguese Foundation for Science and Technology. Her research investigates the embodied musical experiences of young children, particularly their self-regulatory sensorimotor processes in response to music.

In parallel with her academic studies, Ana Almeida has worked for the most prominent Education Services in Portugal developing music workshops and collaborating in artistic and community music projects, such as BebéBabá, an initiative for mothers and babies living in prison. Ana has also has sung for Disney animation dubbing (she is the Portuguese Sleeping Beauty!), and as a regular performer with Companhia de Música Teatral Ana has participated in shows for young audiences all over Europe.

SESSION 4 •

Session Chair: ***Kevin Watson*** *is an Assistant Professor of Music Education specializing in music psychology and jazz pedagogy. Dr. Watson is the Artistic Director of the Western University Jazz Ensemble, and is also co-director of the Western Young Winds program. His research focuses on the areas of jazz education and music teacher preparation and his work is published in major journals including the Journal of Research in Music Education and Music Education Research. He has presented his research at international conferences in England, Brazil, and the United States, and he regularly serves as a music festival adjudicator and clinician (jazz and concert band). Dr. Watson is a graduate of the Indiana University Jacobs School of Music and the Berklee College of Music.*

For more information, see www.kewatson.com.

What Can We Learn from Cognitive Neuroscience about Development and Learning?

When we develop and acquire new skills our brains change physically. This ability of the brain to change in response to experience is called Neuronal Plasticity. In this talk I will provide an overview of what we have learned about the Neuronal Plasticity. I will discuss how non-invasive brain imaging, such as functional neuroimaging, can be used to enhance our insights into learning and development across different domains, including music.

Daniel Ansari *received his Ph.D. from University College London in 2003. Presently, Daniel Ansari is a Professor and Canada Research Chair in Developmental Cognitive Neuroscience in the Department of Psychology and the Brain & Mind Institute at Western University, where he heads the Numerical Cognition Laboratory (www.numericalcognition.org). Ansari and his team explore the developmental trajectory underlying both the typical and atypical development of numerical and mathematical skills, using both behavioural and neuroimaging methods. He has a keen interest in exploring connections between cognitive psychology, neuroscience, and education, and currently serves as the President of the International Mind, Brain and Education Society (IMBES). Ansari has received early career awards from the Society of Research in Child Development, the American Psychological Association as well as the Government of Ontario. In 2014, Ansari was named as a member of the inaugural cohort of the College of New Scholars, Artists and Scientists of the Royal Society of Canada and in 2015 he received the E.W.R Steacie Memorial Fellowship from the Natural Sciences and Engineering Research Council of Canada.*

Musically Cued Motor Training and Neuroplasticity

Musical cues are increasingly used to support movement rehabilitation and motor learning, but research into the neural basis of their effectiveness is currently lacking. Increased structural connectivity in the arcuate fasciculus (AF), a white matter tract connecting auditory and motor regions of the brain, has previously been reported in musicians compared with non-musicians, indicating that training auditory-motor skills may drive structural changes in this tract. We thus hypothesized that the AF would show increased connectivity after a short period of musically cued motor training. 30 adult participants were assigned to either a motor (Non-Music group) or an auditory-motor (Music group) training condition, in which participants trained with musical cues. All participants completed 3 x 20 minutes per week of left-handed finger movement training over a 4-week period. Diffusion Tensor-MRI data acquired before and after training revealed that, as hypothesized, connectivity (as indicated by increased fractional anisotropy values) significantly increased in the right AF of the Music group only. These results indicate that musically cued motor training can induce rapid white matter plasticity. This finding may have relevance for post-stroke movement rehabilitation, where structural reorganization is key for functional motor recovery.

Emma Moore *completed her undergraduate degree in Music at the University of Edinburgh in 2013, where she was awarded the Niecks Essay Prize for her Final Year Dissertation entitled "Does Musical Training-Induced Brain Plasticity have the Potential to Aid the Recovery of Motor and Language Function in Stroke Survivors?" She then completed an M.Sc. by Research in Music and Neuroimaging, which explored the potential of musical cueing to facilitate movement learning and drive structural connectivity changes. Emma is currently completing a Ph.D. at the University of Edinburgh where she is supervised by Dr. Katie Overy,*

Prof. Holly Branigan and Dr. Mark Bastin, and supported by a Thomas Laing Reilly Ph.D. Scholarship in Music. Her research is focused on Music and Dyslexia, and explores the potential of specially designed musical activities to support literacy skills in children with dyslexia as well as the neural mechanisms underlying this potential support. Emma was recently awarded funding from the William Dickson Travel Fund, Gwen Clutterbuck Travel Scholarship, and the Principal's Go Abroad Fund (all University of Edinburgh) to spend one month training with Dr. Jessica Grahn, at the Brain and Mind Institute, Western University.

Pianos, Hands, Ears, and Minds

Piano students have practiced "five-finger melodies" since the early 1800s. More recently, though, these exercises have been used in psychological experiments. Here I'll review three experiments in which participants learned to play five-finger melodies on a keyboard. Together their results suggest that studying an instrument develops particular auditory-motor connections in the brain. I'll discuss how these links between hand and ear affect players' perception and imagination, and how they bring technology into theories about music and the body.

***Jonathan De Souza** is an Assistant Professor in the Don Wright Faculty of Music. He received a Ph.D. in music theory and history from the University of Chicago, where his research was supported by the Social Sciences and Humanities Research Council, and the Mellon Foundation. Jonathan joined the faculty at Western in 2013. His book, Music at Hand: Instruments, Bodies, and Cognition, is forthcoming from Oxford University Press.*

Chair: *Dr.* ***Katie Overy*** *is a Visiting Professor in Music Education, Western University, and Director of the Institute for Music in Human and Social Development (IMHSD), University of Edinburgh. Her core research interest is musical learning, with a particular focus on musical rhythm, which she explores from the perspectives of music psychology, music pedagogy and music neuroscience. She has edited several interdisciplinary special issues on the topic of the musical, rhythmic brain, including for Transactions of the Royal Society B (2015), Proceedings of the New York Academy of Sciences (2012), Cortex (2009) and Contemporary Music Review (2009). Her first academic publication in 1998, "Can music really improve the mind?" was one of only six papers recently selected for reprint in the 40th Anniversary Commemorative Collection special issue of Psychology of Music (2012). Katie was the UK partner in the European international training network EBRAMUS (Europe, Brain and Music) and to date she has supervised ten interdisciplinary PhD students. Her research has been funded by the Economic and Social Research Council, the European Commission, the Royal Society of Edinburgh, the Scottish Arts Council, the Grammy Foundation, and the Harold Wingate Foundation, amongst others.*

Musically, Katie's interests are varied: she holds an Advanced Performance Certificate in Piano from Trinity College London, was the founding manager of Sheffield University Jazz Orchestra, is a keen (albeit sporadic) Taiko drummer, and currently sings soprano with Calton Consort in Edinburgh.

Musical Learning Across the Lifespan (MLAL) is a new research initiative bringing together faculty and students from Western's Don Wright Faculty of Music (DWFoM) and the Brain and Mind Institute (BMI). Our aim is to facilitate collaborative, interdisciplinary research on musical training and expertise, while exploring the variety and richness of positive musical learning experiences across infancy, childhood, adulthood and aging.

For more information, please visit our website:
www.music.uwo.ca/research/research_groups/mlal

We gratefully acknowledge support from the Social Sciences and Humanities Research Council, the Don Wright Faculty of Music, Research Western, and the Brain and Mind Institute.

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

Western Music
Don Wright Faculty of Music

Western Research

Western The Brain and Mind Institute

Thanks also to Rachel Condie, Patrick Feely, Florence Lourdes, Michelle Lynch, Laura Moxey, Natalie Szudy, Greg Yantz, and Erin Woolnough.

Cover photo: Brian Williamson https://www.flickr.com/photos/seriousbri/4148739768