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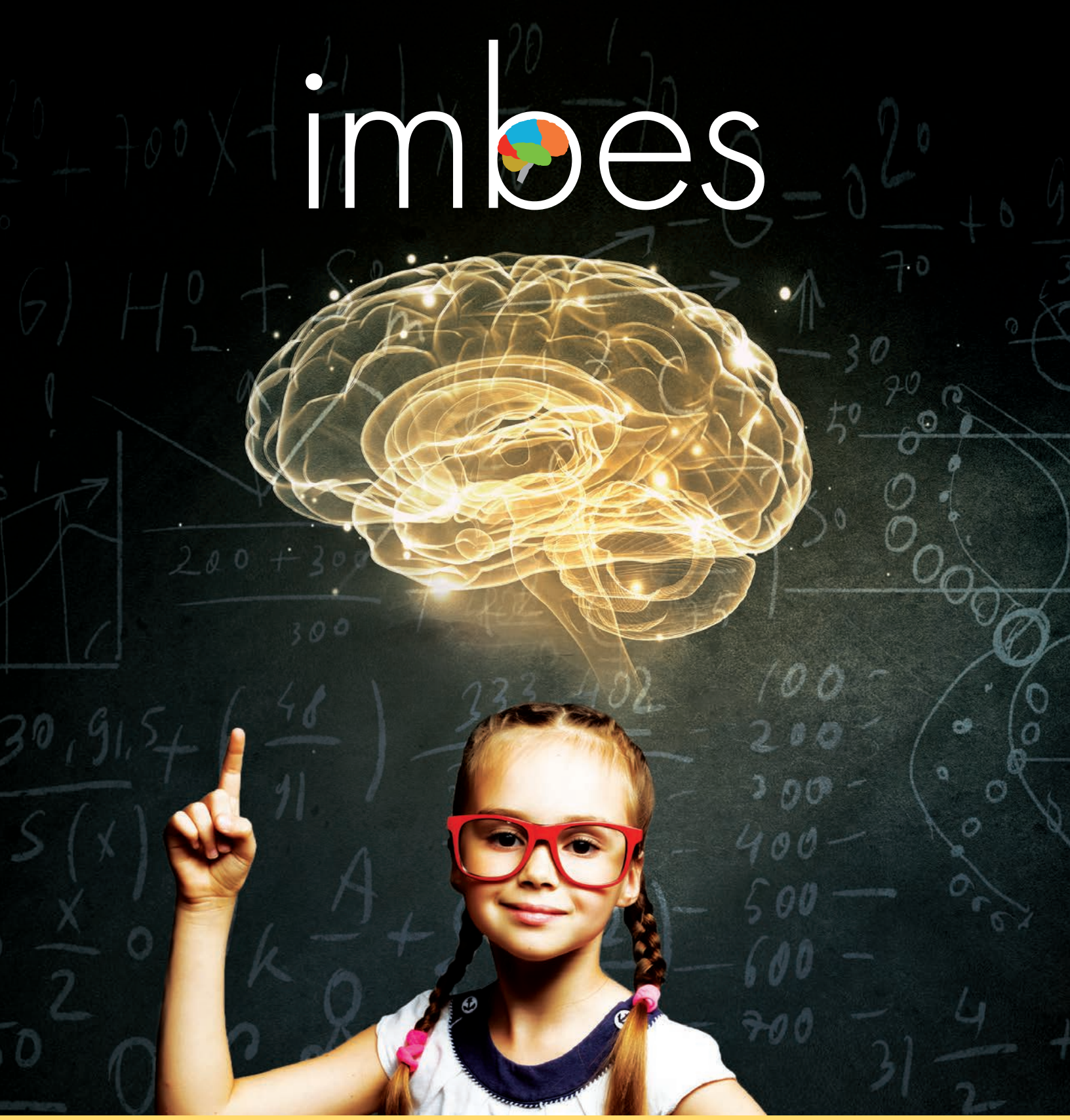

2016 International Mind, Brain and Education Society Conference

SEPTEMBER 15–17

CHELSEA HOTEL, TORONTO, ONTARIO

INTERNATIONAL MIND, BRAIN & EDUCATION SOCIETY

Our mission is to facilitate cross-cultural collaboration in biology, education and the cognitive and developmental sciences.

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Agenda

Thursday, September 15

TIME	WHAT IS HAPPENING	LOCATION
2:00 PM–5:00 PM	Registration	**Churchill Court**
5:15 PM–5:30 PM	Welcome and Conference Overview	**Churchill Ballroom**
5:30 PM–6:30 PM **Keynote Address**	**Tania Lombrozo**, University of California, Berkeley "The Good, The Bad and the Beautiful"	**Churchill Ballroom**

Friday, September 16

TIME	WHAT IS HAPPENING	LOCATION
7:30 AM–8:30 AM	Breakfast	**Churchill Ballroom**
8:30 AM–9:30 AM Keynote Address	**Clancy Blair**, New York University, "The Development of Self-Regulation in Early Childhood"	**Churchill Ballroom**
9:30 AM–9:40 AM	Break	**Churchill Ballroom**
9:40 AM–11:40 AM	**3 Concurrent Symposia**	
	Growing up in a digital world: the good, the bad and the ugly (pg.9)	**Seymour**
	New neuroimaging insights into the brain bases of typical reading and reading disorders (pg.9)	**Gerrard**
	Science and mathematics education: Possible educational implications supported by recent neuroeducational studies (pg.10)	**Stevenson**
11:45 AM–1:15 PM	Lunch and Award Presentations	**Churchill Ballroom**
1:15 AM–1:45 PM	Poster Set Up	**Churchill Court**
1:45 PM–3:45 PM	**5 Concurrent Symposia**	
	The bilingual advantage: Evidence, controversy, and implications for translational practice (pg.10)	**Churchill Ballroom B**
	Translational work in mind, brain and education: Mapping the field {Kurt Fischer symposium} (pg.11)	**Churchill Ballroom A**
	Reconciling domain-specific and domain-general influences on numerical cognition: Implications for education (pg.11)	**Gerrard**
	Science learning, education and cognitive neuroscience (pg.12)	**Seymour**
	Neuroscience and development of executive function (pg.12)	**Stevenson**
3:55 PM–4:55 PM Keynote Address	**Pasi Sahlberg**, Harvard Graduate School of Education, "About the Facts and the Myths about Education in Finland: Mind, brain and smart education policies"	**Churchill Ballroom**
5:00 PM–7:00 PM	Poster Presentations and Reception (pgs. 18–21)	**Churchill Court**
8:00 PM	Student and Postdoctoral Student Forum	**Churchill Ballroom**

Saturday, September 17

TIME	WHAT IS HAPPENING	LOCATION
7:30 AM–8:30 AM	Breakfast	**Churchill Ballroom**
8:30 AM–9:30 AM Keynote Address	**Janet Werker**, University of British Columbia "Perceptual Foundations of Language Acquisition"	**Churchill Ballroom**
9:30 AM–10:00 AM	Break and Poster Set Up	
10:00 AM–NOON	**5 Concurrent Symposia**	
	Spatial thinking and STEM education (pg.12)	**Seymour**
	Bilingualism, bilingual education, and neural organization for learning to read (pg.13)	**Gerrard**
	Integrating Mind, Brain and Education through Teacher-Researcher Collaboration (pg.14)	**Churchill Ballroom A**
	Probing the relationship between number sense and math achievement: insights from training studies (pg.14)	**Stevenson**
	Revealing the invisible: multimodal analysis of implicit game-based learning (pg.15)	**Churchill Ballroom B**
NOON–1:30 PM	Poster Presentations (pgs. 21–24) & Buffet Lunch "Meet the Funders" Q & A	**Churchill Court** **Stephenson**
1:35 PM–3:30 PM	**4 Concurrent Symposia**	
	Factors supporting children's early informal science learning (pg.15)	**Seymour**
	MBE perspectives on the learning of fractions and their magnitudes (pg.16)	**Stevenson**
	Fadeout and persistence of the effects of early childhood educational interventions: Problems and possible solutions (pg.17)	**Churchill Ballroom B**
	The interdependence of brain and cognitive development in social context and implications for education (pg.17)	**Churchill Ballroom A**
3:30 PM–3:45 PM	Break	**Rossetti**
3:45 PM–4:45 PM Keynote Address	**Marla Sokolowski**, University of Toronto, "Gene-Environment Interplay in Individual Differences in Behaviour"	**Rossetti**
5:00 PM–6:00 PM	Reception and Poster Award Presentations Introducing Mary Helen Immordino-Yang, IMBES President-Elect	**Bb33 Restaurant**

KEYNOTES

SYMPOSIA

Keynote Speakers

Tania Lombrozo is an Associate Professor of Psychology at the University of California, Berkeley, as well as an affiliate of the Department of Philosophy and a member of the Institute for Cognitive and Brain Sciences. She received her Ph.D. in Psychology from Harvard University in 2006 after receiving a B.S. in Symbolic Systems and a B.A. in Philosophy from Stanford University. Dr. Lombrozo's research aims to address foundational questions about cognition using the empirical tools of cognitive psychology and the conceptual tools of analytic philosophy. Her work focuses on explanation and understanding, conceptual representation, categorization, social cognition, and causal reasoning. She is the recipient of numerous early-career awards including the Spence Award from the Association for Psychological Science, a CAREER award from the National Science Foundation, and a James S. McDonnell Foundation Scholar Award in Understanding Human Cognition. She blogs about psychology, philosophy, and cognitive science for NPR's 13.7: Cosmos & Culture.

Clancy Blair, PhD, Professor, Department of Applied Psychology, Steinhardt School of Culture, Education, and Human Development, New York University, is a developmental psychologist who studies self-regulation in young children. His research focuses primarily on the effects of early life stress on executive function development, the relation of executive functions to other aspects of self-regulation, and the relation of executive functions to school readiness and early school achievement. His projects include a longitudinal study in which he examines early experiential and biological influences on self-regulation development and three randomized controlled trials of innovative early education curricula designed to promote executive functions and self-regulation. Prior to coming to NYU, he spent ten years as an assistant and then associate professor in the department of Human Development and Family Studies at Penn State University. He received his doctorate in developmental psychology and a master's degree in public health from the University of Alabama at Birmingham in 1996.

Pasi Sahlberg is a Finnish educator, author and scholar. He has worked as a schoolteacher, teacher educator, researcher and policy advisor in Finland and has studied education systems and reforms around the world. In his long career in education, he has served the World Bank in Washington, DC, the European Commission in Torino, Italy, and the OECD as education specialist. He currently advises several governments about education policies and reforms. He is the author of a best-seller book "Finnish Lessons 2.0: What can the world learn from educational change in Finland" and has published numerous academic and professional articles and book chapters. He is an active contributor to global education dialogue through his columns and op-eds that have appeared in the Washington Post, The Guardian, The Conversation and CNN. His professional honors and awards include the 2012 Education Award in Finland, the 2013 Grawemeyer Award in the United States, the 2014 Robert Owen Award in Scotland, and 2016 Lego Award in Denmark. He is a former Director General of CIMO (Centre for International Mobility and Cooperation) at the Finland's Ministry of Education and Culture in Helsinki, and visiting Professor of Practice at Harvard University's Graduate School of Education. He is currently Professor of Practice at the University of Helsinki and a visiting Professor of Practice at the Arizona State University. More on his website: pasisahlberg.com and Twitter: @pasi_sahlberg

Janet F. Werker is Professor and Canada Research Chair in the Department of Psychology at the University of British Columbia. Her research interests center on understanding the perceptual foundations of language acquisition in infancy. She studies both the neural and behavioral foundations of speech and language processing in young infants, and seeks to explain how different types of experience at different points in development interact with and shape these initial biases, and how changing sensitivities bootstrap language acquisition. In this endeavor, she studies infants and young children growing up in different language communities, including infants growing up with two or more languages from birth. Her work has been recognized with many awards including the Killam Research Prize, the UBC Alumni Prize in Social Sciences, the Jacob Bieley Prize (UBC's premier research prize), and the Anne L. Brown Award in Developmental Psychology. In November, 2015 she was awarded the Gold Medal from the Social Sciences and Humanities Research Council of Canada, and in September, 2016 designated as a University Killam Professor at UBC. She is an elected Fellow of many societies, including the Canadian and American Psychological Associations, the Royal Society of Canada, the Cognitive Science Society, the American Association for the Advancement of Science, and the American Academy of Arts and Sciences.

Marla B. Sokolowski, PhD, FRSC is a University Professor. Her research is esteemed worldwide as a clear, integrative mechanistic paragon of the manner in which genes interact with the environment to impact behaviour. She trail-blazed the development of a branch of Behaviour Genetics that addresses the genetic and molecular bases of natural individual differences in behaviour and is best known for her discovery of the foraging gene. She has published over 140 publications, given 250 invited lectures and multiple international distinguished visiting professorships. She was awarded a Fellow of the Royal Society of Canada (RSC) in 1998 for her pioneering work in the field of Behavioural Genetics and held a Tier 1 Canada Research Chair in Genetics and Behavioural Neurology from 2001-2015. Her awards include: the Genetics Society of Canada's Award of Excellence (2007), University Professorship (2010), Senior Fellow of the Canadian Institute for Advanced Research (CIFAR) and the Queen Elizabeth II Diamond Jubilee Medal both in 2013 and the Distinguished Investigator Award from the International Behaviour and Neurogenetics Society (2014). She directed the Life Sciences Division of the Academy of Sciences of the RSC from 2009-2012 and she currently co-directs the Child and Brain Development Programme of CFAR where she is the Weston Fellow.

Keynote Abstracts

Tania Lombrozo, University of California, Berkeley

The Good, The Bad, and the Beautiful

Like scientists, children and adults are often motivated to explain the world around them, including why people behave in particular ways, why objects have some properties rather than others, and why events unfold as they do. Moreover, people have strong and systematic intuitions about what makes something a good (or beautiful) explanation. Why are we so driven to explain? And what accounts for our explanatory preferences? In this talk I'll present evidence that both children and adults prefer explanations that are simple and have broad scope, consistent with many accounts of explanation from philosophy of science. The good news is that a preference for simple and broad explanations can sometimes improve learning and support effective inferences. The bad news is that under some conditions, these preferences can systematically lead children and adults astray.

Clancy Blair, New York University

The Development of Self-Regulation in Early Childhood

This talk will describe recent advances in the scientific study of self-regulation in early childhood, focusing on the development of executive functions, the complex thinking skills that are important for learning in school and for controlling behavior and emotions. Research in neuroscience indicates that stress and adversity early in life negatively impact executive functions and self-regulation in young children. A growing body of research in early intervention and early childhood education, however, indicates that self-regulation and executive functions can be fostered through supports for families and through innovative programs that enhance the quality of children's early education experiences.

Pasi Sahlberg, Harvard Graduate School of Education

About the Facts and the Myths about Education in Finland: Mind, brain and smart education policies

Finland is the poster child of education and the destination of tens of thousands of education tourists seeking inspiration to school improvement and education system change. Since the mid-2000s educators around the world have been asking what makes some education systems perform better than others, and why some countries seem to be stuck in mediocracy. There are numerous theories of change and programs to better education, some of them have proved to be successful and some of them have not. In this presentation I explore common myths, established facts and some lessons from Finnish schools and education system. I explain the key characteristics of Finland's school system and how they resonate with and often oppose those in other countries. In the end I discuss briefly how evidence from mind, brain and education have influenced policy decisions and how we should forward for better future.

Janet Werker, University of British Columbia

Perceptual Foundations of Language Acquisition

We study the earliest foundations of language acquisition, in the perceptual biases young infants show for processing language from the first days of life. We then explore how these biases change as a function of growing up with one or more languages, and how growing perceptual knowledge of the native language intersects with higher levels of language acquisition. Our work shows that infants not only listen to the speech around them, and in this way learn about the properties of the native language, but that they also watch others speaking and that both heard and seen speech influence their development. Bilingual infants may be particularly adept at this. More recently we have begun to explore how infants' own oral motor movement interact with heard and seen speech. Recent findings, and the implications of this work for ensuring optimal language acquisition for all children, will be presented.

Marla Sokolowski, University of Toronto

Gene-Environment Interplay in Individual Differences in Behaviour

We are interested in how DNA variation predisposes organisms to be more or less affected by their experiences (gene-environment interactions), how our experience gets embedded in our biology (epigenetics) and finally how DNA variation interacts with epigenetic processes to affect behaviour. Experiential affects, like developmental ones can occur on different time scales. For example nutritional or social adversity (or enrichment) can occur throughout an organisms life, in early life alone with enduring effects on later life stages, or acutely over a matter of minutes or hours. To address these issues we take a genetic perspective using mostly Drosophila melanogaster but also rats and humans and consider both candidate single genes and candidate pathways. This approach provides interesting opportunities and challenges because many genes and pathways that modulate behaviour have multiple functions (pleiotropy) and do themselves exhibit plastic responses to experience.

Symposia

Growing up in a digital world: The good, the bad and the ugly

Fri., Sept. 16, 9:40am–11:40am: Seymour Room

Chair: **Kathy Hirsh-Pasek**, Temple University and The Brookings Institution
Speakers: **Kathy Hirsh-Pasek**; **Roberta Michnick Golinkoff**, The University of Delaware; **Anna Sosa**, Northern Arizona University; **Jennifer Zosh**, Pennsylvania State University Brandywine; **Michael Levine**, Joan Ganz Cooney Center; **Michael Rich**, Harvard University

Children are in the midst of a vast, unplanned experiment, surrounded by digital technologies. Though the smart phone was introduced in 2007 and tablets appeared only 6 years ago, a recent survey reported that three-fourths of children under the age of 4 years had their own mobile device (Kabali et al., 2015)! At the apex of this boom is the introduction of applications ("apps") for tablets and smartphones, as well as toys like talking shape sorters that "come alive" through an implanted digital chip. Indeed, "educational apps" – which as of December 2015 stand at 1.5 million apps in the App Store – are largely unregulated and untested. And play with digital toys is only now being investigated. As one magazine boasted, "Gone are the days when a spinning top or wind-up car were the pinnacle of toy technology. Nowadays kids expect their toys to connect to the internet, paired with smart devices…" (www.gizmag.com/best-tech-toys-chirstmas-2015-guide/40640/).

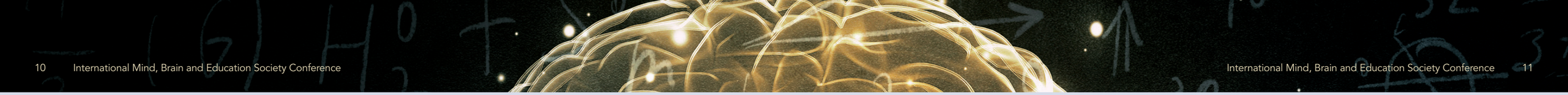
This symposium surveys the digital landscape and asks about the consequences of growing up in a digital world. Building on decades of work from the Science of Learning, the symposium features top scientists in medicine, psychology, communication, and media speaking on 4 topics: **1) A Primer on Mediatrics: What the science can tell us about the effects of digital media on health and development** (Michael Rich, Harvard University); **2) Can we put real "education" into educational apps?** (Kathy Hirsh-Pasek, Temple University & Roberta Michnick Golinkoff, University of Delaware); **3) Parents' interaction with children around talking versus traditional toys** (Anna Sosa, Northern Arizona University; Jenn Zosh, Pennsylvania State University Brandywine); and, **4) Tap, Click, Read – Optimizing education through digital learning** (Michael Levine, Joan Ganz Cooney Center). After short presentations, the group will invite open discussion on these hot button items.

New neuroimaging insights into the brain bases of typical reading and reading disorders

Fri., Sept. 16, 9:40am–11:40am: Gerrard Room

Chair: **Marc Joanisse**, University of Western Ontario
Speakers: **Marc Joanisse**; **Jeffrey Malins**, Haskins Laboratories; **James Booth**, University of Texas, Austin; **Jeffrey Gruen**, Yale University
Discussant: **Maureen Lovett**, SickKids, University of Toronto

Functional neuroimaging of reading is entering its third decade, and continues to generate considerable ongoing interest. Of note is the wealth of new information about how literacy development changes the brain, and about the neural markers of developmental dyslexia. Yet we continue to struggle with question of how to apply these findings to understanding, identifying and ameliorating reading disorders. This symposium brings together experts who are using cutting-edge neuroimaging techniques to examine typical reading development and reading impairment in children. Talks will present data from multiple neuroimaging modalities including fMRI and diffusion tensor imaging (DTI), as well as event-related potentials (ERPs). Of special interest are studies that link neuroimaging data to individuals' behavioral and genetic markers. A key goal of the symposium is to present findings in a way that is informative to researchers interested in the application of basic science to clinical and educational settings. That is, this research focuses much less on questions of "which brain region does what", and instead seeks to be relevant to how reading researchers approach issues concerning the identification of reading disorders, competing views about instructional techniques in the classroom, and the efficacy of intervention methodologies.



Science and mathematics education: Possible educational implications supported by recent neuroeducational studies

Fri., Sept. 16, 9:40am–11:40am: Stevenson Room

Chair: **Reuven Babai**, Tel Aviv University
Speakers: **Reuven Babai**; **Patrice Potvin,** Université du Québec à Montréal; **Ruth Stavy**, Tel Aviv University
Discussant: **Layne Kalbfleisch**, George Washington University

Many students encounter difficulties in solving a wide range of problems in science and mathematics. Research on students' conceptions and reasoning in science and mathematics indicates that some of these difficulties may stem from intuitive interference. Overcoming this intuitive interference is therefore a key pedagogical challenge. In this symposium we will describe several lines of cognitive neuroeducational studies carried out in order to deepen understanding of these difficulties and their underlying reasoning mechanisms. We will also discuss possible educational implications that are supported by recent neuroeducational studies.

Students express a variety of intuitive scientific conceptions that are often resistant to instruction. Such conceptions can prevail and distract learners from producing accurate answers. Indeed, scientific performance appears to be delayed when the problem contains interfering irrelevant salient variables. Recent neuroimaging studies have shown that overcoming the interference is associated with neural activations related to the function of inhibition. These results suggest that initial conceptions persist through the development of expertise and can coexist and interfere with scientific conceptions. Teaching models that are consistent with the idea of coexistence will be discussed.

As for scientific concepts, irrelevant salient variables intuitively interfere with students' reasoning. In the symposium we will describe two examples of such interference, one in geometry and another in proportional reasoning.

In geometry, a brain-imaging study indicated that overcoming this interference is associated with activation in prefrontal brain regions known for their executive inhibitory control. This study suggested that intervention aimed at activating inhibitory control mechanisms could improve students' success. This study also suggested that increasing the level of salience of the relevant variable would increase participants' performance. Indeed two types of interventions, (1) activating inhibitory control mechanisms and (2) increasing the salience of the perimeter, significantly improved students' performance.

In proportional reasoning the role of congruity and salience was studied. It was found that accuracy was lower and RT was longer in conditions in which there was an intuitive interference (no correspondence between congruity and salience). Brain-imaging showed lower activation in fronto-parietal numerical processing regions for these conditions. These findings suggested that the automatic processing of natural numbers that compose the ratios suppress the comparison of ratios as a function of congruity and salience. Reducing this interference when solving ratio problems in school could be achieved by directing students to calculate "rate per unit". A preliminary study suggests that this is a promising approach.

The bilingual advantage: Evidence, controversy, and implications for translational practice

Fri., Sept. 16, 1:45pm–3:45am: Churchill Ballroom B

Chair: **J. Bruce Morton**, Brain and Mind Institute, University of Western Ontario
Speakers: **J. Bruce Morton**; **Kenneth Paap**, San Francisco State University; **Gigi Luk**, Harvard School of Education; **Debra Titone**, McGill University
Discussant: **Raymond Klein**, Department of Psychology and Neuroscience, Dalhousie University

There is abundant evidence that a lifetime of speaking two languages bestows cognitive advantage and may protect the brain from neurological decline associated with aging. Critics however charge basic claims are overblown and represent a biased interpretation of available data. Translating insights from bilingualism research into educational practice therefore poses unique challenges. What are the benefits of a bilingual education? Are they primarily cultural, or are there additional long-term cognitive and neurological benefits linked to the mastery of multiple languages? Does a bilingual curriculum promote the development of higher-order cognitive abilities, or does it tend to select for intellectually stronger students? This symposium brings together a panel of distinguished scholars with widely varying views on these questions. The goal is an open discussion of the basic science and its implications for translational practice.

Translational work in mind, brain and education: Mapping the field

Fri., Sept. 16, 1:45pm–3:45am: Churchill Ballroom A

Kurt Fischer Symposium in Mind, Brain and Education

Chair: **Marc Schwartz**, The University of Texas at Arlington
Speakers: **Marc Schwartz**; **Joanna Christodoulou**, MGH Institute of Health Professions; **Donna Coch,** Dartmouth College; **Mary Helen Immordino-Yang**, University of Southern California; **Juliana Pare-Blagoev**, Johns Hopkins University

The emerging and interdisciplinary field of Mind, Brain, and Education is addressing a number of intriguing challenges. Clear theoretical boundaries do not yet exist, and there is not a unifying set of methodological and conceptual tools that define the field. In fact, such an outcome may lack the same relevance that it has for disciplines or subdisciplines because the number of tools and the ways in which they are being used in MBE is still growing. Thus, defining individual work within the framework of MBE requires students and researchers new to the field to recognize the processes that underscore the mission of IMBES, as well as the kind of work emerging from the field.

This presentation will explore the unique ways in which researchers in IMBES have been pursuing research with MBE as an organizing framework. Each presentation will address and balance two different goals: (1) providing a selection of key theoretical and methodological approaches used by the researcher; and, (2) mapping out the researchers' journeys reflecting more serendipitous events and insights that guided their work in MBE. The dual approach supports a more complex picture of how the researchers gained critical basic knowledge that is relevant to the MBE community, while also helping the audience think strategically about how to pursue their own work in MBE.

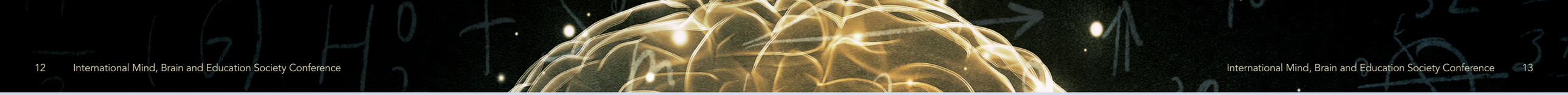
Reconciling domain-specific and domain-general influences on numerical cognition: Implications for education

Fri., Sept. 16, 1:45pm–3:45am: Gerrard Room

Chair: **Gaia Scerif,** University of Oxford
Speakers: **Gaia Scerif**; **Jo-Anne Lefevre**, Carleton University; **Anna Matejko**, University of Western Ontario; **Gavin Price**, Vanderbilt University

Math competence is of critical importance for individual success in modern society, yet a significant proportion of economically active adults fail to acquire the necessary math skills to enable that success. Accordingly, ever increasing research attention is being paid to understanding how humans learn math so that we can develop more effective teaching methods. The cognitive foundations of emerging mathematical abilities are under intense debate: most existing work focuses either on domain-specific cognitive skills, such as non-symbolic "number sense", or on domain-general attentional and executive skills, often pitting them against each other. This symposium brings together researchers using a range of approaches to investigate the roles of domain-general and domain-specific cognitive skills, as well as their neural substrates, in mathematics learning and assessment. We argue that an overarching framework encompassing these multiple skills and their interactions over time is necessary. Importantly, discussion will focus on interdisciplinary and cross-cultural perspectives as the speakers work with schools in Canada, the US and the UK and span developmental psychology, cognitive neuroscience, and education.

Scerif will discuss an ongoing project exploring preschool mathematical development. The aim is to develop a more comprehensive model of the cognitive and educational foundations of numerical skills, by: a) investigating the interplay of both domain-general (attention, executive functions) and domain-specific (number sense, symbolic understanding) foundations for math longitudinally; b) establishing a partnership between cognitive scientists, education experts, and practitioners. Lefevre will talk about the role of subitizing, the core system of processing small exact numerosities, in numerical learning. She will explore whether subitizing is domain-specific, domain-general, or both, and highlight implications for education. Matejko will present a study investigating the neural substrates underlying arithmetic, visuo-spatial working memory (VSWM) and number processing. Much behavioral evidence has demonstrated a strong relationship between these abilities, therefore they may have common underlying neural substrates. Matejko will discuss an fMRI study that investigates how the arithmetic network overlaps with those for VSWM and basic number processing and how these shared networks change over development. Price will discuss results from two recent studies investigating the relationship between brain structure and performance on a standardized math measure (Woodcock-Johnson) and performance on the Tennessee Comprehensive Achievement Program (TCAP) math subtest, respectively. Results suggest that while performance on standardized math measures is associated with grey matter density in the left parietal lobe (a region related to processing numerical



magnitude), TCAP math performance is associated with higher density in the bilateral hippocampal formation and the right inferior frontal gyrus, regions associated with learning and memory. Thus, considering the role of development and environment in the relation between neuroscience and education is of critical importance. Together, these presentations address key questions about the role of fundamental cognitive processes and their neural substrates in mathematics learning and performance. Successes and challenges in bridging research and practice will be discussed.

Science learning, education and cognitive neuroscience

Fri., Sept. 16, 1:45pm–3:45am: Seymour Room

Chair: **Adam Green**, Georgetown University
Speakers: **Silvia Bunge**, University of California at Berkeley; **David Kraemer**, Dartmouth College; **Christian Schunn**, University of Pittsburgh
Discussant: **Robert Kolvoord**, James Madison University

Effective science education requires both imparting knowledge and developing cognitive resources and strategies, especially reasoning skills, to meaningfully integrate that knowledge for deep understanding and innovation in the sciences. Work presented in this symposium engages the neural "how" of effective science education by investigating howknowledge is represented in the brain, and how learning-related changes in the developing brain support the development of scientific reasoning capacities. Attention will be paid to differences in efficacy between educational strategies, including consideration of science reading strategies, intensive reasoning training, spatially based approaches to STEM learning, and individual differences in learning styles that can inform selection of educational strategies. The translation of this science to real-world learning will be a major theme, including research that is testing hypotheses from the educational cognitive neuroscience lab by investigating the impact of real-world high school STEM education on structural and functional plasticity in the brain. By engaging the how of science learning, the presented work informs fundamental neural mechanisms that transcend cultural boundaries, providing a strong basis for cross-cultural collaboration. Investigations of individual differences in the neurocognition of learning also have the potential to support efforts at reducing inequalities in STEM achievement across demographic groups. Panel discussion among the presenting authors will directly address questions of translation to real-world learning environments, and cross-cultural engagement in STEM.

Neuroscience and development of executive function

Fri., Sept. 16, 1:45pm–3:45am: Stevenson Room

Chair: **Frederick Morrison**, University of Michigan
Speakers: **Jennie Grammer**, University of California; **Stephanie Haft**, University of California San Francisco; **Maria Arredondo** and **Benjamin Katz**, University of Michigan

Extant research suggests that children's executive functions (EF), such as working memory, response inhibition, and attentional control, predict academic success throughout the course of schooling. However, much remains unknown regarding the neural mechanisms underlying EF development. While the use of neuroscience techniques to study the development and improvement of executive function is a fairly recent phenomenon, there is a growing body of research in the field that has significant implications for educators and scientists alike. This symposium will focus on new work that draws on a variety of neuroscience methods, including EEG, fMRI, fNIRS, and non-invasive brain stimulation to study EF, in the service of two primary questions. First, how do these findings improve our understanding of the link between executive function and academic achievement, and the underlying neural mechanisms supporting this connection? Second, how might this work be used to improve educational pedagogy and learning outcomes, either indirectly or directly? These questions will frame the work presented during the symposium, which will include ERP research of schooling effects on EF (Grammer), imaging work that explores the connection between kindergarten EF and later literacy acquisition (Hoeft & Haft), an fNIRS study investigating the connection between bilingualism and EF in children (Arredondo), and transcranial direct-current stimulation to improve learning of EF-intensive tasks (Katz).

Spatial thinking and STEM education

Sat., Sept. 17, 10:00am–Noon: Seymour Room

Chair: **Nora Newcombe**, Temple University
Speakers: **Nora Newcombe**; **Alina Nazareth**, Temple University; **Jennifer Sutton, University of Western Ontario**; **David Uttal**, Northwestern University

Spatial thinking is critically important for education, particularly in Science, Technology, Engineering, and Mathematics (STEM). Enhancing spatial thinking therefore could improve performance in STEM courses, which are often notoriously challenging. In the current symposium, we discuss enhancement in spatial thinking from two perspectives:

(1) Developmental Factors: Spatial thinking is an overarching cognitive construct comprising distinct spatial skills. Spatial navigation, an important spatial skill, is a complex cognitive process imperative for our everyday functioning in the environment. Understanding developmental factors influencing individual differences in spatial navigation can aid in designing timely interventions. Adolescence is a time of increasing mobility and independent navigation for young people, yet we know little about how large-scale spatial thinking changes during this period. In the first two presentations, we discuss findings from two independent studies examining spatial navigation in pre-adolescence and adolescence. Collectively, we present spatial navigation findings for participants ranging from 8 years to 19 years of age. In both studies, participants completed a test of small-scale spatial perspective taking (Spatial Orientation Test, Hegarty & Waller, 2004) and explored a novel virtual environment (Silcton; Weisberg et al, 2014). Following exploration, participants completed direction estimation and map-building tasks that assessed the accuracy of their cognitive map of the virtual environment. We discuss and contrast developmental trends in accuracy on different spatial measures in the two studies. We suggest that mental representations created as a result of large-scale navigation are still developing during pre-adolescence and adolescence, and spatial perspective taking appears to play a key role in accuracy.

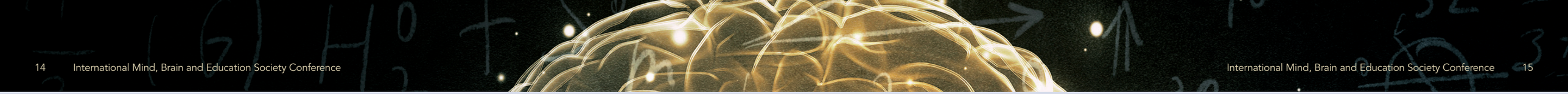
(2) Cognitive Factors: Spatial thinking is central to many scientific domains like GIScience, which involves understanding multi-level spatial relations. GIScience, itself can act as a tool for improving spatial thinking. In the third presentation, we focus on the cognitive and neural consequences of using Geographic Information Systems (GIS), which are computer-based mapping systems that allow users to simultaneously represent different layers of spatial information. For example, a city planner could simultaneously represent land parcels, housing density, housing cost, and the location of parks when planning a new sub-division. We hypothesize that thinking about complex spatial relations in this way can facilitate both spatial thinking and problem-solving skills. Therefore, we are investigating the impact of enrollment in a high school course that emphasizes GIS (i.e. the GeoSpatial semester, or GSS). Pre- and post-test assessments of spatial tests and problem solving indicate substantial improvement in spatial thinking. We are currently completing MRI data collection to identify structural and functional plasticity that mediates these improvements.

Bilingualism, bilingual education, and neural organization for learning to read

Sat., Sept. 17, 10:00am–Noon: Gerrard Room

Chair: **Iouila Kovelman**, University of Michigan
Speakers: **Iouila Kovelman**; **Lisa Lopez**, University of South Florida; **Marc Joanisse**, University of Western Ontario; **Xi Chen**, University of Toronto

Bilingualism is a common life experience, yet little is known about the impact of bilingualism on children's neural architecture for learning to read. This symposium offers four studies/presentations aiming to disambiguate the nature of bilingual acquisition by investigating the impact of home language environment, age of acquisition, and learner variability on children's emergent literacy and the neural networks supporting dual language mastery. This is done through systematic investigations of bilingual and monolingual children attending either bilingual or monolingual educational settings, observed through multiple behavioral as well as neuroimaging (fMRI, DTI and EEG) methodologies. The first study used fMRI imaging with 5-year-old children attending Chinese-English and Spanish-English schools. During phonological awareness tasks, children with better combined dual language proficiency showed greater activation in left hemisphere regions typically associated with language and literacy, as compared to children with lower combined dual language proficiency. Study two investigated low-income Spanish-English preschoolers, finding that Spanish exposure and use at home had a significant impact on children's emergent literacy skills. Taken together, these fMRI (study 1) and behavioral literacy findings (study 2) emphasize the importance of dual language experiences for learning to read. The third study uses multimodal neuroimaging methods (fMRI, DTI, EEG) to understand individual differences in bilingual acquisition of English, French and Chinese. Finally, the fourth study expands from bilingualism to multilingualism. This study's longitudinal findings suggest that multilingual children achieve similar reading proficiency to children learning only two languages. The findings are discussed in terms of bilingual language transfer theories and how learning to read in two new languages offers reciprocal support towards the emergence of robust literacy networks. The symposium will therefore offer new evidence to inform theories of reading acquisition as well as educational practice for bilingual learners of different languages.



Integrating mind, brain and education through teacher-researcher collaboration

Sat., Sept. 17, 10:00am–Noon: Churchill Ballroom A

Chair: **Zack Hawes**, Brain and Mind Institute, University of Western Ontario
Speakers: **Cathy Bruce and Tara Flynn**, Trent University; **Petra Le Duc**, Ontario Ministry of Education; **Joan Moss**, OISE/University of Toronto; **Beverly Caswell**, University of Toronto; **Zack Hawes**; **Michelle Cain** and **Nicole Thomson**, Rainy River District School Board

In this symposium, teachers, researchers, and school-board numeracy consultants present a teacher Professional Development (PD) model that offers a promising approach to bridging the gap between research and practice. In the first of three presentations, we describe the Math for Young Children (M4YC) project; an initiative taking place throughout the province of Ontario that aims to better understand and improve early years (K – Gr.3) mathematics learning and instruction. Central to this initiative is collaboration amongst math educators, researchers, teachers, principals, and school-board numeracy consultants. Key features of the PD model are discussed, with an emphasis on the importance of embedding research within and as part of everyday classroom practice. In the second presentation, we share the effects of PD implementation on children's learning. In comparison to active control classrooms, children in the experimental classrooms have demonstrated significant pre-post gains in spatial reasoning, geometry, and basic number skills and numeration. The role of psychological science in the design of the intervention is discussed, namely, the decision to focus on developing children's spatial reasoning skills as an integral part early mathematics instruction. Finally, in the third presentation, teachers and a numeracy coach share their experiences implementing the PD model in their own classrooms and schools. We will also hear about their experiences working with researchers and applying research findings to practice. The symposium will end with a discussion on both the strengths and shortcomings of the PD model in its capacity to fulfill the central goals of Mind, Brain, and Education.

Presentation 1:
Math for Young Children: Introducing a Classroom-based Professional Development Model that Integrates Research and Practice

Presentation 2:
Enhancing Young Children's Spatial and Numerical Skills Through a Research-based Professional Development Model

Presentation 3:
Stories from the Field: Educators' Perspectives on Implementing the PD Model in Their Own Classrooms and Schools

Probing the relationship between number sense and math achievement: Insights from training studies

Sat., Sept. 17, 10:00am–Noon: Stevenson Room

Chair: **Miriam Rosenberg-Lee**, Stanford University School of Medicine
Speakers: **Miriam Rosenberg-Lee**; **Joonkoo Park**, University of Massachusetts - Amherst; **Moira Dillon**, Harvard University
Discussant: **Jennifer Venalainen**, Toronto District School Board

The recent explosion of research into number sense –the ability to rapidly apprehend and compare quantities–has been driven by the observation that performance on number sense tasks predicts math achievement scores. At the brain level, both numerical and mathematical processing activate the intraparietal sulcus, suggesting a common neural pathway underpins this relationship. Moreover, these results raise the tantalizing possibility that training number sense skills could improve math performance. This symposium reports on emerging research aimed at testing this proposal and understanding the mechanisms underlying the relationship between number sense and math achievement. It also connects directly to educational practice by exploring the effects of distinct number sense programs on the acquisition of mathematical knowledge. The first presentation, building on successful training programs in adults, will examine the effects of training approximate addition and subtraction on symbolic math skills in preschool-aged children. The second presentation examines the effectiveness of a preschool suite of games exercising non-symbolic, numerical and spatial reasoning in fostering poor children's readiness for learning primary school mathematics. The final presentation will examine the behavioral and neural effects of a number sense training aimed at mapping number symbols to their non-symbolic quantities.

Revealing the invisible: Multimodal analysis of implicit game-based learning

Sat., Sept. 17, 10:00am–Noon: Churchill Ballroom B

Chair: **Jodi Asbell-Clarke,** TERC
Speakers: **Jodi Asbell Clarke**; **Ibrahim Dahistron-Hakki,** Landmark College; **Jan Plass** and **Bruce Homer**, New York University
Discussant: **Paul Darvasi**, Royal St. George's College

Jodi Asbell-Clarke will discuss how EdGE at TERC is designing games that use sticky game mechanics within STEM relevant environments to support and measure implicit learning in games. Data mining detectors used on the data logs from Impulse are able to show that students who demonstrate game behaviors consistent with an implicit understanding of Newton's laws of motion (e.g. consistently push more massive object with more force) and show that they also perform better on the related pre/post tests. Learning analytics using the data from a laser puzzle game (Quantum Spectre) were able to distinguish errors consistent with science misunderstandings from errors consistent with puzzle mechanics misunderstandings. Students who exhibited more science misunderstandings also showed less gains on the related pre/post assessments. These types of analyses of game-based learning behaviors that are consistent with implicit science knowledge (or misunderstandings) provide the bas is of multimodal research with Landmark College.

Ibrahim DahIstrom-Hakki from Landmark College will discuss how they are working with EdGE, MIT, and FunAtomic to build a multimodal lab and data architecture that integrates eye-tracking models of player attention, physiological measures of engagement and arousal, and neurological indicators of working memory along with learning analytics that identify patterns of game play activities that are associated with STEM learning. This system is designed to be used "in the wild" and to synchronize the data streams to within milliseconds for use in action-oriented video games. This tight synchronization is required to correlate fixations and saccades from eye-tracking data with clicks from an action game. In Summer 2016 we will begin integration of a research-grade EEG into the system.

Jan L. Plass (NYU) and Bruce D. Homer (CUNY GC) of the CREATE lab will discuss their research designing and using brain training games that target different sub-skills of executive functions (a set of cognitive processes involved in the control of behavior) such as updating, shifting, and inhibition. The studies include effectiveness research (to what extent are the games able to train the targeted cognitive skill?) as well as identification of game features that increase the impact of the games. They will report on results from studies with high school and college students and with neuro-atypical populations. They will also discuss findings from other studies related to the adaptivity of the in-game algorithm and other design features and executive function subskills.

Our panel, facilitated by Paul Darvasi, a master teacher at St Paul's College will facilitate the discussion among the panelists and the audience about research questions that lie at the interface of cognitive and neuroscience, Game-Based Learning analytics; multimodal data collection. The discussion and questions will be guided by the theme of revealing learning that may be invisible (e.g. implicit learning that is demonstrated through behaviors) through traditional educational assessments.

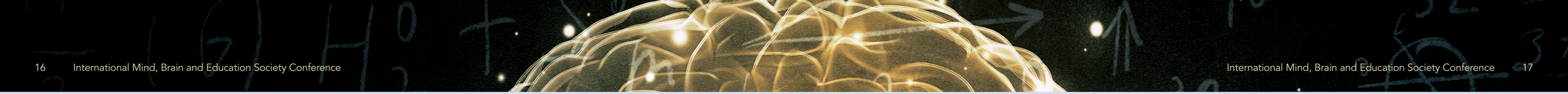
Factors supporting children's early, informal science learning

Sat., Sept. 17, 1:35pm–3:30pm: Seymour Room

Chair: **Angela Nyhout**
Speakers: **Gabrielle Strouse**, University of South Dakota; **Haley Vlach**, University of Wisconsin-Madison; **Maria Marcus**, Loyola University Chicago; **Vaunam Vendakasalam**, University of Toronto
Discussant: **Chriss Boggert**, University of Toronto

Teaching children scientific concepts in the early years is recognized as a worthwhile endeavour by most researchers and educators. Recently, a large-scale, longitudinal study found that children's science knowledge at kindergarten entry was a strong predictor of the later science achievement gap observed in eighth grade (Morgan, Farkas, Hillemeier, & Maczuga, 2016). These results underscore the importance of early science-promoting experiences to increase interest and knowledge, especially in at-risk groups.

In the current symposium, developmental and educational psychologists will describe experimental work on early, informal science-promoting experiences. This field is, by nature, interdisciplinary, but could benefit from even more collaboration between psychologists, educators, sociologists, policy-makers, museum curators, and media industry. Following the presentations, Christine Boggert, Vice Principal at the Dr. Eric Jackman Institute of Child Study Laboratory School, will act as a discussant, considering the work from the perspective of an educator.



In the first talk, Venkadasalam, Nyhout, & Ganea present a recent set of studies investigating the features of picture books that best promote early science learning. Examining four- and five-year-olds' learning of various physical science concepts (gravity, buoyancy, and motion) from different picture book genres (informational, realistic fiction, and fantasy books), they demonstrate that children show significant learning of the target concepts from picture books, and books that are more realistic are best at promoting learning.

In the second talk, Strouse & Ganea describe their work investigating whether electronic touchscreen books may mimic the beneficial effects of adult questioning during reading. Children were read an electronic book about camouflage in 3 conditions, which varied how prompts were provided: 1) read by the book, 2) read by a researcher, or 3) extra-textual prompts provided by the researcher. Overall, all conditions supported children's learning about camouflage. However, low vocabulary children scored poorly when the book read itself, and low executive function children scored poorly when prompts were not written into the text. Reasons for these interactions, such as the added social cue supports provided by adults and the need for task-switching between reading and conversation will be discussed.

In the third talk, Marcus, Uttal, & Haden address how parent-child conversations during hands-on activities in museum exhibits can foster children's understanding of science and engineering. They have observed more than 125 families with 4-8 year old children in a building construction exhibit within the Chicago Children's Museum. Providing families with brief instructions about a key engineering concept prior to building in the exhibit leads to hands-on activities that reflect engineering and science practice, and to increased parent talk about STEM.

In the final talk, Vlach and Noll offer a caveat. Their experiments examined whether and how adults change their explanations when talking to children vs. adults about science. The results demonstrate that adults are not particularly adept at modifying explanations and often include information that could deter children's science learning (e.g., magical information). These findings suggest that children's early linguistic environment is not reaching its potential to support science learning.

MBE perspectives on the learning of fractions and their magnitude

Sat., Sept. 17, 1:35pm–3:30pm: Stevenson Room

Chair: **David Gómez**, University of Chile
Speakers: **David Gómez**; Edward Hubbard University of Wisconsin-Madison; **Lisa Fazio**, Vanderbilt University

Fractions and rational numbers constitute an important milestone in the middle school mathematics curriculum, as they often represent students' first experience with a number system beyond the natural numbers. Highlighting their relevance, recent research has linked achievement in learning fractions with future math achievement in advanced math topics such as algebra (Booth & Newton, 2012; Siegler et al., 2012). However, the transition from natural numbers to fractions and rationals poses great difficulty for many students. A problem often observed in research and practice is the lack of understanding that fractions have an associated magnitude that depends not on the absolute magnitudes of their components (numerator and denominator), but on their relative magnitudes. This leads students to make common mistakes, such as claiming that 18/27 < 18/30 because 27 < 30 (Pearn & Stephens, 2004), that 7/8 + 12/13 is approximately 19 or 21 (Carpenter, 1981), or that 5/6 = 7/8 "because each has one left" (Clarke & Roche, 2009). These examples demonstrate that many students lack basic intuitions about fraction magnitude, an issue important for MBE research. Some researchers (e.g. Gallistel & Gelman, 1992; Gelman, 2015) have argued that, in opposition to natural numbers and the approximate number system located in parietal cortex in humans, fractions have no mental/brain systems available to support their learning, but recent MBE research has proved this belief wrong (for a review, see Lewis, Matthews, & Hubbard, 2016). From the perspective of practice, it is also essential to comprehend how different representations and contexts for fractions affect students' thinking. In particular, number lines seem to provide an optimal context to highlight fraction magnitude, and current MBE research is also exploring the effect of using them to this aim.

In this symposium, three researchers will present recent findings and perspectives about the learning of fractions from different standpoints in the MBE continuum. The first presentation will focus on the Ratio Processing System, a recently discovered neural system that might provide an intuitive basis for understanding ratio magnitudes and provide a scaffold for the learning of fractions. The second presentation will show what a brief fraction comparison questionnaire can reveal about students' strategies, as well as how these strategies are modulated by the use of a number line task adapted to indirectly test fraction comparison. Finally, the third presentation will discuss data from an intervention study examining how playing a fraction game based on circular vs. number line representations of fractions may affect students' understanding of fraction magnitude.

Fadeout and persistence of the effects of early childhood educational interventions: Problems and possible solutions

Sat., Sept. 17, 1:35pm–3:30pm: Churchill Ballroom B

Chair: **Drew Bailey**, University of California, Irvine
Speakers: **Drew Bailey** and **Greg Duncan**, University of California, Irvine; **John Protzko**, University of California, Santa Barbara
Discussant: **Douglas Clements**, **University of Denver**

Interventions targeted at children's early cognitive or academic skills, even when initially successful, often show quickly disappearing impacts. We will discuss the conditions under which fadeout and persistence have been observed (Duncan and Protzko) and evaluate the evidence for plausible hypotheses of why fadeout occurs (Protzko and Bailey). Each speaker will discuss the sets of conditions – including the malleability and fundamentality of targeted skills, capacities, or beliefs, and children's developmental trajectories under counterfactual conditions – under which persistence may be most likely. Finally, to further the objectives of IMBES, we will focus on how more effective communication within and between researchers and practitioners in the fields of cognitive psychology, developmental psychology, and education will be necessary to make accurate predictions about which interventions will be most persistent (Clements and Bailey).

The interdependence of brain and cognitive development in social context, and implications for education

Sat., Sept. 17, 1:35pm–3:30pm: Churchill Ballroom A

Chair: **Mary Helen Immordino-Yang**, University of Southern California
Speakers: **Amy Finn**, University of Toronto; **Ping C. Mamiya**, University of Washington
Discussant: **Mary Helen Immordino-Yang**

Unlike the predominant conceptions from a few decades back, brain development is currently understood to be an active, dynamic process involving complex interactions between a person's biological and genetic predispositions, cognitive opportunities and social environment. This symposium explores three examples of research at the nexus of brain, cognitive, and social development. (1) Amy Finn will discuss how core memory-related systems change across development, and the implications for learning certain aspects of language. In particular, she will characterize the functional development of working memory systems in the brain, and discuss research on how age is associated with qualitative differences in the neural structures recruited. She will end by discussing how social context might influence language development by shifting how working memory systems are recruited during language learning. (2) Ping Mamiya will discuss how individuals' brain and genetic features interactively influence second language learning through dopamine/serotonin-mediated modulation of prefrontal executive functions. Specifically, her talk will explore how an individual's brain structural properties are related to the amount of second language immersion he/she receives, and how this relationship varies by genetic variations. (3) Mary Helen Immordino-Yang will discuss her research on how social and cultural experience shape the neural processing of social-emotional feelings in adolescents, and how these socialized neural processing patterns relate to real-world social cognition. She will share findings from her cross-cultural studies of admiration and compassion in Beijing and Los Angeles, and from ongoing cross-cultural, longitudinal studies of low-SES American adolescents from immigrant families living in neighborhoods with high levels of community violence. The symposium will conclude with a panel discussion facilitated by Mary Helen Immordino-Yang on the implications of social context for neural development and learning, and recommendations for educational practice.

Posters

Friday, September 16

1. WEIGHING THE COST AND BENEFIT OF TRANSCRANIAL DIRECT CURRENT STIMULATION ON DIFFERENT READING SUBSKILLS
Jessica Younger, University of Texas at Austin; **Melissa Randazzo-Wagner**, Teachers College, Columbia University and **James Booth**, University of Texas at Austin

2. A NEUROSCIENTIFIC REVIEW OF THE NEURAL BASES FOR THE MULTIPLE INTELLIGENCES
Branton Shearer, MI Research and Consulting, Inc.

3. NEUROMYTHS AND INSTRUCTIONAL PRACTICES
Alexandra Murtaugh, Johns Hopkins University

4. TODDLERS' UNDERSTANDING OF REGULAR POLYGONS
Joanna Zambrzycka, OISE, University of Toronto; **Samantha Makosz**, **Joanne Lee and Donna Kotsopoulos**, Wilfrid Laurier University

5. THE NEURAL DIFFERENCES AND SIMILARITIES BETWEEN CHILDREN WITH AND WITHOUT LEARNING DISORDERS DURING ARITHMETIC
Lien Peters, **Hans Op de Beeck and Bert De Smedt**, KU Leuven

6. CHILDREN'S REASONING WHEN COMPARING FRACTIONS IN A NUMBER LINE CONTEXT
David Gomez, University of Chile; **Ken Bertels** and **Wim Van Dooren**, University of Leuven

7. CORRELATIONS AMONG COGNITIVE SUPPORTS FOR ANALOGIES IN WESTERN AND EAST ASIAN MATHEMATICS CLASSROOMS
Bryan Matlen, WestEd; **Lindsey Richland**, University of Chicago; **Osnat Zur**, WestEd; **Nina Simms**, **Emily Lyons** and **Alanna O'Brien**, University of Chicago

8. EVALUATING THE EFFECTS OF MINDFULNESS PRACTICES IN CHILDREN USING EEG MEASURES OF ATTENTION AND SALIVARY MEASURES OF STRESS
Trey Avery, Teachers College, Columbia University; **Meriah DeJoseph**, NYU and **Karen Froud**, Teachers College, Columbia University

9. MATH ANXIETY MODERATES THE RELATION BETWEEN APPROXIMATE NUMBER ACUITY AND MATH PERFORMANCE
Emily Braham and **Melissa Libertus**, University of Pittsburgh

10. THE INTEGRATION BETWEEN NON-SYMBOLIC AND SYMBOLIC NUMBERS AND ITS RELATION TO MATH ABILITY
Ruizhe Liu, **Allison Liu**, **Christian Schunn**, **Julie Fiez** and **Melissa Libertus**, University of Pittsburgh

11. THE DEVELOPMENT OF FORMAL OPERATIONS: THE CASE OF ADULT POPULATION
Ghada Jabareen, Tel Aviv University

12. MIND, BRAIN, AND EDUCATION FOR SOCIAL JUSTICE
Bibinaz Pirayesh, Loyola Marymount University

13. WHAT CAN COGNITIVE NEUROSCIENCE TELL EDUCATION ABOUT LEARNING FROM EXTERNAL FEEDBACK? A SYSTEMATIC REVIEW OF THE LITERATURE
Jan-Sébastien Dion and **Gérardo Restrepo**, Université de Sherbrooke

14. EDUCATOR PERCEPTIONS AND RESOURCES OF NEUROSCIENCE
Lauren Vega O'Neil, University of Oregon

15. INTEGRATING PARTIAL VIEWPOINTS OF SPACE: ARRAY STABILITY SUPPORTS FLEXIBILITY
Corinne Holmes and **Nora Newcombe**, Temple University

16. GENDER AND SES DIFFERENCES IN SUBCOMPONENTS OF EXECUTIVE FUNCTION IN KINDERGARTEN AND FIRST GRADE
Sammy Ahmed, **Ying Wang** and **Frederick Morrison**, University of Michigan

17. AN OBSERVATIONAL PRESCHOOL MEASURE OF MINDFULNESS: CONCEPTUALIZATION, DEVELOPMENT AND PSYCHOMETRIC PROPERTIES
Almut Zieher and Matthew Lemberger-Truelove, University of New Mexico

18. MATH TRAINING LEADS TO MORE EFFICIENT BRAIN NETWORKS: AN ACTIVATION LIKELIHOOD ESTIMATE (ALE) META-ANALYSIS
Hengshuang Liu, **James B. Hale** and **Annabel S.H. Chen**, Nanyang Technological University
*Poster will be presented by Annabel S.H. Chen

19. KEEP IT SIMPLE, SILLY! THE EARLY ENVIRONMENT REPRESENTS SIMPLE, REPETITIVE, CONTEXT-INDEPENDENT LEARNING OPPORTUNITIES
Nicole A. Sugden and **Margaret C. Moulson**, Ryerson University

20. SIMULATING CLASSROOM DYNAMICS USING AGENT-BASED MODELING
Zhengsi Chang, **Michael Connell** and **Marc Schwartz**, University of Texas at Arlington

21. SCIENCE AND MATHS REASONING AND INHIBITORY CONTROL IN ADOLESCENCE: AN FMRI STUDY
Annie Brookman, Birkbeck, University of London; **Andy Tolmie**, UCL Institute of Education; **Denis Mareschal** and **Iroise Dumontheil**, Birkbeck, University of London

22. A COLORFUL ADVANTAGE IN ICONIC MEMORY
Radhika Gosavi and Edward Hubbard, University of Wisconsin-Madison

23. SHINING LIGHT ON THE BRAIN BASES OF DIVISION AND MATHEMATICAL COMPETENCE
Alexa Ellis, **Xiaosu Hu, Melanie Armstrong**, **Jennifer Bullen**, **Craig Smith**, **Pamela Davis-Kean** and **Ioulia Kovelman,** University of Michigan

24. TAKING ATTENTION BACK TO SCHOOL: MULTISENSORY CONTEXTS REVEAL EFFECTS OF EXPERIENCE ON ATTENTION ALLOCATION
Pawel J. Matusz, University Hospital Centre – University of Lausanne; **Rebecca Merkley**, University of Western Ontario and **Gaia Scerif**, University of Oxford

25. NEW METHOD FOR CALCULATING INDIVIDUAL SUBITIZING RANGE
Tali Leibovich and **Daniel Ansari**, University of Western Ontario

26. NATIVE LANGUAGE NEIGHBORHOOD INFLUENCES PRODUCTION OF NEWLY-LEARNED WORDS
Gabriela Meade, **Katherine Midgley** and **Phillip Holcomb**, San Diego State University

27. EXECUTIVE FUNCTION AND VOCABULARY SKILLS MEDIATE EFFECTS OF PARENTING AND POVERTY-RELATED RISK ON EARLY SCHOOL OUTCOMES
Stephen Braren, **Rosemarie Perry** and **Clancy Blair**, New York University

28. INDIVIDUAL DIFFERENCES IN SPATIAL REPRESENTATIONS OF FRACTIONS RELATE TO BASIC MATH ABILITIES BUT NOT ALGEBRA
Elizabeth Toomarian and **Edward Hubbard**, University of Wisconsin-Madison

29. THE MECHANISM OF LEARNING, MEMORY AND THE DEVELOPMENT (A UNIFIED THEORY OF LEARNING)
Nageswar Chekuri, Woodbury University

30. MORE IS NOT ALWAYS BETTER: HIGH WORKING MEMORY HINDERS PERFORMANCE ON AN APPROXIMATE SYMBOLIC CALCULATION TASK
Conner Black, Jennifer Brandley and **Elizabeth Gunderson**, Temple University

31. MENTAL ROTATION AND VERBAL CONFOUNDING: COMPARING THE RELATIONS OF DIFFERENT MENTAL ROTATION TASKS TO EARLY ARITHMETIC CALCULATION
Ying Lin, **Riley Brown** and **Elizabeth Gunderson,** Temple University

32. GENOME-WIDE ANALYSIS OF RAPID AUTOMATIZED NAMING IN HISPANIC AND AFRICAN AMERICANS
Dongnhu Truong, **Andrew Adams**, **Mellissa DeMille** and **Jeffrey Gruen**, Yale School of Medicine

33. THE RELATION BETWEEN NUMERICAL ESTIMATION FLEXIBILITY AND MATHEMATICAL COMPETENCE
Darren Yeo, **Eric Wilkey** and **Gavin Price**, Peabody College, Vanderbilt University

34. THE EFFICACY OF NEUROFEEDBACK TRAINING IN BUILDING LEARNING SKILLS AND WORK HABITS
Jason Krell, **Patrick Dolecki** and **Anderson Todd**, The Study Academy

35. SPATIAL PREDICTORS OF NUMBER LINE PERFORMANCE: A CASE FOR NON-SYMBOLIC PROPORTIONAL REASONING
Lindsey Hildebrand, **Audrey Wrobel** and **Elizabeth Gunderson**, Temple University

36. EXECUTIVE FUNCTIONS DEVELOPMENT IN PRESCHOOLERS FROM DIFFERENT SOCIOECONOMIC BACKGROUNDS IN URUGUAY
Veronica Nin, Facultad de Psicologia; **Hernan Delgado-Vivas**, Universidad de la Republica, Uruguay; **Andrea Goldin**, Universidad Torcuato di Tella, Argentina; **Diego Fernandez-Slezak** and **Laouen Belloli**, Universidad de Buenos Aires, Argentina and **Alejandra Carboni**, Universidad de la Republica, Uruguay

37. THE INFLUENCE OF NON-NUMERIC VISUAL PARAMETERS ON PERFORMANCE AND NEURAL ACTIVATION PATTERNS DURING NONSYMBOLIC NUMBER COMPARISON
Eric D. Wilkey, and **Jordan C. Barone**, Vanderbilt University; **Michele M. M. Mazzocco**, University of Minnesota; **Stephan E. Vogel**, University of Graz, Austria and **Gavin R. Price**, Peabody College, Vanderbilt University

38. ANXIOUS ATTENTION: MATH ANXIETY PREDICTS AMYGDALA REACTIVITY TO MATHEMATICAL STIMULI
Rachel Pizzie and **David Kraemer**, Dartmouth College

39. CAN INSIGHT BE INDUCED? SUBLIMINAL TRIGGERS AND NEURAL CHARACTERISTICS OF INSIGHT
Miriam Reiner and **Amit Rosen**, Technion, Israel Institute of Technology

40. THE NEURAL CORRELATES OF AUDITORY AND VISUAL SYMBOLIC NUMBER PROCESSING: INVESTIGATIONS WITH FMRI ADAPTATION
Stephan Vogel, University of Graz; **Celia Goffin** and **Ian Lyons**, University of Western Ontario; **Joshua Bohnenberger**, Georg-August-University Goettingen; **Karl Koschutnig**, University of Graz; **Gernot Reishofer**, Medical University of Graz; **Roland Grabner**, Educational Neuroscience/ Institut of Psychology, University of Graz and **Daniel Ansari**, University of Western Ontario

41. LINEAR MEASUREMENT MEDIATES THE RELATION BETWEEN MENTAL TRANSFORMATION AND NUMBER LINE ESTIMATION IN YOUNG CHILDREN
Noora Hamdan, **Lillian Ham** and **Elizabeth Gunderson**, Temple University

42. IS INHIBITION INVOLVED IN OVERCOMING THE INTUITIVE CONCEPTION "MOVING THINGS ARE ALIVE" AT ALL AGES?
Jérémie Blanchette Sarrasin, Université du Québec à Montréal; **Emmanuel Ahr**, Paris Descartes University - University Caen Basse-Normandie; **Lorie-Marlène Brault Foisy**, Université du Québec à Montréal; **Patrice Potvin**, Université du Québec à Montréal; **Olivier Houdé**, Paris Descartes University - University Caen Basse-Normandie - Institut Universitaire de France; **Grégoire Borst**, Paris Descartes University - University Caen Basse-Normandie and **Steve Masson**, Université du Québec à Montréal

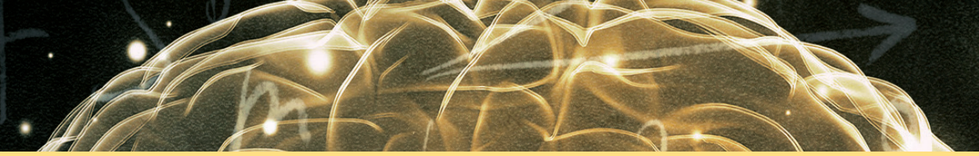
43. NOVICES' NEURAL CORRELATES OF ERROR-CORRECTION IN MECHANICS
Lorie-Marlène Brault Foisy, **Patrice Potvin**, **Martin Riopel**, **Geneviève Allaire-Duquette**, **Lucian Nenciovici** and **Steve Masson**, Université du Québec à Montréal

Saturday, September 17

44. BRAIN BASIS OF LANGUAGE PROFICIENCY IN BILINGUAL CHILDREN
Rebecca Marks, University of Michigan, **Zhichao Xia**, **Supriya Munsh**, University of California, San Francisco; **Yuuko Uchikoshi**, University of California, Davis; **Ioulia Kovelman**, University of Michigan and **Fumiko Hoeft**, University of California, San Francisco

45. BRAIN RESPONSES TO COUNTERINTUITIVE SCIENTIFIC STATEMENTS IN STUDENTS SHOWING HIGH AND LOW SCIENCE COMPETENCE
Genevieve Allaire-Duquette, Université du Québec à Montréal; **Michel Bélanger**, Université du Québec à Rimouski; **Roland H. Grabner**, University of Graz and **Steve Masson**, Université du Québec à Montréal

46. EMOTIONAL STIMULI IMPROVE CHILDREN'S COUNTING
Karina Hamamouche, **Jenna Taylor** and **Sara Cordes**, Boston College



47. THE IMPACT OF PLAYWRITING FRAMED BY COGNITIVE NEUROSCIENCE ON THE NARRATIVE WRITING SKILLS OF CHRONICALLY ILL STUDENTS
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49. APPLICATIONS OF NEUROSCIENCE TO LESSON DEVELOPMENT
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50. ALERTING CUES ENHANCE THE SUBITIZING PROCESS
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71. CULTURAL IDENTITY, SELF-REFLECTION AND THE ROLE OF "FUTURE SELF": QUALITATIVE AND QUANTITATIVE ANALYSES OF AN ONGOING, LONGITUDINAL, K-8 SCHOOL INTERVENTION
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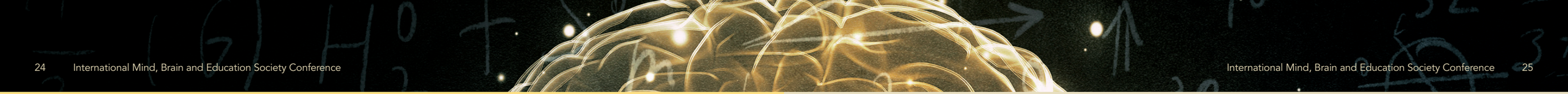

76. THE GAP BETWEEN IMPLICIT AND EXPLICIT KNOWLEDGE IN PHYSICS – EVIDENCE FROM EVENT RELATED NEURAL ACTIVATIONS
Miriam Reiner, Technion – Israel Institute of Technology, Stanford, Biological Science; **Lulu Gera**, Technion – Israel Institute of Technology

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79. AN INTERACTIVE POSTER DESIGNED TO CONNECT & CREATE A MODEL OF A SHARED VISION OF MBE
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84. MATH TALK VARIABILITY IN PRESCHOOL CLASSROOMS: THE ROLE OF TEACHERS' ABILITIES AND BELIEFS
Emily Braham and **Melissa Libertus**, University of Pittsburgh

85. THE RELATIVE IMPORTANCE OF EXECUTIVE FUNCTION COMPONENTS ON ACADEMIC ACHIEVEMENT IN YOUNG CHILDREN.
Sammy Ahmed, **Ying Wang** and **Frederick Morrison**, University of Michigan

86. BEHAVIOURAL AND NEUROIMAGING EVIDENCE OF REDUCED VERBAL WORKING MEMORY IN CHILDREN WITH DYSLEXIA
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*Poster will be presented by Annabel S.H. Chen

87. MENTAL HEALTH THROUGH A NEURO-EDUCATION LENS
Ellyn Lucas Arwood, **Chris Merideth** and **Carole Kaulitz**, University of Portland

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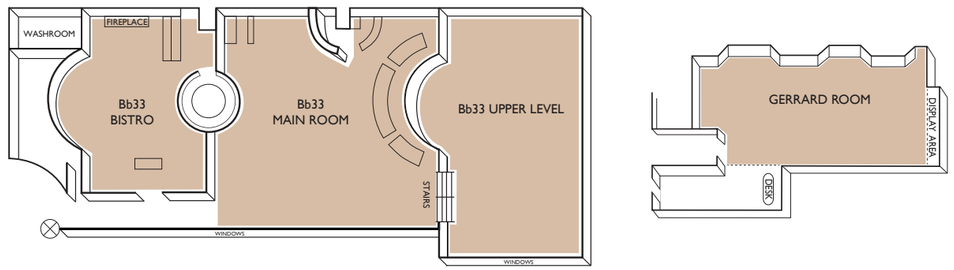

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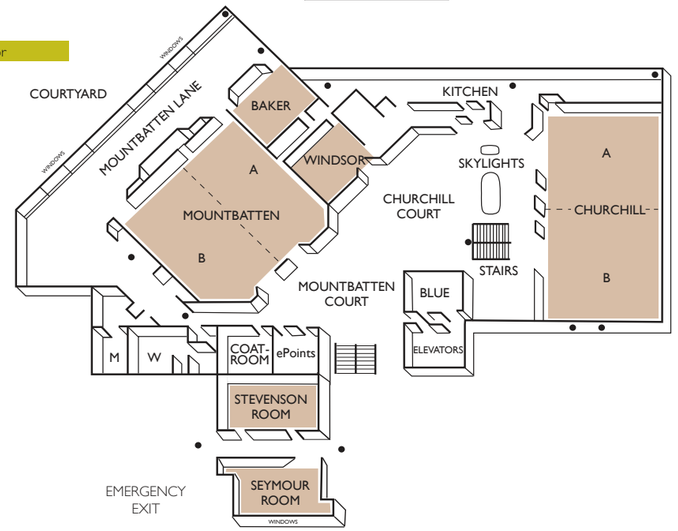
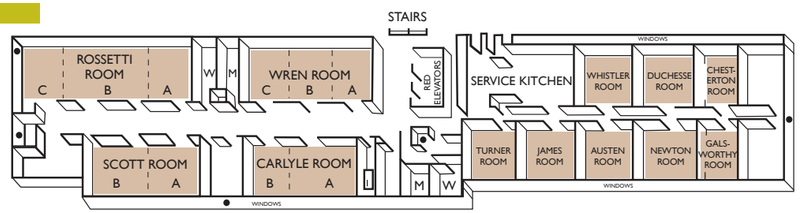
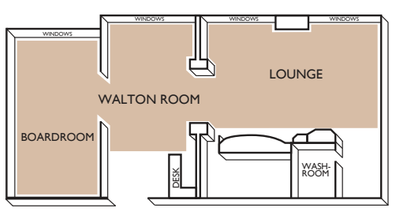


Location : Third Floor



Location : Twenty-fifth Floor



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