



33rd Banff Annual Seminar In Cognitive Science

Friday May 4

5:00 pm Welcome and opening remarks

Please register with Peter Dixon if you have not already done so (\$70 for faculty, \$25 for students and postdoctoral fellows).

5:15 pm **Jo-Anne LeFevre** (Carleton University), *Numerical cognition: Adding it up*

In this talk, I will start with a historical overview of one field – variously labeled “numerical cognition” or “mathematical cognition.” Focusing on the more inclusive term “numerical cognition,” I will discuss the evolution and development of this field in the context of the cognitive revolution, which started in the mid-1950s. I will discuss the development of numerical cognition as it connects, more generally, to the six areas that form the interdisciplinary enterprise of cognitive science. I will discuss highlights of my own work over the last 30 years and outline two directions of my current work: on mental arithmetic and on the development of mathematical cognition in children aged 4 through 10. One important goal will be to highlight the major findings in the field both for the experts and those who are less familiar with this topic. In sum, I intend to sketch a context within which to appreciate the neural, computational, and behavioural work that the other four speakers will present on Saturday.

6:45 pm Dinner break

8:00 pm Reception and poster session

10:00 pm Adjourn

Saturday May 5

8:30 am Coffee, tea, juice, pastries

9:00 am **Daniel Ansari** (University of Western Ontario), *Number symbols in brain and mind: Evidence from typical and atypical development*

Humans share with animals the ability to process numerical quantities in non-symbolic formats (e.g., collections of objects). Unlike other species, however, over cultural history, humans have developed symbolic representations (such as number words and digits) to represent numerical quantities exactly and abstractly. These symbols and their semantic referents form the foundations for higher-level numerical and mathematical skills. It is commonly assumed that symbols for number acquire their meaning by being mapped onto the pre-existing, phylogenetically ancient system for the approximate representation of non-symbolic number over the course of learning and development. In this talk I will challenge this hypothesis for how numerical symbols acquire their meanings (“the symbol grounding problem”). To do so, I will present a series of behavioural and neuroimaging studies with both children and adults that demonstrate that symbolic and non-symbolic processing of number is dissociated at both the behavioural and brain levels of analysis. I will discuss the implications of these data for theories of the origins of numerical symbol processing and its breakdown

in children with mathematical learning disorders, such as Developmental Dyscalculia.

10:30 am Coffee, tea, juice

11:00 am **Patrick Lemaire** (Aix-Marseille University), *Aging and strategic variations in arithmetic*

One of the most fascinating aspects of arithmetic for cognitive psychologists is that this domain sheds incredibly deep insights to basic fundamental issues in human cognition. These include as important issues as, among others, structural and functional cognitive architecture, strategic variations, long-term/working-memory interface, executive control processes, age changes, In this talk, I will illustrate this by discussing data on strategic variations in arithmetic and age-related changes of these variations during adulthood. I will first consider age-related changes and stability in strategy repertoire (i.e., which strategies are used?), strategy distribution (i.e., how often participants use available strategies), strategy execution (i.e., relative speed and accuracy of each strategy), and strategy selection (i.e., or how participants choose among each strategy on each problem). I will present behavioral and neuroimaging data collected while young and adults were accomplishing simple and complex arithmetic. I will also consider general processing resources (e.g., executive control mechanisms, processing speed) mediating age-related changes in strategic variations.

12:30 pm Lunch break

2:00 pm **Wim Fias** (Universiteit Gent), *Basic number representations and their neural basis*

In the first part of my talk I will focus on basic number representations and how they are neurally implemented. Two types of number coding can be distinguished: summation coding and number-selective coding. I will discuss the results of computational modelling and fMRI studies that show how these number representations are functionally related and integrated along an occipito-parietal network. In the second part I will focus on how these basic number representations are associated to space. It is commonly assumed that basic number representations are spatially coded as a mental number line. Access to specific number representations is supposed to be mediated by mechanisms of spatial attention. I will present evidence from neglect patients and from behavioural experiments in healthy controls that question this idea. An alternative framework is presented. It proposes that the coding of position in working memory is spatially coded and that it is these spatial codes that drive the phenomena that have been interpreted as being signatures of a mental number line.

3:30 pm Coffee, tea, juice, cake

4:00 PM **Roi Cohen Kadosh** (University of Oxford), *From cortical inhibition and excitation to cognitive enhancement*

Academic achievements such as mathematics and reading are key predictors for an individual's future professional success, whereas failure in these critical capacities negatively impacts the welfare of society as a whole. Current understanding of the link between high-level cognition and brain is mainly restricted to understanding the relationship between brain structure/function and

achievements, despite a substantial body of animal and clinical research showing that cortical inhibition and excitation at the molecular or cellular levels play a critical role in efficient information transfer in the brain. Specifically, it has been suggested that cortical inhibition and excitation affects cognition in humans. I will present studies that show how cortical inhibition and excitation are linked to high-level cognitive abilities in the child and adult human brain. Moreover, I will show that we can exogenously modulate cortical inhibition and excitation during cognitive training to optimize brain functions and improve cognition in typical and atypical development. Such a multidisciplinary approach has the potential to bridge the separated strands of current research in psychology and education, system and molecular neuroscience, as well as animal models.

5:30 pm Closing remarks

6:00 pm Reception and poster session

8:00 pm Adjourn

Notes

Friday Posters

- 1 Liangzi Shi, Connie Svob, Norman R. Brown (University of Alberta), *Intergenerational transmission of the reminiscence bump in Chinese immigrants*
- 2 Angela Lambert, A. Taikh, E. J. Shumlich, C. C. Weinsheimer, G. E. Bodner (University of Calgary), *Evaluating the basis of the production effect in recall*
- 3 Ashley Plumtree, Cheryl Techentin (Mount Royal University), *Hemispheric laterality of emotional faces*
- 4 Lauren Krowicki, Javid Sadr (University of Lethbridge), *Compare and contrast: A study of image quality and visual preference*
- 5 Chang Xu, Jo-Anne LeFevre (Carleton University), *Relations between space and math for preschool aged children*
- 6 Carmela White, Bob Uttl, Alain Morin (Mount Royal University), *Sex differences in students' dislike for numbers*
- 7 Ruoqing Zhou, Weimin Mou (University of Alberta), *Getting from A to B: How do we integrate spatial locations using different cues*
- 8 Shrida S. Sahadevan, Yvonne Y. Chen, Jeremy B. Caplan (University of Alberta), *The peg list method can support memory for associations*
- 9 Reyhaneh Bakhtiari, Wahab Hanif, Ivor Cribben, Carol Boliek, Jacqueline Cummine (University of Alberta), *Exploring speech and language networks using graph theory*
- 10 Layla Gould, M. J. S. Mickleborough, C. Ekstrand, P. Babyn, R. Borowsky (University of Saskatchewan), *An fMRI investigation of the neuroanatomical connection between word and picture processing*
- 11 Thomas Phenix, Heather Price (Campion College at the University of Regina), *Are false memories in children suppressed by retrieval-induced forgetting?*
- 12 Alyssa Cheema, Jayna Hermann, Cheryl Techentin (Mount Royal University), *Gender differences in the identification of emotional facial expressions*
- 13 Jeff Keith, Chris Westbury (University of Alberta), *Performance impact of stop-lists and morphological decomposition on corpus-based semantic space models*
- 14 Celia Goffin, (University of Western Ontario), Stephan Vogel (Georg-August-Universitat Gottingen), Daniel Ansari (University of Western Ontario), *Reliability and validity of effects commonly used in numerical cognition research*
- 15 Erica Ingraham, Trevor James Hamilton (MacEwan University), *12-Day reinforcement-based memory in African cichlids (*Labidochromis caeruleus*)?*
- 16 Carla Sowinski, Jo-Anne LeFevre (Carleton University), *Basic number skills and number line task performance*
- 17 Miranda Lucas, John Vokey, Peter Henzi, Louise Barrett (University of Lethbridge), *Tough guy or small fry? Humans can detect dominance among vervet monkeys*
- 18 Sara Caviola, Irene C. Mammarella, Cesare Cornoldi (University of Padova), *Computer training on mental calculation: A study with 3rd and 5th graders*
- 19 Rodney Schmaltz (MacEwan University), *Strategies to enhance students' study sessions*
- 20 Kayla Stone, Claudia Gonzalez (University of Lethbridge), *5 minus 2: What would you do? Grasping without touch and sight*
- 21 Anna Consoli, P. Pexman (University of Calgary), *Effects of emotional or manipulative experience on word recognition*

Friday Posters

- 22 Karyn Russell, Priya Nath, Christopher Striemer (MacEwan University), *Does size matter? The effects of magnitude of prism shift on spatial attention in healthy individuals*
- 23 Marla Mickleborough, Layla A. Gould, Chelsea Ekstrand, Paul Babyn, Ron Borowsky (University of Saskatchewan), *Altered activation of the ventral portion of the network of attention during visual orienting in migraineurs*
- 24 Jessica MacLean, Kelly Mills, Nicole Netelenbos, Claudia Gonzalez, Robbin Gibb (University of Lethbridge), *Starting at 2, how well does your child do? A comparison of a parent executive function questionnaire and novel behavioural tasks*
- 25 Lauren D. Goegan, Kelly McManus, Gina Harrison (University of Victoria), *The development of metacognitive knowledge in skilled and less-skilled elementary school writers*
- 26 Kayla Solvason, Alain Morin, Bob Uttl (Mount Royal University), *Age differences in inner speech*
- 27 Chelsea Vainio, G. E. Bodner (University of Calgary), *Survival processing effects on memory: Pictures versus words*
- 28 Carley Piatt, Marian Coret, Joanne Volden, Jeffrey Bisanz (University of Alberta), *How children solve number-line estimation problems*
- 29 Isha Ober, Christopher R. Madan, Yvonne Y. Chen, Jeremy B. Caplan (University of Alberta), *The feedback related negativity may reflect changes in reward expectancy in learning of large sets of item values*
- 30 Melissa Fonseca, Jillian Gilmour, Jasmine Sinclair, Alyssa West, Malinda Desjarlais (Mount Royal University), *An examination of within-task changes in mental effort for memory and learning tasks*
- 31 Stephanie Bugden, Daniel Ansari (University of Western Ontario), *Probing the nature of deficits in the "approximate number system" in children with persistent developmental dyscalculia*
- 32 Famira Racy (Mount Royal University), *Effects of mood and mortality salience on purpose in life*
- 33 Jezz Stone, Briana Cassetta, Chelsea Christie, Penny Pexman, Vina Goghari (University of Calgary), *Emerging social functioning in eight year olds: Empathy, irony, and theory of mind*
- 34 Jennifer L. Briere, Tammy A. Marche (University of Saskatchewan), *Do kindergarteners demonstrate retrieval-induced forgetting due to interference or inhibition?*
- 35 Carley Borza, Christopher Striemer (MacEwan University), *The influence of directional prism adaptation on the initiation of leftward and rightward movements*
- 36 Kelsey Berntson, Samantha Alcock, Cheryl Techentin (Mount Royal University), *Eye movement and laterality effect in dichotic listening*
- 37 Erin Maloney, Elizabeth Gunderson, Gerardo Ramirez, Susan Levine, Sian Beilock (University of Chicago), *Teachers' and parents' math anxiety affects children's math achievement*
- 38 Scott Stone (University of Lethbridge), *The attention-hungry left space: An examination of eye gaze during a reach-to-grasp task*

Saturday Posters

- 1 Anna Matejko, Daniel Ansari (University of Western Ontario), *Trajectories of math and number development in Grade 1: Evidence from brain and behaviour*
- 2 Jason Flindall, Natalie de Bruin-Nutley, Claudia L. R. Gonzalez, Lesley Brown (University of Lethbridge), *One track mind: Young adults prioritize grasp production over obstacle clearance while walking*
- 3 Joy Hodgson, Bob Uttl, Carmela A. White, Brittney J. Stevens (Mount Royal University), *GRE verbal reasoning prep books: Reliability and validity*
- 4 Alex Taikh, G. E. Bodner (University of Calgary), *Effects of levels-of-processing and test context on pupil dilation and recollect/familiar judgments.*
- 5 David Sidhu, Penny Pexman (University of Calgary), *Priming boubas and kikis*
- 6 Connie Svob, Norman R. Brown, John R. Reddon (University of Alberta), *Understanding the impact of the southern Alberta flood*
- 7 Yvonne Y. Chen, Jeremy B. Caplan (University of Alberta), *Alpha desynchronization explains individual variability in recognition-memory but theta synchronization does not*
- 8 Shannon Thiemer (Thompson Rivers University), *False memory for actions performed, imagined, or witnessed*
- 9 Stanislau Hrybouski, Arash Aghamohammadi Sereshki, Andrea T. Shafer, Tyler Rolheiser, Christopher R. Madan, Corey A. Baron, Peter Seres, Fraser Olsen, Nikolai Malykhin (University of Alberta), *Functional role of amygdala: A high-resolution functional magnetic resonance imaging study of emotional processing*
- 10 Kenichi Kato, Jeremy B. Caplan (University of Alberta), *Memory for pairings and constituent-orders of verbal associations*
- 11 Chris Piat, Rodney Schmaltz (MacEwan University), *"I'm unique, just like everyone else": Music preferences and optimal distinctiveness needs*
- 12 Lara Coelho, Claudia Gonzalez, Kayla Stone (University of Lethbridge), *1st to the right, 2nd to the left: Spatial neglect in reaching and grasping*
- 13 Ian Newman, Valerie Thompson (University of Saskatchewan), *Think fast: Can intuition be logical?*
- 14 Yalin Chen, Jamie I. D. Campbell (University of Saskatchewan), *Operator and operand preview effects in simple addition and multiplication: A comparison of Canadian and Chinese adults*
- 15 Ian Newcombe, Brian Duffels, Kaleigh Pelletier, Paul Siakaluk (University of Northern British Columbia), *Effects of emotional experience and valence in lexical decision*
- 16 James Farley, Peter Dixon (University of Alberta), *The effect of false feedback on mind wandering self-report*
- 17 Zorry Belchev, G. E. Bodner (University of Calgary), *Effects of initial testing and previewing on recognition*
- 18 Brea Chouinard, Jacqueline Cummine, Joanne Volden (University of Alberta), *Simultaneous versus serial processing of figurative language*
- 19 Adam Morrill, Nicole Anderson (MacEwan University), *Visual beat perception induced by salient visual stimuli*

Saturday Posters

- 20 Eric Lorentz, Layla Gould, Marla Mickleborough, Mark Boyer, Jim Cheesman, Ron Borowsky (University of Saskatchewan), *Subjective and objective thresholds of consciousness: All 'in one fell Strop'*
- 21 Ian M. Lyons, Anniek Vaessen, Leo Blomert, Daniel Ansari (University of Western Ontario), *The development of ordinal processing of numbers in grades 1-6*
- 22 Yang S. Liu, Jeremy B. Caplan (University of Alberta), *Memory judgements of relative order and chunking*
- 23 Chunyun Ma, Jo-Anne LeFevre (Carleton University), *The role of declarative versus procedural knowledge in simple arithmetic*
- 24 Jordan Rozario, Nathaniel Barr (University of Waterloo), Erin Maloney (University of Chicago), Evan Risko, Jonathan Fugelsang (University of Waterloo), *The number sense and math achievement: Testing the predictive power of multiple indices of the numerical distance effect*
- 26 Kateryna Morayko, John Vokey (University of Lethbridge), *On telling more than we can know*
- 27 Natasha Dienes, Lana M. Trick (University of Guelph), *Enumeration of illusory contour figures ii: Kanizsa figures*
- 28 Cory Tam, Oliver Schweickart, Norman R. Brown (University of Alberta), *Two biases and a heuristic: The effects of response frequency and preference on judgmental anchoring*
- 29 Kelly Mills, Ben Rousseau, Claudia Gonzalez (University of Lethbridge), *0 to 9, Crossing the Line: The start of the SNARC effect in a grasping task*
- 31 Bob Uttl, C. A. White, K. Mathison, A. Morin, L. Grant (Mount Royal University), *Prospective memory, personality, and psychopathology*
- 32 Kayla Lucas, Joshua Gallup, Adam Morrill, Megan Harris, Meghan Healey, Melike Schalomon, Trevor James Hamilton (MacEwan University), *The anxiolytic effect of scopolamine on zebrafish (danio rerio)*
- 33 Michele Wellsby, Penny M. Pexman (University of Calgary), *The role of embodied experience in children's word learning and reading comprehension*
- 34 Chelsea Ekstrand, L. Gould, M. J. S. Mickleborough, R. Borowsky (University of Saskatchewan), *Interactivity of dorsal and ventral stream contributions during reading processes at the orthographic lexical system*
- 35 Tiffany Rivette, Michael Woloszyn (Thompson Rivers University), *The effect of list versus story context on false recognition in the DRM paradigm*
- 36 Joshua Gallup, Trevor James Hamilton (MacEwan University), *Does nicotine alter cognition in zebrafish (danio rerio)?*
- 37 Sarah Dada, Louise Barrett, Peter Henzi (University of Lethbridge), *Can't take my eyes off you: Gaze bias predicts selection and preference*
- 38 Iro Xenidou-Dervou (VU University Amsterdam), Daniel Ansari (University of Western Ontario), Menno van der Schoot, Ernest C. D. M. van Lieshout (VU University Amsterdam), *Nonsymbolic and symbolic approximate magnitude processing: a large-scale longitudinal study*

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Notes