6TH CONFERENCE OF THE ASSOCIATION FOR RESEARCH IN NEUROEDUCATION

INTERNATIONAL SCIENTIFIC CONFERENCE
PROGRAM

SORBONNE, LOUIS LIARD AMPHITHEATRE
17, rue de la Sorbonne, 75005 Paris

*Entrance only upon presentation of an invitation card on a list of names

JUNE 7-8, 2018

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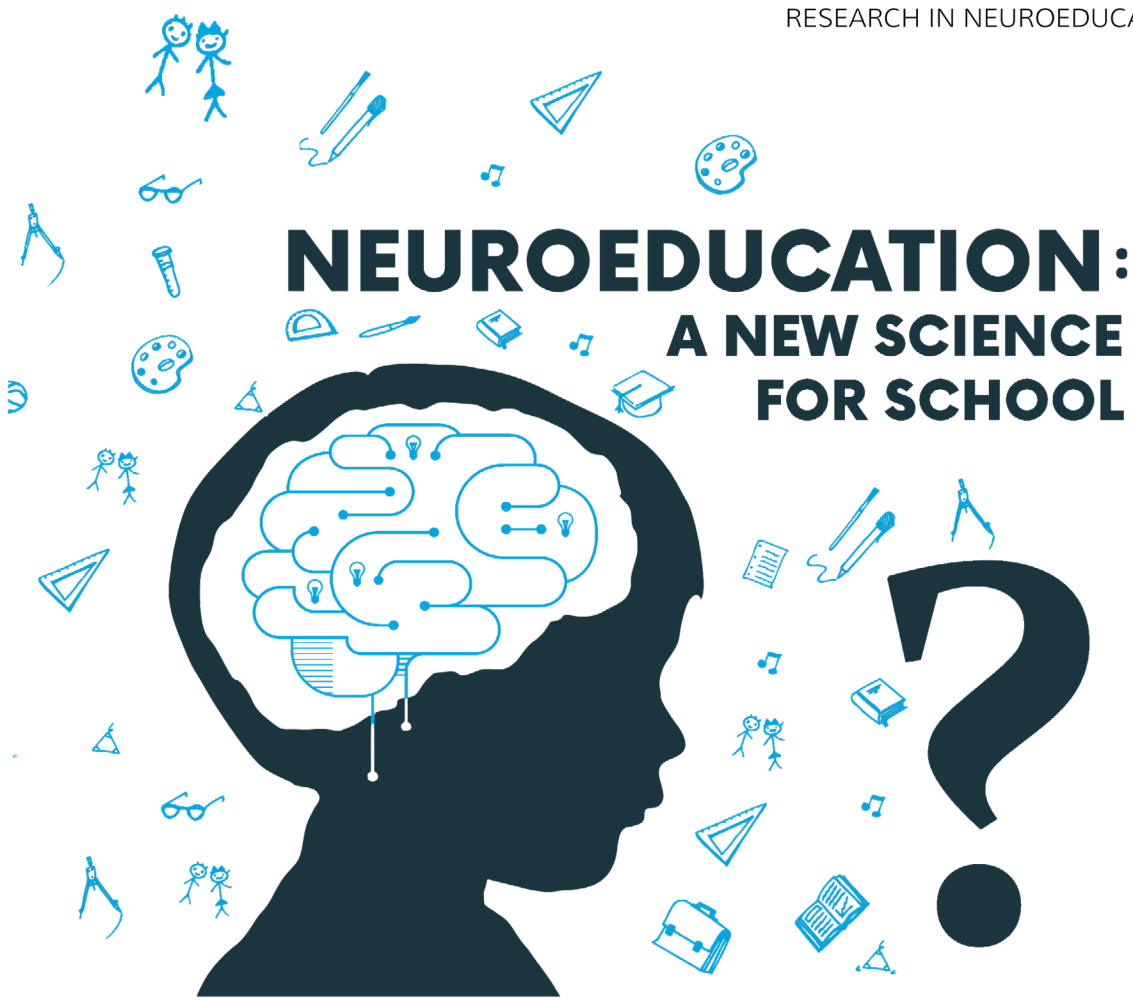
ASSOCIATION POUR LA RECHERCHE EN NEUROÉDUCATION / ASSOCIATION FOR RESEARCH IN NEUROEDUCATION



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FONDATION PARIS DESCARTES

INTERNATIONAL SCIENTIFIC CONFERENCE

THURSDAY, JUNE 7TH 2018

8:45 — WELCOMING REMARKS BY GRÉGOIRE BORST
Laboratory for the Psychology of Child Development and Education (France)

9:00 — **Heterogeneity of skills reflects different functional brain plasticity of dedicated neurocognitive systems during mathematical learning**
Teresa IUCULANO, Laboratory for the Psychology of Child Development and Education (France)

9:30 — **Emergence of arithmetic biases during childhood - the operational momentum in 8-12 year-olds**
André KNOPS *et al.*, Laboratory for the Psychology of Child Development and Education (France)

10:00 — **Which tools would be useful in order to succeed in mathematics if using fingers is not adequate?**
Nolwenn GUEDIN, University of Geneva (Switzerland)

10:30 — COFFEE BREAK

11:00 — **Exploratory analysis of EEG signature of inhibition in two conceptual tasks in science**
Yannick SKELLING-DESMEULES *et al.*, Université du Québec à Montréal (Canada)

11:30 — **Neural recycling and inhibitory control as core neurocognitive mechanisms of cultural tools acquisition**
Margot ROELL *et al.*, Laboratory for the Psychology of Child Development and Education (France)

12:00 — LUNCH BREAK

13:30 — **The critical role of visual attention in reading acquisition** KEYNOTE
SYLVIANE VALDOIS, Grenoble-Alpes University, LPNC, CNRS (France)

15:00 — **POSTER SESSION 1**
COFFEE BREAK

16:00 — **Can we learn to de-bias ourselves? Implicit learning in the Cognitive Reflection Test**
Matthieu RAOELISON, Laboratory for the Psychology of Child Development and Education (France)

16:30 — **The benefits of causal diagrams for recall of causal sequences in educational settings**
Sara VERBRUGGE, KU Leuven (Belgium)

17:00 — **A study of the evolution with age of the status of three competing conceptions about buoyancy using response times measured with a single task**
Patrice POTVIN & Guillaume CYR, Université du Québec à Montréal (Canada)

9:30 **Neuromyths and their origin among teachers in Quebec**
Jérémie BLANCHETTE SARRASIN & Steve MASSON, Université du Québec à Montréal (Canada)

10:00 **A longitudinal functional MRI study to test behavioral and brain changes following an intensive inhibitory control training in children**
Emilie SALVIA *et al.*, Laboratory for the Psychology of Child Development and Education (France)

10:30 COFFEE BREAK

11:00 **Symbolic numerical processing is a key predictor of learning arithmetic**
BERT DE SMEDT, KU Leuven (Belgium) **KEYNOTE**

12:30 LUNCH BREAK

14:00 **An experimental-psychology-based protocol to bridge the gap between neuroscience and education**
Emmanuel AHR *et al.*, Institut Villebon - Georges Charpak (France)

14:30 **Neuroscience - Validation of a learning-strategy workshop based on metacognitive knowledge**
Tina MONTREUIL *et al.*, Department of Educational & Counselling Psychology, C.A.R.E. Lab, McGill University (Canada)

15:00 **POSTER SESSION 2**
COFFEE BREAK

16:00 **How does social context influence inhibitory control and creative idea generation?**
Lison BOUHOURS, Laboratory for the Psychology of Child Development and Education (France)

16:30 **From fundamental research in the psychology of creativity to school applications**
Anaëlle CAMARDA, Laboratory for the Psychology of Child Development and Education (France)

17:00 **Playing 10 minutes daily in class improves the inhibitory control of students from 6 to 12 years old**
Marie LÉTANG, Laboratory for the Psychology of Child Development and Education (France)

17:30 CLOSING REMARKS BY OLIVIER HOUDÉ
Laboratory for the Psychology of Child Development and Education (France)

HETEROGENEITY OF SKILLS REFLECTS DIFFERENT FUNCTIONAL BRAIN PLASTICITY OF DEDICATED NEUROCOGNITIVE SYSTEMS DURING MATHEMATICAL LEARNING

9:00

Teresa IUCULANO, Laboratory for the Psychology of Child Development and Education (France)

The ability to solve simple arithmetical operations such as "3+4" involves the orchestrated effort of multiple neurocognitive systems. These include higher-level visual areas in the ventral temporal-occipital cortex supporting symbol recognition, posterior parietal cortices for quantity manipulations, and prefrontal regions involved in domain-general cognitive functions, such as cognitive control, and some aspects of working memory. The involvement of these systems during arithmetic problem-solving changes with learning and development and, most critically, with heterogeneity of skills. I will present a series of studies that use an ecologically valid, well-controlled arithmetic learning paradigm combined with functional magnetic resonance imaging (fMRI) to assess plasticity of these neurocognitive systems in different cohorts of elementary-school children. In the first study, we show that 8 weeks of arithmetic training induces significant neuroplasticity in children with mathematical learning disabilities (MLD) by reducing functional brain activity in multiple ventral temporal-occipital, parietal and prefrontal regions. Crucially, in typically developing children, the same 8-week training was associated with greater engagement of medial temporal lobe memory systems anchored in the hippocampus, and these increases were coupled with higher use of efficient retrieval strategies. Any cognitive learning is often accompanied and influenced by emotional factors. Notably, it has been shown that amygdala circuits implicated in processing negative emotions are over-engaged in highly math-anxious individuals. Using the same arithmetic training paradigm, we report training-contingent decreases in activity and connectivity of these emotional circuits in a population of children with high levels of math anxiety. Collectively, these findings suggest that functional brain plasticity of neurocognitive systems important for arithmetic learning varies as a function of skills and emotional state. More generally, this work helps refine developmental neurocognitive models of mathematical learning, and highlights the potential of integrating neuroscience methods with pedagogical and cognitive models to disentangle sources of heterogeneity in academic learning.

EMERGENCE OF ARITHMETIC BIASES DURING CHILDHOOD - THE OPERATIONAL MOMENTUM IN 8-12 YEAR-OLDS

9:30

André KNOPS, Laboratory for the Psychology of Child Development and Education (France)
Daniele DIDINO, Humboldt University of Berlin, Department of Psychology (Germany)
Pedro PINHEIRO-CHAGAS, Université Paris-Sud, Cognitive Neuroimaging Unit (France)
Vitor HAASE, Universidade Federal de Minas Gerais, Department of Psychology (Brazil)
Guilherme WOOD, University of Graz, Department of Psychology (Austria)

Mental calculation is thought to be tightly related to visuospatial abilities. One of the strongest evidence for this link is the widely replicated operational momentum (OM) effect: the tendency to overestimate the result of additions and to underestimate the result of subtractions. Although the OM effect has been found in both infants and adults, no study has directly investigated its developmental trajectory until now. In the present study, we investigated the development of the OM effect in a group of 162 children (8 to 12 years). Participants had to select among five response alternatives the correct result of approximate addition and subtraction problems. Response alternatives were simultaneously presented on the screen at different locations. The OM effect monotonically increased with age, exhibiting an adult-like size at 12 years old. The increase of the OM effect was accompanied by an increase in overall accuracy. That is, while younger children made more and non-systematic errors, older children made less but systematic errors. The OM effect did not correlate with the acuity of the approximate number system (i.e. Weber fraction), rendering the possibility that the OM effect is a by-product of an imprecise numerosity representation highly unlikely. This monotonous increase of approximate calculation bias with age is not predicted by two of the current accounts proposed to explain the OM (i.e., compressed account and the heuristic account). The attentional shift account however provides a possible explanation of these results based on the functional relationship between visuospatial attention and mental calculation and on the developmental changes that affect these two systems. This novel finding may provide a substantial step in the understanding of the mechanisms underlying approximate calculation and an important empirical constraint for current accounts on the origin of the OM effect.

WHICH TOOLS WOULD BE USEFUL IN ORDER TO SUCCEED IN MATHEMATICS IF USING FINGERS IS NOT ADEQUATE?

10:00

Nolwenn GUEDIN, University of Geneva (Switzerland)

Finger use in the first grade correlates with mathematical achievement (Dupont-Boime & Thevenot, 2017; Jordan et al., 2008). But then, the link disappears. More importantly, the longitudinal study of Jordan et al. shows that the correlation between fingers and numerical performance becomes negative for children in the second grade. In other words, counting on fingers is a useful tool for young children to develop their first numerical skills, but for dealing with larger numbers, other skills have to be mobilized. We hypothesized that using canonical configurations of dots (Krajcsi et al., 2013) could be a solution. Actually, we chose quantities having the same sub-base 5 as on fingers, organised similar to dice. Such visual numerical constellations could provide a link between concrete sensori-motor actions and abstract symbolic numbers, which is precisely recommended by the report of Villani and Torossian (2018). Our hypothesis has been tested in four classes of the first grade. Only the children of two classes were learning quantities with the constellations of dots. By using the Tedi-Math assessment, the comparison of pre-tests and post-tests showed systematically a similar or a better level for children who performed mathematics with the visual device. More remarkably, those children were significantly better regarding two abstract skills: the cardinality conception and the base-10 comprehension. In another study, we also tested if such visual numerical representations could be accessible to children with cerebral palsy. This motor impairment, due to a cerebral lesion from birth, leads to sensori-motor deficits and is commonly associated with neuro-visual problems. Nevertheless, compared to typical children, impaired participants have only difficulties in counting the dots in random configurations ($p = .001$) and reach the same level in canonical configurations ($p = .29$). Then, constellations of dots could be a useful tool when using fingers is not adequate.

EXPLORATORY ANALYSIS OF EEG SIGNATURE OF INHIBITION IN TWO CONCEPTUAL TASKS IN SCIENCE

11:00

Yannick SKELLING-DESMEULES, Lorie-Marlène BRAULT FOISY, Hugo G. LAPIERRE, Emmanuel AHR, Frédéric CHAREST, Patrice POTVIN, Steve MASSON, & Patrick CHARLAND, Université du Québec à Montréal (Canada)

Research has shown that inhibition is essential for learning in various domains (e.g. reasoning, reading and categorizing) that require overcoming intuitive conceptions or automated strategies. The field of science education is no exception as an extensive literature research reveals that students often hold intuitive conceptions about various phenomena. In line with other domains, recent fMRI studies have shown that inhibitory control mechanisms are indeed involved in understanding basic science concepts in mechanics and electricity. Studies using reaction times (negative priming paradigm) corroborate these results in similar subdomains, such as physics and biology, strengthening the previous conclusions. This paper proposes to use electrophysiological measurements in order to investigate the neural signature associated with scientific tasks requiring inhibition. While EEG signals may provide less spatial resolution than fMRI, its temporal resolution allows for the detection of cognitive processes over a very small time frame. The use of EEG also allows the integration of more ecologically valid tasks, and is more accessible to researchers, both technically and financially. This research therefore intends to explore the neurocorrelates of specific scientific learning contexts known to involve inhibition. To do so, two cognitive tasks in science requiring strong levels of inhibition were selected. These tasks targeted two well-documented misconceptions that are known to interfere with teaching and learning efforts: 1- “moving things are alive” and 2- “heavier objects will sink more than lighter objects”. Twenty-eight undergraduate students participated in both tasks, while their EEG signals were recorded. Considering previous results from reaction time studies, our hypothesis is that event-related potential (ERP) signals will differ at N200 and P300 locations between intuitive stimuli (for which no inhibition is required) and counter-intuitive ones (for which inhibition is required). Undergoing analysis will allow us to present preliminary results and discuss possible implications for future research in neuroeducation.

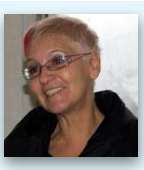
NEURAL RECYCLING AND INHIBITORY CONTROL AS CORE NEUROCOGNITIVE MECHANISMS OF CULTURAL TOOLS ACQUISITION

11:30

Margot ROELL[1,2,3], Emmanuel AHR[5], Arnaud VIAROUGE[1,2], Olivier HOUDÉ[1,2,4], & Grégoire BORST[1,2,4]

[1] Université Paris Descartes, Université Sorbonne Paris Cité, LaPsyDÉ, UMR CNRS 8240 (France)
[2] Université de Caen (France)
[3] École des Neurosciences de Paris (France)
[4] Institut Universitaire de France
[5] Institut Villebon - Georges Charpak (France)

Cultural learning such as reading and mathematics rely on dedicated brain areas, such as the visual word form area (VWFA) for the visual processing of letters and words and the intra-parietal sulcus (IPS) for numerical processing. The existence of these brain area are paradoxical given that these cultural tools are too recent to be a product of Darwinian phylogenetic evolution. The brain areas emerge presumably after intense school learning via a process of neuronal recycling: neurons in the lateral occipitotemporal cortex originally tuned to the visual recognition of stimuli and neurons originally tuned to process space are recycled respectively for the visual recognition of letters and words and for numerical processing. Due to this neural recycling process, the new acquired functions of these neurons are influenced by original properties of these neurons. In particular, the VWFA inherits the mirror generalization property (a process allowing a fast recognition of a stimulus irrespective of its left-right orientation) which is detrimental for recognizing letters that are mirror image of each others (such as b/d) while the IPS inherits the automatic processing of space which is detrimental for processing decimal numbers in certain contexts. We will present a series of negative priming studies showing that, at all levels of expertise, inhibitory control of inherited properties of the recycled neurons is needed to prevent systematic errors in reading and mathematics. Taken together, our findings show that neural recycling and inhibitory control could be core neurocognitive mechanisms of cultural tools acquisition.



KEYNOTE

13:30

THE CRITICAL ROLE OF VISUAL ATTENTION IN READING ACQUISITION

SYLVIANE VALDOIS, Grenoble-Alpes University, LPNC, CNRS (France)

Printed words are not just sequences of letters but these letters form units like graphemes or syllables that have to be processed as a whole. Processing such units requires multi-letter parallel processing which in turn depends on general visual attention capacity for multi-element processing, dubbed the visual attention (VA) span. In this talk, I will (1) demonstrate the critical role of visual attention in the processing of words (2) show how attention affects reading acquisition and (3) present new tools for training visual attention in the classroom. More specifically, I will first present the visual constraints on reading, together with evidence for a link between VA span and reading acquisition in typical readers. I will show that a subgroup of children with a specific reading acquisition disorder (or developmental dyslexia) shows a VA span deficit and how training programs specifically conceived to improve VA span result in better reading skills in dyslexic children. Last, I will discuss the role of action video games on reading acquisition and present the e-FRAN project “FLUENCE” in which an action video game specifically conceived to train VA span is used in classrooms to improve the children’s reading skills.

CAN WE LEARN TO DE-BIAS OURSELVES? IMPLICIT LEARNING IN THE COGNITIVE REFLECTION TEST

16:00

Matthieu RAOELISON, Laboratory for the Psychology of Child Development and Education (France)

The Cognitive Reflection Test and the notorious bat-and-ball problem have been extensively used to show that people are biased by their intuitions. The literature indicates that prior experience with this particular problem or repeated exposure to it does not help to avoid bias. This seemingly implies that biased intuitions are pervasive and robust, leading us to stay biased. However, previous studies face a number of methodological limitations including the fact that they relied on a small number of trials. Therefore, in the present study we had participants (n = 62) solve 100 bat-and-ball items with varied content and conflict status to investigate whether participants were able to learn the underlying structure and avoid being biased after extensive exposure. We used a two-response paradigm in which participants were asked to first respond with the very first answer that intuitively came to mind and a final response for which they were allowed to reflect on their answer. To make sure that the initial response was truly intuitive in nature, it was generated under time pressure and cognitive load. In line with previous findings results show that there is overall little improvement (i.e., 12% accuracy increase after 100 trials). However, in those cases that learning did occur we observed that it was equally likely to result from immediate intuitive insight or more careful deliberation: when people switched from an incorrect answer on trial n to a correct answer on trial n+1 this correct responding was equally likely to occur at the initial and final response stage. This indicates that although learning is rare, there is evidence that it can result from sudden intuitive insight that does not require effortful deliberation. Results support recent findings suggesting that our intuitions can also cue correct logico-mathematical responses. We discuss potential applied educational and theoretical implications.

THE BENEFITS OF CAUSAL DIAGRAMS FOR RECALL OF CAUSAL SEQUENCES IN EDUCATIONAL SETTINGS

16:30

Sara VERBRUGGE, KU Leuven (Belgium)

We set up two experiments studying the benefits of adding causal diagrams and illustrations to expository texts for recall of information in an educational setting. The first study investigates the added value of adjunct displays for retaining causal information in an expository text by adolescents in secondary school. The second is an eye tracking experiment with university students, investigating recall of causal relations and the division of attention between text and diagram. 91 pupils from the fifth and sixth grade secondary education took part in the first experiment. Recall of causal sequences differed according to text type. Causal diagram led to greater recall than any of the other text types (text only - text and diagram - text and images). In order to provide us with a more precise understanding of participants' processing of texts and causal diagrams, we set up an eye tracking study with 24 university students. Results showed that a text containing more causal relations was better retained than a text containing fewer causal relations, irrespective of prior knowledge. However, a main effect of prior knowledge could also be observed, texts that matched participants' prior knowledge were better retained. As for the eye tracking part, the relative attention devoted to text and diagram was examined per text and per participant. For the text containing many causal relations, no correlations could be found between overall scores of recall and division of attention between textual information and diagrams. However, for the text containing fewer causal relations, the more students focused on the diagram, the better their memory of the text. We will discuss the implications for educational practice. We will situate our results with regard to the causal explication hypothesis, the issue of verbal redundancy and the mediating effect of prior knowledge.

A STUDY OF THE EVOLUTION WITH AGE OF THE STATUS OF THREE COMPETING CONCEPTIONS ABOUT BUOYANCY USING RESPONSE TIMES MEASURED WITH A SINGLE TASK

17:00

Patrice POTVIN[1,2] & Guillaume CYR[1,2]

[1] Équipe de recherche en éducation scientifique et technologique (EREST)
[2] Université du Québec à Montréal (Canada)

Recent publications in the field of neuroeducation have argued that students' misconceptions about natural phenomena cannot be considered as being erased or transformed during conceptual change learning processes. Indeed, they appear to continue to interfere during the production of correct answers. This interference can be recorded during tasks in which counter-intuitive stimuli take longer to be successfully answered than intuitive ones. Such interference can also be seen in fMRI studies that show the activation of brain regions usually associated with the cognitive function of inhibition. Hence, some researchers have proposed to reduce the learning process of overcoming misconception to a dual-process - or systems 1, 2 (and 3) - phenomena. In this research, we tested the hypothesis according to which there could be more than two conceptions that compete for cognitive utility during the development and consolidation of scientific understanding. Using a single task about buoyancy that presents intuitive, neutral and counter-intuitive stimuli to participants, we have recorded accuracies and response times of 62 preschoolers, 557 elementary students, 127 secondary students, and 22 science teachers. This task allowed us to determine the status and prevalence of the involved conceptions as well as the interference caused by two possible conceptual distractors with regard to correct answers. Results describe the progression of the desired conception with age as well as the modifications in the statuses of two misconceptions. They also show that misconceptions continue to interfere with performance even when there is a high degree of scientific expertise, and that patterns of such interference can be studied. In keeping with these conclusions, we argue for the use of a model of conceptual learning called "conceptual prevalence" that appears to be more suited to science education than other models from cognitive psychology.

NEUROMYTHS AND THEIR ORIGIN AMONG TEACHERS IN QUEBEC

9:30

Jérémie BLANCHETTE SARRASIN[1,2,3] & Steve MASSON[1,2,3]

[1] Laboratoire de recherche en neuroéducation (LRN)
[2] Équipe de recherche en éducation scientifique et technologique (EREST)
[3] Université du Québec à Montréal (Canada)

Recent studies have revealed the existence of misconceptions about brain function among teachers (Dekker et al., 2012; Howard-Jones, 2014). Often called 'neuromyths', these beliefs sometimes result from distorted or misinterpreted research results (Howard-Jones, 2014; OECD, 2007). For example, a widely perpetrated neuromyth is to think that adapting teaching to learning styles, such as visual or auditory, increases learning (Pashler et al., 2008). Frequently, these misconceptions encourage schools to invest considerable resources to implement teaching practices in the classroom that have not been scientifically validated (Pasquinelli, 2012). These neuromyths could also prevent teachers from effective teaching practices recognized and supported by research (Pasquinelli, 2012). Moreover, recent studies conducted in different countries report a particularly high prevalence of certain neuromyths: as many as 90% of teachers adhere to some of them (Dekker et al., 2012; Gleichgerrcht et al., 2015). The current literature also highlights some factors that could be causing the belief in these neuromyths, but, to date, the understanding of these factors remains mostly superficial. More research is therefore needed to understand the origins of neuromyths and provide potential solutions to help teachers to overcome these erroneous and counterproductive beliefs (Dekker et al., 2012). The present research aims to identify the prevalence of frequent neuromyths among teachers in Quebec and their origin, that is the sources that can influence their belief in specific neuromyths (e.g. popular science texts, training, intuitions, etc.). 972 teachers from Quebec responded to an online questionnaire. The results will be presented and discussed, allowing a better understanding of the importance of the issue of neuromyths in Quebec and a more accurate measure of the sources that may influence these beliefs among teachers. This could ultimately help to prevent neuromyths more effectively and dispel those already prevalent in education.

A LONGITUDINAL FUNCTIONAL MRI STUDY TO TEST BEHAVIORAL AND BRAIN CHANGES FOLLOWING AN INTENSIVE INHIBITORY CONTROL TRAINING IN CHILDREN

10:00

Emilie SALVIA[1,2], A. CACHIA[1,2,3,4], C. TISSIER[1,2,3], S. CHARRON[1,2,3,5], K. MEVELL[1,2], L. DELALANDE[1,2], M. MOYON[1,2], N. POIREL[1,2], J. VIDAL[1,2], S. LION[3,5], C. OPPENHEIM[1,3,5], O. HOUDÉ[1,2,4*], & G. BORST[1,2,4]

[1] Paris Descartes University, Sorbonne Paris Cité, Paris, France
[2] CNRS UMR 8240, Laboratory for the Psychology of Child Development and Education, Sorbonne, Paris, France
[3] INSERM UMR894, Imaging biomarkers for brain development and disorders, Paris, France
[4] Institut Universitaire de France, Paris, France
[5] Department of Radiology, Centre Hospitalier Sainte-Anne, Paris, France

Executive functions, including inhibitory control (IC), is critical for academic and professional success. The development of these functions during childhood and adolescence is underlain by the high neuroplasticity of the prefrontal cortex during this developmental period. Recent researches suggest that short term cognitive training may improve their efficiency. 43 healthy children (8-9 years old) were recruited from elementary schools in Caen, France. We used functional magnetic resonance imaging on a 3T MRI scanner and a longitudinal design to test the effects of an intensive (25 sessions, 15 min a day, 5 weeks) and individualized IC computerized adaptive training on tactile tablets. Participants were randomly assigned to receive either IC (n = 19, Cognitive Stroop and Stop-signal tasks [SST]) or active control (AC) (n = 24, knowledge-based task) training. Behavioral efficiency and IC neural network, assessed with 'Successful Inhibition vs Baseline' contrast in SST, was compared before and after training. Whole brain voxel-based were performed using SPM12 software. We observed an overall session (pre vs. post-tests) effect on IC efficiency (i.e. improvement of SST performance) but no interaction between session and group (IC vs. CA). Analyses, performed on the pre-test session data, revealed increased activity within brain regions involved in IC (including ACC, insula, inferior parietal lobule, SMA, superior temporal gyrus) while participants succeed to inhibit their motor responses. Unlike behavioral changes, we observed group-specific fMRI activation changes after training within these regions, with changes mainly observed in the anterior part of the brain (e.g. bilateral insula) in the IC group and in the posterior part of the brain (e.g. left inferior parietal lobule) in the AC group. These preliminary results may suggest that brain functional mechanisms allow to detect finer-grained changes than behaviour.

KEYNOTE

11:00

SYMBOLIC NUMERICAL PROCESSING IS A KEY PREDICTOR OF LEARNING ARITHMETIC

BERT DE SMEDT, KU Leuven (Belgium)

Being fluent and efficient in performing basic calculations has been regarded as an important building block for the development of mathematical skills. On the other hand, deficits in retrieving arithmetic facts from memory are the hallmark of children with dyscalculia. In this talk, I will present a series of behavioural and neuroimaging studies that have investigated the origins of these individual differences in arithmetic, echoing an educational neuroscience approach. In these cross-sectional and longitudinal studies, we have investigated the role of numerical magnitude processing in the development of arithmetic fluency. These studies also examined the potential contributions of domain-general factors, such as working memory or inhibitory control. The key message from these studies is that particularly children's symbolic magnitude processing skills are a unique and very stable predictor of children's arithmetic development. These data all suggest that screening children's symbolic processing skills is useful for detecting children at risk children and I will present data from a recent large-scale validation of such a screening measure.

AN EXPERIMENTAL-PSYCHOLOGY-BASED PROTOCOL TO BRIDGE THE GAP BETWEEN NEUROSCIENCE AND EDUCATION

14:00

Emmanuel AHR[1,2], Martin RIOPEL[2], Marianne WOJCIK[3,4], Jeanne PARMENTIER[1], & Bénédicte HUMBERT[1]

[1] Institut Villebon - Georges Charpak (France)
[2] Département de didactique, Université du Québec à Montréal (Canada)
[3] Rectorat de Nancy-Metz (France)
[4] Maison pour la Science en Lorraine (France)

In his seminal paper, Bruer (1997) argued that one cannot bridge some practical and epistemological gaps between neuroscience and education, unless one steps into the field of cognitive psychology. More than twenty years later, researchers in "neuroeducation" still experiment ways to create a dual pathway between researchers in neuroscience and practitioners in education. As suggested by Bruer, one way has been to popularize neuroscience discoveries by explaining how brain mechanisms transform into behaviors and vice-versa. Consequently, more and more teachers are now into neuroeducation. This knowledge urges them to modify their teaching practices, but they lack a tool to assess the efficacy and legitimate such new practices. In the present paper, we propose a way to fill this practical gap between neuroscience and education by stepping into the field of experimental psychology. A protocol to assess the efficacy of a teaching practice was designed by researchers in psychology and didactics then discussed and tested to compare the efficacy of a neuroeducation-inspired versus a usual teaching practice by university teachers from the Institut Villebon - Georges Charpak, and secondary education teachers from the Neuroscience group of the Maison pour la Science of Lorraine University. This applied research aimed at optimizing both the scientific and daily teaching aspects of the protocol. As regards to the scientific side, we propose a classical pre-test, post-test, delayed post-test paradigm for both the neuroeducation-inspired and the usual practice. Instructions are notably designed to warrant the equivalency of the six assessments and the two classes. As regards to the daily teaching aspect, we collaboratively aimed at the best perceived (time) cost/benefits balance for teachers by focusing on their practical needs rather than fundamental research questions. We wish to discuss this balance we found with regard to the results obtained by teachers.

NEUROSCIENCE - VALIDATION OF A LEARNING-STRATEGY WORKSHOP BASED ON METACOGNITIVE KNOWLEDGE

14:30

Tina MONTREUIL[1], David DELFOLIE[2], Camille BENOIT[3], Eva AUZOU[4], & Elsa GEROULT[5]

[1] Department of Educational & Counselling Psychology, C.A.R.E. Lab, McGill University (Canada)
[2] Institutions et Dynamiques Historiques de l'Économie et de la Société, Sciences Po (France)
[3] Service de Psychiatrie de l'Enfant et de l'Adolescent de la Pitié Salpêtrière (France)
[4] Laboratoire de Pédagogie Active, Sciences Po (France)
[5] Sciences Po (France)

The joint research project between Sciences Po (Paris, France) and McGill University (Montreal, Canada) offers new and promising insights following the preliminary results of an experimental learning-strategy teaching tool, primarily based on principles of metacognition. Since September 2017, the 24-hour workshop, implemented weekly over a semester to first-year students at Sciences Po, was carried out with two cohorts presenting with very different learning profiles. At McGill University (Montreal), the workshop is currently being adapted for a September 2018 launch. The objective of the metacognitive knowledge workshop is primarily to allow students to learn about and reflect on their learning strategies and re-evaluate their usefulness if necessary. Through the pedagogical activities provided to the students, reflective techniques were introduced, mainly in terms of attention, memorization, planning and stress management. The experimental design of the workshop combined survey protocols and self-report questionnaires (pre and post measures) data collection, including a longitudinal follow-up (2 conditions - active and control groups. Observations and qualitative interviews were also conducted. This joint experiment is graciously supported by the Samuel de Champlain Program of the Fonds de Recherche du Québec - Société et Culture (FRQSC) for the development of innovative teaching and instructional methods.

HOW DOES SOCIAL CONTEXT INFLUENCE INHIBITORY CONTROL AND CREATIVE IDEA GENERATION?

16:00

Lison BOUHOURS, Laboratory for the Psychology of Child Development and Education (France)

Considerable efforts have been devoted at identifying the influence of social contexts (e.g., effect of the presence of peers or adults) in the domains of reasoning and decision making, but surprisingly there are to date few studies that have examined whether social contexts may facilitate (or constrain) inhibitory control and creative ideation and whether the effect of social contexts on these processes change with age. Thus, the aim of this presentation is to determine how distinct social contexts affect inhibitory control and the ability to generate creative ideas in children, adolescents and adults. Results of a series of studies revealed that the social evaluation 1) facilitated inhibitory control only in adolescents, 2) has two opposite impacts on children's and adolescents' creativity: children were constrained in their ability to propose solutions under social scrutiny, whereas this ability was enhanced in adolescents. Taken together, these results can have a high impact not only for fundamental research by refining developmental model of the influence of social context on inhibitory control and creativity but also for education by providing cues to help children, adolescents and young adults overcome systematic difficulties they might face to solve problems in various social contexts.

FROM FUNDAMENTAL RESEARCH IN THE PSYCHOLOGY OF CREATIVITY TO SCHOOL APPLICATIONS

16:30

Anaëlle CAMARDA, Laboratory for the Psychology of Child Development and Education (France)

Creativity defined as the ability to think of something original and adaptive concerning task constraints is crucial during circumstances in which individuals must generate new solutions to solve a problem. In such circumstances, individuals propose solutions that are built on the most common and accessible knowledge within a specific domain leading to fixation effects whereas other classes of more creative solutions could be explored. According to our triple systems model of creativity (Cassotti et al., 2016), the difficulty to generate creative ideas results from a specific failure to inhibit intuitive responses leading to fixation effects generated automatically by the intuitive and heuristic System 1. This model posits that inhibitory control is a core process to overcome fixation effects and generating original solutions in creative problem-solving. Therefore, this presentation aims to provide empirical evidence 1) in support of the triple systems model of creativity, and 2) of the improvement of children's creative ideation after a 5-week training. In a series of four experimental studies in children, adolescents and adults, we have demonstrated that 1) fixation effects develop with age and change with the introduction of external cues such as examples of solutions (Cassotti et al., 2016), 2) overcoming fixation to explore creative solutions involves inhibitory control and the ability to detect that initial responses that come quickly to mind are not original (Camarda et al., 2017), 3) this conflict detection ability develops with age during adolescence. Based on the behavioral and neurocognitive results obtained, we have developed and assessed the effect of interventions aiming at developing both the ability to inhibit fixation effect and explore new ideas. These results can have a high impact for education by providing cues to help children, adolescents and young adults overcome systematic difficulties they might face in generating creative ideas at school.

PLAYING 10 MINUTES DAILY IN CLASS IMPROVES THE INHIBITORY CONTROL OF STUDENTS FROM 6 TO 12 YEARS OLD

17:00

Marie LÉTANG, Laboratory for the Psychology of Child Development and Education (France)

Inhibitory control refers to the ability to resist a spontaneous intuition or a misleading strategy. At school, this capacity is fundamental for pupils to be more efficient in their learning and to resist to misleading automatisms. Based on the principle of Tools of the Mind, teachers proposed to the children 10 minutes of specific classroom activities involving, either inhibitory control (experimental group) or no inhibitory control (control group), 4 days a week, over a 5-week period. The aim of the study was to determine whether classroom activities involving inhibitory control can help improve pupils' inhibitory capacity, assessed by a color-word Stroop task. 1049 French-speaking children from 6 to 12 years of age participated in this study (experimental group, $n = 525$; control group, $n = 524$). Teachers ($n = 48$) were recruited in a digital pedagogic community of teachers (lea.fr). We used the platform to explain the project, to train teachers on using an experimental method, to download all the materials for the classroom activities, and to collect children's performance on the Stroop task. Each class was divided into two groups: the experimental group performed activities involving inhibitory control and the control group performed activities similar to the ones performed by the experimental group but that did not require inhibitory control. Before and after the 5-week intervention, children performed a paper-and-pencil color-word Stroop task. Performance in the Stroop task improved pre and post 5-week classroom intervention to a greater extent in the experimental than in the control group. These results provide evidence that a 5-week classroom intervention can improve inhibitory control abilities of children and that teachers can successfully run experimental studies in their classroom. Future studies need to determine whether such 5-week inhibitory control intervention can improve learning in contexts in which inhibitory control is needed.

- 1 -
The role of executive functions and language in 4-year-olds' mathematics skills

Andrea DÍAZ-BARRIGA YÁÑEZ, Daniel CARROLL, Danielle MATTHEWS, & Michelle MCGILLION
University of Sheffield, Psychology Department (United Kingdom)

Mathematics skills during the preschool years provide a solid foundation for future learning. Specifically, they have been linked to later academic and career outcomes (Passolunghi et al., 2015). The preschool years are particularly important for research investigating mathematics development since they provide an appropriate window to examine how individual differences in general cognitive abilities relate to mathematics skills; offering guidance on where to focus educational effort. In recent years it has been found that general cognitive abilities, such as executive functions and language skills, play an important role. We are interested in the specific contribution of working memory, inhibitory control, and language skills, to early mathematics skills in 4-year-olds. A sample of 89 children (48 female) between 48 and 55 months (M=50.18, SD=1.55) completed two mathematics measures (Mathematical Reasoning [WIAT-II] and NFER Mathematics), one working memory measure (Self-ordered pointing task), one inhibitory control (Flanker task) measure, and two language skills measures (BPVS-II and NFER Language). Preliminary results suggest that inhibitory control and language skills are significant unique predictors of 4-year-olds' mathematics skills. Furthermore, the β values indicated that in predicting mathematics, language skills (β=.46) were slightly more important than inhibitory control (β =.29). These results are consistent with previous findings that have suggested that language skills are significant predictors of calculation skills and knowledge of the number system in preschool children (LeFevre et al., 2010; Sowinski et al., 2015). Theoretical implications will be further discussed.

- 2 -
Vers une neurodidactique de l'apprentissage du langage?

Fabien DWORCZAK
Université Lumière - Lyon 2 (France)

Les récentes avancées des neurosciences présagent, aujourd'hui, une compréhension toujours plus fine des mécanismes cérébraux relatifs au langage. Didacticiens et neuroscientifiques doivent donc travailler ensemble avec l'objectif de cerner l'impact des méthodologies d'enseignement des langues étrangères sur les fonctions cérébrales. La complexité du langage est extraordinaire, que l'on évoque sa nature, sa conception, son expression, sa signification ou ses relations avec la pensée et la conscience. La neurodidactique pourrait, ainsi, réunir les neurosciences cognitives et la didactique de la langue étrangère/seconde et se pencher sur les problématiques de l'expression et de la compréhension orales et écrites. Chez les apprenants débutants, les études de neuroimagerie ont pu montrer que l'apprentissage d'une langue étrangère devrait privilégier l'oral, surtout s'il est associé à la mimique et au gestuel, en raison du rôle majeur de la prosodie. La découverte récente des « neurones miroirs » le confirmerait : l'observation d'un mouvement chez autrui stimule par mimétisme dans notre propre cerveau les mêmes circuits neuronaux que si nous avions nous-mêmes effectué le geste. Les méthodes didactiques qui activeraient les mêmes aires cérébrales que le langage oral spontané, en dehors de toute contrainte grammaticale ou écrite, seraient donc probablement les plus efficaces. Une neurodidactique innovante nous paraitrait, ainsi, très heuristique et pourrait nous éclairer sur le rôle des multiples facteurs qui peuvent conditionner la qualité des apprentissages : les différents types de mémoire, la motivation, l'attention, le contexte émotionnel... Il devrait être possible d'améliorer la qualité des méthodologies en développant tel ou tel aspect de l'enseignement ou en proposant des approches nouvelles et inédites. L'imagerie cérébrale ouvrirait aussi des perspectives fascinantes sur les relations du langage avec les fonctions dites supérieures, telles que la conscience, la pensée, l'esprit, la personnalité.

- 3 -
The integration of Science of Learning into secondary initial teacher education

Paul HOWARD-JONES, & Konstantina IOANNOU
University of Bristol (United Kingdom)

Teachers base daily decisions about practice on their understanding of how learning occurs, and their training can be considered as a foundational period during which their models of learning form. This paper explores the potential of Science of Learning (SoL) concepts to prompt insights in aspects that include planning, management and teaching strategies, differentiation and pastoral care. Specifically, the SoL concepts were introduced into the secondary PGCE course across eight subject areas. Interdisciplinary collaborative research resulted in the development and trialing of resources focused on supporting critical reflection, assessment and monitoring of practice amongst trainee teachers, as well as the scaffolding of talk and use of language around learning involving SoL concepts. An instrument was designed to evaluate the scientific understanding of learning amongst the student teachers, and this was administered twice (towards the beginning and end of the course) to monitor the development of SoL understanding. Based on the results of the project, possible characteristics for the successful implementation and integration of such perspective are proposed and discussed.

- 4 -
Study project on neuromyths among teachers and students teachers in morocco

Abdelkrim JANATI IDRISSI, Zouhayr SOUIRTI, & Saïd BOUJRAF
Clinical Neurosciences Laboratory (Morocco)

Interests and context of the project: The high prevalence of these misunderstandings and its extensiveness among practicians in the field of education can accentuate its negative effects. To our knowledge, no study of the prevalence of neuromyths among teachers has been performed in Morocco, and for this reason it appears necessary to carry out this study in Morocco. **Objectives:** In this project, we have targeted two important components: First, we want to appreciate the prevalence of neuromyths among Morrocan classroom teachers and predict the origins of these neuromyths. However, in the second part of this project, we will look at the impact of teacher training programs provided in training centers on conceptions towards neuromyths. **Methodology and survey design:** The scientific tool we are considering using in this study, and which will allow us to appreciate the general knowledge of our interviewed teachers on brain knowledge and neuromyths, is inspired from Dekker and colleagues' 2012 study. We are considering using their survey, after obtaining their consent to use and adapt it for our study. The questionnaire contains 32 questions about the functioning of the brain and the use of this knowledge in teaching, among which 15 are neuromyths.

- 5 - Intégrer les facteurs psycho-sociaux dans les thérapies par neurofeedback

Aurore JAUMARD-HAKOUN[1,2], Svjetlana VUKUSIC[1], Katia ANDREADE[1], & François-Benoît VIALATTE[1]
[1] Équipe interfaces cerveau-machine, Laboratoire plasticité du cerveau, CNRS UMR 8249, Paris (France)
[2] ESPCI Paris, PSL Université Recherche, CNRS UMR 7587, INSERM U979, Paris (France)

Le neurofeedback est une forme de thérapie cognitive, dont l'efficacité reste controversée en raison de résultats contradictoires. Identifier les variables cachées expliquant ces contradictions est un enjeu majeur. En particulier, le cadre d'application du neurofeedback implique des facteurs psycho-sociaux qui restent à ce jour peu documentés. En considérant que le neurofeedback s'appuie sur un mécanisme d'apprentissage de compétences (skill learning), nous proposons d'utiliser un entretien métacognitif post-session, développé par notre équipe pour les apprentissages en boucle fermée. Cet entretien permet au patient d'expliciter ses stratégies de contrôle du signal de feedback. L'objectif est d'induire un effet à la fois motivationnel et de guidage, facilitant l'autonomisation du patient et donc le transfert de l'apprentissage pendant la tâche vers son quotidien. Nous avons regroupé ces stratégies en 4 catégories : les stratégies d'étayage, de modulation, de régulation et d'introspection. Nous présenterons des résultats préliminaires obtenus sur une tâche princeps d'apprentissage du chant par biofeedback. Nous montrerons les relations entre la qualité de l'apprentissage, et l'évolution au cours des séances des stratégies.

- 6 - The musical neuropedagogy at the service of language

Thomas LEJOLY
Université d'Angers (France)

Present throughout our schooling, nursery rhymes to Brassens, music is part of our school curriculum. Teaching that tries to partition and specialize with time. Music pedagogy, however, remains a favorable learning tool that is transferred to other disciplines. In a study conducted in Switzerland, Wetter (2009) focuses on students practicing music and sees an increase in school performance in all other disciplines, including language teaching. What is the real usefulness of music in language learning? Bernstein (1976) found that the notions of linguistic structures apply to music. Music and language are communicative tools that use the same auditory and cognitive mechanisms (Lowe, 1998). They respond to the need to structure and signify auditory information (Sloboda, 1985). The assimilation of linguistic structures using the same processes as musical perception (Heller & Campbell, 1981) requires phonological and semantic processing, since auditory skills are crucial in the acquisition of a language (Rivers, 1981). Musical activities can contribute to increasing vocabulary, pronunciation, syntax, and grammatical construction (Dominguez, 1991). Patel (2003) suggests that music shares a set of functions in the frontal brain regions. Indeed, Second language pronunciation ability in children was positively associated with musical aptitude tests (Levetin, 2009). In this continuity, I currently focus a research on the phonological and lexical acquisition in FLE context exolingue (French Foreign Language in non-French speaking country). Based on neuroscience research, I seek to evaluate the effectiveness of a musical neuropedagogy by exploiting original audio documents in order to create musical texts. The intersection of research in neuropsychology allows the music to take all its legitimacy in linguistic learning.

- 7 - Topics and teaching strategies in NeuroEducation courses

Lauren O'NEIL
University of Oregon (United States)

In the growing age of mind, brain and education intersectional research, it is important to consider implementing Neuroeducation courses into undergraduate curriculums. This poster will highlight the conference theme, "Neuroeducation: A new science for school?", by presenting a description of topics and content taught in a new Neuroeducation course in the University of Oregon's Psychology Department over the past two years. Offered both to Psychology and Education majors, the topics focus on neuroscience, cognition, learning and teaching research, as well as the biological, psychological, and sociological influences on learning in the classroom. The most prominent brain systems affecting learning are covered, as well as research implications in educational and laboratory contexts. The development of the course and the related, evidence-based teaching strategies incorporated into the class will be discussed. Finally, sub-topics that cover the skills and knowledge necessary to teach students in economically, racially, culturally, linguistically and physically diverse communities are presented.

- 8 -
Schèmes d'attachement et difficultés d'apprentissage des apprenants de 5 ans à 14 ans

Opely PATRICE-AIME DJELLE, & Coulibaly HAOUA
Laboratoire d'études et de prévention en psychoéducation (LEPPE)
École normale supérieure d'Abidjan (Côte d'Ivoire)

Cette étude s'inscrit dans le cadre de l'influence des schèmes sur les difficultés d'apprentissage. L'objectif est de mettre en relation les schèmes d'attachement et les difficultés d'apprentissage. Il s'agit de déterminer les dimensions des problèmes psychoaffectifs des schèmes d'attachement qui sont les plus prédictibles des difficultés d'apprentissage source des échecs scolaire. Nos investigations ont été réalisées à S.O.S village d'enfants avec un échantillon de 150 enfants tous sexes confondus du CP1 au CM2. Deux méthodes d'analyse des données ont été utilisées: l'analyse qualitative de contenu et l'analyse quantitative pour le traitement statistique des données. Deux hypothèses ont été identifiées : (h1) plus les pensionnaires maitrisent les schèmes d'attachement, moins ils éprouvent des difficultés d'apprentissage, (h2) plus les schèmes sont pathogènes, plus les pensionnaires ont des difficultés d'apprentissage. La qualité de l'attachement, primordiale pour l'évolution psychologique de l'enfant, varie à la facilitation des apprentissages. Les résultats aux tests psychologiques, notamment le test de dessin de Corman à travers l'histoire et le dessin de famille, le test de Stein représenté par les planches et le TAT à travers le complément de phrases, ont enrichi nos résultats. Il en ressort que les apprenants ayant des schèmes positifs et maîtrisés ont de meilleurs résultats que leurs pairs qui développent des schèmes pathogènes.

- 9 -
Corrélation entre la psychopathologie du lien et la performance scolaire

Opely PATRICE-AIME DJELLE, & Coulibaly HAOUA
Laboratoire d'études et de prévention en psychoéducation (LEPPE)
École normale supérieure d'Abidjan (Côte d'Ivoire)

La performance scolaire est relative d'un enfant à un autre. Tout dépend du comportement psychologique de celui-ci. La performance scolaire de certains enfants est mise en cause pour plusieurs raisons. Soit parce qu'ils présentent des troubles cognitifs et mentaux, d'où la psychopathologie, soient d'autres variables en sont les causes explicatives. Parmi ces troubles, nous pouvons citer la phobie scolaire qui regroupe des situations diverses et variées qui ont toutes la même conséquence : l'enfant est malade à l'idée d'aller à l'école. Selon Blackburn et Cottraux (2001), il est possible de caractériser la dépression par l'hypothèse cognitive de base suivante « le déprimé se maltraite en traitant mal l'information ». Rousvoal et Zapata (2001) estiment que l'enseignant, sous l'effet de son statut social et de son histoire, se construit une représentation sociale (de l'écolier, idéal et/ ou du mauvais) qui se traduit en attentes. Celles-ci vont moduler leurs interactions et agir sur la qualité des performances scolaires. Deux hypothèses orientent cette étude: (h1) plus l'enfant maitrise sa pathologie, plus il est performant, (h2) plus l'apprenant éprouve des difficultés psychoaffectives, moins il est performant. Notre étude veut mettre en évidence, la relation qui pourrait exister entre la pathologie du lien et les performances scolaires chez les apprenants. Elle porte sur un échantillon de 513 élèves âgés de 10 à 18 ans issus de la 6e, 5e et 4e, tous sexes confondus. Les résultats ont montré qu'il y a une relation significative entre la pathologie du lien et les performances scolaires chez les apprenants. Nous pouvons conclure que les recherches consacrées à la psychopathologie du lien et les performances scolaires des élèves mettent en avant les problèmes psychoaffectifs, les liens avec les parents, la fratrie et la société.

- 10 -
Multilayer integration and metacognition: Implications in music learning

Ester PINEDA[1], François MADURELL[1], & Hervé PLATEL[2]
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[2] Université de Caen Normandie, Centre de Recherche Inserm : Unité de recherche 1077 INSERM-EPHE-UNICAEN, CEA, CNRS, ISTCT (France)

Plusieurs études nous montrent que la pratique musicale est plus efficace quand les musiciens s'engagent dans une démarche métacognitive (Chaffin et al., 2003; Hallam, 2001) et envisagent la pratique de manière structurée pour construire une interprétation instrumentale par cœur (Chaffin, 2006; Ericsson, 2008; Hallam, 1997; Lisboa et al., 2015). Cependant, peu d'études ont abordé la façon dont la musique elle-même (style, structure) et le profil cognitif du musicien déterminent les stratégies cognitives mises en œuvre. Eminemment multimodales sur le plan cognitif, les représentations mentales internes de la musique (visuelles, motrices, auditives, perceptives, etc.) constituent les différentes composantes de l'audition intérieure. Le niveau de métacognition dans lequel un musicien est capable de s'engager semble être une fonction de l'expertise musicale (Barry et Hallam, 2002). Explorer les stratégies des experts est intéressant aussi bien au niveau théorique qu'au niveau pratique. Sur le plan théorique, cela peut nous aider à comprendre les processus en œuvre et, sur le plan pratique, cela peut ouvrir un champ d'application et d'innovation en pédagogie. Nous présentons les premiers résultats d'une première recherche, de type exploratoire, conduite auprès de cinq pianistes professionnels. Elle a pour objectif d'analyser l'élaboration d'une interprétation par cœur et les processus d'intégration multimodale. En particulier, l'étude vise à mettre en lumière le caractère associatif des représentations mentales internes de la musique pour l'élaboration d'une méthodologie en didactique instrumentale.

- 11 -
Trends towards educational neuroscience productivity: A bibliometric study

Astrid SCHMIED[1], & Amy RIEGELMAN[2]
[1] Department of Educational Psychology, University of Minnesota (United States)
[2] Wilson Library, University of Minnesota (United States)

Trends within the field of Educational Neuroscience can be followed over extended periods of time by using bibliometric studies. To evoke some of these trends, we conducted literature searches for evaluating scientific production in terms of the number of published articles by year, journal, language, and country. Specifically, articles for this study were identified in a computer search of the databases of PsycINFO, Ovid Medline, ERIC, and Education Source. We used the earliest possible start date (1988) until February 2018. The following terms were used to search in title, abstract, and keywords: ("neuroeducation*" or "neuro-education*" or "education* neuroscience*" or "education* and neuroscience*"). The terms education* and neuroscience* allowed for inclusion of educational and neurosciences, respectively. Literature searches were limited to journal articles or peer reviewed articles. Using the previously mentioned databases, a total of 314 articles were identified that matched our inclusion criteria (PsycINFO, 96; Ovid Medline, 58; ERIC, 71; and Education Source, 89). The time-lapse results indicate that there are relatively few articles published before 2008. However, there is a substantial increase in the number of articles published after that date, with three peaks at years 2016 (46), 2015 (64), and 2013 (38). Among 100 different journals, the three most frequent utilized for publication were *Mind, Brain, and Education* (48), *Frontiers in Psychology* (23), and *Educational Philosophy and Theory* (16). The four most common languages for publishing were English (296), French (5), and German (3). Finally, the leading countries that dominated the number of publications were United States (143), Canada (33), and United Kingdom (32). The present study displays how bibliometric analysis may be a useful tool for the Educational Neuroscience community. Researchers can advantage their investigations considering how the field evolves, becoming aware of the scientific production, as well as the new trends.

- 12 -
Teachers' perceptions, beliefs and knowledge about brain development, executive functions and factors of academic achievement of students living in poverty

Simona TANCIG[1], & Maja TAŠNER[2]
[1] University of Ljubljana (Slovenia)
[2] Teacher of special education needs

Growing up in a family with low SES can lead to poorer outcomes in cognitive and socio-emotional development, educational achievement, and both physical and mental health (Hackman et al., 2010). Another longitudinal study found a relationship between SES and children's development of executive functions (Hackman et al., 2015; Moffitt et al., 2011). The role of neuroscience is to focus on possible biological mechanisms by which SES influences child development (Thomas, 2017). Noble used MRI and found major differences in brain structure in children from the lowest SES (Noble et al., 2015). Fortunately, due to neuroplasticity of the brain, that impact can be reversed through proper instructions and support (at home and in school). It is also teachers' responsibility to help students improve their learning abilities and develop their brains. Jensen identifies a number of suggestions for purposeful teaching aimed at helping students from poverty (Jensen, 2009). **The aim** of this study is twofold: (a) to examine teachers' perceptions, beliefs, and knowledge about brain development, learning and academic achievement of students from poverty; (b) to identify teachers' strategies of teaching students from poverty. Mixed methods research has been applied. **Measures-Instruments:** A questionnaire for background information; the Likert-scale survey was constructed based on neuroeducational research findings of poverty issues related to at-risk students; Walker and Plomin's survey (2005) about teachers' perceptions how genes and home-school environment influence academic achievement of students from poverty; open-ended questionnaire about teachers' strategies (interventions) of teaching and working with students from poverty; **Participants:** 100 primary school teachers. **Data analysis:** Descriptive statistics, Mann-Whitney U test, and ANOVA were applied to quantitative data; content analysis was applied to qualitative data. **Discussion:** Results and implications for teaching and teacher education will be discussed in relation to models of helping at-risk students to succeed and improve their life chances.

- 13 -
Vision, Attention and Reading: Identifying preschool children at risk for reading difficulties

Marie VERNET, Stéphanie DUCROT[1], Laurie LEIBNITZ, & Yves CHAIX
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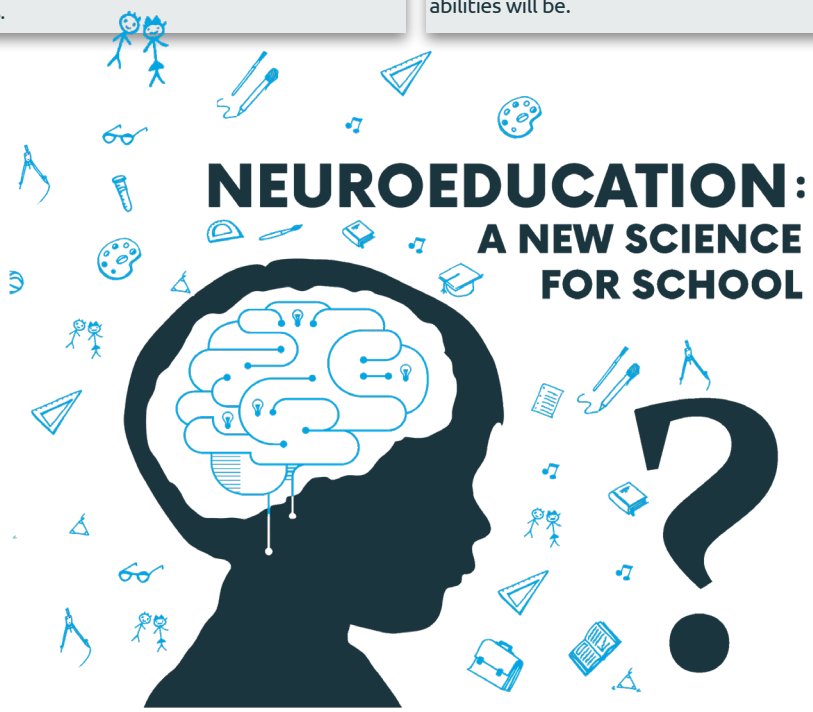
Although a large majority of school children manage in the end to exhibit "expert" reading behavior, a non-negligible number of pupils have real problems learning this skill. There is strong evidence suggesting that the problems children experience in learning to read are related to the preliteracy skills that they bring with them from kindergarten. Most tools available to professionals are designed for the evaluation of child language problems. In comparison, there are very few tools assessing the relations between visual skills and the process of learning to read. Longitudinal research has however shown that preschool visuo-attentional and perceptual skills are predictors of later reading abilities (e.g., Bellocchi et al., 2017). The main goal of this study aimed at improving screening for future reading difficulties in preschool children. We used a prospective, longitudinal approach where oculomotor processes (assessed with the DEM test) were measured in pre-readers, and the impact of these skills on future reading development was explored. The DEM test specifically measures the time taken to name numbers arranged irregularly in horizontal rows (horizontal time, HT), and the time taken to name numbers arranged in vertical columns (vertical time, VT). A total of 61 preschoolers took part in this study. At Time 0 (kindergarten), the mean VT, HT, errors were recorded. One year later, at Time 1, the reading level of the same children was evaluated. First, this study allowed us to provide normative data for a standardized evaluation of the oculomotor skills in 5- and 6 year-old children. The data also revealed that 25% of our sample of preschoolers showed oculomotor impairments (without any clinical complaints). Finally, the results of this study assessed the validity of the DEM test for predicting reading outcomes; the better a child's oculomotor skills are, the better his/her reading abilities will be.



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LABORATORY FOR THE PSYCHOLOGY OF CHILD DEVELOPPEMENT AND EDUCATION

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At the interface of child psychology, pedagogy, and human biology (brain imaging technologies), working with a large network of schools (preschool and up), the LaPsyDÉ, directed by Olivier Houdé who is known for his cognitive-inhibition theory of reasoning, explores the mechanisms of development and learning. In each child's or adult's brain, fast and intuitive heuristics or cognitive biases (System 1, D. Kahneman) and logical rules or exact algorithms (System 2, J. Piaget) may compete at any time. Such competitions are called "cognitive conflicts". There are examples in all academic learning skills: reading, writing, counting, thinking (or reasoning) and respecting others. To overcome these conflicts, the whole-brain adaptation (i.e., intelligence or flexibility) depends on the executive control ability of the prefrontal cortex (System 3) in connections with emotions and feelings to inhibit System 1 and to activate System 2 on a case-by-case basis, depending on the context. Metacognitive training in the laboratory or at school may be designed to help the brain to do so. It is useful for both children and adults, as the latter remain poor reasoners in many situations where their System 1 dominates, often unconsciously.

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The Association for Research in Neuroeducation (ARN) is a non-profit organization whose mission is to contribute to the development of research in neuroeducation and to help the education community to identify, understand and evaluate the educational benefits of this new field of research. To this day, there are more than 2000 members around the world.

Its objectives are to 1) Build a network of researchers and students to share expertise in order to accelerate the development of research in neuroeducation; 2) Disseminate the results of research in neuroeducation to the education community.

To achieve these goals, the ARN uses its website, its Facebook, Twitter and Youtube accounts, as well as an email list with news of the month about neuroeducation. Also, the ARN organizes every two year an international scientific conference for researchers in neuroeducation and a pedagogical conference for teachers. Finally, the association edits and publishes the scientific journal *Neuroeducation*.

To become a member and find out about the advantages our membership provides, visit our website at www.associationneuroeducation.org/devenir-membre.

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THANK YOU FOR COMING! WE HOPE TO WELCOME YOU AGAIN IN 2020!