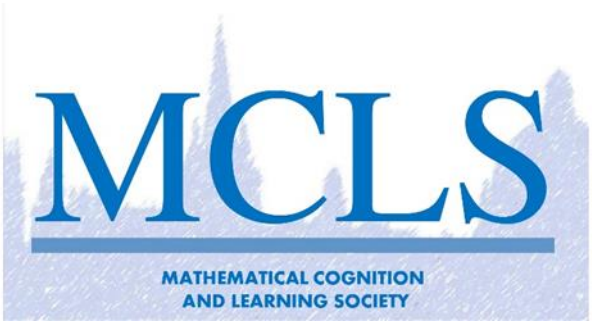

Book of Abstracts

The 1st Mathematical Cognition and Learning Society Conference

8th and 9th of April 2018
Examination schools, Oxford (UK)

Organisers:
Roi Cohen Kadosh
Francesco Sella

Conference committee members:
Bert De Smedt
Martin Fischer
Jo-Anne LeFevre
Robert Reeve
Xinlin Zhou

they highlight the benefit of the state-trait-anxiety model for research on MA, because inconsistencies can be explained.

21. Numerical magnitude extraction process improved in children using mental abacus: evidence from ERP study

Yuan Yao; Feiyan Chen

When the semantic distance between two numbers becomes larger, the easier it is to discriminate between them. This phenomenon is called the Distance effect, which has been regarded as the best established marker of basic numerical magnitude processes. This study explored whether long-term abacus-based mental calculation (AMC) training improved the extraction process of numerical magnitude. Thirty-eight children participated in the study and were randomly assigned to two groups at primary school entry: 24 from the abacus group and 14 from the control group. They were matched for age, gender and IQ. After a five-year training, they were tested with a number comparison paradigm: comparing the symbols (digital or the number of dots) with "5". Meanwhile, Electroencephalographic (EEG) recording techniques were used to monitor the temporal dynamic. In terms of behavioral results, the distance effect was obvious: the response time was shorter and the accuracy was higher in the abacus group. We further defined the size of distance effect (DE) as the result of difference between the two distance conditions derived by the Close distance. A 2 (symbol) x 2 (group) ANOVA showed that the DE in abacus group was significantly smaller than the control group. As for the ERP analysis, PO7 and PO8 were selected as two representative electrodes. The distance effect of the abacus group appeared both in N1 and P2p while the control group only showed in P2p. Besides, DE appeared on both sides of parietal lobe in the abacus group, while the control group only on the left side. This may reflect that in the process of numerical processing, the children with long experience of AMC training entered the quantitative extraction phase earlier and adopted different processing strategies with the control group.

22. The Open Calculation Based on Numbers (ABN) method for learning mathematics as an alternative to the Closed Calculation Based on Ciphers (CBC)

Carmen M. Canto; Manuel Aguilar; José I. Navarro; Carlos Mera Cantillo

The open calculation based on numbers (ABN) is an innovative mathematics teaching-learning methodology used with a huge number of school children in several countries. Last years the cognitive processing involved on this new methodology is being explored. The main goal of this study was to compare results obtained by primary school students in several mathematic tasks after teaching through ABN or a more traditional procedure, such us the calculation based on ciphers (CBC). Written and mental calculation, numeracy, problem solving, and numerical line estimation task were assessed. 49 second grade primary school children have being learning mathematic during the last two academic years, by using one of the two methods: CBC or ABN, were evaluated. Participants were distributed in two groups: experimental group (ABN method; N = 24) and control group (CBC method; N = 25). Aquasi-experimental ex-post-facto design was used. The results confirmed that students who used ABN method achieved higher scores on arithmetic and estimation tasks, than those who followed the CBC methodology. Experimental group scores in number’s decomposition and composition tasks and solving problems were statistically significant in contrast to the control group. Ananalogous to others studieslineal math function was found for the experimental group. These findings suggest that the ABN method could improve mental and written calculation, numeracy and estimation tasks.

23. Training early numerical skills: Preliminary evidence on preschoolers

Cristina Semeraro; Rosalinda Cassibba; Daniela Lucangeli

learning and teaching of mathematics. We are especially interested in the relationship between intuitive and analytical thinking. In this respect, the difference between psychologists and mathematics educators is analogous to that between scientists and engineers: While psychologists aim to understand how the mind works, thus for example documenting the gap between the two modes of thinking, we as educators are in the business of designing ways to help our students bridge this gap. Our design work branches in two different directions, both in the context of a specific intuition trap, namely, a task which elicit an intuitive non-normative response from a majority of people. The first branch, called bridging down, is designing a bridging task, namely, a task that is logically equivalent to the original task but is psychologically much easier. We demonstrate this kind of bridge via the famous medical diagnosis problem, where healthy and sick people are replaced by green and red pebbles, and the medical diagnostic test is replaced by a color-sensitive robot. This method does help students understand (and sometimes discover) the analytical solution, but it leaves untreated the pedagogically undesirable clash between that solution and their original intuition. For this we invoke the second branch, called bridging up: Following Seymour Papert, who compared students' learning to computer programming, we design interventions to help students debug (rather than discard) their original intuitive answer. We demonstrate this process via an interactive scenario involving a classical intuition trap: the 2-glass puzzle.

Talk 3: **Visuospatial working memory in mathematical performance using Open Calculation Based on Numbers Algorithm (ABN)**
Estibaliz Aragon; Manuel Aguilar; Carmen M. Canto; Carlos Mera; Candida Delgado; Gamal Cerda; Carlos Perez Wilson; José I. Navarro

The Open Calculation Based on Numbers (ABN) is a state-of-the-art mathematics teaching-learning procedure being used with a large number of school children in Spain and South American countries. Although first ABN experiences started in 2008 with few numbers of students, the amount of participants has been increasing in the last few years. Some recent research data suggests that general domain cognitive abilities, associated to short term memory, should be involved in improving early math performance. Considering this, we carried out a study describing the cognitive profile for students that were leaning early math using the ABN method. The main target of this study was to found cognitive profiles associated to ABN method. The cognitive and mathematical performances for a total of 128 first-year students were evaluated. A large series of cognitive tasks composed by the Automated Working Memory Assessment (AWMA) test was administered: Non-word recall, dot matrix, backward digit recall, Odd-One-Out. In addition, students' mathematic skills were evaluated by the Early Numeracy Test-Revised (ENT-R) Spanish version. Participants were distributed in an experimental group (n=74) and a control group (n=54). The experimental group learned mathematic using the ABN methodology; the control group used a CBC methodology. The linear stepwise regression analysis suggested the cognitive profile of the experimental group emphasized the significance of visuospatial working memory in mathematical performance. Students trained with ABN method seem to operate better with working memory, applying mentally visuospatial representations.

Talk 4: **Students' Mathematical Practices of Defining: A Piagetian Perspective**
Amelia Farid; Ellen Kulinsky

Mathematical definitions often evolve through a process of iterative refinement - a definition is proposed, a counterexample is encountered, the definition is refined, another counterexample is encountered, and so on. Considering mathematical definitions in light of counterexamples, or "monsters" (Lakatos, 1976), is a productive process both for definition formulation and concept

mechanisms) and other biologically useful mathematical (mostly non-numerical) discoveries not necessarily previously documented, and informally explored abilities of colleagues and students to make those discoveries (e.g. if ABC is a planar triangle what happens to the size of angle A if A moves away from the side BC along a line that passes between B and C?, and many others involving topology and geometry including non-metrical relations such as partial orderings -- extending Gibson's theory of affordances). The forms of reasoning used don't seem to map onto any known mechanism, so, using many such examples, I have begun to collect requirements for evolved mechanisms that might provide a basis for implementing the required capabilities. E.g. instead of a discrete TM-tape, or logical axioms, or arrays of bits, it may be necessary to have multiple movable and deformable surfaces (sub-neural virtual membranes?) on which structures can be projected then moved and deformed relative to one another, and possibilities and impossibilities discovered (generalising manipulations of discrete logical structures). Whether this Super-Turing mental-diagram machine can be implemented as a virtual machine on digital computers would be a secondary question. I invite collaboration on the task of assembling requirements and possible solutions, and collecting evidence. I already have a lot of online examples and conjectures, and now need collaborators. http://goo.gl/9eN8Ks

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Time: 17:45 – 18:45
Room: South school

Business meeting (open to all members)
