Programme Expert Meeting
2016

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**Time Schedule**

- 10:00-10:15  
  Opening

- 10:15-10:45  
  **Delphine Sasanguie**  
  *Predictors for mathematics achievement: a thorough investigation of the usual suspects*

- 10:45-11:15  
  **Kiran Vanbinst**  
  *Symbolic numerical magnitude processing: developmental trajectories and associations with arithmetic (fact) development*

- 11:15-11:45  
  Break

- 11:45-12:15  
  **Marian Hickendorff**  
  *Third to sixth graders’ word-problem solving: student and problem factors*

- 12:15-12:45  
  **Annemiek van Leendert**  
  *Reading and comprehending algebraic expressions by sighted and braille-dependent students*

- 12:45-14:00  
  Lunch

- 13:15-14:00  
  Poster session
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| 14:00-14:30 | **Elke Baten**  
The predictive value of non-cognitive factors in mathematical performance |
| 14:30-15:00 | **Eva Schmitz**  
| 15:00-15:15 | Break |
| 15:15-15:45 | **Nastasya Honoré**  
The role of general and specific cognitive factors in numerical development: results from two training studies |
| 15:45-16:15 | **Tijs Kleemans**  
Enhancing second grade basic arithmetic skills by using a serious game |
| 16:15-16:30 | Closure |

We will proceed to restaurant Oudaen at 16:45, were we will have a guided tour at 17:30 and dinner at 18:00, which will end at 21:00.
Predictors for mathematics achievement: a thorough investigation of the usual suspects

Delphine Sasanguie

The value of several ‘usual suspects’, i.e. predictors for mathematics achievement that have been put forward in previous studies will be discussed based on data of studies I’ve recently conducted. The first ‘suspect’ is the ANS, operationalized by means of the performance on a non-symbolic comparison task. Results from a training study with tDCS showed that not the ANS, but rather an interplay between number and complex inhibition skills influences arithmetic performance in adults. Furthermore, meta-analyses (e.g. Schneider et al., 2015) already showed that rather than the ANS, symbolic number processing is more predictive for arithmetic. Therefore, I unraveled this second ‘suspect’ and observed that the relation between symbolic comparison performance and arithmetic is in fact totally mediated by individual differences in ordering ability, both in adults and in children. In line with a recent review on order processing (Lyons, Vogel & Ansari, in press), this finding suggests that ordering ability thus can be considered as the third ‘suspect’. In two experiments, we showed that the contribution of this ordering ability to individual differences in arithmetic is largely domain-general and only for a small part numberspecific. Together, this thorough investigation of the usual suspects therefore lets us conclude that what is important for arithmetic performance, might be rather the automatization of domain-general instead of number-specific ordinal associations, a conclusion which has of course important consequences for (elementary) education.
Symbolic numerical magnitude processing: developmental trajectories and associations with arithmetic (fact) development

Kiran Vanbinst

In this talk, I will present a series of longitudinal studies with typically developing children, in which we investigated the role of numerical magnitude processing skills for learning arithmetic facts. The first study focused on the early grades of primary school and revealed that symbolic numerical magnitude processing skills at the onset of formal schooling predicted children’s subsequent development in arithmetic, irrespective of their IQ, preschool mathematical abilities and domain-general cognitive competencies. A second study further demonstrated that these symbolic numerical magnitude processing skills are as important to arithmetic development as phonological awareness is to the acquisition of reading. In a third study, we further investigated through cluster-analysis, trajectories of symbolic numerical magnitude processing development in the first three grades of primary school. Three groups of children were identified and further compared in terms of domain-specific (nonsymbolic numerical magnitude processing; digit identification) and domain-general (components of working memory; processing speed) cognitive competencies that might underlie children’s acquisition of symbolic numerical magnitude processing skills. The data revealed that each of these cognitive competencies only contributed to a limited extent to the development of symbolic numerical magnitude processing skills. This highlights the need for future studies to understand the factors that contribute to children’s symbolic magnitude processing development.
Third to sixth graders’ word-problem solving: student and problem factors
Marian Hickendorff

In contemporary mathematics education, word problems (also called verbal or story problems) are very prevalent in instruction and assessment. Solving word problems is a complex, multi-phase process involving an interplay of various cognitive processes. Central phases are (a) the construction of a mental representation of the problem situation, and (b) the transformation of this situation model to a mathematical model, often a specific arithmetic operation. Although many researchers assume that word problems are particularly difficult because they require these representation steps, there is no consensus: others argue that word problems may facilitate problem solving because they activate real-world knowledge eliciting meaningful strategies. The current study therefore aimed to systematically analyze how student factors and problem factors affect word-problem solving. A sample of 444 third to sixth graders solved a total of 48 arithmetic problems, distributed over three presentation formats: symbolic (no text), standard word problems, and non-standard word problems including an irrelevant number. Results showed that the overall performance increased with grade, but that this increase did not depend on problem format. Furthermore, the performance on standard word problems did not differ from the performance on symbolic problems, while the non-standard word problems (with irrelevant number) were more difficult than the other two problem types. Next, individual student factors (reading comprehension competence, working memory, non-verbal intelligence) were positively correlated with overall performance on the arithmetic problems, but not differently with respect to problem format. Finally, the effect of problem format on solution strategy use will be discussed.
Blind and low vision students read by touch, which has a sequential character. Consequently, braille-dependent students encounter difficulties in reading and manipulating mathematical expressions. In this explorative study we investigated and compared the tactile and visual reading strategies of respectively braille-dependent and sighted students when comprehending mathematical expressions. We created two measurement setups to obtain reading patterns. One setup assessed tactile reading patterns of three braille-dependent students using a motion tracking system; the other setup assessed reading patterns of five sighted students using a wearable eye tracking system. The students were asked to read and orally (start to) solve four mathematical items. We found that sighted students have overview over the expressions within a few seconds and are quickly able to start solving the problem, while the braille-dependent student needed more tactile reading time. Furthermore, the reading strategies of the sighted students seemed more item-dependent than the reading strategies of the braille-dependent students.
14:00-14:30h
The predictive value of non-cognitive factors in mathematical performance
Elke Baten

Explaining inter-individual differences in mathematical abilities has been subject of research for many years. Most of these studies have investigated the role of cognitive factors such as working memory, intelligence and counting. Although this research suggests the importance of these cognitive factors, the role of non-cognitive factors such as motivation and well-being keeps unexplained. Therefore this presentation will focus on two study's that examine the incremental validity of several non-cognitive factors in math performance. One study was conducted in adults, the other in secondary school children. Several theoretical frameworks are used to operationalize the non-cognitive constructs. We use a hedonic approach to investigate the role of well-being, conceptualize motivation in terms of the Self-Determination Theory (Deci & Ryan, 1985) and investigate transactional pattern through the Process Communication Model (Kahler, 1982). For personality we measure the traits of the Big Five Personality Theory (Costa & McRae, 1992) and temperament is approached by the Reward Sensitivity Theory (Gray, 1970). Results of the first study (n = 30, 15 male, age: M = 22.3 y, SD= 2.59 y, IQ (Raven Advanced Progressive Matrices; Raven, 1990): M = 99.1, SD= 12.66) show that non-cognitive factors play an important role in the prediction of mathematical abilities. The specific impact of these factors depends on the kind of mathematical task (speed or power). Data of the second study conducted in secondary school children (n=70) is still being analysed. Theoretical and practical implications will be discussed. Suggestions for future research will be given.
14:30-15:00h
Math anxiety and the relationship with math performance in secondary school. Development of instruments to measure math anxiety
Eva Schmitz

Math anxiety is a crucial factor in math achievement and might play a role in psychopathology, especially in adolescence. Math anxiety refers to the persistent feelings of tension, apprehension and excessive fear in situations that require solving math problems. Math anxiety is known to be negatively related to math performance. Theoretical models suggest that a drop in performance can be attributed to math anxiety independent of the individual’s competence in math.

In order to unravel the relationship between math anxiety and math performance a more detailed conceptualization of math anxiety is required. Possibly, a general model of anxiety can be applied to math anxiety. Anxiety disorders are characterized by the components anxious feelings, worrisome cognition and associated changes in behavior (avoidance or perfectionism). In math anxiety, anxious feelings and worry deteriorate math performance by reducing available cognitive resources required for math. Behavioural avoidance might hinder math practice. Differentiating between components of anxiety might benefit the understanding of mechanisms and consequences in math anxiety.

An overview of the development of two instruments will be presented. First, the Components of Math Anxiety Questionnaire (COMAQ) is developed, discriminating between components of math anxiety. Second, a behavioural task is developed, aiming to discriminate the influence of anxiety from performance by manipulating math anxiety during test taking.

Results of two assessment studies, including 105 students and 997 adolescents, will be presented.
The role of general and specific cognitive factors in numerical development: results from two training studies

Nastasya Honoré

In the first study, examining the impact of a general factor, working memory, on working memory abilities and numerical development, forty six preschoolers were randomly assigned to an experimental (Cogmed working memory program) or a control condition. We observed an immediate impact of the experimental condition on visuo-spatial short-term and working memory and on Arabic number comparison. Ten weeks later, an effect appeared on number line positioning. No training effect was observed in verbal short-term and working memory, in counting, collection comparison and addition. In the second study, we took an interest in specific numerical factors, by testing the expectations of the two existing models explaining numerical development. The unique-representation model considers the approximate number system, which underlies symbolic and non-symbolic skills, to be the basis of numerical learning while the dual-representation model suggests that symbolic and non-symbolic skills rely on different processes and that the ability to build an exact representation of symbolic numbers underlies math learning. Fifty-six preschoolers were randomly assigned to one of the three conditions: (1) training aiming at enhancing the processing of non-symbolic numbers, (2) or the exact representation of symbolic numbers, or (3) control training. Both numerical conditions were more efficient than the control condition in improving magnitude processing. However, symbolic training led to larger improvement in arithmetic than the non-symbolic and control conditions; which supports the dual-representation model. Taken altogether, these results suggest that it is more efficient to work on very specific numerical factors than on working memory to boost numerical development and that symbolic training only impacts arithmetic competences.
Enhancing second grade basic arithmetic skills by using a serious game
Tijs Kleemans

The effects of a serious game aimed at enhancing basic arithmetic skills in children with arithmetic problems (< P25) were tested. Following a pretest, posttest, retention design with a waiting control group, 65 children with poor arithmetic skills in second grade received a four-hour tablet intervention across a period of three weeks. During intervention, participants practiced basic addition and subtraction problems while playing in a gaming context. Prior to, directly after, and three weeks following the intervention, basic arithmetic skills were assessed using four cards: addition below 10, subtraction below 10, addition above 10 and less than 20, and subtraction above 10 and less than 20. The results showed significant increases in learning addition and subtraction above 10 and less than 20 as a result of the brief gaming intervention. The used motivational game, which included repetition, immediate corrective feedback and an adaptive design elicited transfer and retention effects.
Kindergartners’ spontaneous focusing on numerosity during picture book reading
Sanne Rathé, Joke Torbeyns, Bert De Smedt, & Lieven Verschaffel
Individual differences in kindergartners’ Spontaneous Focusing On Numerosity (SFON) as measured by experimental tasks have been shown to predict later mathematics achievement in primary school. This predictive relation is hypothetically explained by children’s self-initiated spontaneous practice in number recognition during everyday activities (Hannula, Lepola, & Lehtinen, 2010). This study aimed to evaluate this hypothesis by investigating the association between kindergartners’ SFON as measured by experimental tasks and the frequency of their spontaneous number-related utterances during a daily picture book reading activity. Sixty-five 4-6-year-olds individually took part in two separate sessions. In the first session, they completed a behavioral SFON Imitation task (Hannula & Lehtinen, 2005), a visuo-motor buffer task, and a verbal SFON Picture task (Batchelor, Inglis, & Gilmore, 2015). During the second session, all children participated in a picture book reading activity in which they were invited to spontaneously comment on the pictures of a slightly modified version of the picture book Boer Boris (van Lieshout & Hopman, 2013). In line with previous studies, we observed large individual differences in children’s SFON as well as in the frequency and the type of their number-related utterances during picture book reading. Furthermore, correlation analyses revealed a positive association between children’s SFON as measured by the verbal Picture task (but not by the behavioral Imitation task) and the frequency of their spontaneous number-related utterances during picture book reading. These findings partially support Hannula et al.’s (2010) hypothesis but also raise questions about the construct and the measurement of SFON (verbal versus behavioral).

Ecuadorian children’s SFON and its contribution to their early numerical abilities at kindergarten entry
Joke Torbeyns, Gina Bojorque, Jo Van Hoof, Daniël Van Nijlen, & Lieven Verschaffel
Young children’s Spontaneous Focusing on Numerosity (SFON) importantly contributes to their early numerical abilities and later mathematical performances (Hannula-Sormunen, 2015; Rathé et al., in press). Unfortunately, current findings on the pivotal role of SFON in children’s early numerical and later mathematical achievements are
constrained to well-developed (mainly European) countries. The present study analyzed the contribution of young children’s SFON to their early numerical abilities in Ecuador, a developing country that largely differs in its socio-economic, cultural, and educational characteristics from the previously studied well-developed countries. Participants were 355 Ecuadorian 5-year-olds. At kindergarten entry, children were offered the SFON Elsi Bird Imitation task (Hannula & Lehtinen, 2005), the Ecuadorian Test of Early Number and Arithmetic (Bojorque et al., 2015) and the Tools for Early Assessment in Math (Clements & Sarama, 2011). In line with previous findings, we observed large inter-individual differences in Ecuadorian children’s SFON and early numerical abilities at kindergarten entry. Moreover, Ecuadorian kindergartners’ SFON was positively related to their early numerical abilities at kindergarten entry, even after controlling for IQ, working memory, age, and SES. Our results suggest highly analogous cognitive structures and processes underlying young children’s early numerical development in countries that largely differ in socio-economic, cultural, and educational characteristics. They also point to the importance of SFON for future theoretical models and educational reforms in the domain of early mathematics.

**Geometry and Visual art in the classroom**

*Eveline Schoevers, Evelyn Kroesbergen, Ronald Keijzer, Vincent Jonker, & Monica Wijers*

This pilot study aims to test the effectiveness of an integrated visual art and geometry program for the upper grades of primary school. This program aims to improve students’ geometric ability, to increase students’ creative problem solving skills in geometry and to change the teaching practice of teachers. To reach these goals a professional development (PD) program for teachers and a teaching sequence for students was designed in which geometry and visual art education are integrated. We believe that the expertise of visual art education can give an impulse to mathematics educations and can help to reach these goals. In September until December 2016 the program will be piloted in 5 schools with 10 teachers and 250 4th and 5th grade students. In this pilot study we test the effectiveness of the program and why there are (no) effects obtained (evaluate the program theory). On student level a geometrical ability test and a geometrical creativity test will be administered before and after the program. On teacher level ‘teaching for creativity’ will be observed in the classroom in the first, fifth and tenth lesson of the program. Furthermore a questionnaire will be administered before and after the program regarding their attitude towards
(stimulating) creativity and the integration of geometry and visual art education. The poster that will be presented at the Mathematical Expert Meeting will show why and in what way geometry and visual art are integrated in this program; we will show some examples of the teaching sequence and the professional development program. Furthermore we will present the research design and some examples of the measurements used in this study.

Age modulates the relation between number-space associations and arithmetical abilities in elementary school children

*Carrie Georges, Danielle Hoffmann, & Christine Schiltz*

Evidence for number-space associations comes from the SNARC effect, consisting in faster RTs to small/large digits with the left/right hand respectively. In adults, number-space associations relate to mathematical proficiency in that individuals with weaker arithmetic performances feature stronger SNARC effects (Hoffmann et al., 2014). However, in children far less is known about number-space associations and how they affect arithmetic performance. We therefore investigated the relationship between the classical parity SNARC effect and mathematical proficiency, assessed using the Heidelberger Rechentest, in elementary school children aged 8-11 years (n=55, mean=9.5). Overall, the parity SNARC regression slopes (-11.37, p<.001) negatively correlated with HRT arithmetical (r=-.28, p=.04; even when controlling for parity judgment RTs: r=-.37, p=.01), but not HRT visuo-spatial subscale scores (r=-.03, p=.82), indicating better arithmetic performances with stronger number-space associations. However, this relation was significantly moderated by age, since the interaction between the parity SNARC effect and age accounted for a significant proportion of the variance in HRT arithmetical scores (ΔR²=.07, b=0.26, t(51)=2.29, p=.03). A significant negative association was observed only in younger children (b=-0.35, t=-3.49, p=.001) aged below 9.5 years (n=29), while the SNARC effect did not relate to arithmetic performance in the remaining older children. This suggests that number-space associations are beneficial for arithmetic performance at relatively early stages of mathematical learning. During the course of mathematical development in childhood, number-space associations then turn superfluous for arithmetic achievement until they possibly become interfering in young adults, who have reached the peak of their developmental trajectory.
Investigating the relationship between two Home Numeracy Measures: A Questionnaire and Observational data
Belde Mutaf, Delphine Sasanguie, Bert De Smedt, & Bert Reynvoet
Home numeracy has been defined as parent-child interactions that include experiences with numerical content in daily life settings and commonly operationalized by two methods, i.e. via questionnaires and observational data. Results from studies using one method or the other have shown that both types of measures of the home numeracy environment have been related to variability in children’s mathematical skills. The current study investigated whether these technically distinctive data collection methods index the same aspect of home numeracy. We assessed parents reports of the frequencies of numeracy activities and parents’ opinion about their children’s mathematics education. With two videotaped parent-child activity sessions (Lego play and book reading), we observed the frequencies of numeracy talk. Furthermore, children’s mathematical skills were examined with two calculation subtests. We found that the two home numeracy assessment methods were not related to each other. Interestingly, home numeracy activities were positively related to children’s calculation abilities; however, home numeracy talk was negatively related to children’s calculation abilities. The results indicate that home numeracy is a multidimensional concept and the two methods tap on different aspects of home numeracy. The findings suggest that including both questionnaires and observations in the same study would provide a larger view of home numeracy.

Unraveling the mechanisms involved in digit order processing and its relation to arithmetic
Helene Vos, Iro Xenidou-Dervou, Delphine Sasanguie, Wim Gevers, & Bert Reynvoet
Digit order processing is strongly related to individual differences in arithmetic. To gain more insight in digit order processing and its relation to arithmetic the current study addressed two aims. The first aim was to examine the involvement of cardinality-based mechanisms and working memory components in digit order processing. Different working memory models were taken into account. First, working memory was approached by the structural multi-component model of Baddeley and Hitch including the phonological loop, visuospatial sketchpad and central executive. Second, the functional working memory model of Oberauer was considered including direct access of information and long-term memory. Third, serial order working memory was measured. The second aim of this study was to
examine which mechanisms involved in digit order processing are responsible for the relation with retrieval and procedural skills in calculation. By examining the relation between digit order processing, cardinality, working memory components and different calculation strategies, we hope to gain insight in the underlying cognitive mechanisms of the relation between digit order processing and arithmetic.

How to analyze number line estimation in preschool and kindergarten children
Jaccoline van ’t Noordende, Korbinian Moeller, Stefan Huber, Tanja Dackermann, Evelyn Kroesbergen, Chiel Volman, & Paul Leseman

Number line tasks are among the most used instruments to assess numerical understanding in children. In these tasks children have to estimate the placement of numbers on a line marked with a numerical start- and endpoint (e.g. 0 and 100). In many studies the participants’ estimates are regressed unto a linear or logarithmic regression line to classify their performance. Another outcome measure used on number line tasks is the absolute difference between the requested and estimated number. These analysis methods have been applied to symbolic number lines (using digits) and non-symbolic number lines (using quantities, like amount of dots) in kindergarten and primary school children. However, it is not known yet if the same analytical models can be applied to children who did not yet enter kindergarten.

In this study, different methods to analyze number line estimation were applied to 3.5- and 5-year-old children’s performance on a non-symbolic number line. It was found that more traditional outcome measures like percentage absolute error, linear and logarithmic fit all have their limitations when analyzing performance on number line tasks in young children. The non-parametric correlation coefficient Kendall’s tau b is proposed as an alternative. Kendall’s tau b can be used to measure children’s understanding of ordinality – by analyzing the ordering of the estimated numbers on the line – without making inferences of specific estimation patterns like linear or logarithmic.

The development of number line estimation: A strategy perspective
Dominique Peeters, Lieven Verschaffel, & Koen Luwel

With age, the shape of children's number line estimation patterns develop from logarithmic towards linear. This change is usually interpreted as a reflection of the development of the underlying number representation. However, recent findings challenge this assumption by suggesting that
strategies might play an important role in children’s development of number line estimation performance. The present study tested this assumption by gathering trial-by-trial verbal strategy reports when solving a number line estimation task. Seventy-six third graders, 79 sixth graders, and 63 adults made number line estimations on a 0 to 100 and/or 0 to 1000 number line. Participants were assigned to one of three conditions in which the number of benchmarks on the number line was varied to elicit potential benchmark-based estimation strategies: (a) only the origin and endpoint were indicated (control condition); (b) an extra benchmark at the midpoint (500) was presented (midpoint condition); (c) three additional benchmarks (250, 500, and 750) were specified (quartile condition). Results indicated an age-related improvement in overall estimation accuracy. Contour analyses (Ashcraft & Moore, 2012) revealed that numbers surrounding the benchmarks at 25, 50, and 75% of the number line were estimated more accurately by fifth graders and adults compared to third graders. Furthermore, verbal reports indicated that, with increasing age, participants not only made more use of the externally presented benchmarks, but also created more refined internal benchmarks. The theoretical and educational implications of these findings will be discussed at the meeting.

Use of mathematics in inquiry and design lessons in primary education
Marja van Graft, Martin Klein Tank, Jos Tolboom, & Marc van Zanten
Learning by inquiry and design (LIND) in the science field in primary education offers pupils an opportunity to use different mathematical skills and knowledge in an authentic context. In relation to the questions or problems to be solved LIND appeals upon the understanding of dimensions like length, width and surface, as well as interpreting and composing diagrams and graphs and to accurately read measuring devices, use statistics and science greats correctly. LIND acts as a rich environment in which mathematics education is integrated with science. In the series of lessons that are developed to study the possibilities of the LIND strategy in practice, pupils first investigate how wild animals survive in their surroundings. Based on the information they find and the conclusion they draw upon this information, they formulate design principles for a zoo shelter, make a sketch on scale and subsequently build a scale model. Especially in these design steps, pupils have to use different maths skills they already developed during the maths lessons. In the classroom we observe some difficulties pupils encounter while using these skills. Also, some pupils show skills we do not expect that teachers will have payed attention to in their curriculum.
In this paper we will discuss the skills pupils need and effects of maths education in relation to the development of pupils' skills and understanding of dimensions. What are the consequences for the teaching of mathematics or for the mathematics curriculum?

**A tablet intervention for children with mathematical difficulties**  
*Jurgen Tijms, Mirthe Stoop, & Heide Lukosch*

In this pilot study, we aimed to evaluate the effects of a tablet-based intervention for children with mathematical difficulties. We developed an intervention focused on systematically training (a) explicit knowledge of numerical system, (b) symbolic-nonsymbolic numerical mapping, and (c) instrumental using this numerical knowledge in math (addition and substraction). The tablet screen was therefore divided in three parts, (1) a nonsymbolic part (integers represented by blocks) at the left, (2) a symbolic part (Arabic digits) at the right, and (3) a number line at the bottom.

28 children with specific, and persistent math problems were randomly allocated (stratified by school) to either the intervention group or a waiting-list control group. A short-term intervention was provided on a one-to-one basis in weekly 45 minute sessions at school during a 8 week period. Four tasks were measured at pretest and posttest: two basic numerical tasks, i.e., Symbolic Number Comparison, Verbal-Arabic Number Matching, and two arithmetic tasks, i.e. Addition and Substraction.

Results showed that Number Comparison, but not Verbal-Arabic Matching, was significantly related to the two arithmetic tasks at baseline. Pre-posttest comparisons (by MANCOVA's) revealed that the intervention group accrued significant greater gains than the control group in both symbolic comparison ability and in substraction skills, but not in addition. Furthermore, using regression analysis, it was shown that gain in symbolic comparison during the intervention period was a strong predictor for substration gains, support the internal validity of the intervention.

Implications of these results and future directions are discussed.

**Parents attitudes towards math, children’s math anxiety and the association with mathematics performance**  
*Tinne Buelens & Delphine Sasanguie*

Math anxiety impairs children’s performance in mathematics, which might put them behind in our modern science-driven society. In order to accurately measure math anxiety, more knowledge is needed on the reliability and validity of the questionnaires that are currently used. Therefore, we assessed the psychometric properties of the Abbreviated Math Anxiety Scale
(AMAS; Hopko, Mahadevan, Bare, & Hunt, 2003) and the revised Child Math Anxiety Questionnaire (CMAQ-R; Ramirez, Gunderson, Levine, & Beilock, 2013) when administered to Flemish primary school children (i.e., 1st-2nd graders in case of the CMAQ-R and 3th-to-6th graders in case of the AMAS). First, we confirmed the original factor structures and found good reliability for both questionnaires in our Flemish samples. Furthermore, we observed that girls reported more math anxiety than boys, but there were no differences in reported math anxiety between grades. Next, we examined the relationship between math anxiety and two tests for math performance (i.e. a timed versus an untimed test). We found that math anxiety is related to both math tests for older children (3th-6th grade), but younger children’s math anxiety (1st-2nd grade) was only related to the timed test. Finally, as the first, we hereby took into account the influence of parent’s attitudes towards exposure to mathematics. We observed that the higher the parents rated the importance of their child being exposed to mathematical concepts, the lower the child’s math anxiety. Possible theoretical and educational implications of the results will be discussed at the conference.

Units first or tens first: Does language matter when processing visually presented two-digit numbers?
Alexandre Poncin, Amandine Van Rinsveld, & Christine Schiltz
The German number word system inverts units and tens compared to the Arabic notation. This is not the case in French, where the relative position of tens and units is in line with the Arabic number code. It was suggested that the specific linguistic structure of number words can facilitate or impede numerical development and performances in tasks such as number transcoding. To better understand these impacts, we tested French- and German-speaking 4th grade children and adults with an original transcoding paradigm. Our task required participants to match spoken two-digit number words with the corresponding visually presented Arabic number presented amongst four alternatives. The novelty of the paradigm consisted in manipulating the order of appearance of the units and tens of the Arabic numbers, leading to three conditions: Units-first, Tens-first and Simultaneous appearance.
While in German-speaking children were overall slower than French-speaking children, the largest group difference was observed for the Tens-first condition. This indicates that transcoding in children was systematically faster when the order of appearance was congruent with the number word system of the participant’s language (i.e. Units-first in German and Tens-first in French).
In university students, German-speaking participants were also significantly slower than French-speaking participants when the tens were presented first. However, generally in both languages the Tens-first condition was always faster than the two other conditions, indicating that adults seem to process two-digit Arabic numbers sequentially from left to right. Taken together, these results provide new insights into how language structure qualitatively impacts basic numerical processing at different stages of development.

**Formative Assessment in Mathematics Education by Primary School Teachers**

*Ilona Friso-van den Bos, Marijke Veugen, & Marja van den Heuvel-Panhuizen*

Formative assessment is assessment with the aim to adjust instruction to the level and needs of the students. Research has shown that formative assessment has positive effects on learning outcomes. Therefore, recently there is much interest in how teachers collect information about their students. In this study, the formative assessment practice in Dutch primary education is investigated through semi-structured interviews with 14 teachers. Results show that the teachers have a variety of techniques at their disposal, and that they use these techniques both to determine the pace of instruction and to detect obstacles in learning. The assessment techniques mentioned by teachers match the techniques brought forward in research literature as beneficial to learning outcomes. Yet, the teachers reported that they are in need of more formal support and professional development in the area of formative assessment. Moreover, many teachers reported that they wanted to use more ICT in the future. Also in this area they require support and professional development.

**Limited near and far transfer effects of Jungle Memory working memory training on learning mathematics in children with attentional and mathematical difficulties**

*Micel Nelwan & Evelyn Kroesbergen*

Considering its influence on mathematics, effects of working memory training have been predominantly unsatisfactory. There have been, however, some notable exceptions. The goal of this randomized controlled trial was to investigate whether Jungle Memory working memory training (JM) affects performance on working memory tasks, performance in mathematics and gains made on a mathematics training (MT) in school aged children between 9-12 years old (N = 64) with both difficulties in mathematics, as well as attention and working memory. Children were randomly assigned to
three groups and were trained in two periods: (1) JM first, followed by MT, (2) MT first, followed by JM, and (3) a control group that received MT only. Bayesian analyses showed possible short term effects of JM on near transfer measures of verbal working memory, but none on visual working memory. Furthermore, support was found for the hypothesis that children that received JM first, performed better after MT than children who did not follow JM first or did not train with JM at all. However, these effects could be explained at least partly by frequency of training effects, possibly due to motivational issues, and training-specific factors. Furthermore, it remains unclear whether the effects found on improving mathematics were actually mediated by gains in working memory. It is argued that JM might not train the components of working memory involved in mathematics sufficiently. Another possible explanation can be found in the training’s lack of adaptivity, therefore failing to provide the children with tailored instruction and feedback. Finally, it was hypothesized that, since effect sizes are generally small, training effects are bound to a critical period in development.

**Strategy Use on Bounded and Unbounded Number Lines by Adults with Dyscalculia: An Eye-Tracking and CRR study**

_Fae van der Weijden, Robin Willemsen, Erica Kamphorst, & Anne van Hoogmoed_

A task that is often used to measure number sense is the number line task. Adults and children with dyscalculia differ in accuracy and strategy use in these traditional number line tasks. Recently, it has been suggested that the traditional bounded number line task measures proportion estimation instead of tapping into pure number representations. Therefore, Cohen and Blanc-Goldhammer (2011) introduced a new unbounded number line. In this task, only the beginning point and length of unit (0-1) are given, but no endpoint. To our knowledge, no previous study has investigated the performance and strategy use of individuals with dyscalculia on the unbounded number line. The aim of the current study was to explore the strategy use in bounded and unbounded tasks in adults with and without dyscalculia. Combining eye-tracking and Cued Retrospective Reporting (CRR) enabled us to add to previous studies by identifying multiple additional strategies, steps, and tools used by adults with and without dyscalculia on both tasks. No substantive differences between adults with and without dyscalculia were found in accuracy or strategy use, indicating that the ability to map numbers on a number line is possibly delayed rather than impaired among children with dyscalculia. However, in this study we did discover new strategies used
in both bounded and unbounded number lines. These new strategies can be used in future studies with larger samples and with children with dyscalculia to identify their (possibly maladaptive) strategies and perhaps teach them more useful strategies.

**Sense-making in contextual mathematical problem solving**

*Kees Hoogland*

Recently a series of studies was completed to answer the following research question: In solving contextual mathematical problems, what is the effect of changing the representation of the problem situation from descriptive to mostly depictive on the performance of students?

The theoretical framework underlying the research to find an answer to this research question consisted of literature on word problems and the difficulties students encounter in solving them, of literature on problem solving and sense-making in contextual mathematical problem solving, and of literature on recent insights from cognitive psychology on representations. One of the studies contained a randomized controlled trial with over 30,000 students on the effects on the students’ performance when changing the representation of the problem situation from descriptive to mainly depictive. The results of the trial will be presented and the relation with sense-making will be laid out.
**Dinner info**

Dinner will be held at restaurant Oudaen in Utrecht. We will have a guided tour of the restaurant’s brewery at 17:30, and then dinner at 18:00.

The address of restaurant Oudaen is Oudegracht 99, Utrecht. If you want to park your car, you can do so at parking Springweg (8 minute walk, address: Strosteeg 83), La Vie (4 minute walk, address: Rozenstraat 1, Utrecht) or Paardenveld (7 minute walk, address: Kroonstraat 9). Parking at Springweg costs €0,50 per 7 minutes, and max. €30,- per 24 hours. Parking at La Vie costs €4,- the first 56 minutes, then €2,- every 28 minutes and €30,- max. per 24 hours. Parking at Paardenveld costs €2,80 for the first 65 minutes, €5,60 for up to 125 minutes, €8,40 for up to 180 minutes, and then €2,80 per hour and max. €28,- per 24 hours. The parking garages are open 24/7.

However, we would advise you to park your car at Utrecht University (parking Cambridgelaan) and take the bus to restaurant Oudaen. You can take bus 128 (direction Utrecht Central Station) or bus 228 (direction Nijenoord) and get off at bus stop Neude. This costs €1,55 for a single fare if you have a Dutch travel card (OV Chipcard). If you do not have a Dutch travel card, you can buy a ticket from the bus driver, which is €2,70 for a one-way ticket.
Travel directions

Getting to Utrecht University-Uithof by car

From Amsterdam (A2):
- A2, exit Utrecht Noord
- N230 follow to the A27
- A27, Rijnsweerd junction towards Utrecht/De Uithof A28, towards Amersfoort/De Uithof
- A28, first exit: exit 2 De Uithof
Turn left at the traffic lights and follow the road until the T-junction. Turn right onto Cambridgelaan. You will find the entrance to the car park on your right after 200m.

From Rotterdam/Den Haag or Arnhem (A12):
- A12, Lunetten junction towards Amersfoort
- A27, Rijnsweerd junction towards Utrecht/De Uithof A28, towards Amersfoort/De Uithof
- A28, first exit: exit 2 De Uithof
Turn left at the traffic lights and follow the road until the T-junction. Turn right onto Cambridgelaan. You will find the entrance to the car park on your right after 200m.

From Amersfoort (A28):
- A28: exit 2 De Uithof

From Den Bosch and Eindhoven (A2):
- A2, Oudenrijn junction towards Amersfoort A27, towards Utrecht/Almere
- A27, Lunetten junction towards Amersfoort A28, towards Amersfoort/De Uithof
- A28, first exit: exit 2 De Uithof
Turn left at the traffic lights and follow the road until the T-junction. Turn right onto Cambridgelaan. You will find the entrance to the car park on your right after 200m.
Parking
We advise you to park your car in the car park next to the University Library Uithof. You will find the entrance at the rear of the building, 108 Cambridgelaan. The rate for the car park from Monday-Friday from 7 a.m. to 6 p.m. is €0,50 for 33 minutes (the first half hour is free of charge). The maximum per day is €7,-, a lost ticket will also cost you €7,-. You can pay in cash, or by bank card or credit card. The car park is open 24/7.

Getting to Utrecht University-Uithof by public transport

We advise you to first travel to Utrecht Central Station. From Utrecht Central Station you can either take a bus or a taxi. Maps of Utrecht University can be found on www.uu.nl/maps.

By bus
To pay for buses, trams and metro in the Netherlands you need a Dutch travel card (OV Chipcard). If you do not have a Dutch travel card, you can buy a ticket from the bus driver, which is €2,70 for a one-way ticket. To travel to De Uithof you can take bus 12 or 28 from Central Station. Get off at Heidelberglaan and you will see the library on your left.

By taxi
There is a taxi platform at Utrecht Central Station, just follow the signs. Within the city there are several taxi platforms, for instance at Vredenburg and Janskerkhof.
## List of participants

<table>
<thead>
<tr>
<th>Name</th>
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<tbody>
<tr>
<td>Merel Bakker</td>
<td>Joke Torbeyns</td>
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<td>Elke Baten</td>
<td>Kiran Vanbinst</td>
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<td>Tinne Buelens</td>
<td>Sanne van der Ven</td>
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<td>Michiel Doorman</td>
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<td>Ilona Friso-van den Bos</td>
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<td>Carrie Georges</td>
<td>Isabelle de Vink</td>
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<td>Diana Gerritsen</td>
<td>Helene Vos</td>
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<td>Marja van Graft</td>
<td>Fae van der Weijden</td>
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<td>Mieke van Groenestijn</td>
<td>Eva van de Weijer-Bergsma</td>
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<td>Marja van den Heuvel-Panhuizen</td>
<td>Diede van Wijk</td>
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<td>Marian Hickendorff</td>
<td>Nore Wijns</td>
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<td>Hannah Hofmann</td>
<td>Robin Willemsen</td>
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<td>Nastasya Honoré</td>
<td>Marc van Zanten</td>
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<td>Kees Hoogland</td>
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<td>Brenda Jansen</td>
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<td>Evelyn Krosbergen</td>
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<td>Annemiek van Leendert</td>
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<td>Belde Mutaf</td>
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<td>Brecht Polspoel</td>
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<td>Alexandre Poncin</td>
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<td>Marthe Straatmeier</td>
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<td>Jurgen Tijms</td>
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Thank you

Thank you for coming today, we hope to see you all in the future!

Kind regards,

The organisation

Evelyn Kroesbergen, Eva van de Weijer-Bergsma, Ilona Friso-van den Bos, Sanne van der Ven, Anne van Hoogmoed, Paul Drijvers, Michiel Doorman, Arthur Bakker and Isabelle de Vink