

Brain and Mind – from Concrete to Abstract

»MATHS AND THE BRAIN« FEBRUARY 4TH 2025

AN INTERDISCIPLINARY WORKSHOP BETWEEN MSH AND ST HILDA'S COLLEGE OXFORD UNIVERSITY

Prof Roi Cohen-Kadosh

»Revolutionising Education: How Neuroscience and Neurotechnology Are Shaping the Future of Learning«

In an age of rapid technological innovation, education remains largely untouched by the transformative potential of neuroscience and neurotechnology. This missed opportunity limits benefits for students with neurodiverse needs, those facing learning difficulties, and even high-achieving learners seeking to maximise their potential. In this talk, Prof Cohen-Kadosh will explore how breakthroughs in neuroscience, coupled with advancements in technology, are paving the way for brain-based educational approaches that could transform how we teach and learn. He will discuss how direct, painless, and safe interventions targeting neural systems can enhance key cognitive functions like working memory and sustained attention. Drawing on examples from his lab, he will highlight how neurostimulation has been used to improve mathematical learning and cognition across typical and atypical developmental groups. He will also delve into the exciting future of this field, where artificial intelligence and more ecologically valid settings could further personalise and refine interventions. Through this lens, he will present an innovative project that demonstrates how neuroscience can make learning more accessible, inclusive, and effective for diverse learners.

Prof Roi Cohen-Kadosh is a leading cognitive neuroscientist and psychologist, specialising in brain plasticity, neurostimulation, and enhancing learning and cognition. As Head of the School of Psychology at the University of Surrey, he integrates cutting-edge neuroscience and AI to develop personalised interventions. Prof Cohen-Kadosh is also an entrepreneur, holding patents and founding innovative companies aimed at translating scientific breakthroughs into real-world applications. His work has earned international recognition for its transformative impact on education, mental health, and neurodiversity.

TIMETABLE

18:00 Uhr

Introduction

18:10 Uhr

»*Revolutionising Education – How Neuroscience and Neurotechnology Are Shaping the Future of Learning*«

Prof Roi Cohen-Kadosh,
University of Surrey

18:30 Uhr

»*Children's mathematics anxiety – influences of age and gender*«

Dr Ann Dowker, University of Oxford

18:50 Uhr

Discussion and break

19:30 Uhr

»*Does the Human Mind Have Mathematical Powers Beyond Those of Any Possible Computer?*«

Prof Adrian Moore, University of Oxford

19:45 Uhr

Discussion

20:00 Uhr

End of Workshop

Turn page



Brain and Mind – from Concrete to Abstract

Dr Ann Dowker

»Children's mathematics anxiety: influences of age and gender«

There is much recent research into attitudes to mathematics, most of which suggests a significant relationship between attitudes and performance. In particular, mathematics anxiety is often associated with worse mathematics performance. Worryingly, several studies have suggested that attitudes to mathematics deteriorate with age, though some children show mathematics anxiety and other negative attitudes even at the beginning. Many, though not all, studies also indicate that females have more negative attitudes than males to mathematics. Dr Ann Dowker will discuss some research on children's and adolescents' attitudes to mathematics, with a particular focus on whether and how these are related to age and gender. 216 pupils from Years 2 (6-to 7-year-olds), 6 (10-to 11-year-olds), 9 (13-to 14-year-olds) and 12 (16-to 17-year-olds) participated in the study. They were given (1) the 'Mathematics Attitude and Anxiety' questionnaire (Thomas & Dowker, 2000), which assesses levels of maths anxiety; unhappiness at failure in maths; liking for maths, and self-rating in maths; and (2) the British Abilities Scales Basic Number Skills Test to establish actual mathematics performance. There was a significant effect of age on both liking for maths and self-rating in maths: older children were lower than younger children in both. The negative association between age and attitudes to maths was stronger in girls. There were significant gender differences in self-rating: boys rated themselves higher than girls, though there was no significant gender difference in mathematical performance, or in mathematics anxiety or liking for mathematics. Some implications for our understanding of mathematics anxiety and attitudes to mathematics, and their relationship to mathematical performance, are discussed.

Ann Dowker is University Research Lecturer at the Department of Experimental Psychology, University of Oxford and a College Lecturer in Psychology at St Hilda's College and Keble College. She carries out research on many aspects of developmental psychology and individual differences, and especially on how these relate to education. She has a particular interest in children's mathematical development and mathematical difficulties. She is the lead researcher on the Catch Up Numeracy intervention project and is a collaborator with the ESRC Centre for Early Mathematics Learning.

Prof Adrian Moore

»Does the Human Mind Have Mathematical Powers Beyond Those of Any Possible Computer?«

Kurt Gödel's celebrated theorem, established in 1930, states that no axiomatization can determine the whole truth and nothing but the truth concerning arithmetic. John Lucas and Roger Penrose have argued, on the strength of this theorem, that the human mind has mathematical powers beyond those of any possible computer. Prof Moore will provide a sketch of the theorem and of the Lucas-Penrose argument, then raise some questions about the latter.

A.W. Moore is Professor of Philosophy at the University of Oxford and Fellow in Philosophy at St Hugh's College Oxford. His publications include Gödel's Theorem: A Very Short Introduction (OUP, 2022). In 2016 he presented a ten-part BBC Radio 4 series A History of the Infinite.

