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Numeracy and Arithmetic in the brain: the roles of development and individual differences

Modern Cognitive Neuroscience methods, such as functional Magnetic Resonance Imaging (fMRI) have provided researchers with unprecedented insights into the neural correlates of cognitive functions, such as the representation of numbers and the brain processes that enable adults to calculate. While the brain mechanisms underlying adult number and arithmetic processing have been the subject of significant research, comparatively less is known about how mature brain circuits underlying number processing and mental arithmetic emerge over developmental time and how individual differences in numerical and mathematical competence modulate the activity of brain regions. Furthermore, despite the fact that a large number of children suffer from difficulties with even the most basic aspects of numerical magnitude processing, we currently lack detailed insights into the neurocognitive basis of atypical number development. In this talk, I will present data from behavioral and brain imaging investigations into the developmental trajectories of both symbolic and non-symbolic numerical magnitude representation and calculation abilities. I will discuss data from both typically developing children and those who have mathematical difficulties. These data will illustrate the importance of considering developmental changes and individual differences in the neurocognitive mechanisms underlying numerical magnitude representation and arithmetic in order to gain greater insights into how children develop mathematical skills and how these processes break down in children who have mathematical difficulties.