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Brain Training for Dyscalculic Children

Karin Kucian & Michael von Aster

A wealth of evidence indicates that humans and other animals have an innate sense of approximate numerical magnitudes – a "number sense". Developmental impairments of number processing may be associated with atypical specialization of cortical regions underlying the number sense. In fact, children suffering from developmental dyscalculia, which is a specific impairment of number processing in otherwise typically developing children, show deficient neural representations of numbers. Brain imaging studies point to differences in brain activation and brain morphometry (K Kucian et al., 2006; Rotzer et al., 2008).

Since our brain is a highly plastic organ and able to change as a result of one's experience, specific training of number processing should lead to behavioural improvements accompanied by neuro-plastic changes. The aim of our recent study (K. Kucian et al., 2011) was the development and evaluation of a computer-based training program to improve number representation in children with developmental dyscalculia. The efficiency of the training was evaluated by neuropsychological tests and functional magnetic resonance imaging (fMRI).

Dyscalculic and control children trained during five weeks with our program, called "Rescue Calcularis".

In general, both groups could benefit from the training indicated by (i) improved spatial representation of numbers and (ii) increased number of correctly solved arithmetical problems. Regarding brain activation dyscalculics showed less activation in bilateral parietal regions, which reflects neuronal dysfunction in pivotal regions for number processing. After completion of the training, both groups showed reduced recruitment of mainly frontal brain regions which can be attributed to automatization of cognitive processes necessary for mathematical reasoning. Moreover, results point to a partial remediation of deficient brain activation in dyscalculics after consolidation of acquired and refined number representation.

These results are promising and foster the importance of the understanding of neuronal effects of specific intervention in children with mathematical learning disabilities for the evaluation and construction of effective and suitable therapeutic material to support affected children at the best.

Kucian, K., Grond, U., Rotzer, S., Henzi, B., Schonmann, C., Plangger, F., Galli, M., Martin, E., & von Aster, M. (2011). Mental number line training in children with developmental dyscalculia. *Neuroimage*.

Kucian, K., Loenneker, T., Dietrich, T., Dosch, M., Martin, E., & von Aster, M. (2006). Impaired neural networks for approximate calculation in dyscalculic children: a functional MRI study. *Behavioral and Brain Functions, 2*, 31.

Rotzer, S., Kucian, K., Martin, E., von Aster, M., Klaver, P., & Loenneker, T. (2008). Optimized voxel-based morphometry in children with developmental dyscalculia. *Neuroimage, 39*(1), 417-422.