

Biological Brain, Mathematical Mind & Computational Computers

(how the computer can support mathematical thinking and learning)

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This presentation considers how the peculiar structure of the biological brain may be supported by the computational power of the computer to enhance mathematical thinking. It considers how we think and learn mathematics with particular reference to the use of visualisation and symbol manipulation. Visualisation occupies a major portion of the brain's cortex and enables Homo Sapiens to 'see' how ideas can be formed and related.

Mathematical symbols in arithmetic, algebra, calculus particularly suit the biological brain, acting as pivots between concepts for thinking about mathematics and processes to calculate and predict. We use the term 'procept' to describe this particular combination of symbol as process and concept. Analysis of procepts reveals that the development of symbols does not follow an easy cognitive path for the growing individual because they operate in significantly different ways in arithmetic, algebra and the calculus. We therefore advocate a versatile approach that complements the visualisation of concepts with the power of symbolic calculation to model, calculate and predict. Empirical evidence is provided to show how theory relates to practice when the computational computer is used to enhance and develop the power of the mathematical mind.



Figure 1: brain, mind, computer