The balance between conceptual and inhibitory systems during analogical reasoning development

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Analogical reasoning plays a key role in creating the flexible nature of human cognition. Our ability to make inferences via analogical comparison provides us with a powerful on-the-fly problem-solving tool as well as a mechanism for learning new abstract concepts. Development of this complex cognitive behaviour is a protracted process, with sophisticated analogical reasoning emerging around the age of 3 years and progressing towards adult-like competency during adolescence. During this period, children progress though what is known as the relational shift - a shift from making inferences based on shared perceptual features to inferences based on shared abstract relations. This change is broadly agreed to be the result of development in conceptual, working memory and inhibitory systems. However, how these systems interact with each other across development is not well understood. The study I will present aimed to investigate this gap by examining how individual differences in conceptual development and executive functions predicted children's responses when reasoning by analogy.

Eighty-four children (4-8 years) took part in the study, with each completing ten A:B::C:D analogy problems (e.g. dog^{A} goes with puppy^{B} as cat^{C} goes with ?^{D}). The problems offered a range of possible 'D' responses corresponding to developmental phases in the relational shift: (1) perceptual match, (2) semantic-associate match and (3) analogical match. Individual differences in conceptual development (specific to the analogy task), working memory and inhibitory control were also measured. We then used the cognitive measures to predict the different types of responses children made in the analogy problems using a series of regression models.

The results revealed a different profile of predictors for each of the different response types: Perceptual matches were predicted by poor inhibitory control; semantic-associate matches were predicted by a differential interaction between conceptual development and inhibitory control, with analogical matches predicted by conceptual development. Overall, the results appear to demonstrate children's developing inhibitory control progressively suppressing unnecessary conceptual information (perceptual and semantic-associates) as they transition through the relational shift. However, their ability to do so being determined by a balance between development in both domain-specific conceptual information as well as inhibitory control.