Using Occam's razor and Bayesian modelling to compare discrete and continuous representations in numerostiy judgements

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Abstract

Previous research has suggested that numerosity judgements are based not just on perceptual data but also past experience, and so may be influenced by the form of this stored information. The representation of such experience is unclear, however: numerical data can be represented by either continuous or discrete systems, each predicting different generalisation effects. This study therefore contrasts discrete and continuous prior formats within numerical estimation using both direct comparisons of computational models using these representations and empirical contrasts exploiting different predicted reactions of these formats to uncertainty via Occam's razor. Both computational and empirical results indicate that numeroisty judgements rely on a continuous prior format, mirroring the analogue approximate number system, or number sense. This implies a preference for the use of continuous numerical representations even where both stimuli and responses are discrete, with learners seemingly relying on innate number systems rather than symbolic forms acquired in later life.