Expert Mathematicians Experience Multi-Modal Visualizations that Develop Across Time

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Abstract

Many empirical domains center around acts of abstract perception. In this work, we are exploring the periphery of perceptual experiences, specifically the ways professional mathematicians develop their internal visualizations within domains of particular expertise. In their core domains, mathematicians report having highly vivid perceptual experiences of impossible objects such as infinite sets or multi-dimensional spaces. We apply an empirical lens which has formerly been used to understand deliberate visualization practices in Shamanic and Christian contexts to understand how mathematicians develop vividness in their visualizations, and how they exert control over them. We find that every mathematician in our sample engaged in these multimodal visualizations. We found that shape, movement, and color were much more common qualities than tactile and olfactory qualities. Many mathematicians reported their visualizations to be dynamic and at least partially under their control. Furthermore, visualizations tended to increase in vividness across experience within a domain.

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