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A Sense of Order: Numerical ordering ability predicts complex mental arithmetic performance

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Abstract: What are the key cognitive factors that characterize the potential difference between symbolic and non-symbolic representations of numerical magnitude, and can individual variability in such factors be used to predict differences in more complex mathematical processes? We suggest that the availability of information about relative numerical order is a critical factor that distinguishes symbolic from non-symbolic numbers. In the current experiment, we provide evidence that individual variability in symbolic numerical ordering ability strongly predicts performance on a series of complex mental arithmetic tasks even when controlling for a wide array of competing factors, including individuals' precision in non-symbolic magnitude representations. Moreover, symbolic numerical ordering ability is shown to fully mediate the previously reported relation between non-symbolic magnitude processing and more complex mathematical skills. These results have important implications for designing math-education techniques and identifying reliable math-performance markers.