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The role of physical digit representation and numerical magnitude representation in children's multiplication fact retrieval.

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Summary: Arithmetic facts, in particular multiplication tables, are thought to be stored in long-term memory and to be interference prone. At least two representations underpinning these arithmetic facts have been suggested: a physical representation of the digits and a numerical magnitude representation. We hypothesized that both representations are possible sources of interference that could explain individual differences in multiplication fact performance and/or in strategy use. We investigated the specificity of these interferences on arithmetic fact retrieval and explored the relation between interference and performance on the different arithmetic operations and on general mathematics achievement. Participants were 79 fourth-grade children (M_{age} = 9.6 years) who completed a products comparison and a multiplication production task with verbal strategy reports. Performances on a speeded calculation test including the four operations and on a general mathematics achievement test were also collected. Only the interference coming from physical representations was a significant predictor of the performance across multiplications. However, both the magnitude and physical representations were unique predictors of individual differences in multiplication. The frequency of the retrieval strategy across multiplication problems and across individuals was determined only by the physical representation, which therefore is suggested as being responsible for memory storage issues. Interestingly, this impact of physical representation was not observed when predicting performance on subtraction or on general mathematical achievement. In contrast, the impact of the numerical magnitude representation was more general in that it was observed across all arithmetic operations and in general mathematics achievement.

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