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**Operation-specific effects of numerical surface form on arithmetic strategy.**

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Summary: Educated adults solve simple addition problems primarily by direct memory retrieval, as opposed to by counting or other procedural strategies, but they report using retrieval substantially less often with problems in written-word format (four + eight) compared with digit format (4 + 8). It was hypothesized that retrieval efficiency is relatively low with word operands compared with digits and that this promotes a shift to procedural backup strategies. Consistent with this hypothesis, experiment 1 demonstrated greater word-format costs on retrieval usage for addition than subtraction, which was due to increased counting for addition but not subtraction. Experiment 2 demonstrated greater word-format costs on retrieval for division than multiplication, which was due to increased use of multiplication-fact reference to solve division problems. Format-related strategy shifts away from retrieval reflected both the efficiency of retrieval for a given operation and the availability of viable alternative strategies. The results demonstrate that calculation processes are not abstracted away from problem surface form. The authors propose that retrieval efficiency for arithmetic connects diverse performance and strategy-related effects across key arithmetic factors, including arithmetic operation, numerical size, and numeral format.

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