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Approximate division on multiple visual ensembles

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Abstract

Prior work demonstrates that humans represent the approximate number of items across multiple sets simultaneously. Here we investigated whether adults can approximately divide multiple distinct overlapping sets simultaneously. Participants viewed arrays with dots of one to four colors (potential dividends) and a non-symbolic divisor of 2-4. Participants then estimated the quotient of the division operation. On each trial a cue indicated whether to divide over the superset of all dots or a color subset. The cue was presented before or after the brief presentation of the dividend array. We found that the capacity to divide over a pre-selected subset was not affected by set size. By comparing the estimation error between the cue-before and cue-after conditions, we determined that a substantial proportion of participants can approximately divide three ensembles simultaneously (two subsets plus the superset). These findings demonstrate the computational efficiency and possible utility of ensemble representations.