

An Ecologically Rational Explanation for Set Size Effects

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Presentation Abstract Summary The precision with which the brain encodes items in visual working memory and attention declines with the number of items. This "set size effect" is puzzling from a behavioral perspective, because performance on many tasks would benefit from having high precision at all set sizes, which could in principle be achieved by increasing the amount of encoding resources as set size increases. Current models offer no principled explanation for the existence of set size effects, nor do they explain why the effect strength is task dependent. Here, we propose and test a theory that is based on the principle of ecological rationality: set size effects result from an optimal trade-off between behavioral performance and neural costs associated with stimulus encoding. We show that models derived from this theory quantitatively account for set size effects in four visual working memory and attention tasks. The theory also explains why set size effects are expected to be task-dependent. Our results suggest that limitations in working memory and attention have a rational basis.

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