

Garnering Support for Number and Area as Integral Dimensions

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Abstract

Non-numerical magnitudes such as cumulative area, element size, and density influence the perception of number. However, it is unclear whether interactions between number and non-numerical magnitudes reflect independent representations that interface vis--vis other systems (e.g., language) or, conversely, reflect holistic perception of number and other magnitudes. In the present work, we found converging evidence that number and cumulative area are perceptually integral dimensions. Whether assessed explicitly (Experiment 1) or implicitly (Experiment 2), perceived similarity for dot arrays that varied parametrically in number and area was best modeled by Euclidean, as opposed to city-block, distance. Critically, we also found that the integrality of number and area is comparable to other integral dimensions (Exp. 1: brightness/saturation; Exp. 2: radial frequency components), but different from separable dimensions (Exp. 1: shape/color; Exp. 2: thickness/curvature). In summary, these findings suggest that non-symbolic number perception is holistic, such that the processing of non-numerical magnitudes is obligatory.