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Units of representation: Children’s perception of number in the “connectedness illusion”

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Abstract

The developmental and evolutionary origins of abstract number reasoning have long been debated. Central to this debate is the underlying unit: whether the quantitative reasoning observed in infants and animals necessitates truly numeric object-level representation or can instead be inferred from covarying low-level spatial frequency. Recent studies with adults rely on the “connectedness illusion” to dissociate cardinality from spatial frequency, suggesting object-level representation is fundamental. However, whether these representations exist early in development remains underexplored. We use the connectedness illusion to test whether 3–6-year-old children enumerate objects or spatial frequency. Children complete a non-symbolic comparison task modeled after He et al. (2009). On 50% of trials, two dots are connected by a line, forming a “barbell.” Results show that, like adults, children underestimate connected displays despite instructions to ignore the connections. These findings suggest that object-level representations, rather than low-level spatial frequency, underlie children’s quantitative reasoning.