One-to-One Correspondence in Children and Monkeys

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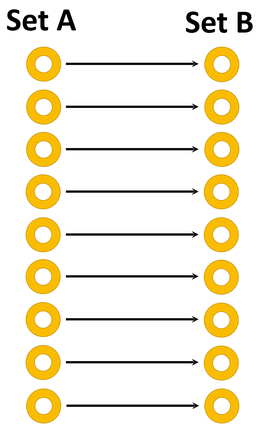
Introduction

- Adult humans can use the logic of one-to-one correspondence to judge exact numerical equality without counting.[1]
- Strong nativist claims propose an innate basis for this ability.[2,3]
- Alternatively, some argue that children's understanding of the relationship between one-to-one correspondence and equality is linked to cardinal principle (CP) acquisition.[4]



(1) We tested children to assess how CP-knowledge and age relate to the ability to use one-to-one correspondence cues.

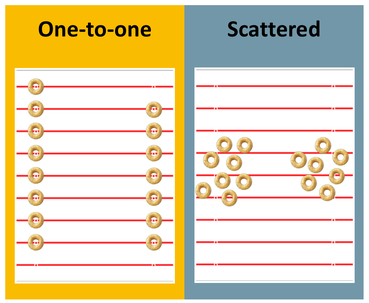
(2) We tested monkeys to clarify whether the logic of one-to-one correspondence can be acquired without language.

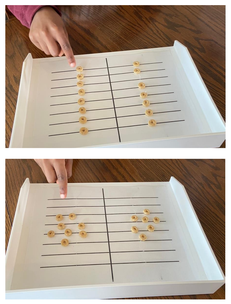
Methods

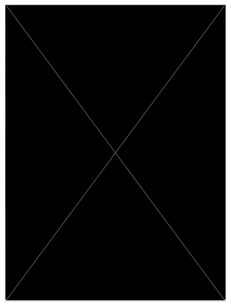
Children: 200 children aged 2–4 years (*M* = 3.59 years, SD = 0.78). Each child completed Give-N to assess CP knowledge and six discrimination trials. Test ratios were 6:3, 5:4, and 8:7.

Monkeys: 10 adult rhesus macaques (*M* = 5.2 years). Each subject completed 200 trials. Test ratios were 5:2, 6:3, 6:4, 7:6, and 8:7.

Procedure: The experimenter presented the participant with two food caches. The participant selected a cache by pointing or reaching.

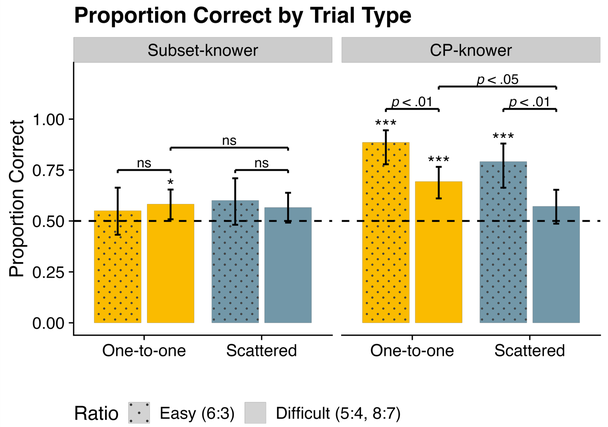






Results

Children

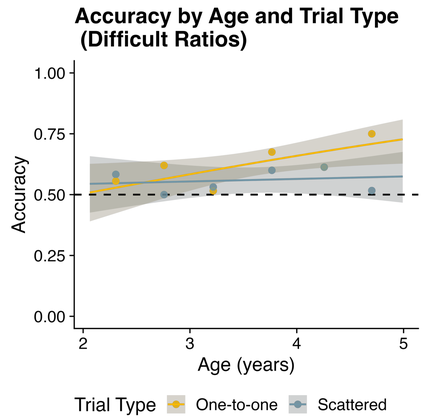


Left: Only CP-knowers showed evidence of using one-to-one correspondence cues.

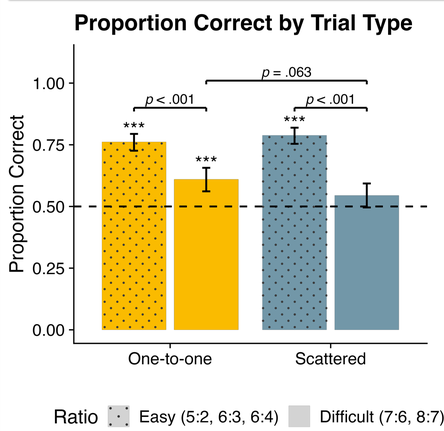
- more accurate on difficult one-to-one versus scattered trials (β = 0.53, *p* = .036)
- however, significant ratio effects for both trial types (both *p* < .05)

Right: Older children were more accurate on difficult one-to-one trials than younger children (β = 0.32, *p* = .027). Age did not predict accuracy on difficult scattered trials (β = 0.04, *p* = .766).

When controlling for age, CP-knowledge did not predict accuracy on difficult trials, and vice versa (both *p* > .05).



Monkeys

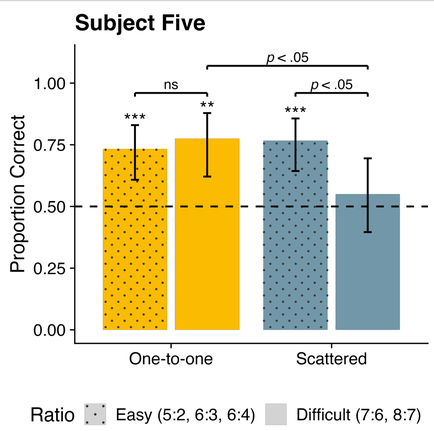


Left: As a group, monkeys showed some evidence of using one-to-one correspondence cues.

- above chance for difficult one-to-one (61%, *p* < .001) but not scattered trials (55%, *p* = .072)
- however, significant ratio effects for both trial types (both *p* < .05)

Right: Subject five showed very strong evidence of using one-to-one correspondence cues.

- more accurate on difficult one-to-one versus scattered trials (β = 1.04, *p* = .036)
- ratio effect for scattered (β = 1.00, *p* = .025) but not one-to-one trials (β = -0.23, *p* = .638)
- no use of length or density cues (both *p* > .05)



Discussion

- CP-knowers utilized one-to-one correspondence cues to increase their discrimination accuracy, but not perfectly (e.g., still exhibited ratio effects for one-to-one trials).
- As a group, monkeys show a similar pattern of results to CP-knowers.
- Among monkeys, subject five shows the strongest evidence of having used one-to-one correspondence cues to make discriminations.

CP-knowledge is *neither necessary nor sufficient* to use one-to-one correspondence cues to make precise quantity discriminations.

Acknowledgements

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