Does eight equal eight? The role of counting knowledge in children's understanding of exact equality

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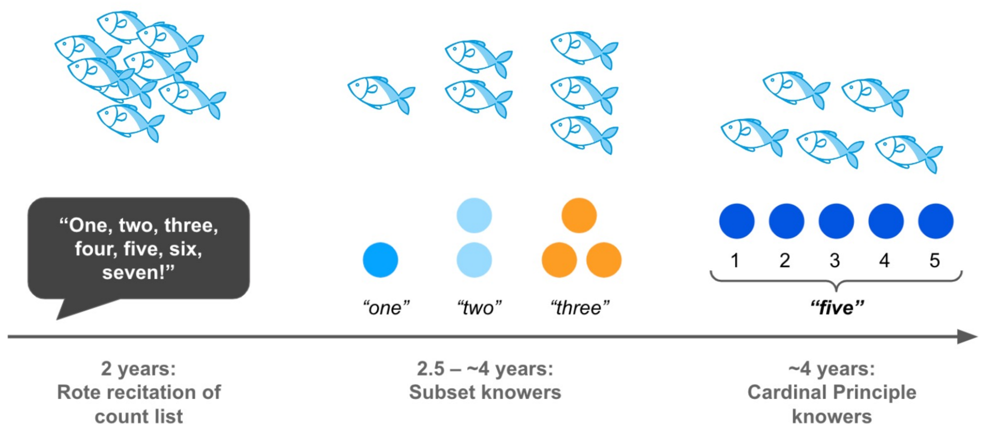
Background

- Children understand numbers over a developmental trajectory:



- Children might understand exact numerical equality without learning the meaning of number words.[1]
- Previous results are mixed. [2345]
- However, their methods might not robustly test knowledge of judging exact equality between two sets:
  - Rely on understanding number words
  - Require set construction
  - Can be solved with other heuristics related to quantities that do not involve 1-to-1 correspondence.

Research Question

- Is proficiency in **counting knowledge** (measured by understanding of the Cardinal Principle, or CP) **critical** to children's understanding of **exact equality / equinumerosity**?

Methods

- English-speaking 2;0 – 5;11 yos
  - n=88 (40 subset, 48 CP knowers)

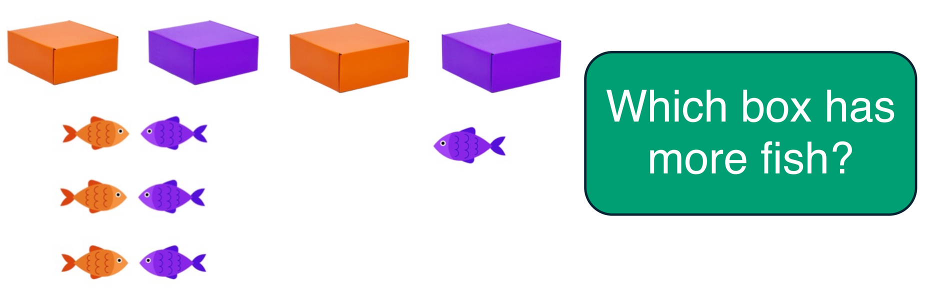
Give-A-Number: measure largest set children can construct, classify children into subset- and CP-knowers (CP-knowers can construct sets of 5/6).

Highest Count: measure highest number children count to, general proxy of counting experience.

'More' Prescreen: ensure children can compare hidden sets that are perceptually distinguishable (ratios >= 2:1) when prompted with "more".

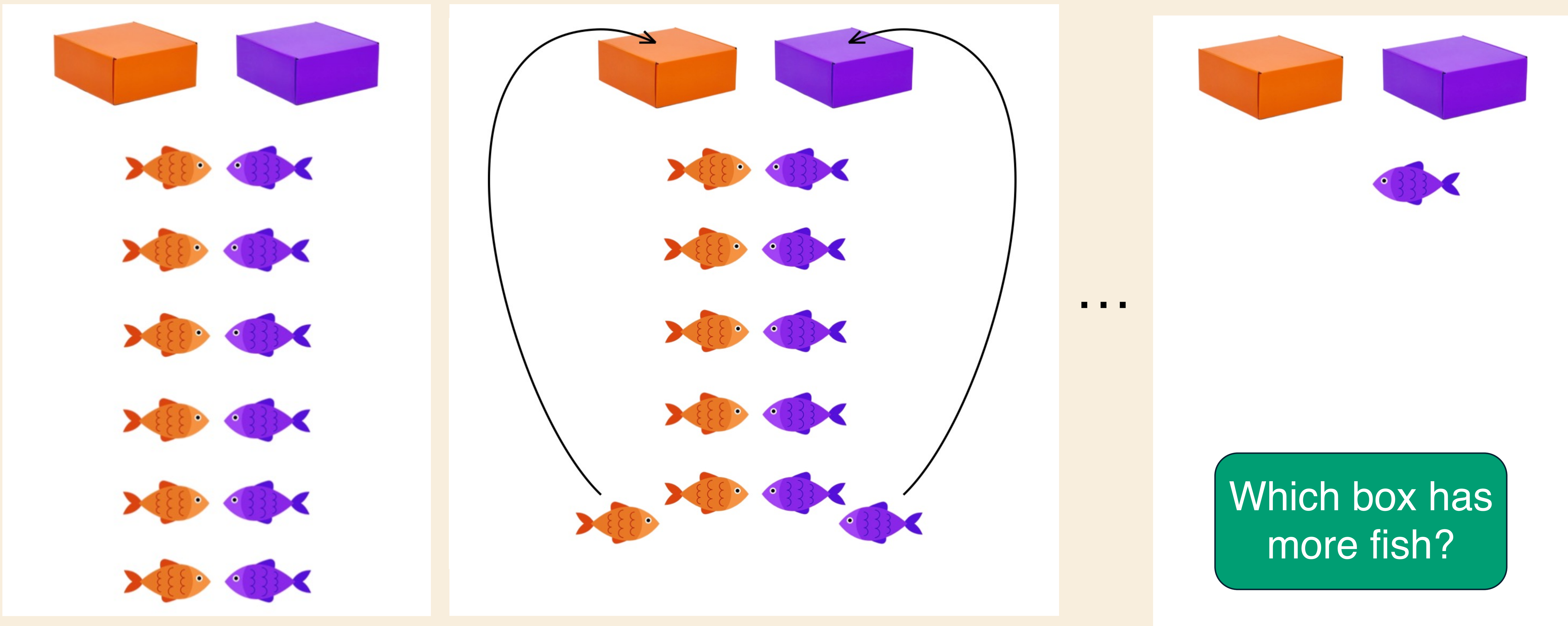
Exact Equality Task:

- 8 trials, 2 of each ratio:
  - Small sets: 1:2, 2:3
  - Large sets: 5:6, 9:10



- No need to understand number words.
- No manipulation of sets.
- No judgment of visible sets, which could prompt using approximate magnitudes.

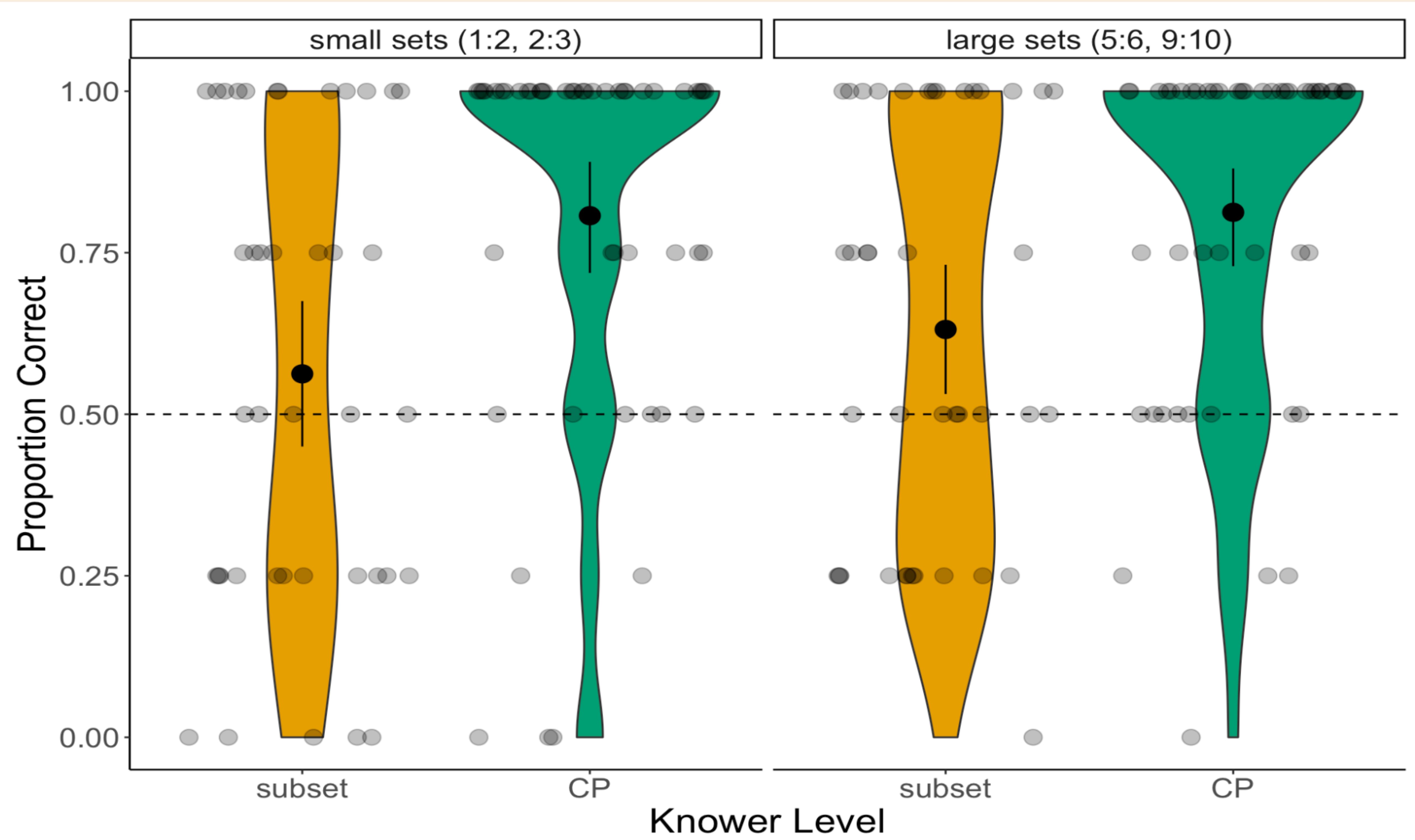
Equinumerosity / Exact Equality: two sets in **1-to-1 correspondence** have the **same number** of items.



Children who **understand counting** (Cardinal Principle knowers) **succeed on both large and small sets**, but there was **individual variability**.

Children who **don't understand counting** (subset knowers) only **succeed on large sets**, but performance does not differ from small sets.

Counting knowledge is not sufficient for understanding of equinumerosity.



Other Results

- **Age** (but not Highest Count) **fully explains difference** between subset and CP knowers.
- **Variability** in CP knowers is **not explained by age**.
- Within each knower level group, performance does not differ between small and large sizes.

Future Directions

- Why do subset knowers succeed in large sets but not small sets? Can we replicate this success?
- How do children gain an adult-like understanding of exact equality?
- What factors predict individual variability?

Contact Information

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References

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