The developmental relation between nonsymbolic and symbolic fraction abilities

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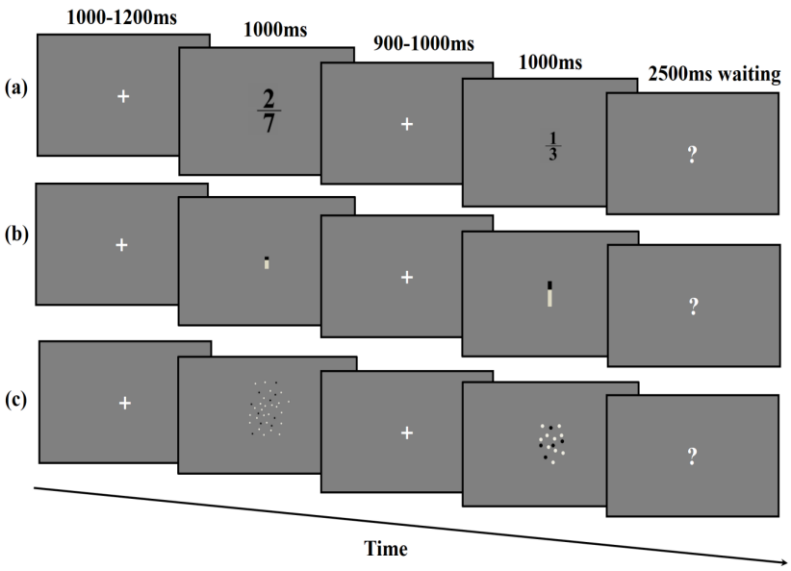
INTRODUCTION

- A fundamental research question in quantitative cognition is about the relation between primary nonsymbolic quantitative abilities and culturally acquired symbolic quantitative abilities (1, 2, 3).
- This study examined the relation between the abilities to process nonsymbolic and symbolic fractions and the developmental change of the nonsymbolic-symbolic relation with age.

METHOD

- Participants: 3 groups, including 86 sixth graders (M_{age} = 11.86 years), 102 tenth graders (M_{age} = 15.72 years), and 97 adults (M_{age} = 22.09 years).
- Measures: Fraction comparison tasks, absolute quantities processing tasks and controlling tasks

Figure 1. Fraction comparison tasks.

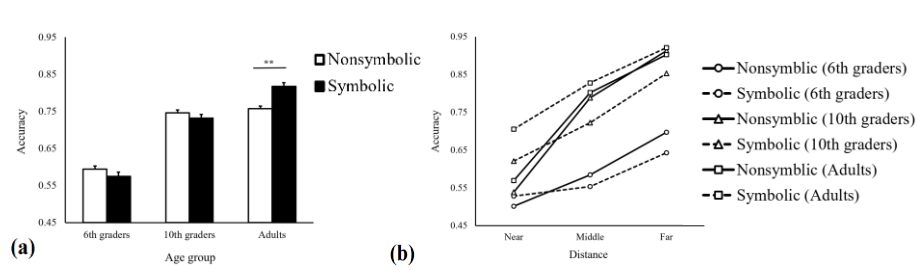


Note. (a) symbolic (digit) fraction comparison; (b) nonsymbolic (bar) fraction comparison; (c) nonsymbolic (dot) fraction comparison. A fraction was represented with the proportion between the black part and the total in the nonsymbolic condition.

RESULTS

- All three groups' nonsymbolic and symbolic fraction abilities were correlated even controlling for multiple cognitive covariates. However, the strength of these nonsymbolic-symbolic correlations decreased during development.
- In addition, symbolic fraction comparison accuracy surpassing the nonsymbolic one during development was founded.

Figure 2. The accuracies of nonsymbolic and symbolic fraction comparisons in three age groups.



Note. (a) the total accuracies of all distance conditions in nonsymbolic and symbolic conditions; (b) the accuracies in each distance condition.

CONCLUSSIONS

- There is unique nonsymbolic-symbolic relation in fraction abilities, but this relation decreases with one's increasing proficiency in symbolic fractions.

TENCENT MEETING

- If you want to know more about this study, please feel free to join the following tencent meeting: Meeting ID: 536 248 779

REFERENCES

1. Dehaene, S. (2011). *The number sense: How the mind creates mathematics*. OUP USA.
2. Feigenson, L., Dehaene, S., & Spelke, E. (2004). Core systems of number. *Trends in Cognitive Sciences*, *8*(7), 307–314. https://doi.org/10.1016/j.tics.2004.05.002
3. Lyons, I. M., Bugden, S., Zheng, S., De Jesus, S., & Ansari, D. (2018). Symbolic number skills predict growth in nonsymbolic number skills in kindergarteners. *Developmental Psychology*, *54*(3), 440–457. https://doi.org/10.1037/dev0000445