Number magnitude comparison by children

A short longitudinal study

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Abstract

- Children had to select the bigger of 2 Arabic digits. They were tested at the end of 1st grade and twice in grade 2.
- The results suggest that the children 's representation of number magnitude first gains in precision, then its compression seems relaxed. Finally, as the child integrates the direction of the writing system, a left-right orientation emerges.

Typical effects in number magnitude comparison are:

• **SIZE effect**: small numbers are faster compared than large numbers (e.g., 2-3 vs. 6-7)
• **SPLIT effect**: numerically distant numbers are faster compared than numerically close numbers (e.g., 2-7 vs. 2-3)
• **SNARC effect**: small numbers are faster responded to with the left hand, large numbers are faster responded to with the right hand.

⟹ This suggests that the magnitude comparison operates on an oriented analog medium with large numbers towards the right end, and an increasing compression as numbers get bigger.

With children, the size effect has been observed in kindergarten (Sekuler & Mierkiewicz, 1977; Duncan & McFarland, 1980) but decreases as grade level increases.

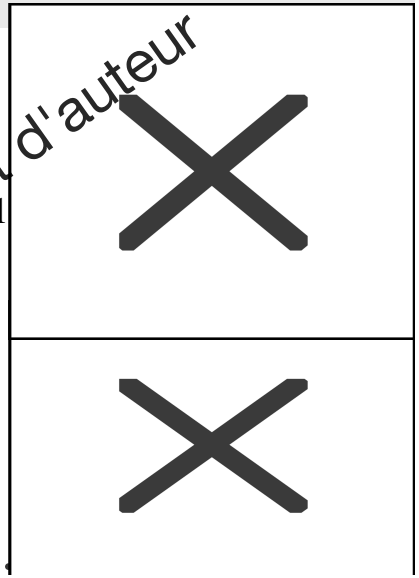
Method

- Population: 24 children tested at the end of 1st grade, begining and end of 2nd grade
- Task 1: selecting the bigger of 2 Arabic digits
- Items: 48 pairs, with small (1 to 5) or large (5 to 9) numbers, and with a small or large split (distance of 1 vs. 3 or 4)
- Task 2: naming Arabic digits from 1 to 9 (assesses the encoding of Arabic digits)

Analysis of RTs in comparison

- Main effect of the testing session: RTs decrease over testing sessions
- Main effect of the size of the numbers: Faster responses for small pairs than for large pairs
- Main effect of the split: Faster responses for large split than small split
- In session 3 only: appearance of a SNARC effect for the small split pairs

- Interaction between testing session and split: the split effect decreases over time, especially between session 1 and 2
- Interaction between testing session and size effect: the size effect decreases over time, especially between session 2 and 3



Analysis of digit naming RTs

- Naming times linearly decreases over the testing sessions.
- There is not effect of the size of the numbers, nor any interaction.

Conclusion

- The size and split effects are present early and suggest that 1st grade children already use a compressed analog medium to compare numbers.
- The split effect decreases over time, and mainly between session 1 and 2, whch suggests that magnitude representation gains in precision.

- The size effect is not present in a digit naming task. It is thus specific to the comparison and not the encoding stage. The size effect decreases over time, mainly between session 2 and 3, which suggests that the number line is less compressed as children get older (for numbers 1 to 9)
- A SNARC effect is not present at the first and second session. It only appears when children have integrated the left-right

Bibliography

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