About number gesture: Which contribution to verbal cardinal knowledge development?

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Fingers: a transitional tool

Acquiring the meaning of number words is a long-lasting process (Wynn, 1992)

Functional role played by fingers in numerical development

- Sustain the acquisition of the verbal number sequence and of the counting procedure
- Iconic cardinal representation
- Spontaneous use when learning to calculate

Crollen, Seron& Noël (2011) & Roesch & Moeller (2015)

Fingers and cardinal knowledge

- Few studies
- Contradictory results :
  - ✧ Young children (2- to 5- y.o.) are **more accurate** to give a number **using number words** than using number gestures (Nicoladis, Pika & Marentette, 2010)
  - ✧ Young children (3- to 5- y.o.) who do not have full cardinal knowledge are **more accurate** labbeling small sets/estimating large sets **using number gestures** compared to number words

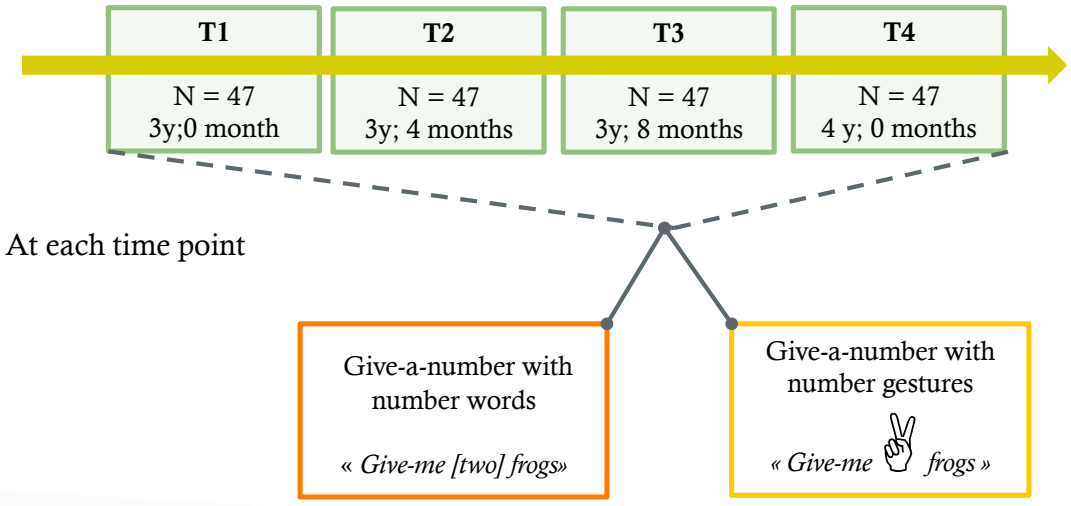
(Gunderson, Speapen, Gibson & Goldin-Meadow, 2015)

Research questions

What's the role played by fingers in the acquisition of verbal number words?

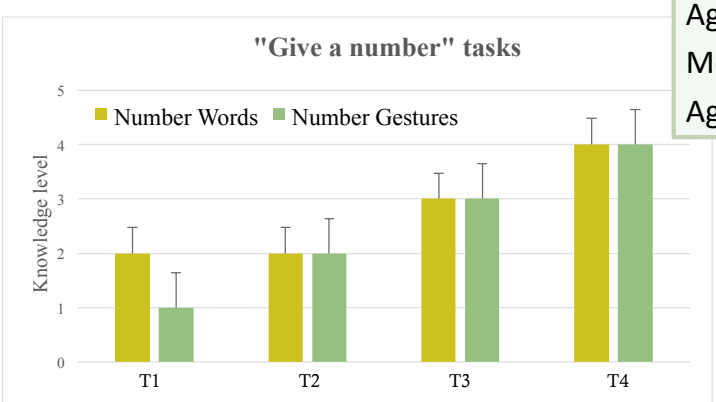
- Is there an age at which children are more skilled to represent number on their fingers than verbally?
- Do finger-based numerical representation contribute to the development of verbal cardinal knowledge?

Longitudinal design



Results

Repeated measures Anova : Modality (2) x Age (4)



Age : p <.01
Modality : ns
Age x Modality : ns

No advantage for any modality at any time point

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Cardinal knowledge development

Multi-level regression analysis : *Verbal cardinal level* $= \beta_{00} + \beta_{01}$*(Initial state) + β_{10}*(Age) + β_{20}*(Nb gesture cardinal level) + β_{30}*(Interaction between Age & Nb gesture level) + r_{0i} + e_{ti}

Time related changes in finger-based numerical representation predict changes in verbal cardinal knowledge development

Table 1. Results of the HLM conditional model of the performances with number gesture predicting the performance with number words in 'Give-a-Number' task

	Give-a-number number words
Fixed effects	
Level 1: Prediction of the time-varying fluctuation	
• Performances with number gestures	0.36***
Level 2: Prediction of linear change	
• Intercept of the slope	1.79***
• Initial state of performances with number gestures	0.01
Deviance	576.37

*p <.05; **p <.01; ***p <.001

Conclusion

- Children do not reach significantly higher cardinal knowledge development with number words than with number gestures at any point between the age of 3- to 4- year-old.
- However, the development of finger-based cardinal representation positively influences the development of the cardinal meaning of number words

Thank you for attention

Thanks to :
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