Strategy use in relation to mathematical ability: Developmental delay or deficit?

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« Model of strategic change »

1. Strategy repertoire	Which?
2. Strategy distribution	How often?
3. Strategy efficiency	How accurate? How fast?
4. Strategy selection	How adaptive?

« Choice/no-choice method »

- Two types of conditions
  1. Choice condition: choose freely
  2. No-choice condition: obligatory use of one particular strategy
- Un-biased data about accuracy and speed of strategy execution, and thus adaptiveness of strategy selection

Aim of the study

- Theoretical goal
  1. Differences in strategy use on additions and subtractions up to 20 between children with strong and weak mathematical abilities (MA)?
  2. Developmental delay or deficit?
- Methodological goal

  Usefulness of the choice/no-choice method: young children of different MA; domain of simple addition and subtraction up to 20

The bridge over 10: Strategies

- Three types of strategies

1. Retrieval

   8 + 5 = (immediately) 13

2. Decomposition

   8 + 5 = 8 + 2 + 3 = 10 + 3 = 13

   13 - 5 = 13 - 3 - 2 = 10 - 2 = 8

3. Counting

   13 - 5 = (13), 12, 11, 10, 9, 8

The bridge over 10: Flanders

- End of first grade
- Decomposition to 10

Subjects and materials

- Three groups
  1. Strong second-graders: strong MA (n = 26)
  2. Weak second-graders: weak MA (n = 25)
  3. Weak third-graders: MA cf. group 1 (n = 26)
- Month of November 2001
- 36 problems with the bridge over 10
  18 additions
  18 subtractions

Conditions

1. Choice condition

   Choose freely between retrieval, decomposition to 10, and counting with steps of one unit

2. Retrieval condition

   Obligatory use of retrieval (max 2s)

3. Decomposition condition

   Obligatory use of decomposition to 10

   (presentation format)

4. Counting condition

   Obligatory use of counting with steps of one unit (presentation format)

Presentation format of the items

	8 + 3 = .	
8 + 3 = .	8 + 3 = . . .	 8 + 3 = .

Conditions

1. Choice condition

   Choose freely between retrieval, decomposition to 10, and counting with steps of one unit

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   Obligatory use of retrieval (max 2s)

3. Decomposition condition

   Obligatory use of decomposition to 10

   (presentation format)

4. Counting condition

   Obligatory use of counting with steps of one unit (presentation format)

Procedure

- Choice condition first
- Order of no-choice conditions counterbalanced
- Registration of answer and reaction time

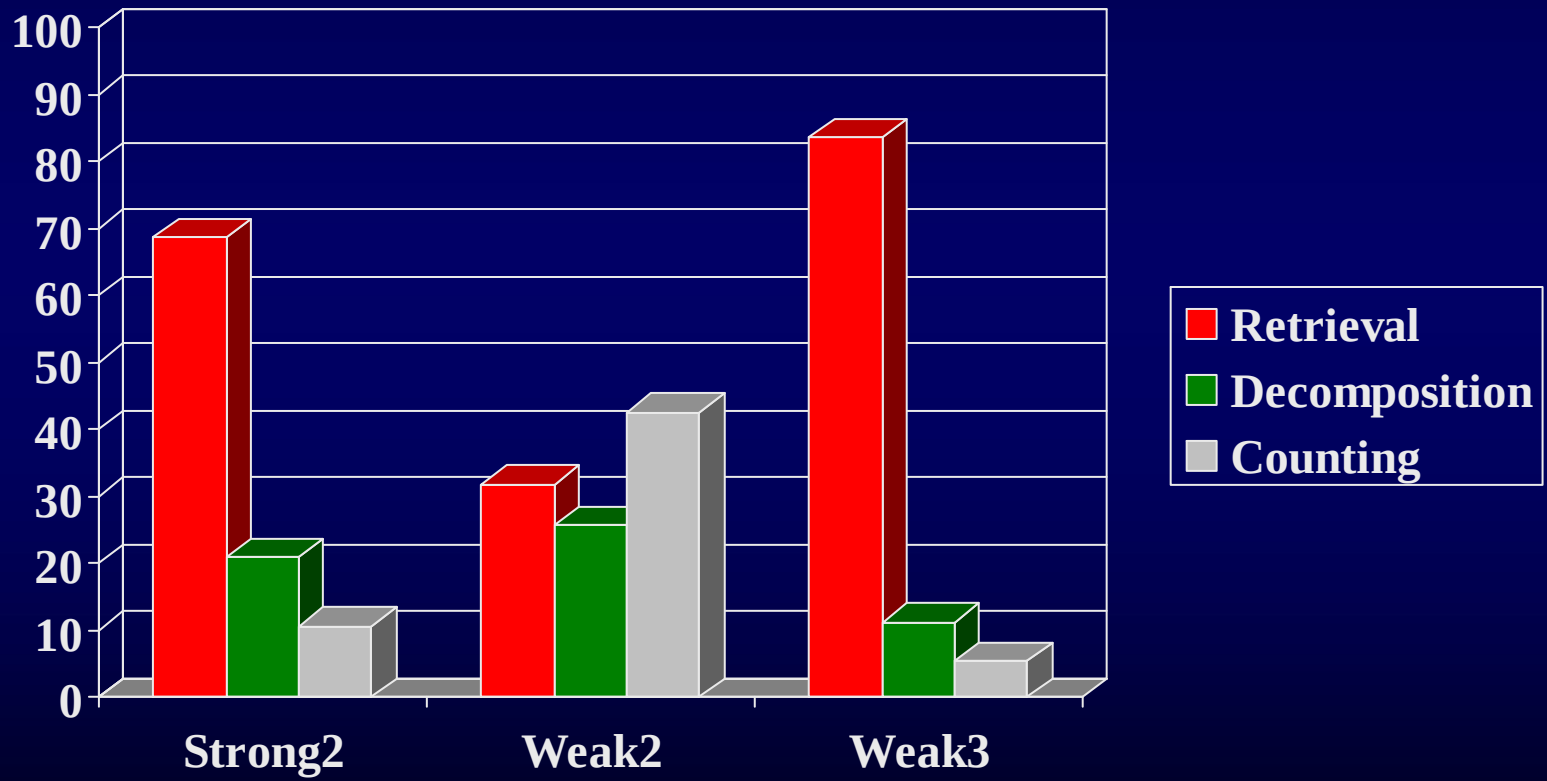
Results (1)

- Model of strategic change
- Differences in strategy use between children with strong and weak MA?
  - → Comparison of strong and weak second-graders
- Developmental delay or deficit?
  - → Comparison of strong second-graders and weak third-graders

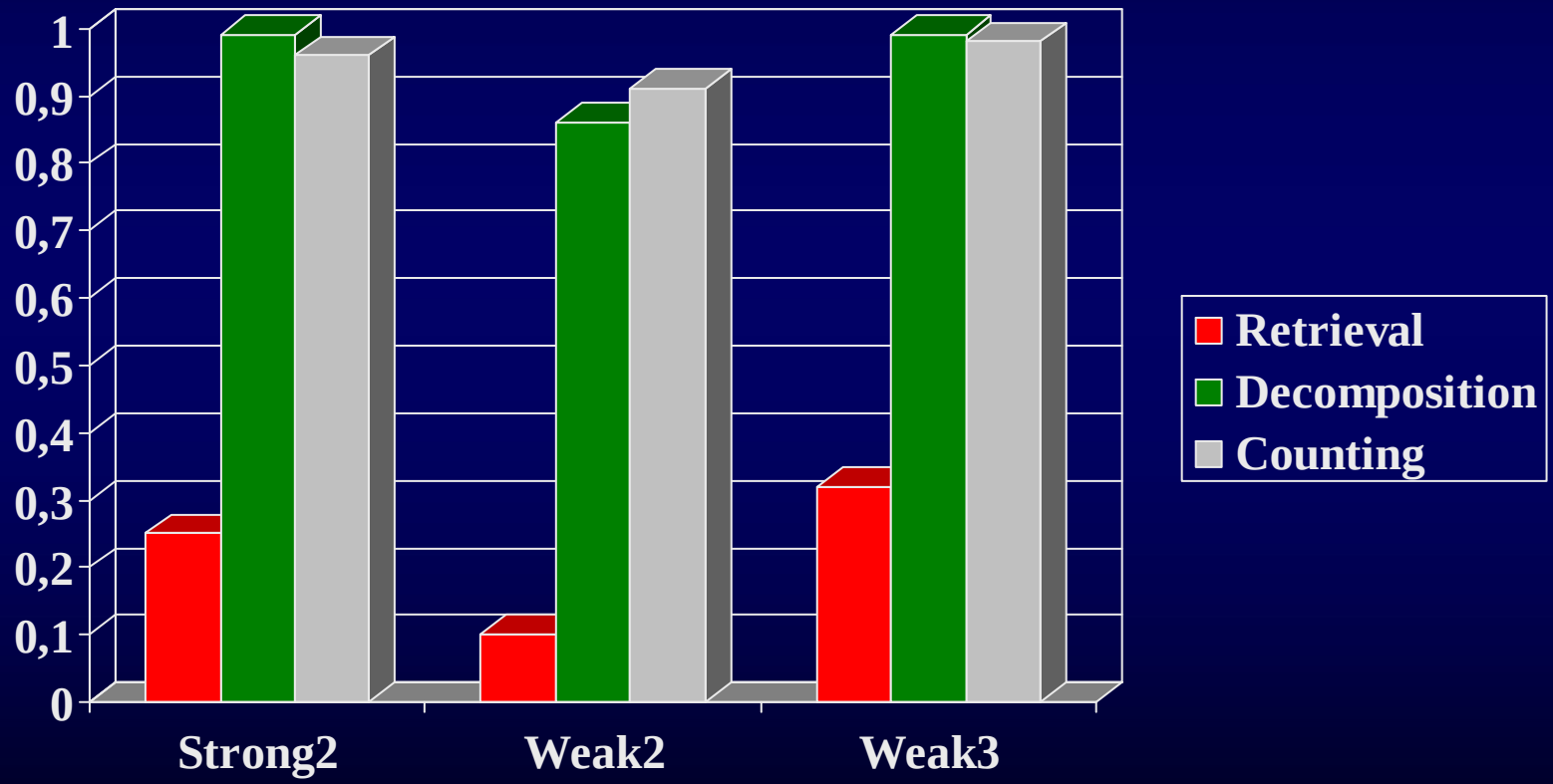
Results (2)

- Developmental delay: same, but slower
  - → No differences between strong second-graders and weak third-graders
- Deficit: fundamentally different
  - → Differences between strong second-graders and weak third-graders

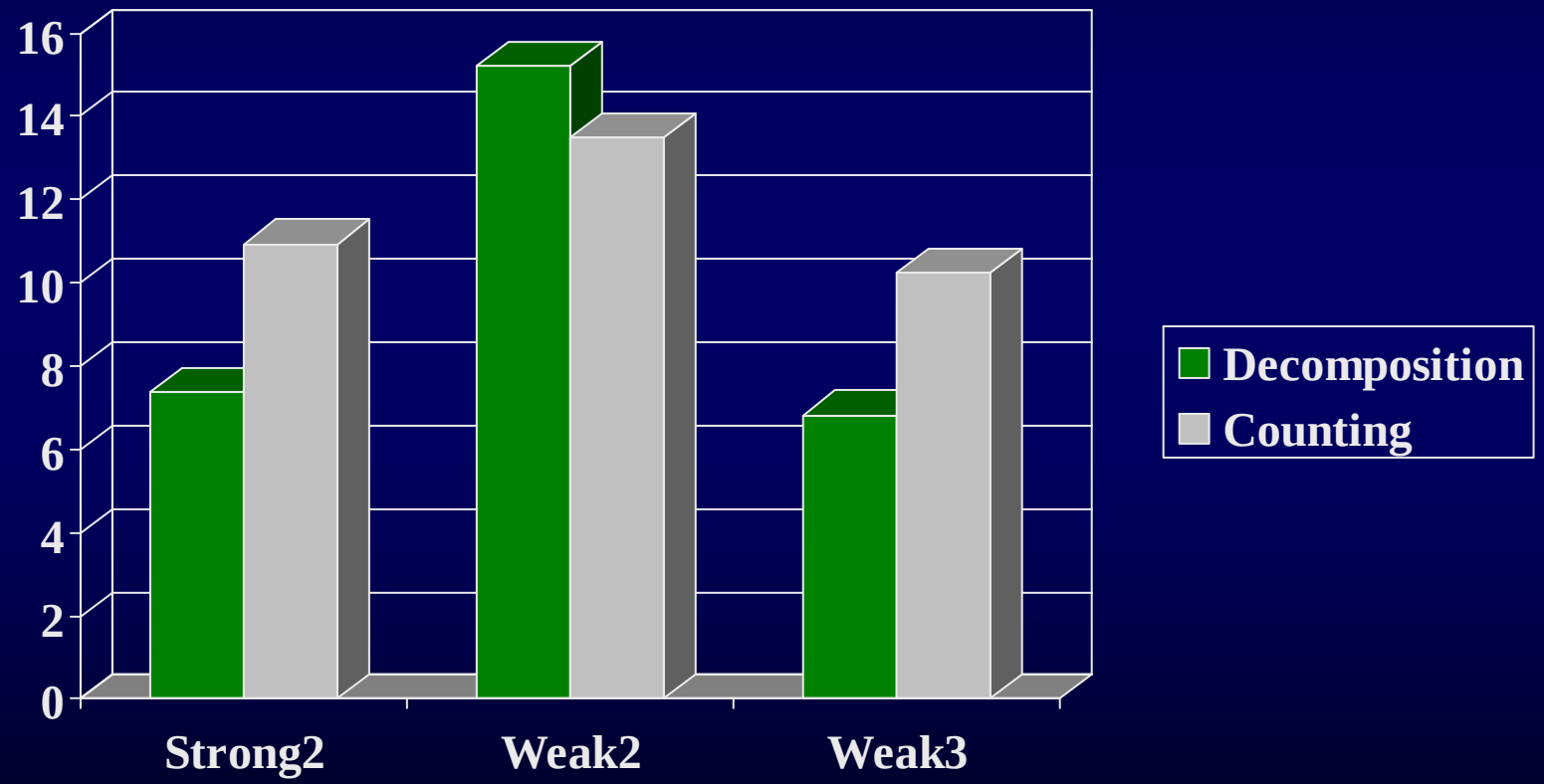
Strategy repertoire and distribution (choice condition)



Strategy accuracy (no-choice conditions)



Strategy speed (no-choice conditions)



Strategy selection: Method (1)

- Comparison of accuracy in choice condition with accuracy in no-choice conditions:

  « Adaptive strategy choices, if more accurate performances in choice condition »
- However: Influence of strategy frequency in choice condition
- Therefore: Projected accuracy in no-choice conditions, taking into account strategy frequency in choice condition

Strategy selection: Method (2)

- Projected accuracy in no-choice conditions

(frequency 1 in choice condition)*(accuracy in no-choice condition 1)

+

(frequency 2 in choice condition)*(accuracy in no-choice condition 2)

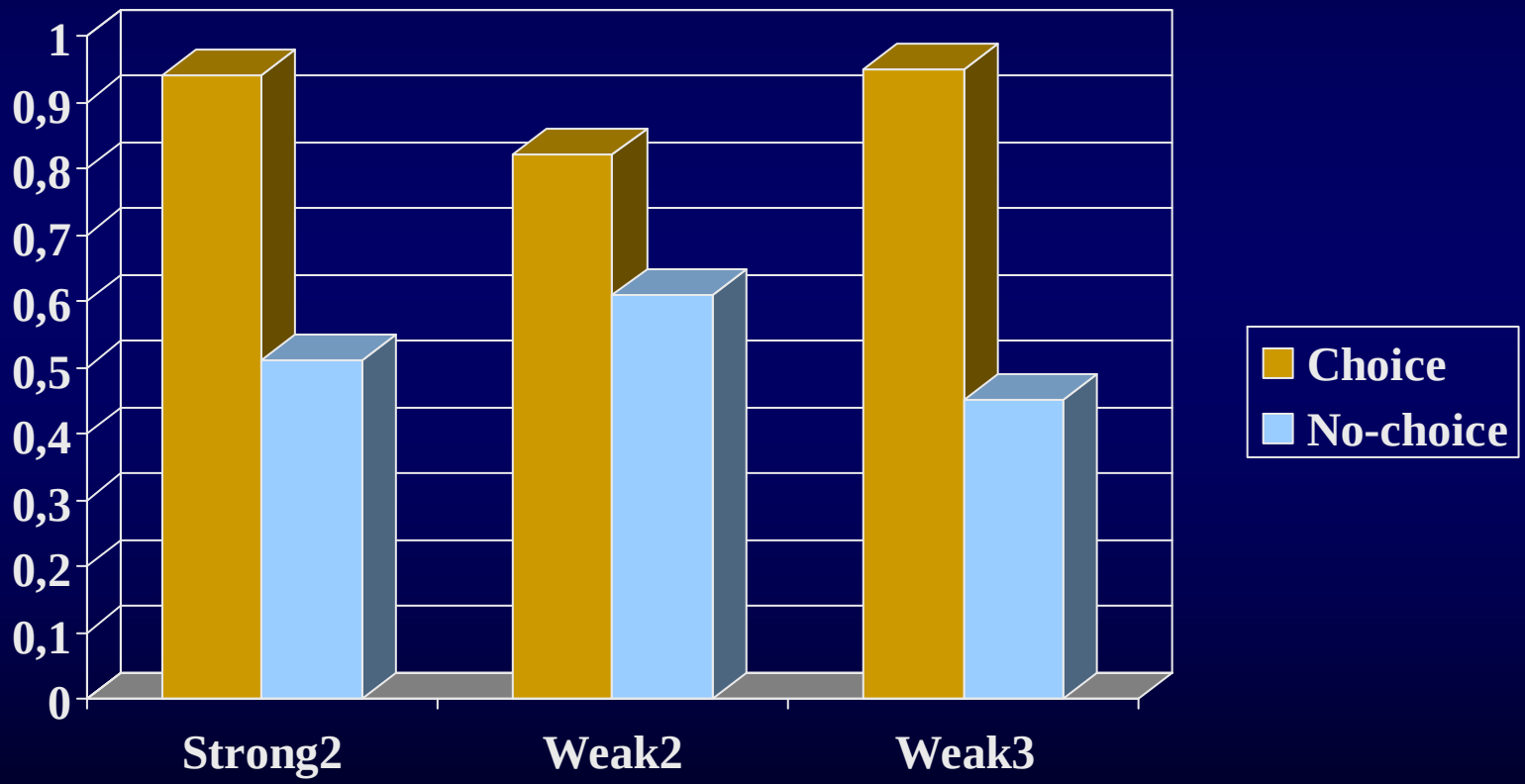
+

(frequency 3 in choice condition)*(accuracy in no-choice condition 3)

- Strong second-graders

0.69*0.28 + 0.21*0.99 + 0.10*0.94

Strategy selection: Results



Conclusion (1)

	Strong and weak second-graders	Strong second- and weak third-graders
Strategy repertoire	=	=
Strategy distribution	≠	± =
Strategy efficiency	≠	=
Strategy selection	≠	=

Conclusion (2)

- Usefulness of the choice/no-choice method
  1. Young children of different MA
  2. Domain of early arithmetic
- Decomposition and counting: Accuracy and speed
- Retrieval: Accuracy, but no speed