

## Promoting cognitive flexibility by varying cognitive load? An empirical study on arithmetic reasoning

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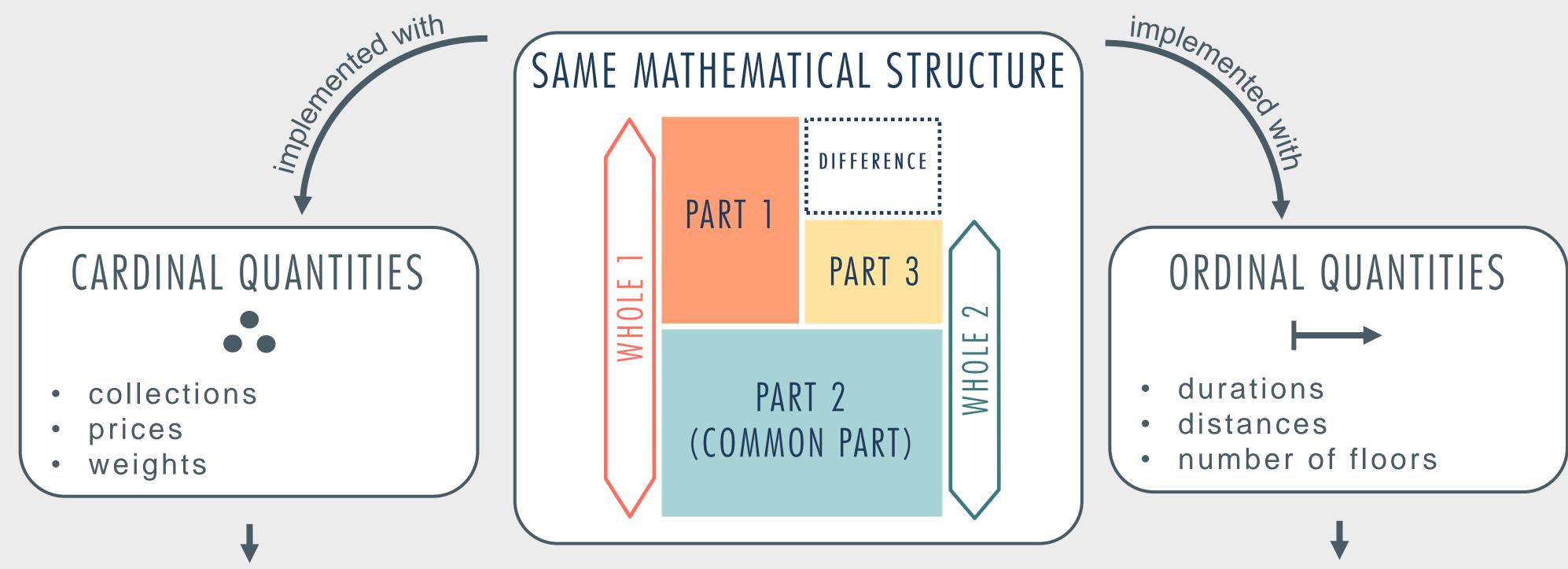
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# PROMOTING COGNITIVE FLEXIBILITY BY VARYING COGNITIVE LOAD?

# PRELIMINARY STUDIES ON ARITHMETIC REASONING

What makes it possible to consider a problem from different perspectives and find a counter-intuitive solution? Cognitive flexibility is thought to play a crucial role in helping learners recode their initial encoding of a situation (Clément, 2022; Gros & Gvozdic, 2022). Yet, identifying the best conditions to promote such flexibility remains an arduous task, especially since recoding is cognitively costly (Gros et al., 2019). According to Cognitive Load Theory (Sweller, 2015, 2016), varying the amount of available cognitive resources may either foster or hinder performance on a task (Sweller et al., 2019; Puma & Tricot, 2019). Here, we investigated the interaction between cognitive flexibility and cognitive load using arithmetic word problems whose optimal solution requires a perspective change (Gros et al., 2021).



# PART 1 Paul has 8 red marbles. PART 2 He also has blue marbles. WHOLE 1 In total, Paul has 14 marbles. PART 2 Jolene has as many blue marbles as Paul, and some green marbles. PART 3 She has 2 green marbles less than Paul has red marbles. WHOLE 2 How many marbles does Jolene have?

PART 1 The construction of the palace took 8 years.

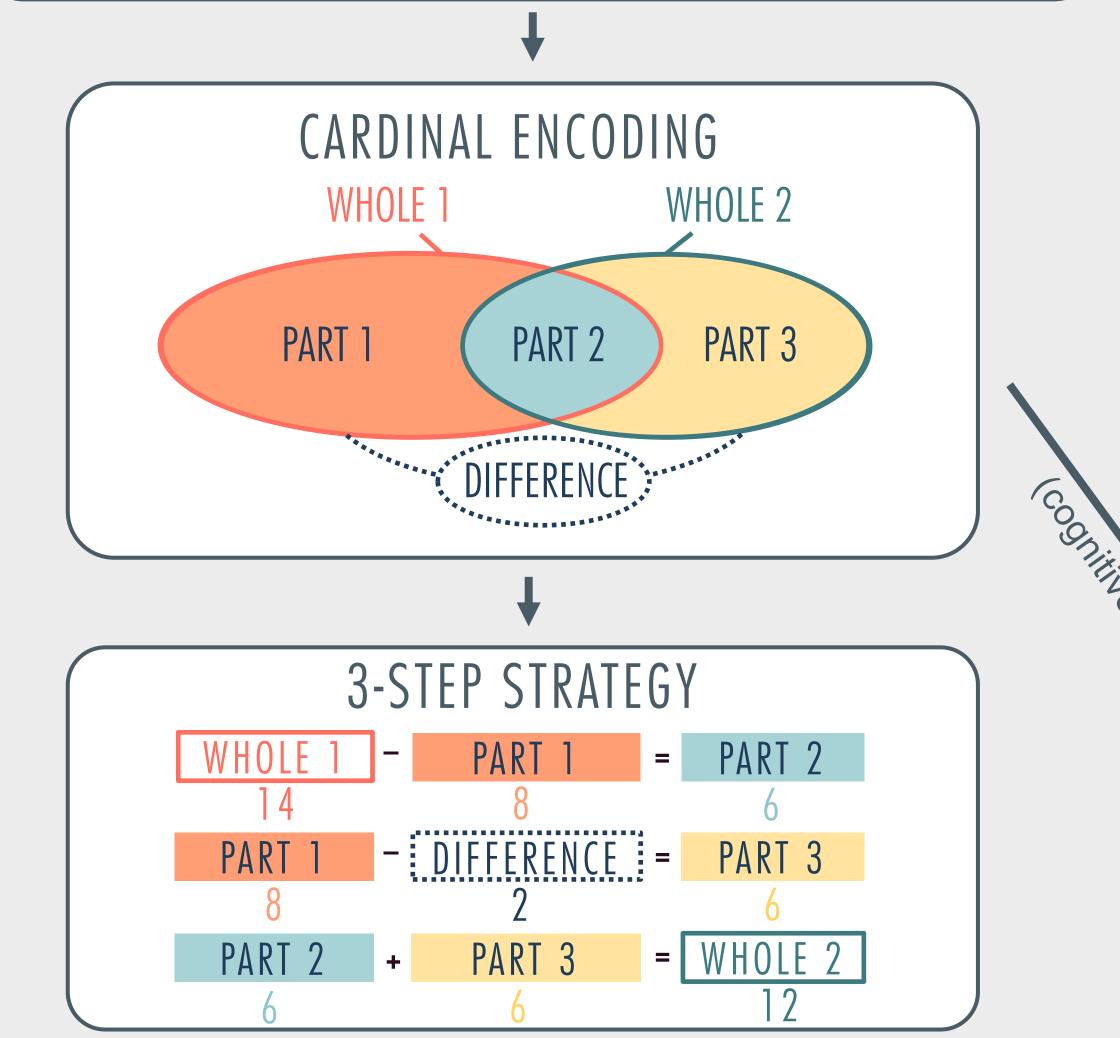
PART 2 Plans for the construction were made beforehand.

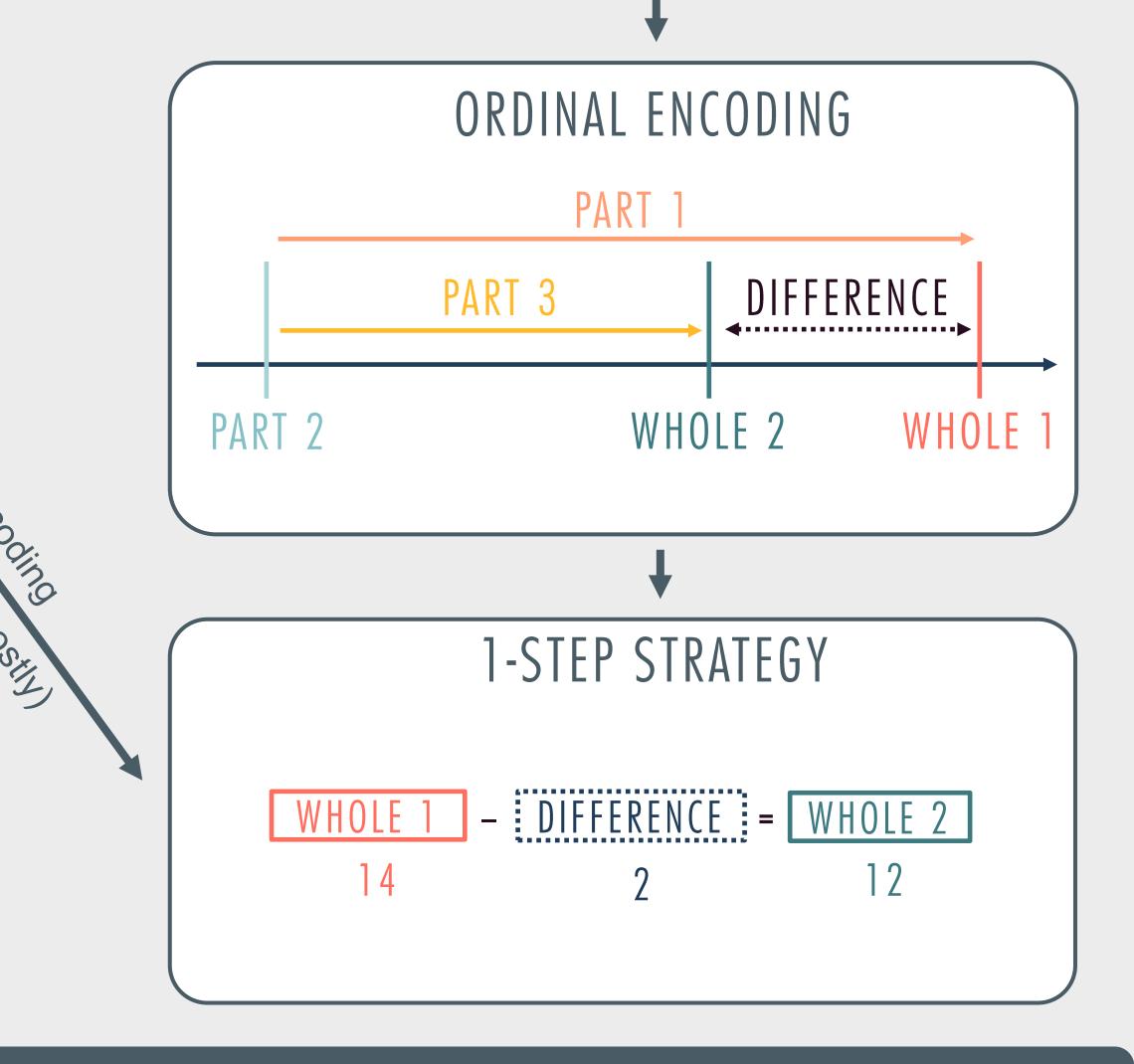
WHOLE 1 The construction of the palace was completed in year 14.

PART 2 The construction of the castle started at the same time as the construction of the palace.

PART 3 The construction of the castle took 2 years less than the construction of the palace.

WHOLE 2 When was the construction of the castle completed?





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## EXPERIMENT 1



## PARTICIPANTS

145 French students (M = 31.26 y, SD = 13.00 y)



## DESIGN

Online experiment with 12 problems and a dual task.

- 6 cardinal problems (requiring a recoding)
- 6 ordinal problems (no recoding necessary)



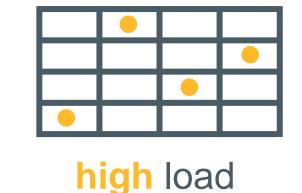
## PROBLEM SOLVING INSTRUCTIONS

"Try to solve the problems using as few steps as possible"



## COGNITIVE LOAD VARIATIONS

Extraneous cognitive load added using a dot memory task.





# PRELIMINARY RESULTS Rate of use of the 1-step strategy for problems with correct dot recall 57.1% 51.3% Low load | High load | Low load | High load | Cardinal problems | Ordinal problems

## EXPERIMENT 2



## PARTICIPANTS

40 English speaking Mturkers (M = 41.21 y, SD = 9.82 y)



## DESIGN

Online experiment with 18 problems.

- 6 cardinal problems (requiring a recoding)
- 6 ordinal problems (no recoding necessary)



## PROBLEM SOLVING INSTRUCTIONS

"Try to solve the problems using as few steps as possible"



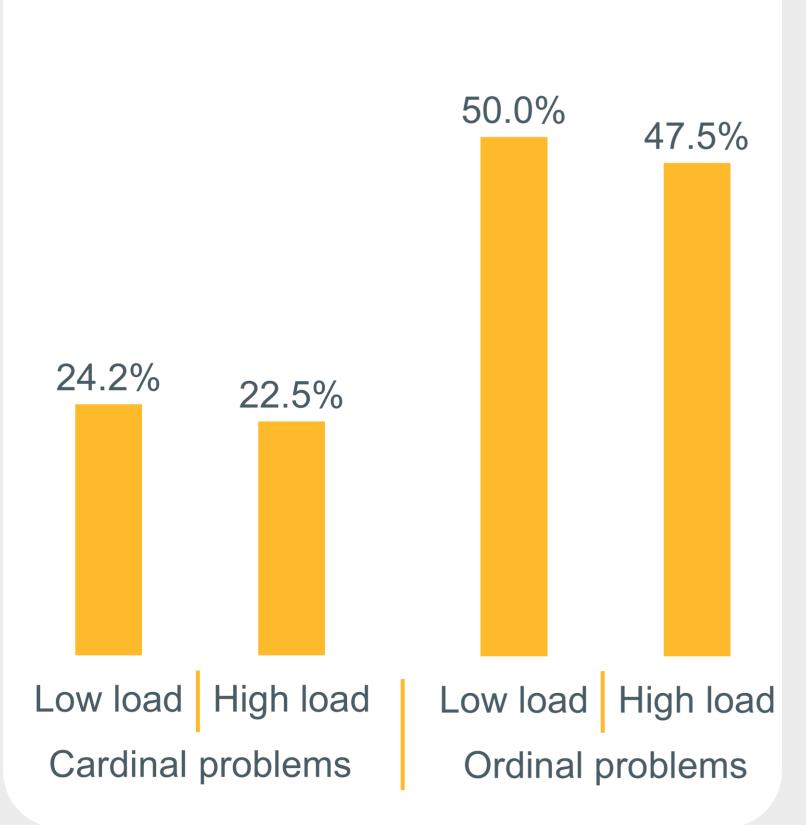
## COGNITIVE LOAD VARIATIONS

Intraneous cognitive load variations using different numerical values.

- Lower range values (e.g., 8; 14; 2)
- Higher range values (e.g., 83; 148; 26)

## PRELIMINARY RESULTS

Rate of use of the 1-step strategy

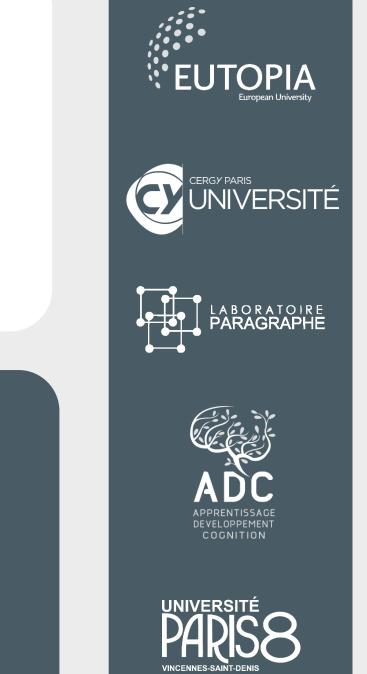


## DISCUSSION

Although these results are only preliminary, it appears that in both experiments, the effect of the **cardinal-ordinal** distinction **overshadowed** that of the **cognitive load**. Surprisingly, the variations of cognitive load (either extraneous or intraneous) **did not seem to interact** with the type of problem used. We intend to further investigate this issue by introducing stronger variations in cognitive load.

## ACKNOWLEDGEMENTS

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> Will an increase in cognitive load have a stronger effect on cardinal problems than on ordinal problems?