



HAL
open science

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

Hippolyte Gros, Sébastien Puma, Evelyne Clément

► To cite this version:

Hippolyte Gros, Sébastien Puma, Evelyne Clément. Promoting cognitive flexibility by varying cognitive load? An empirical study on arithmetic reasoning. The International Mind, Brain, and Education Society (IMBES) Conference 2022, Jul 2022, Montreal, Canada. hal-04064870

HAL Id: hal-04064870

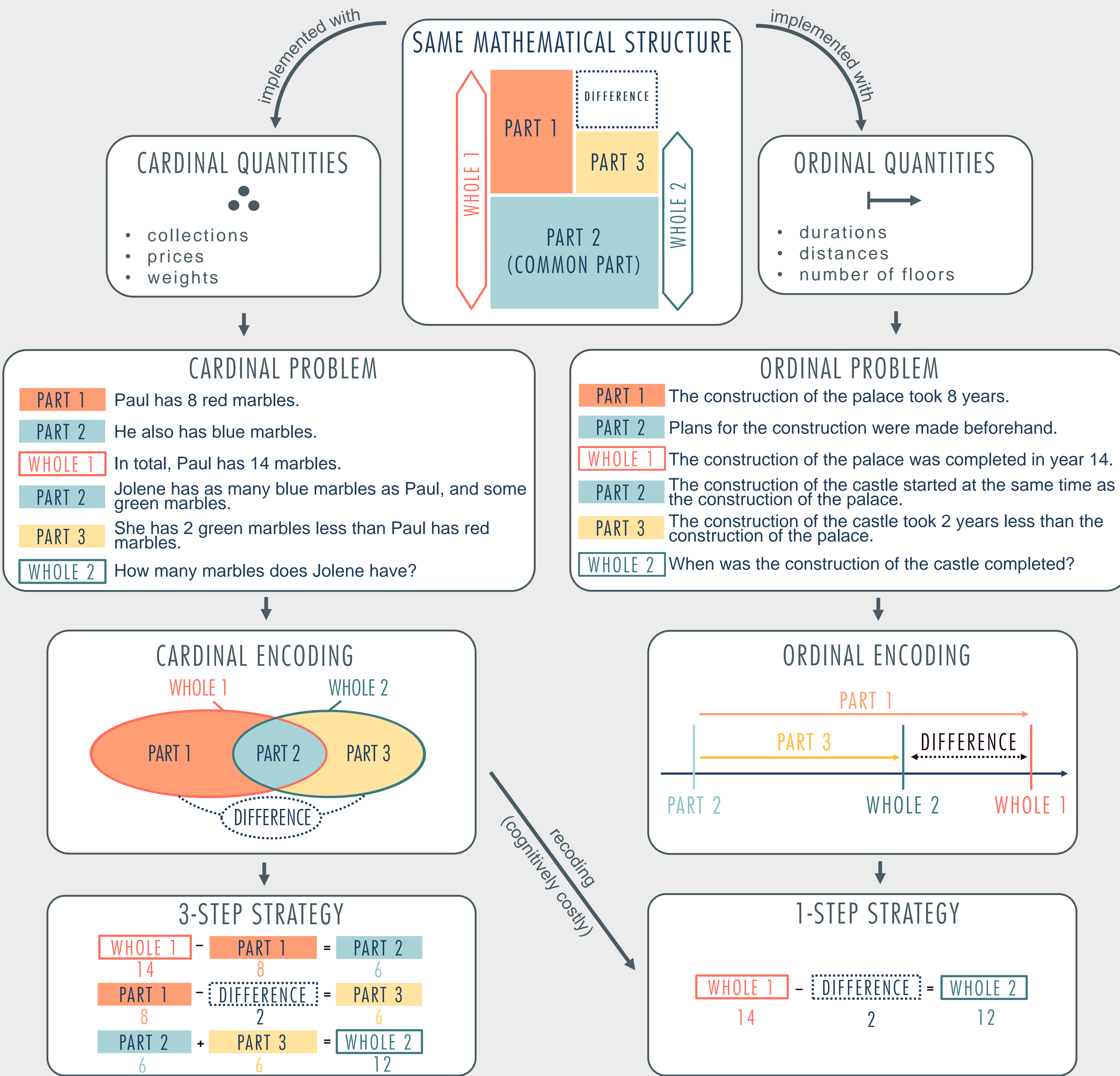
<https://hal.science/hal-04064870>

Submitted on 11 Apr 2023

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

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).



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

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)



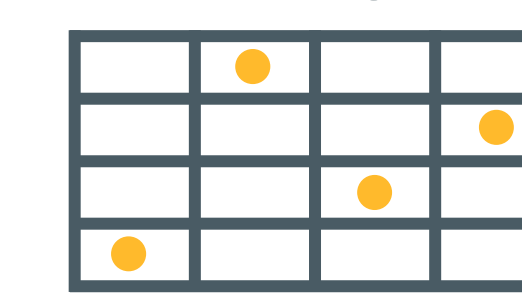
PROBLEM SOLVING INSTRUCTIONS

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

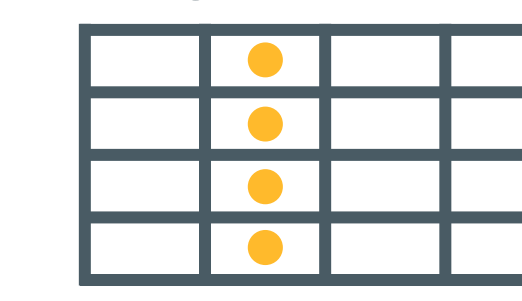


COGNITIVE LOAD VARIATIONS

Extraneous cognitive load added using a *dot memory* task.



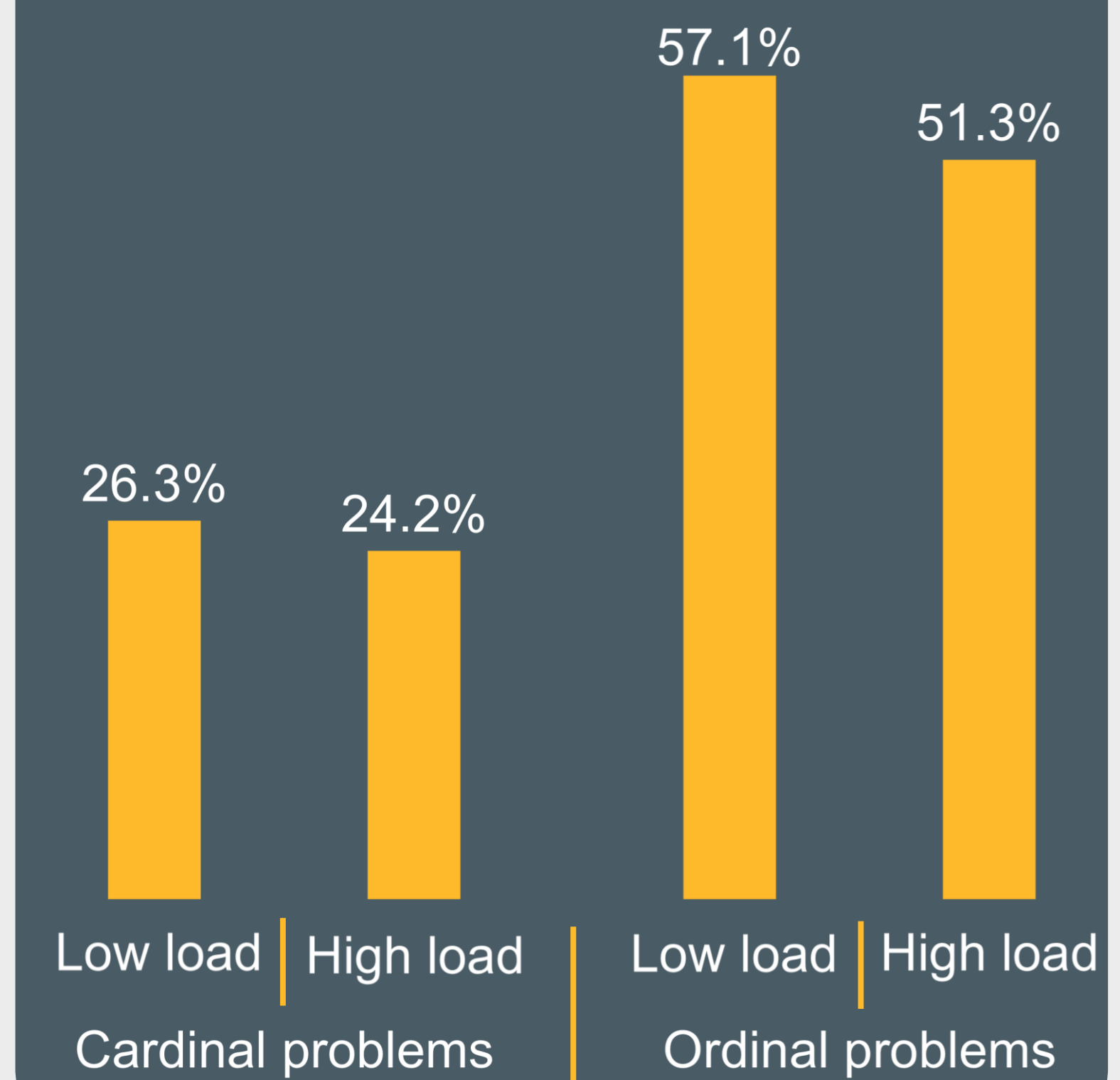
high load



low load

PRELIMINARY RESULTS

Rate of use of the 1-step strategy for problems with correct dot recall



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"



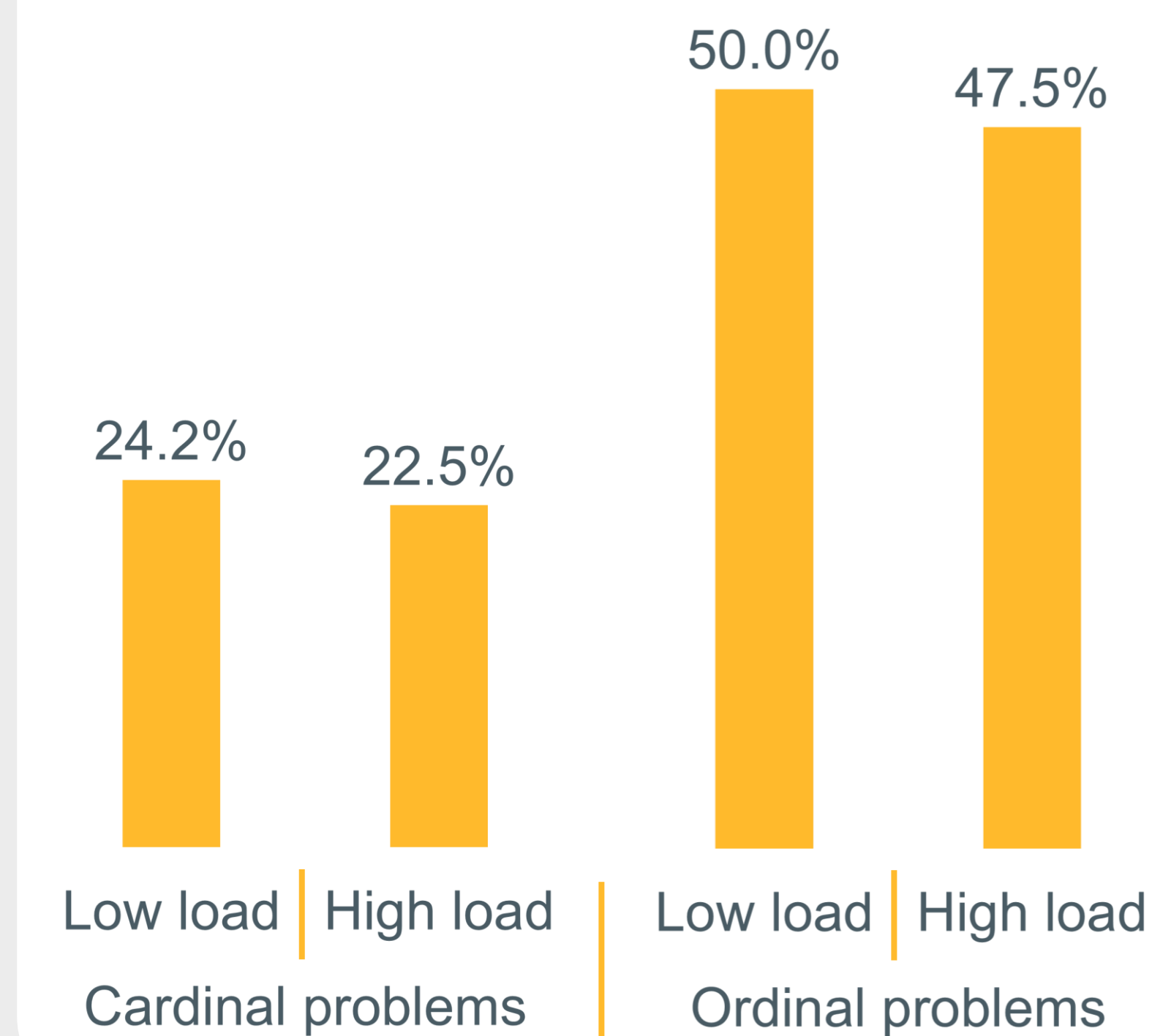
COGNITIVE LOAD VARIATIONS

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

This research is part of an ongoing project in collaboration with the University of Geneva (Katarina Govzdic, Emmanuel Sander), the University of Montpellier (André Tricot) and the University of Nîmes (Florence Lespiau). This project is funded by a research grant (CYIn-AAP2021-AmbEm-000000026) attributed to Hippolyte Gros by *CY Initiative*.

