

CLT meets WMU: Simultaneous experimental manipulation of load factors in a basal working memory task

INTRODUCTION

Research objectives

- Investigate potential of single experimental approach to provide simultaneous and separate measures for load-inducing facets in three-factorial framework of CLT
- Apply task paradigm of working memory updating (WMU; Ecker, Lewandowsky, Oberauer, & Chee, 2010) to facilitate selective and controlled manipulation of factors
- Contribute to valid empirical assessment and formalization of theoretically postulated assumptions on mental resource demands in instructional scenarios
- Shed light on learners' cognitive mechanisms and processes underlying certain task performance to derive predictions on support for successful learning

METHODS

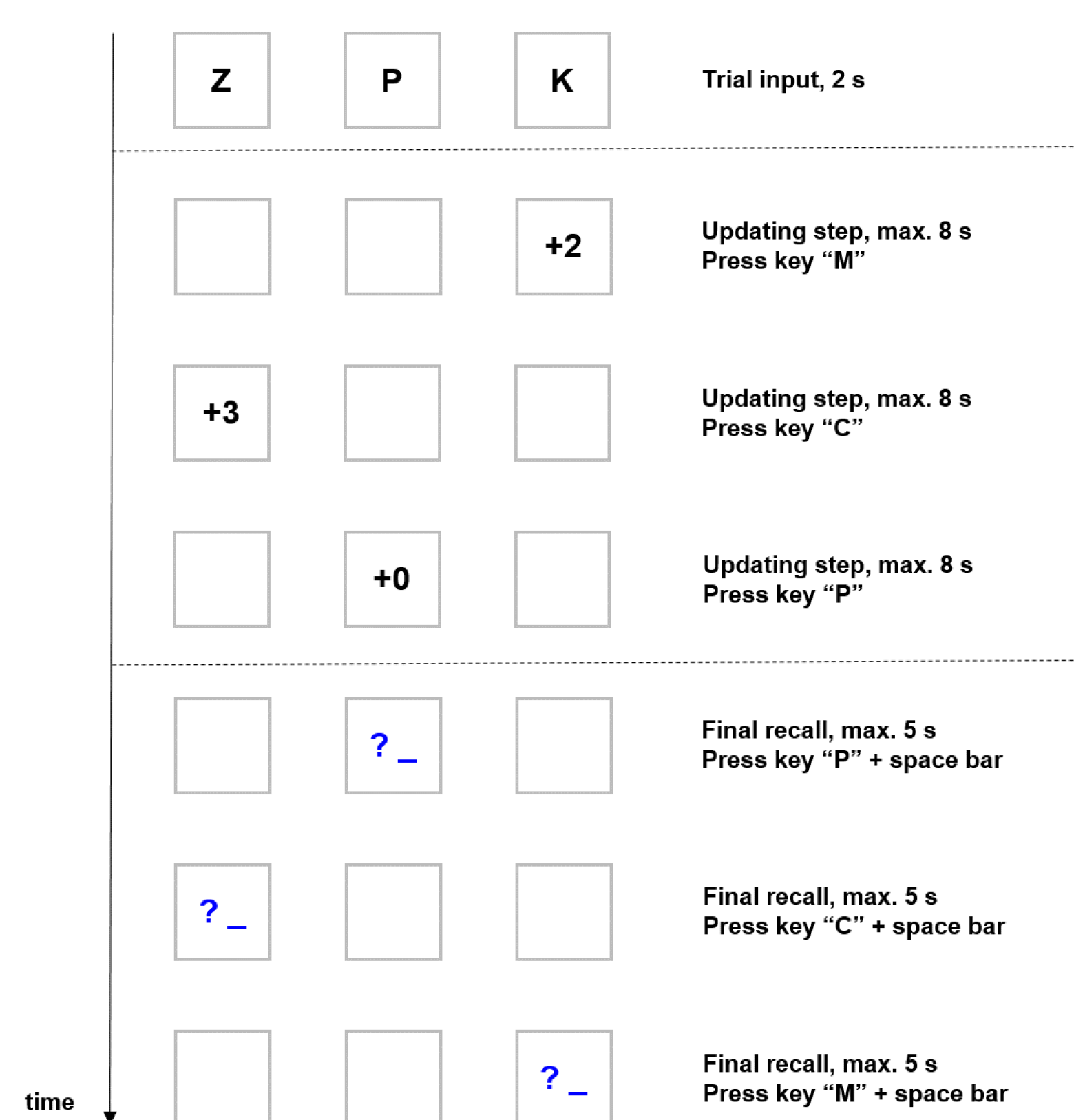


Figure 1. Sample trial sequence (practice trial).

Design

- 3 x 2 x 2 factorial within-subjects design (full repeated-measures)
- **IV:** complexity (low/medium/high), split attention (with/without), schema presence (with/without)
- **DV:** reaction times and errors in update and recall steps of the task

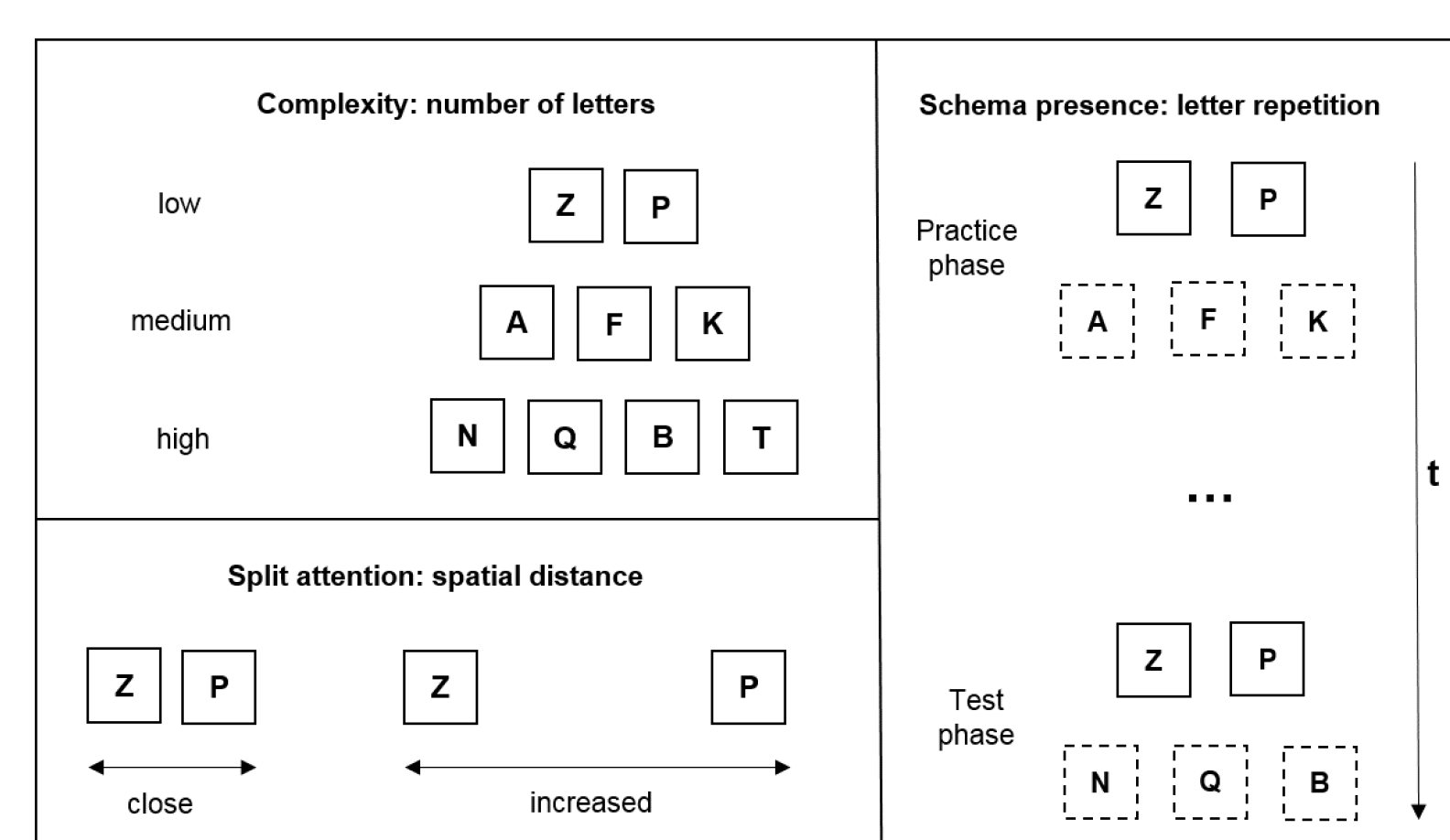


Figure 2. Experimental manipulations of IV.

Task

- WMU task with six practice and 24 test trials
- Presentation of framed letters from Latin alphabet at trial outset
- Six steps of alphabetic update transformations, followed by recall of final result for each letter frame

Participants

96 students ($M_{age} = 24.35$ years, range: 18-48 years, 79 % female)

RESULTS

Linear mixed models

- Observations nested within participants (two levels)
- Random effect for subjects and fixed effects for predictors included

Main effects

- Complexity: medium effects ($.277 < \beta < .442, p < .01$) for all RT and Error scores
- Split attention: small effects ($.033 < \beta < .056, p < .05$) for RT_{recall} and RT_{update}
- Schema presence: small effects ($-.039 < \beta < -.045, p < .05$) for $Errors_{recall}$, RT_{update} and $Errors_{update}$

Interaction effects

- Two-way interaction of complexity and split attention for RT_{update}
- Two-way interaction of complexity and schema presence for RT_{recall}
- Three-way interaction of all factors for $Errors_{update}$

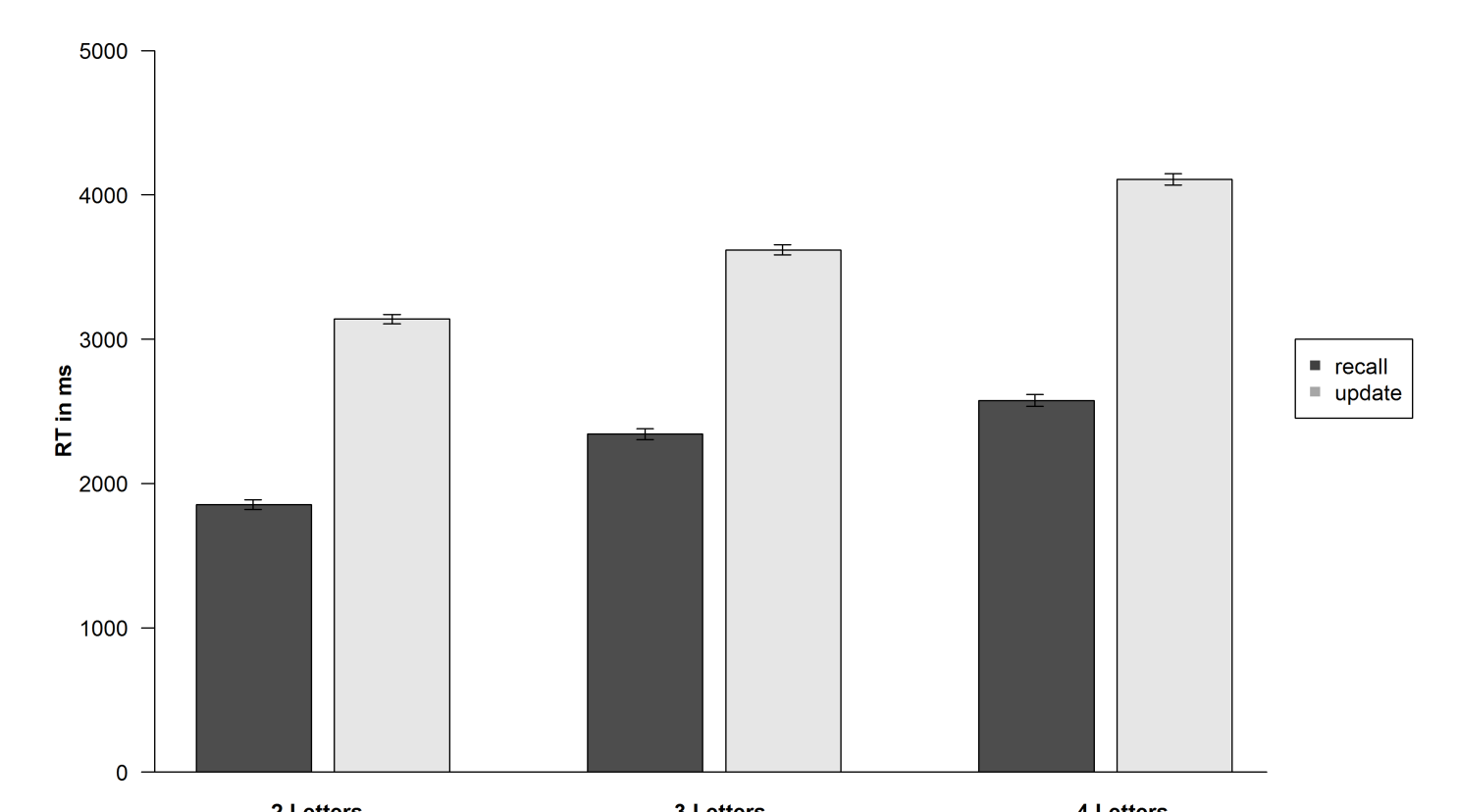


Figure 3. Effect of complexity on RT scores.

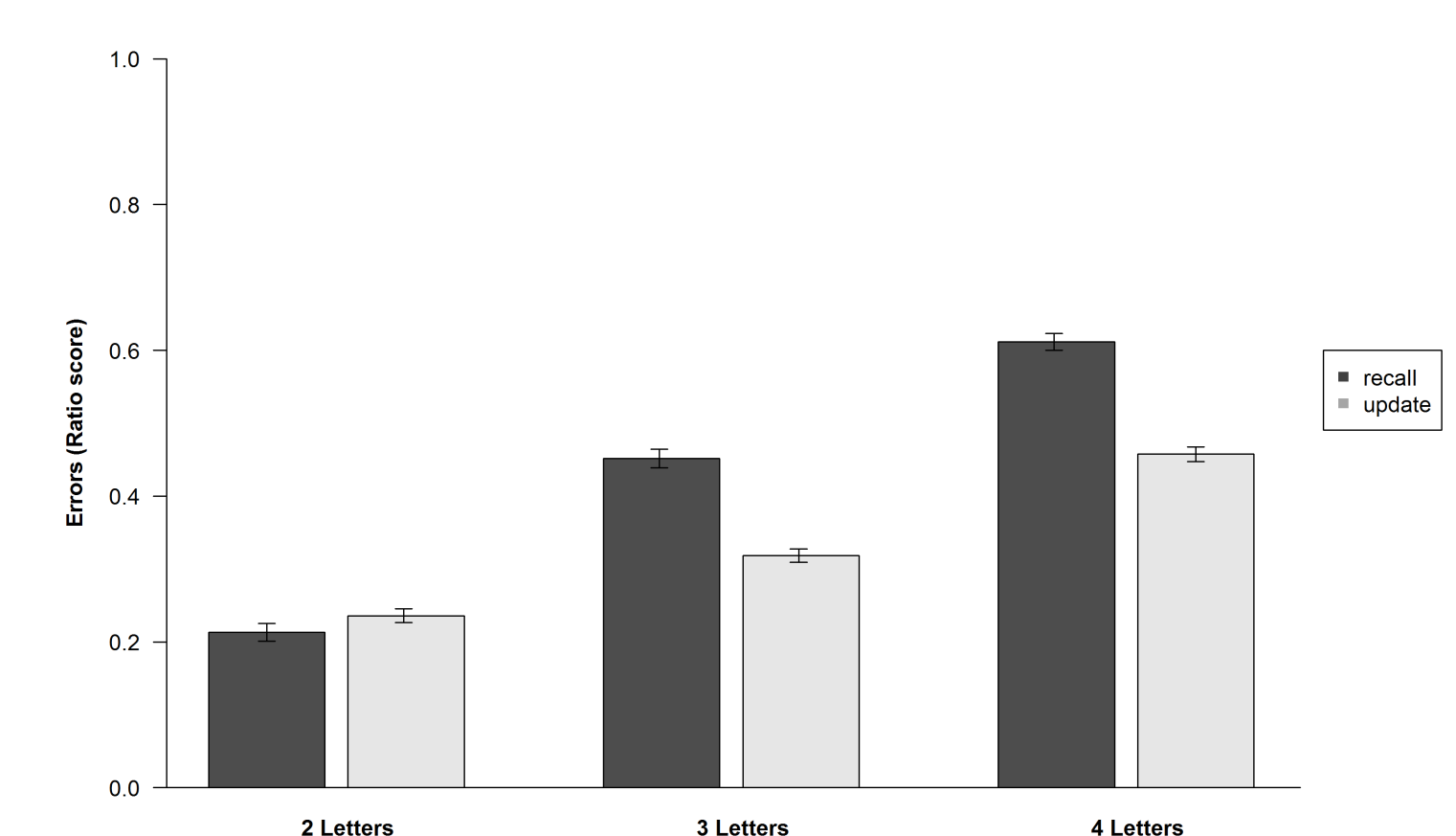


Figure 4. Effect of complexity on Error scores.

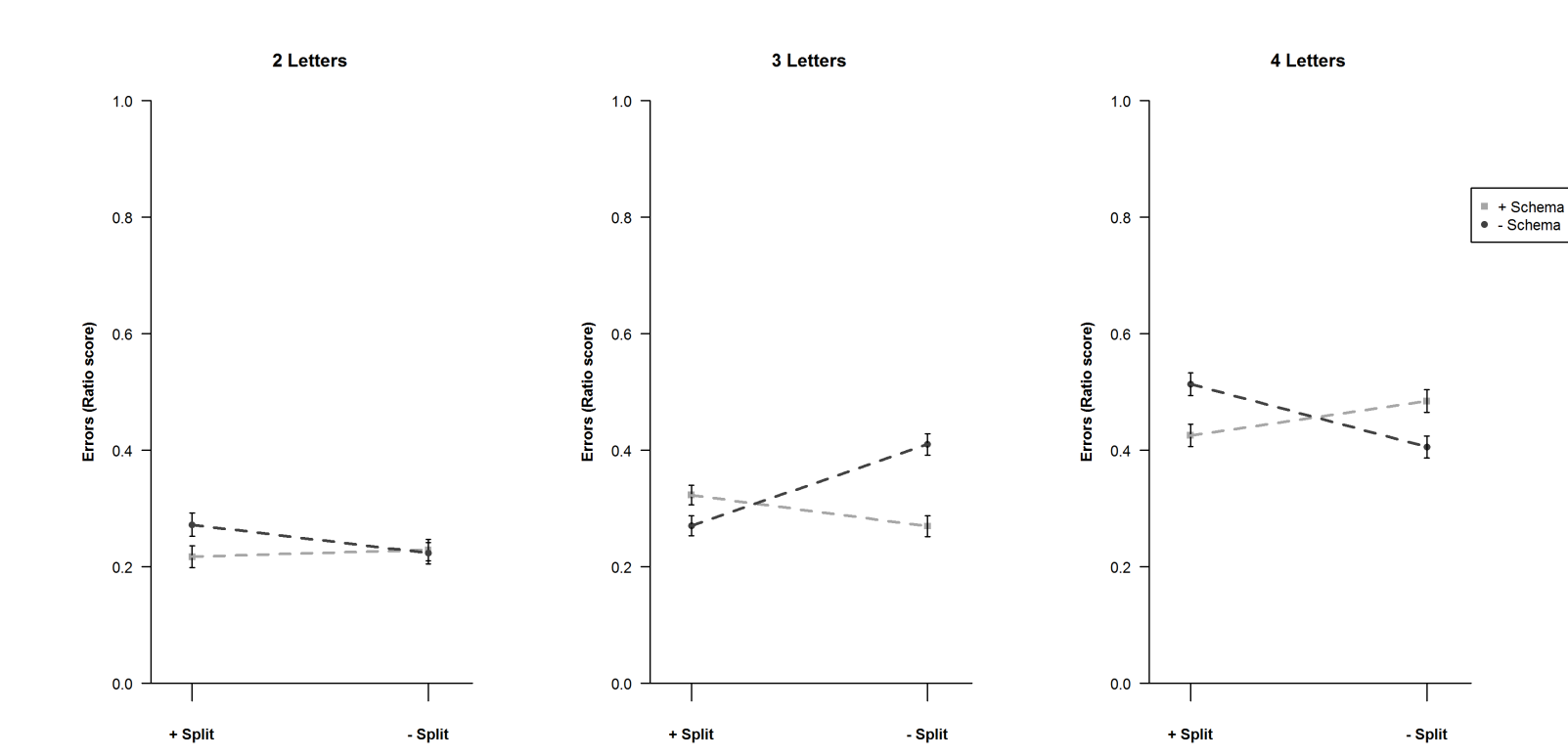


Figure 5. Three-way interaction for $Errors_{update}$

CONCLUSION

- Overlap between facets corresponds to recent approaches of CLT reformulation and supports assumption of distinct levels of observation between load-inducing factors (structural vs. processual load)
- Potential limitations in interrelations between facets on measurement level (e.g., distance between letters affected by number of letters presented on the screen) and overwhelming effect of complexity that could have reduced the potential of split attention and schema presence effects



Got interested?

Read the complete study in **Computers & Education!**

REFERENCES

- Ecker, U. K. H., Lewandowsky, S., Oberauer, K., & Chee, A. E. H. (2010). The components of working memory updating: An experimental decomposition and individual differences. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 36, 170-189.
- Wirzberger, M., Beege, M., Schneider, S., Nebel, S., & Rey, G. D. (2016). One for all?! Simultaneous examination of load-inducing factors for advancing media-related instructional research. *Computers & Education*, 100, 18-31.