GraphoGame Flemish: a computerized literacy training for children at cognitive risk for dyslexia

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Introduction

GraphoGame is a computerized child friendly learning environment designed to train early literacy skills in children. This tool has been applied in a range of alphabetic languages with mixed results regarding its effectiveness (Richardson & Lyytinen, 2014). We developed a first version for Flemish Dutch, which trains letter knowledge, phonological awareness skills in pre-reading children.

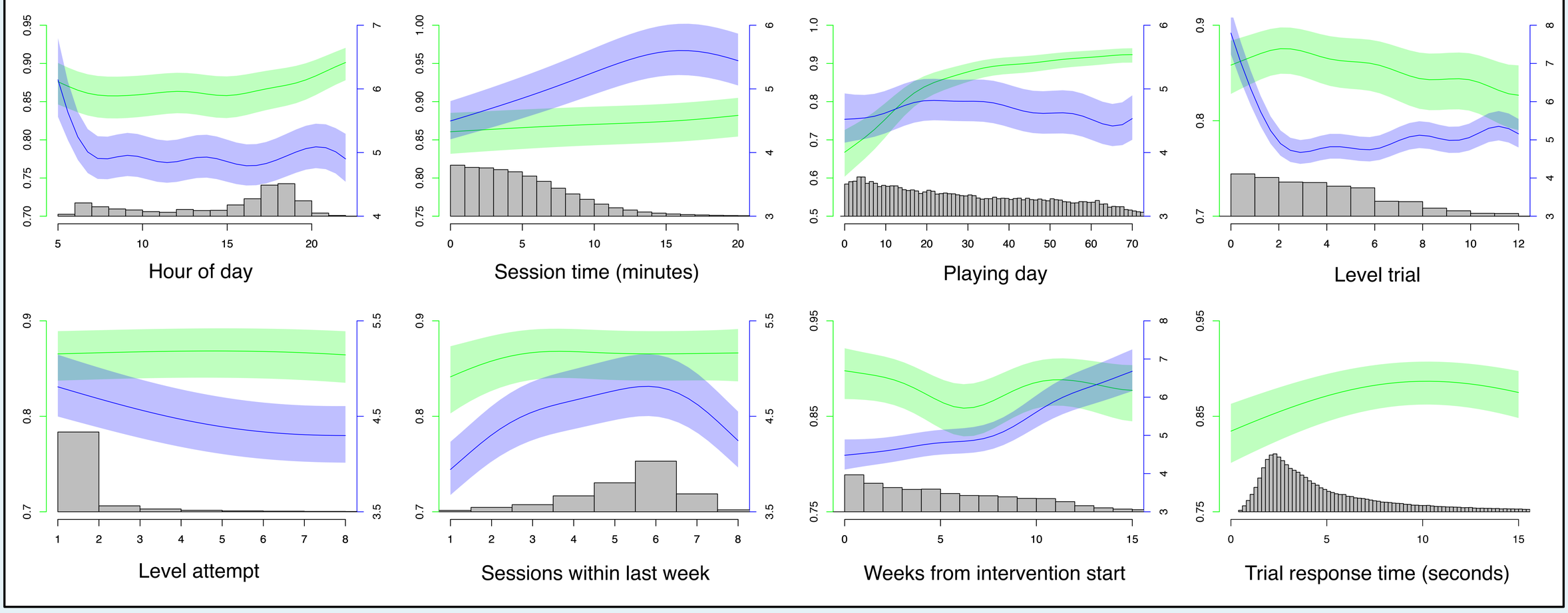
In this study we focus on the in-game data collected from children at cognitive risk for dyslexia during a 12 week intervention phase to investigate which factors impact accuracy and response times within the game.



Results

Accuracy - in percent - higher is better

Response time - in seconds - lower is faster



Materials and methods

For 12 weeks, 62 kindergarteners at cognitive risk for dyslexia (mean age 5;6) played a Flemish adaptation of GraphoGame for 15 minutes per day.

The game trained skills such as visual and auditory discrimination, letter knowledge, phoneme counting, whole word reading and spelling. It contains ~500 training targets, including simple and complex graphemes, syllables, monosyllabic words with and without consonant clusters.

We fitted two generalized additive mixed models (GAMM; Wood, 2006) on single trial accuracy and response time data. We followed a stepwise model selection using AIC to test the inclusion of possible main effects and interactions.

N	62
Gender (f/m)	28/34
Age (y;m)	5;6
IQ	101
Letter knowledge (PC)	23
Rapid automatized naming (PC)	25
Phonological awareness (PC)	25
Sessions played	61
Hours played	16

Which factors affect accuracy and speed in game-based learning?

We found a range of significant predictors, including time of day, exposure within a session, position within a level, or recent playing intensity. Children are:

- most accurate in the evening after 19h, towards the end of a 20 minute session, after playing for at least 30 days, in the first trials of a level, and in trials with slow responses.
- least accurate in the first playing days, in trials with fast responses, and if they did not play in the past 7 days.
- fastest in the afternoon around 16h, at the start of a gaming session, in the third trial of a level, when repeating an already played level, and at the start of the intervention phase.
- slowest in the morning around 6h, in the first two trials of a level, towards the end of gaming sessions, in the second half of the intervention phase, and when playing as advised 6 times a week.

Conclusion

Accuracy and response times gathered from digital game-based learning vary as a function of how a game is envisioned, designed and used. Comparing average accuracy and response times across studies is therefore not meaningful. Future work could explore additional predictors such as age, IQ, playing motivation, letter knowledge, or phonological awareness. Such insights can help to further improve digital game-based learning interventions by suggesting optimal level, session and intervention durations, as well as guide game design and content complexity considerations.

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