# Comparing Passive and Active Learning Conditions via Cognitive Modeling

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## Rationale

Address the limited quantitative research on the cognitive processes involved in active (AL) versus passive learning (PL) strategies

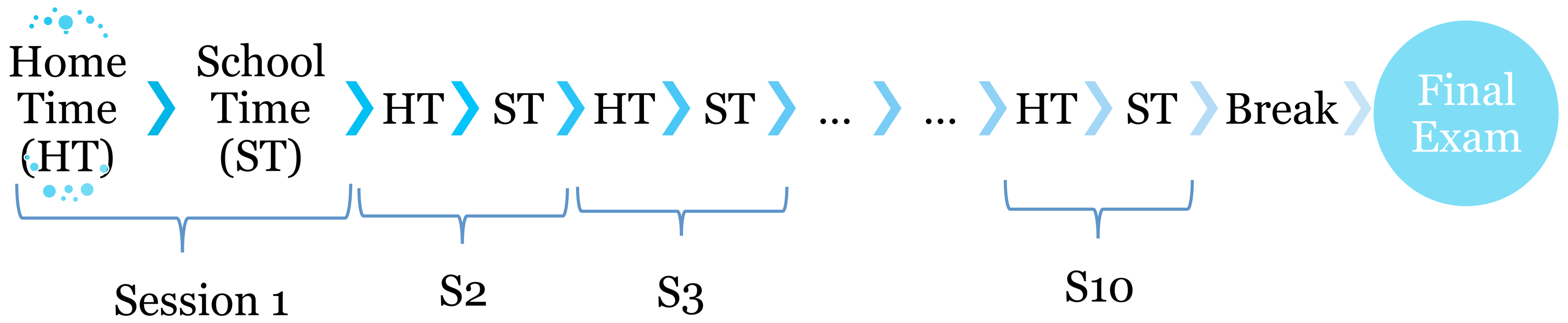
## Hypothesis

Active learning (Bonwell and Eison, 1991), with more opportunities to interact with the learning material than passive learning, will generally increase learner's performance.

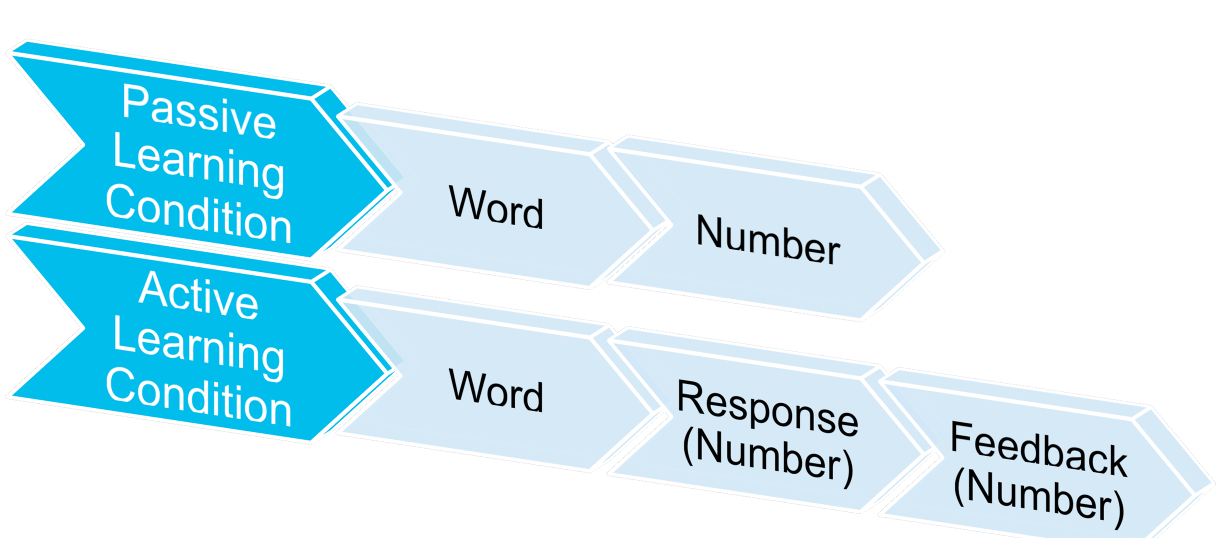
## Experiment Overview

- Investigate the merits of implementing active versus passive learning teaching methods by employing a computational cognitive model
- **Cognitive model** created in the ACT-R cognitive architecture (Anderson, 2007)
- **Paired–Associate task** (Anderson, 1981): learning of association between a word and number (e.g. DART - 9)
- **Stimuli** – administered by an external software
- **ACT–R computational cognitive architecture**:
  - Interacting modules supports the implementation of a theory of human cognition
  - declarative memory ( know what) and procedural memory (know how)
  - Working Memory – a module that holds and processes new and already stored information

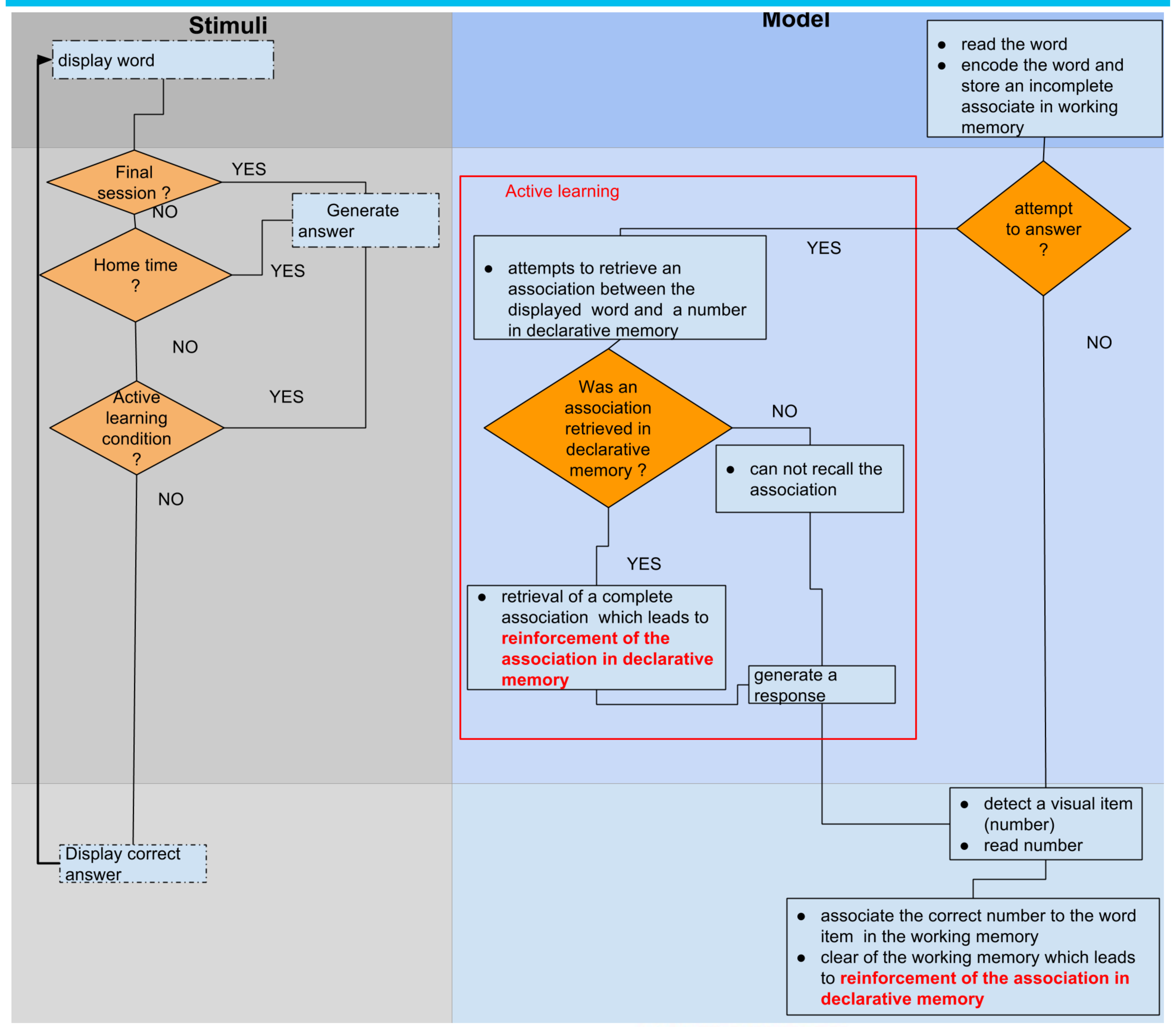
## Passive and Active Learning Conditions

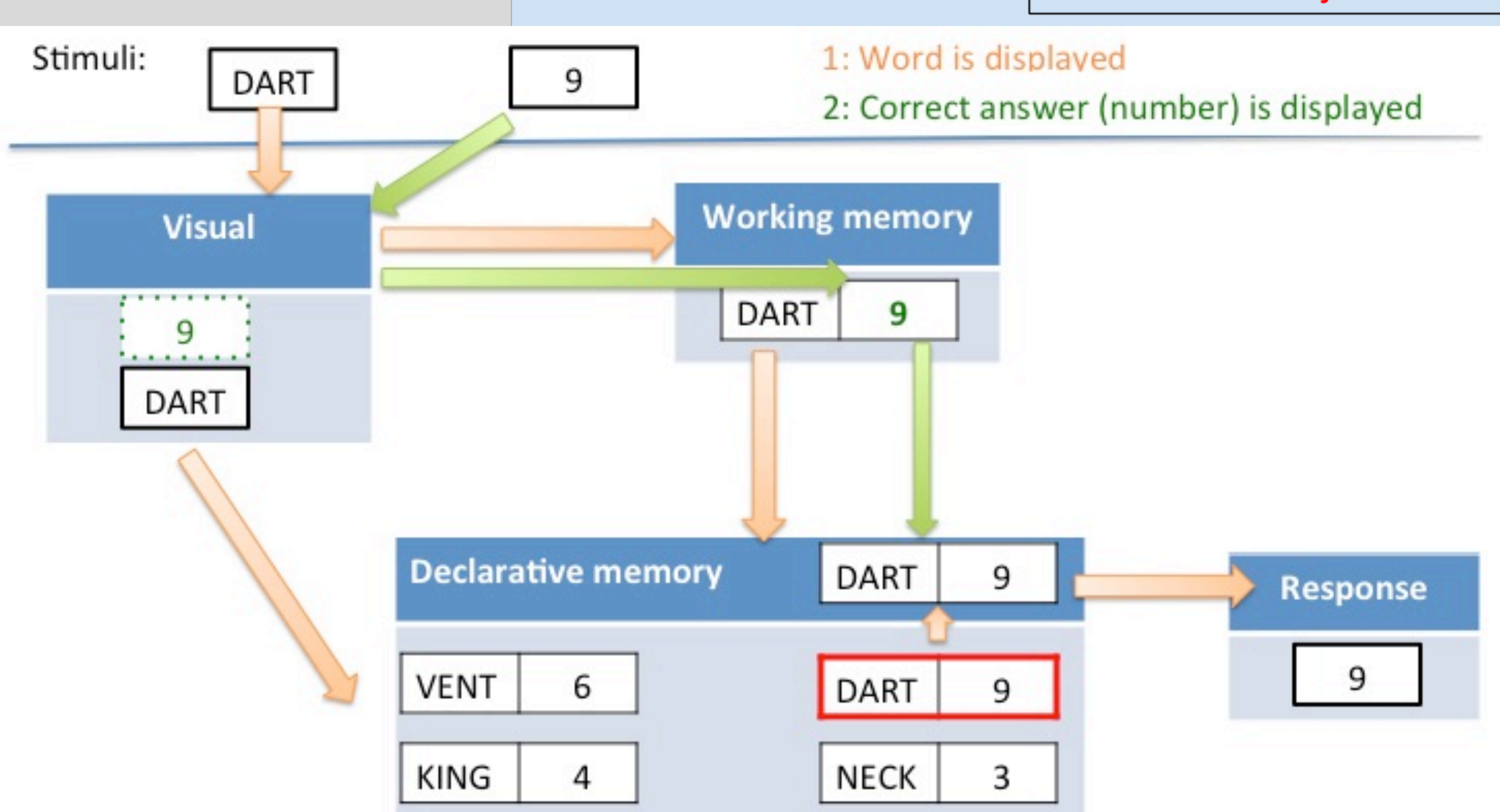



## Passive vs. Active Learning Condition (ST)




## Cognitive Model



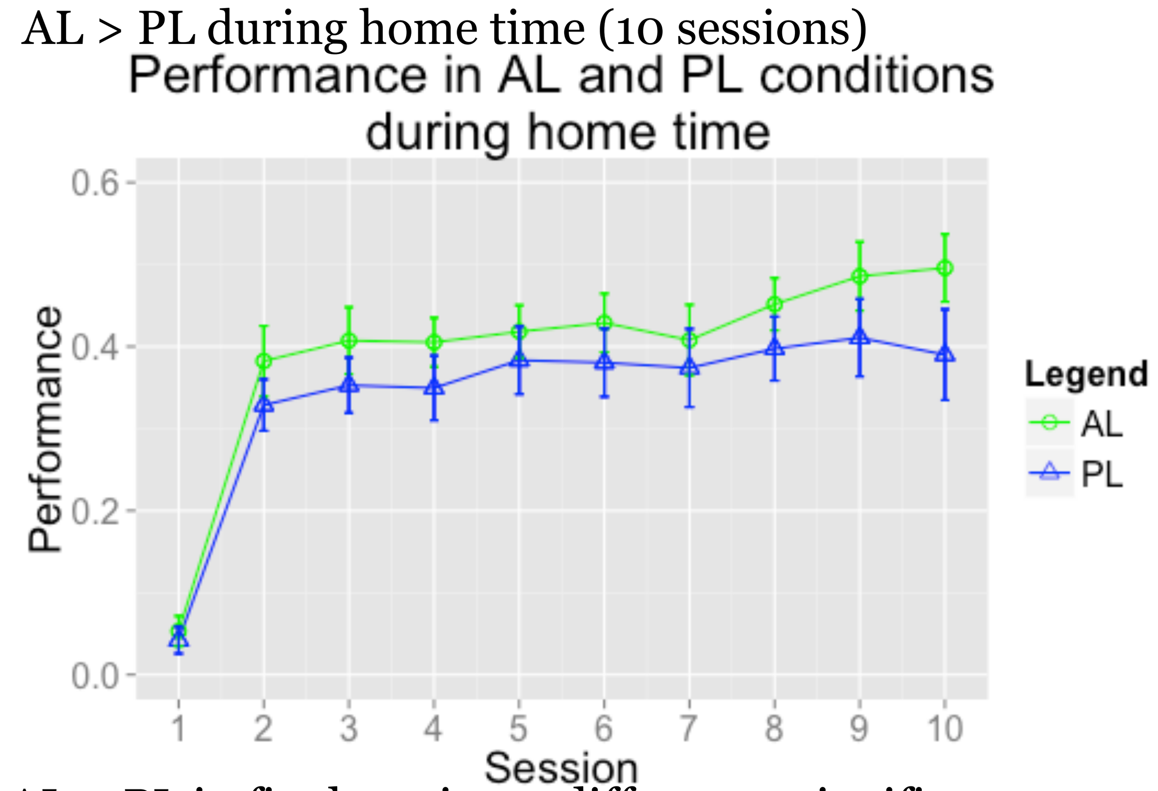




## Results

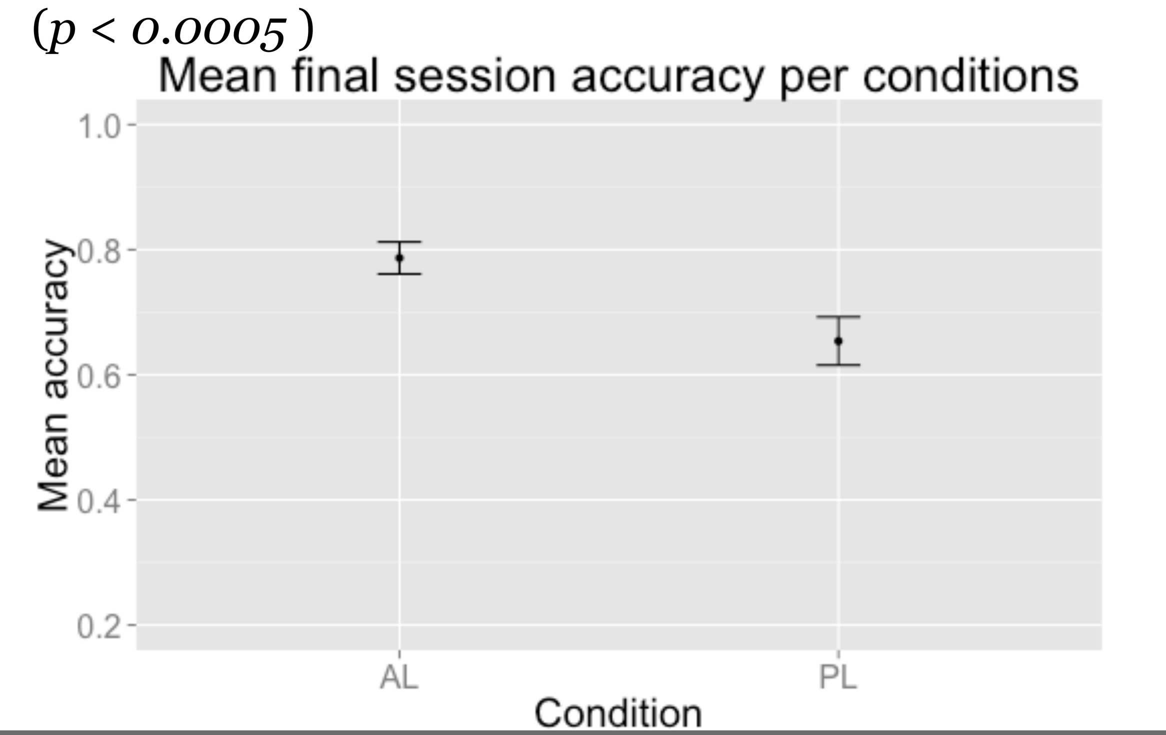
- Simulation parameters:

| Parameter | Value |
|---|---|
| Home time | 300 s |
| Number of words per session | 12 |
| Word increment per session | 4 |
| Number of sessions | 10 |
| AL: Answer duration time | 10 s |
| AL: Correct answer duration time | 10 s |
| PL: Word duration time | 10 s |
| PL: Correct answer duration time | 10 s |
| Final session answer duration time: | 10 s |

- AL > PL during home time (10 sessions)




- AL > PL in final session – difference significant ($p < 0.0005$)




## Conclusions

- Hypothesis confirmed
- A priori prediction for human participants: generating a response before the correct answer is displayed improves performance
- Future work: compare these simulation data with data from human participants

## Acknowledgements

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## References

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