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### Background

People who learn quickly recall more of the previously-learned material after a delay (e.g. 2 days or 1 week)<sup>1,2</sup>.

People who learn quickly also tend to relearn quickly in a same-day relearning session<sup>3</sup>.

This project addresses whether the relearning advantage for quicker learners is retained after a longer delay (i.e., 1 week). Specifically:

- 1) Do faster learners relearn faster 1 week later? If so, does this hold even after accounting for a) differences in delayed recall and b) item-level learning scores?
- 2) Do faster learners show greater savings in relearning 1 week later?

To address these questions, a drop-out procedure was used in an attempt to equate initial learning amount across quicker and slower learners.

### Methods

Participants from *Amazon Mechanical Turk*

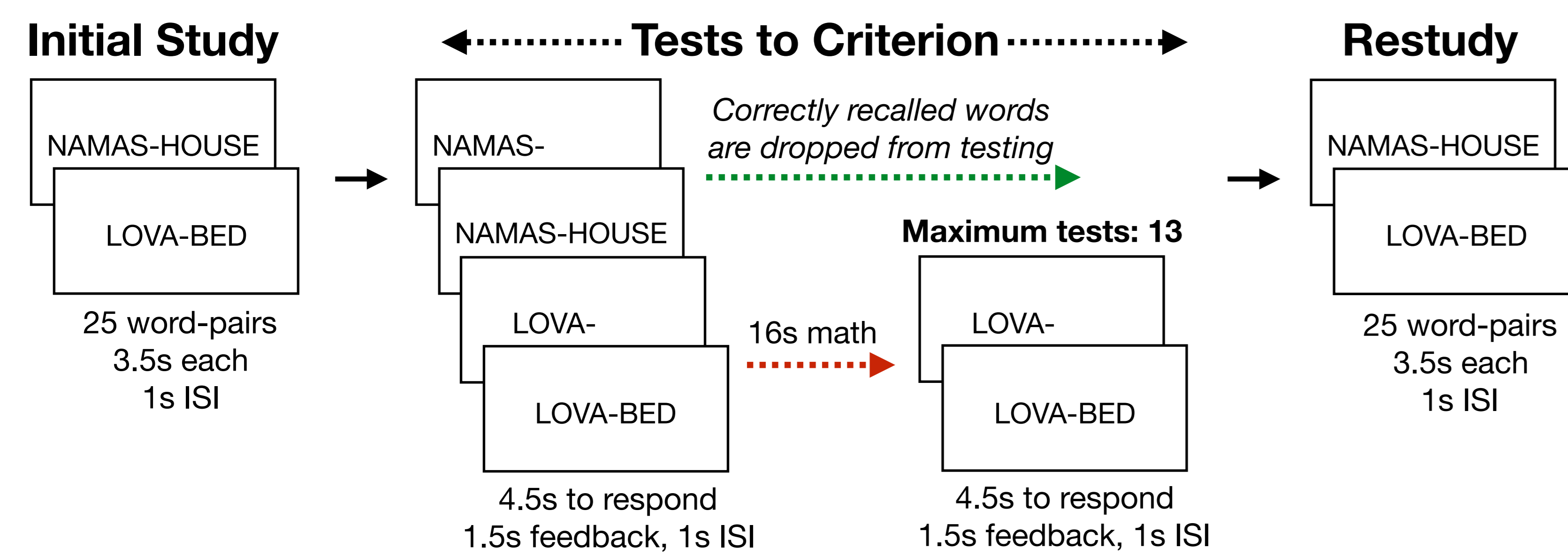
Included:  $N = 188$  (103 F, mean age = 35.2 yrs)

Excluded during or following task:  $N = 109$  (e.g., noted words, restarted task, etc.)

Two Sessions:

#### Session 1: Initial learning

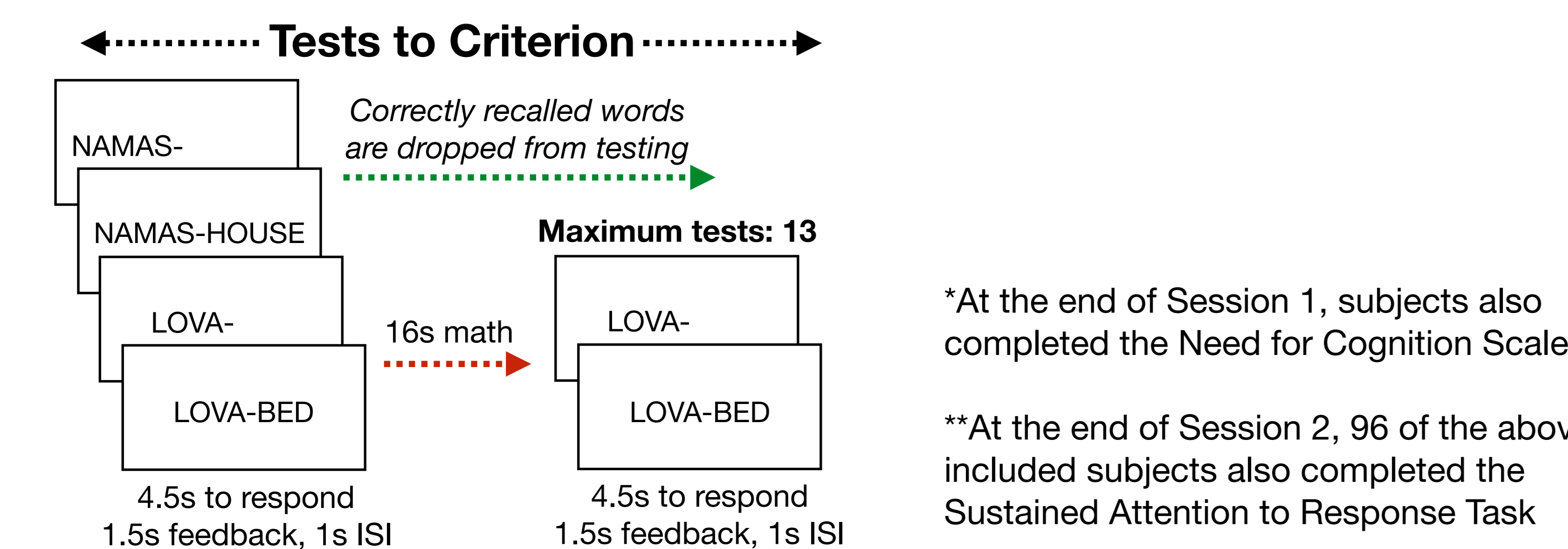
Participants study 25 word-pairs, take repeated cued-recall tests using a drop-out procedure with feedback, and restudy the word-pairs.\*



Delay: ~1 week

#### Session 2: Relearning

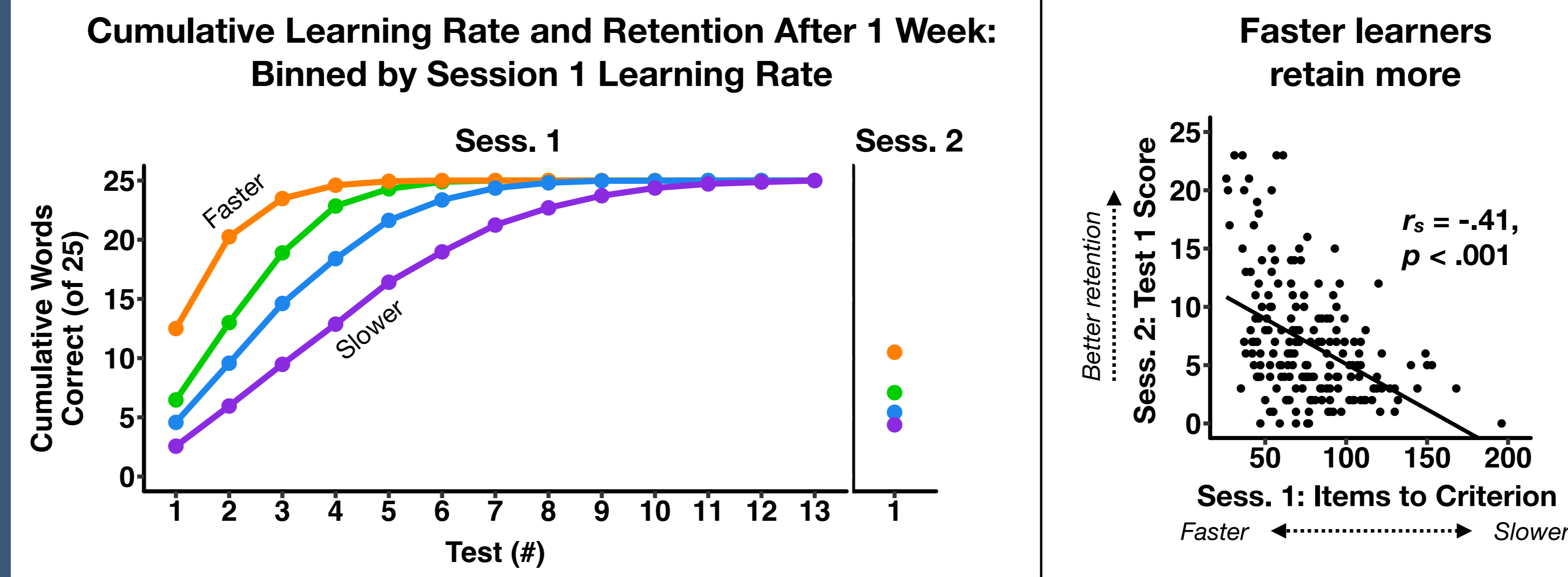
Participants take repeated cued-recall tests using the same test procedure.\*\*



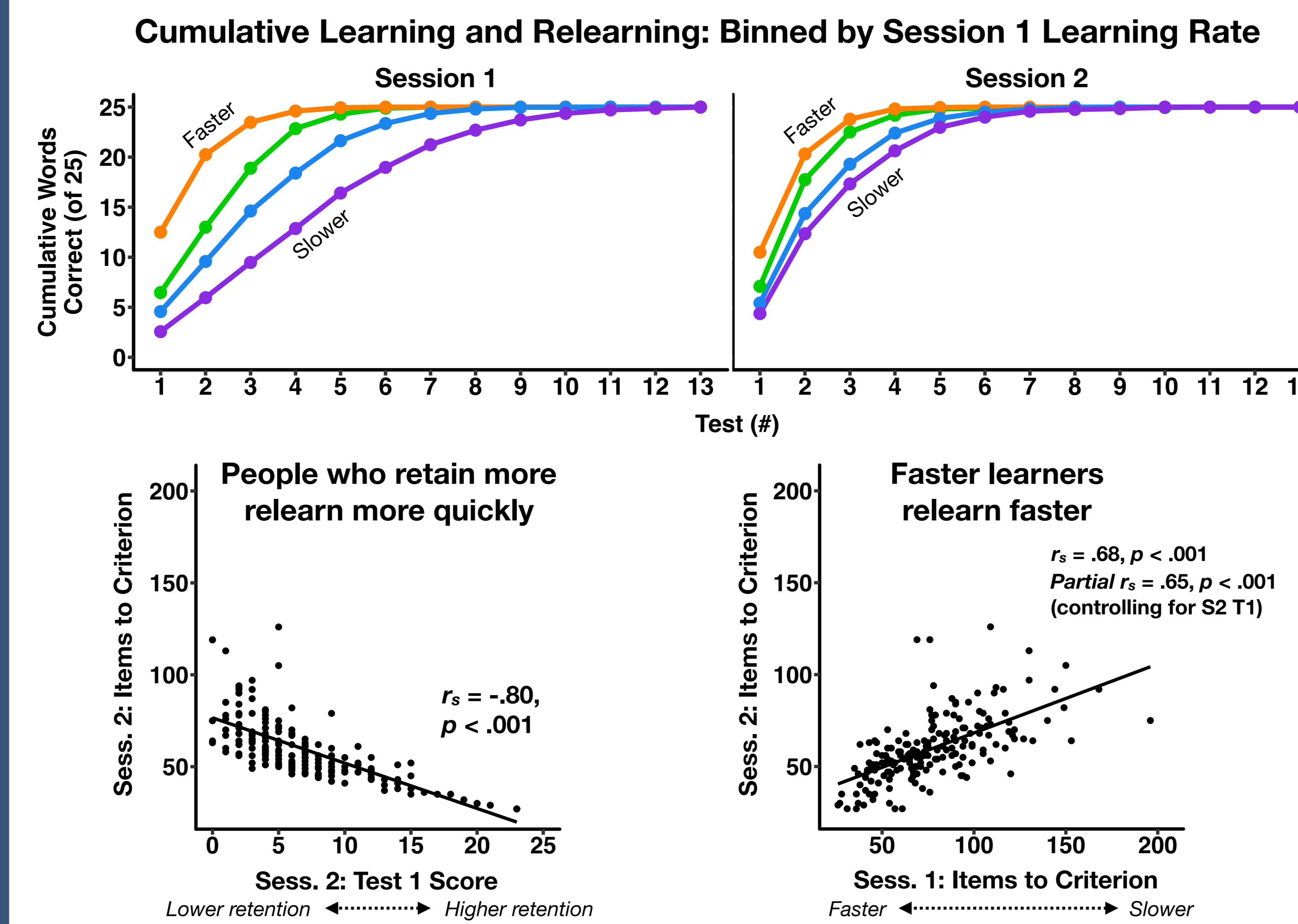
\*At the end of Session 1, subjects also completed the Need for Cognition Scale

\*\*At the end of Session 2, 96 of the above included subjects also completed the Sustained Attention to Response Task

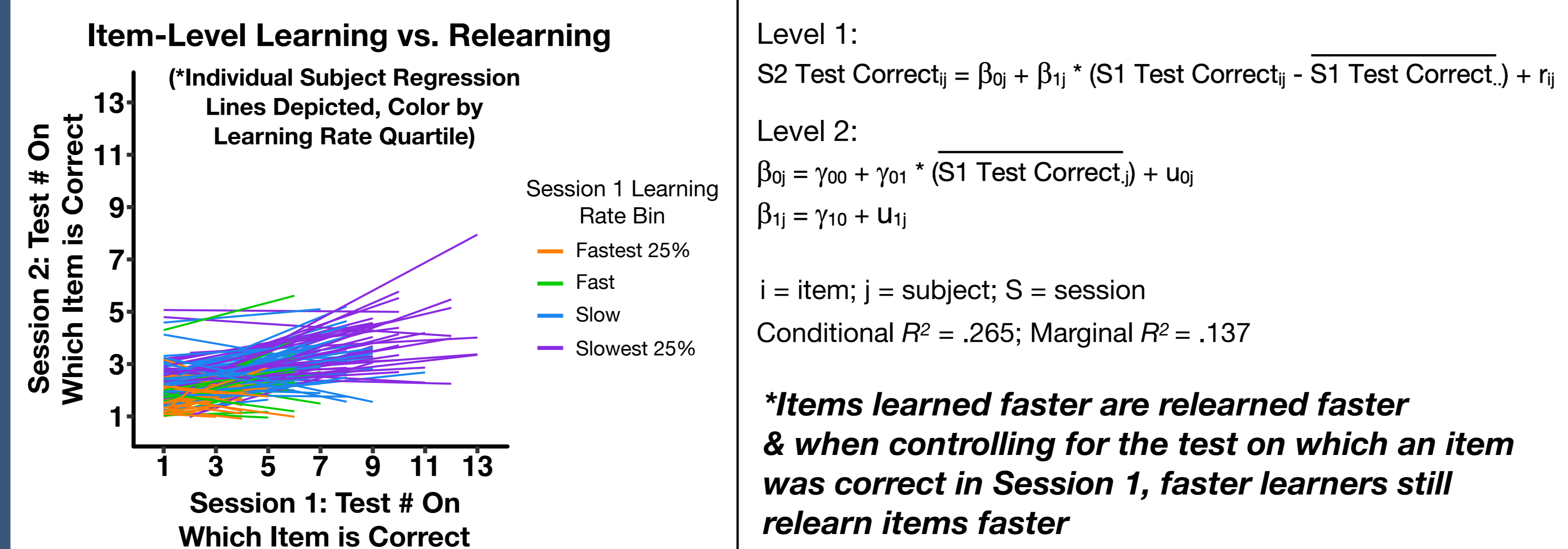
### Faster learners remember more on a test 1 week later, replicating prior literature



### Faster learners relearn faster 1 week later, even after controlling for a) the number of items to relearn and b) item-level initial learning



Hierarchical linear modeling reveals that item-level relearning is predicted by 1) initial learning performance for that item and 2) the individual's average initial learning performance



Level 1:  
 $S2 \text{ Test Correct}_{ij} = \beta_{0j} + \beta_{1j} * (S1 \text{ Test Correct}_{ij} - \overline{S1 \text{ Test Correct}_{ij}}) + \epsilon_{ij}$

Level 2:  
 $\beta_{0j} = \gamma_{00} + \gamma_{01} * (\overline{S1 \text{ Test Correct}_{ij}}) + u_{0j}$   
 $\beta_{1j} = \gamma_{10} + u_{1j}$

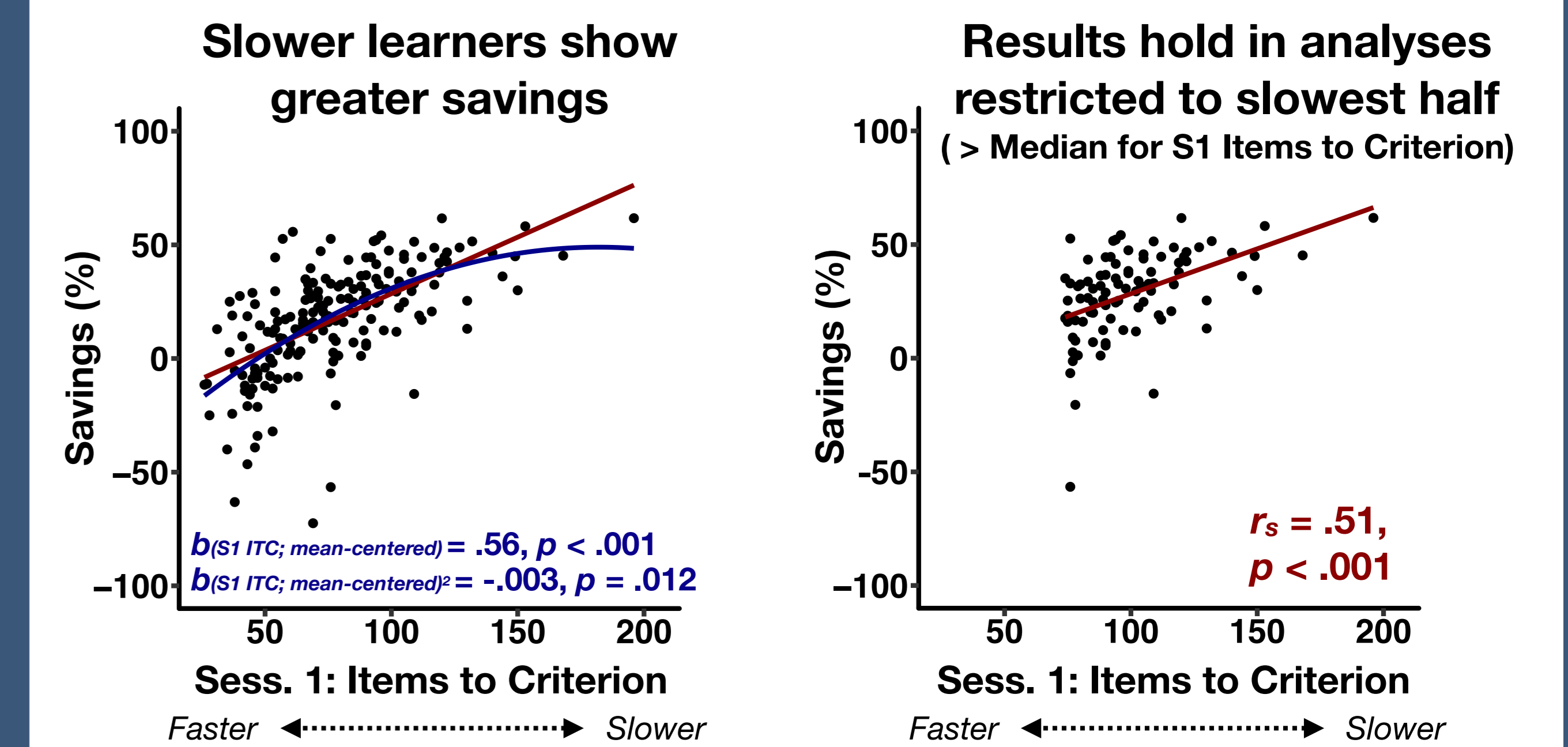
$i = \text{item}; j = \text{subject}; S = \text{session}$   
 Conditional  $R^2 = .265$ ; Marginal  $R^2 = .137$

\*Items learned faster are relearned faster & when controlling for the test on which an item was correct in Session 1, faster learners still relearn items faster

### Slower learners, however, show greater savings in relearning

% Savings calculation<sup>4</sup>:

$$\frac{\text{Sess. 1 Items to Criterion} - \text{Sess. 2 Items to Criterion}}{\text{Sess. 1 Items to Criterion}} \times 100$$



Due to potential ceiling effects for faster subjects (i.e. subjects who learn more quickly have little room to improve), analyses were also performed restricted to subjects in the slower 2 learning quartiles (right plot). The same pattern of results appeared, except that there was no significant quadratic term.

### Conclusions

Faster learners relearned faster after a week delay.

This correlation held after:

- a) accounting for scaling effects (i.e. faster learners remembered more after a week and so had fewer items to relearn).
- b) controlling for item-level effects with HLM

However, slower learners demonstrated greater savings in relearning. Interpretation of these differences in savings can be challenging<sup>5,6</sup>.

These findings align well with prior work using other techniques that aim to equate initial learning amount, suggesting that the findings are robust to the particular deficiencies of any one technique<sup>e-g,6,7</sup>.

References

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