



NUMBER VALUE AND THE SIZE WE PERCEIVE

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אוניברסיטת בן-גוריון בנגב
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BACKGROUND

- Big numbers are perceived as larger in size.
- Numbers are building blocks.
- Numerical processing predicts math competency ($r = 0.3$).

INTRODUCTION

- **Conceptual size** is processed automatically and interacts with numerical judgments.
- Conceptual size describes the size of something as it is perceived in our mind. For example, big numbers feel larger in size.
- We have a basic system that allows us to perceive and manipulate sizes, and it is the basis of number processing.
- A number's value is processed automatically even if it is not related to the task we are doing, and it affects our judgment.

METHODOLOGY

- Participants (N = 84) viewed number pairs and reported according to physical size.
- We used a Multiple-Processing Tree (MPT) model.
- Number-size congruity was manipulated.
congruent: $\begin{matrix} 2 & 5 \\ 2 & 5 \end{matrix}$
incongruent: $\begin{matrix} 2 & 5 \\ 5 & 2 \end{matrix}$
- Participants completed a Math Fluency test.

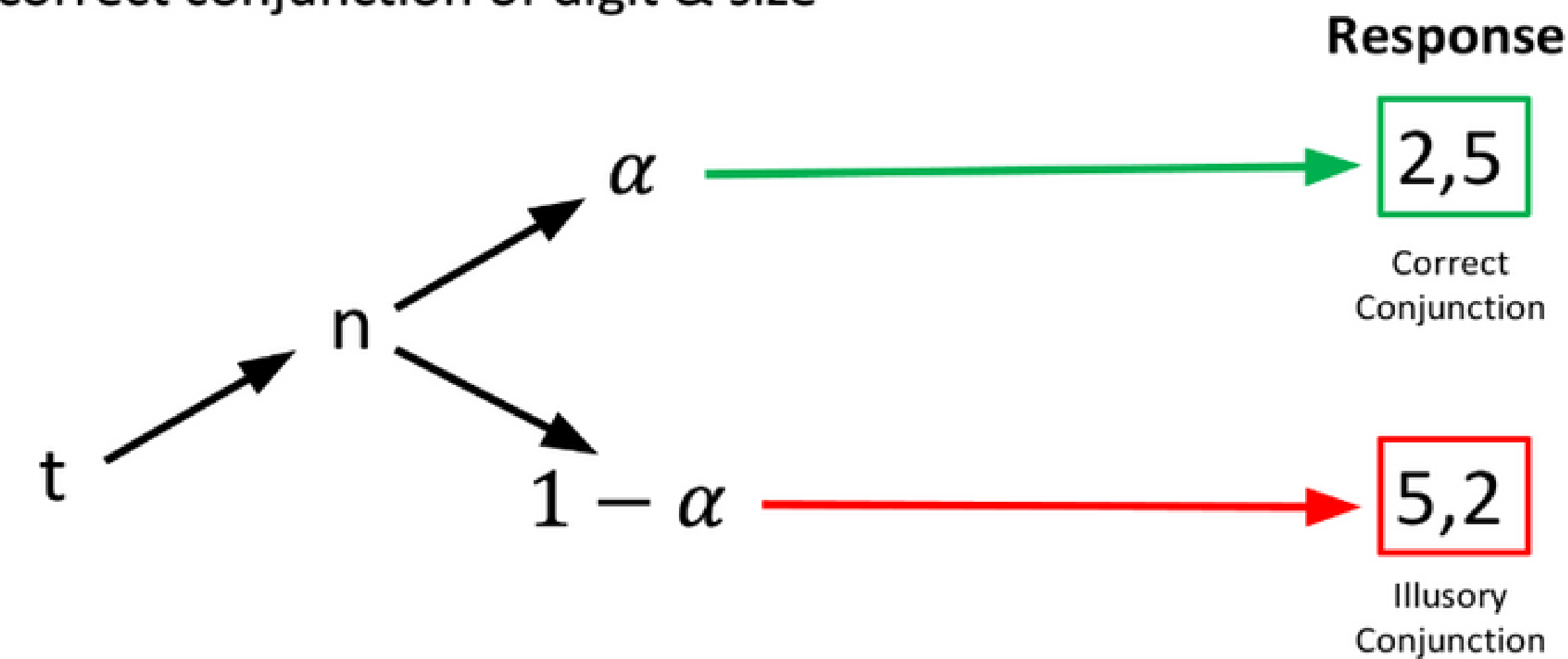
OBJECTIVE

Find if the ability to associate numbers with magnitudes (size) correlates with higher mathematical skills.

t – correct encoding of target digit

n – correct encoding of non-target digit

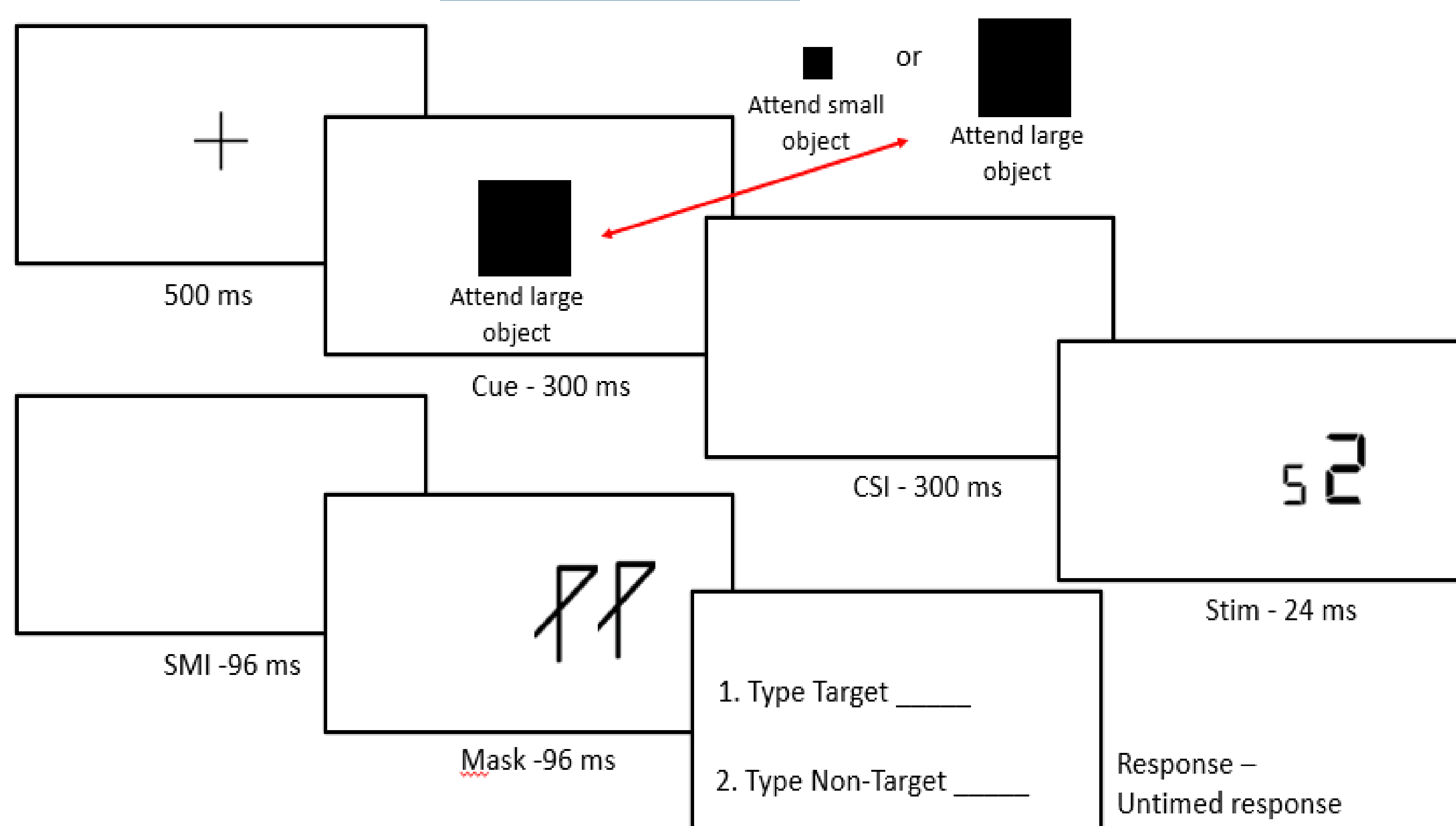
α – correct conjunction of digit & size



MATH FLUENCY TEST EXAMPLES

16-13=___ | 4*9=___ | 10:5=___ | 17+15=___
10-2=___ | 9*1=___ | 40:10=___ | 5+2=___

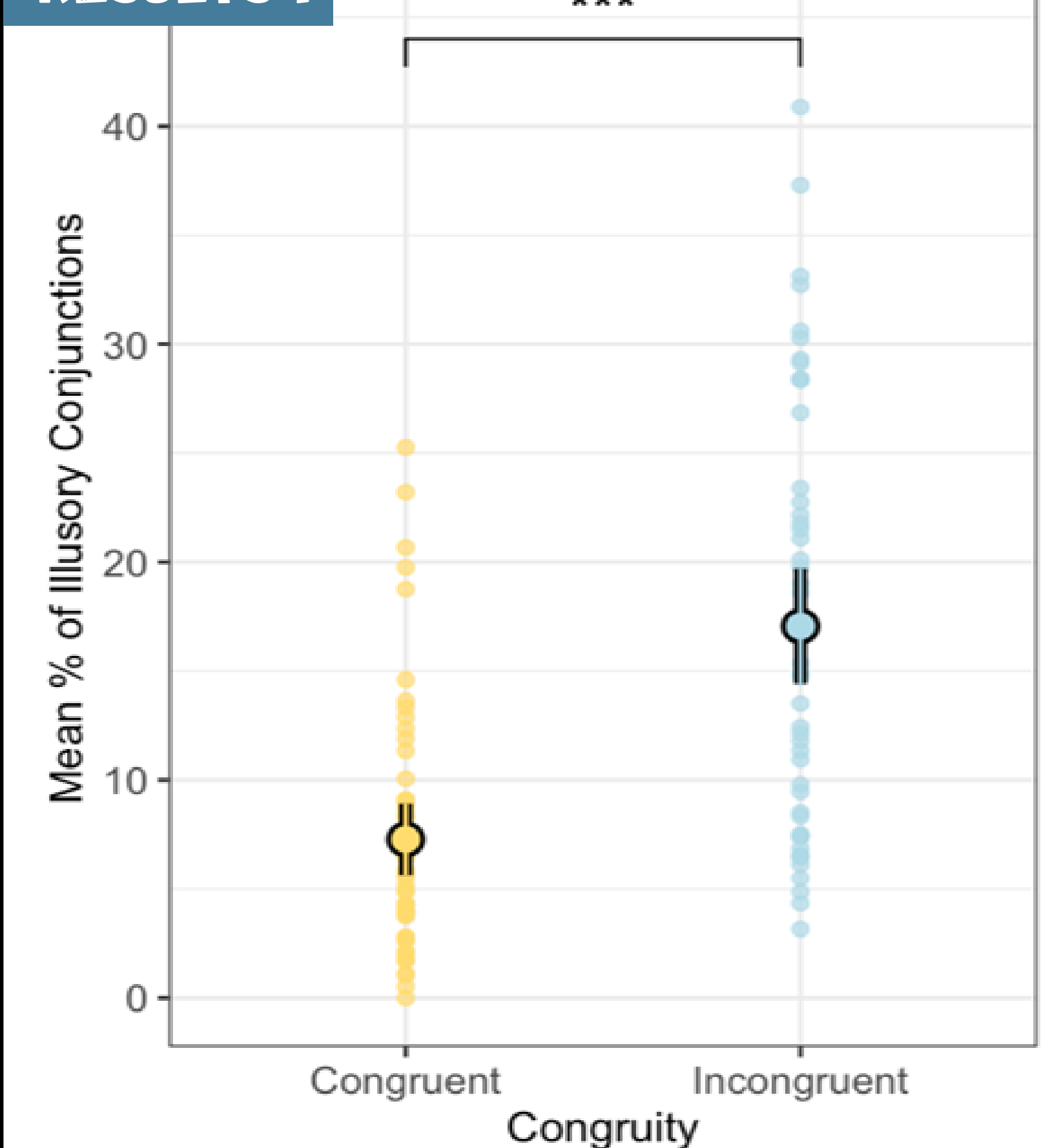
TRIAL SEQUENCE



OVERALL RESULTS

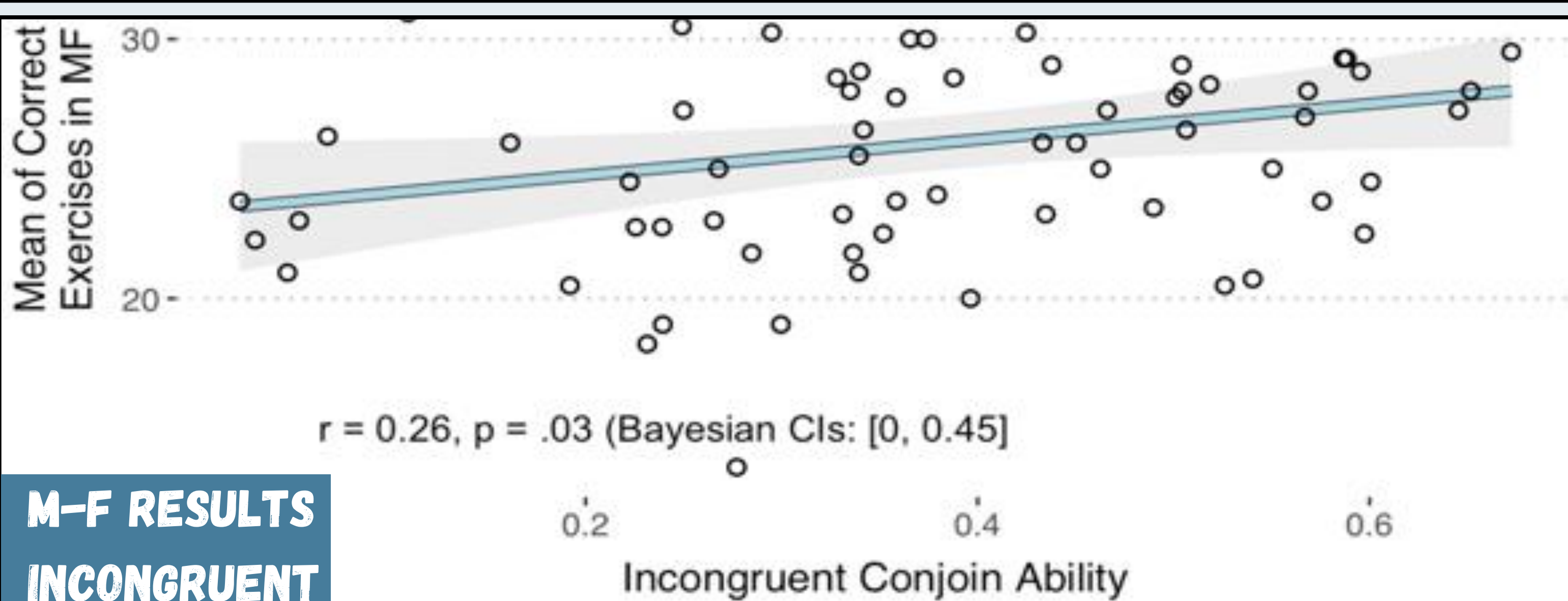
- Illusory conjunctions were more frequent on the incongruent than congruent condition.
- No difference between: t (congruent) and t (incongruent)
- Significant difference between:
a (congruent) > B (congruent)
a (incongruent) > B (incongruent)
a (congruent) > a (incongruent)
B (congruent) > B (incongruent)

RESULTS 1

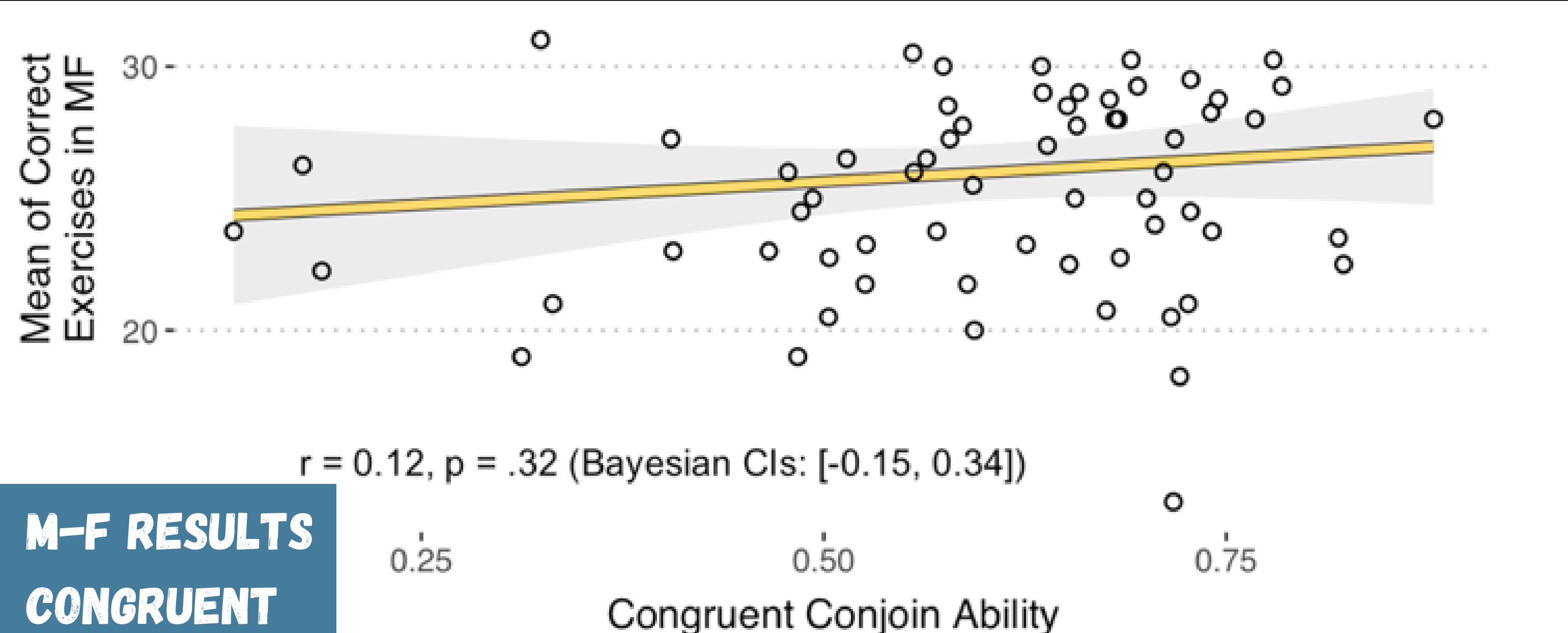


M-F RESULTS

- **No** significant relationship between the ability to couple the target digit & the right size and M-F performance in the congruent condition.
- **Significant** relationship between the ability to couple the target digit & the right size and M-F performance in the incongruent condition.

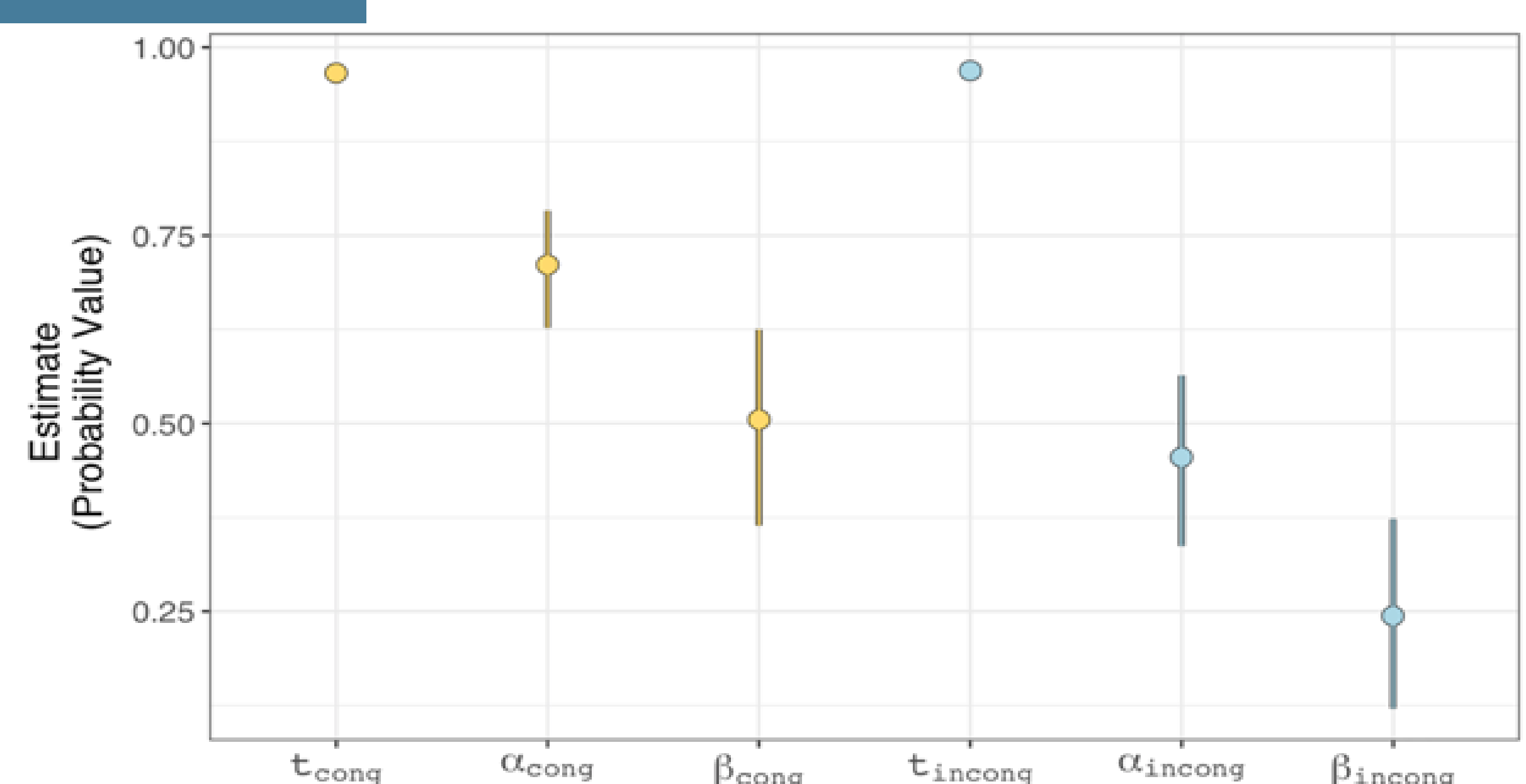


M-F RESULTS INCONGRUENT



M-F RESULTS CONGRUENT

OVERALL RESULTS 2



DISCUSSION

Is there a connection between mathematical abilities and executive functions? Should mathematical abilities be tested in a different way? Executive functions are related to domain control (arithmetic ability, cognitive control) and include functions that help manage conflicting information and delay response. Domain control is characterized by automaticity of the response and the ability to delay it. We found that the ability to suppress information (higher domain control) about the digit's value (which is not relevant) is correlated with higher arithmetic ability.

CONCLUSION

The probability of matching the target digit and the correct size in the incongruent condition is correlated with math ability. The ability to control the coupling between a number's value and a certain size is related to the arithmetic ability of individuals.