

Interfering with fluid intelligence:

When competing answer alternatives influence Raven's performance

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Motivation

The Raven's Advanced Progressive Matrices task¹ is one of the most widely used measures of fluid intelligence.

There is tantalizing evidence that Raven's performance improves following extensive n-back training,²⁻³ yet the mechanisms governing these transfer effects remain largely unidentified.⁴

Little is also known about the cognitive abilities that conspire to influence Raven's performance, including interference resolution (or the ability to select among multiple conflicting options⁵).

We examined the role of interference resolution in Raven's by manipulating the degree to which answer alternatives conflicted with the correct response for problems.

One recent study linked performance on a similar version of modified Raven's to working memory capacity.⁶

Here we sought to extend this profile of results by asking:

- (1) Does the amount of interference among answer alternatives affect Raven's performance?
- (2) Does the presence of interference alter Raven's test-retest effects?

Material Creation

Data from 188 participants across several studies was aggregated.

Incorrect answer alternatives were ranked in terms of interference based on how often they were selected by participants.

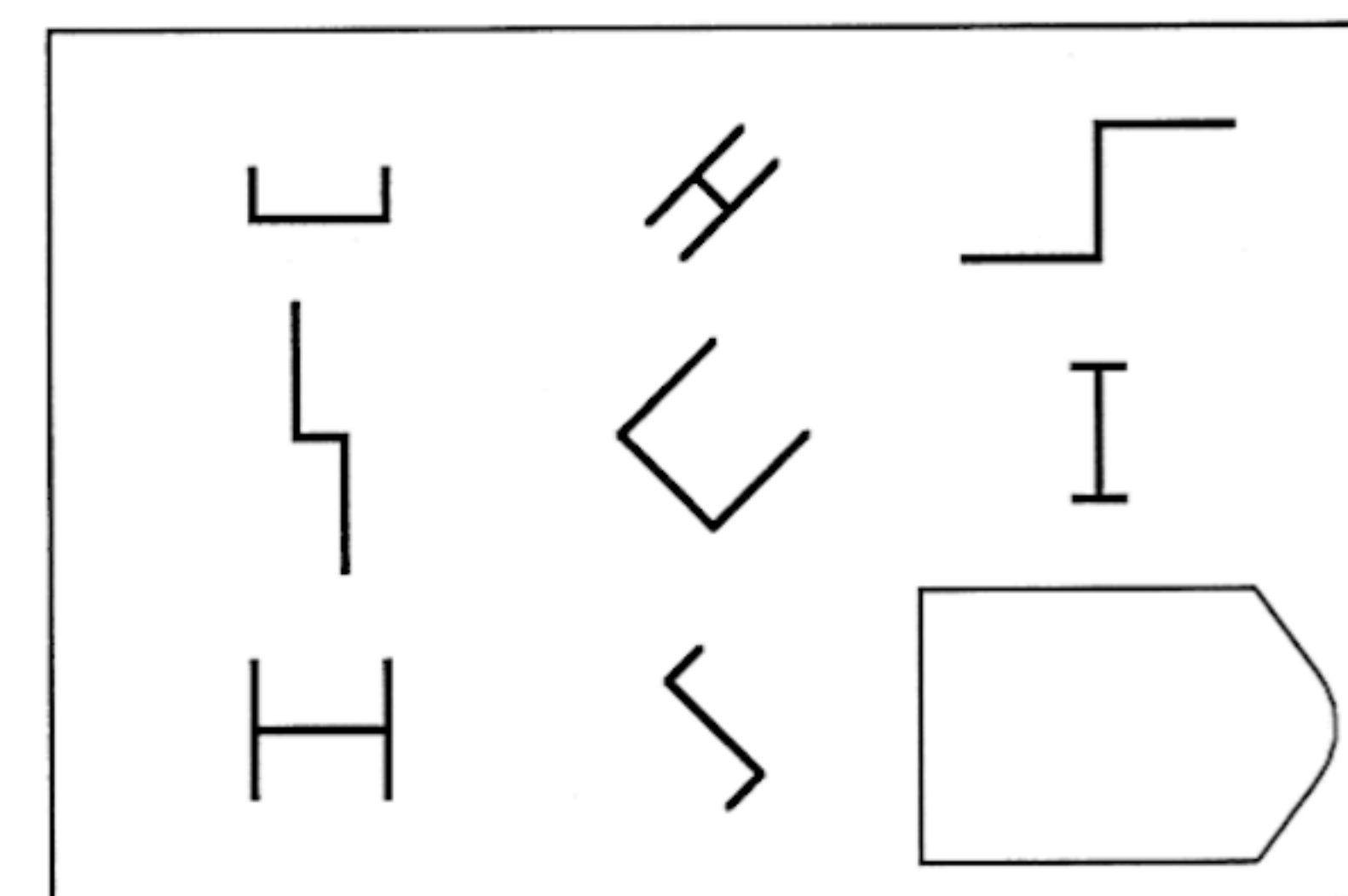
Versions of each Raven's problem were created:

1. High-interference contained the 3 most selected incorrect options
2. Low-interference contained the 3 least selected incorrect options

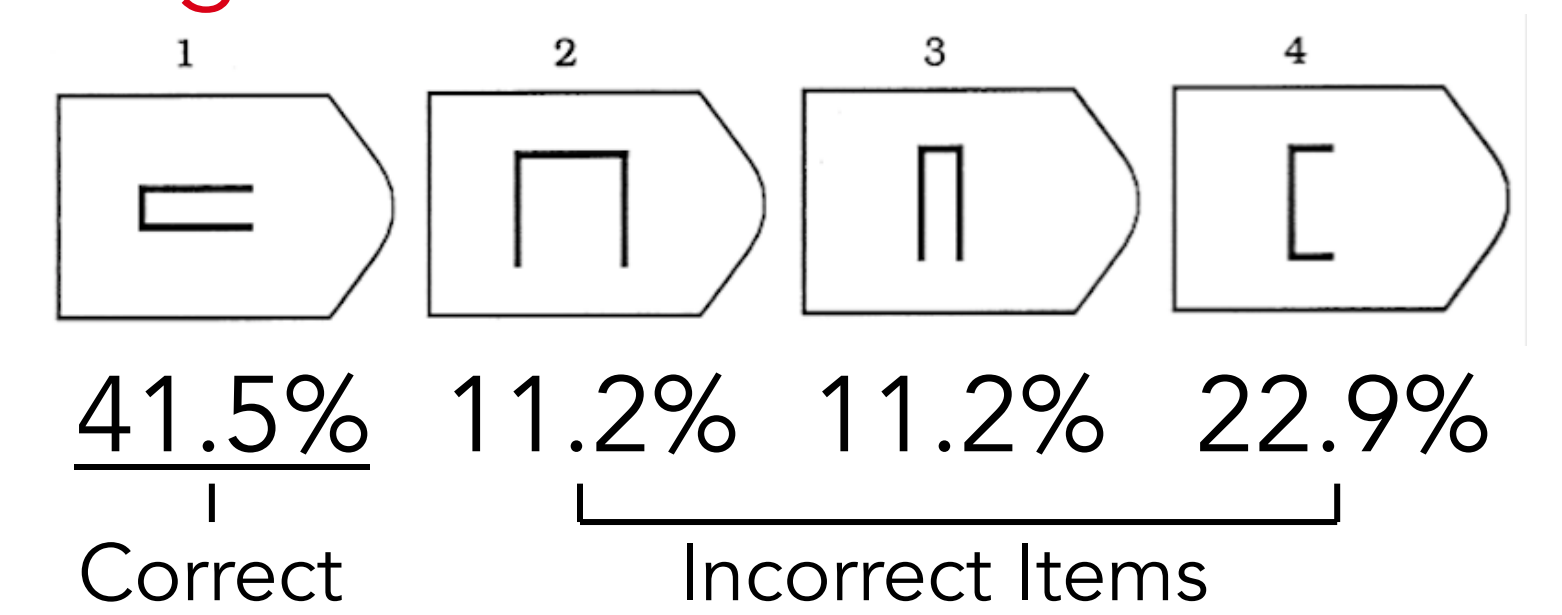
Two complementary sets of problems were created with 18 high- and 18 low-interference problems.

Across 2 sessions, 20 participants performed each set.

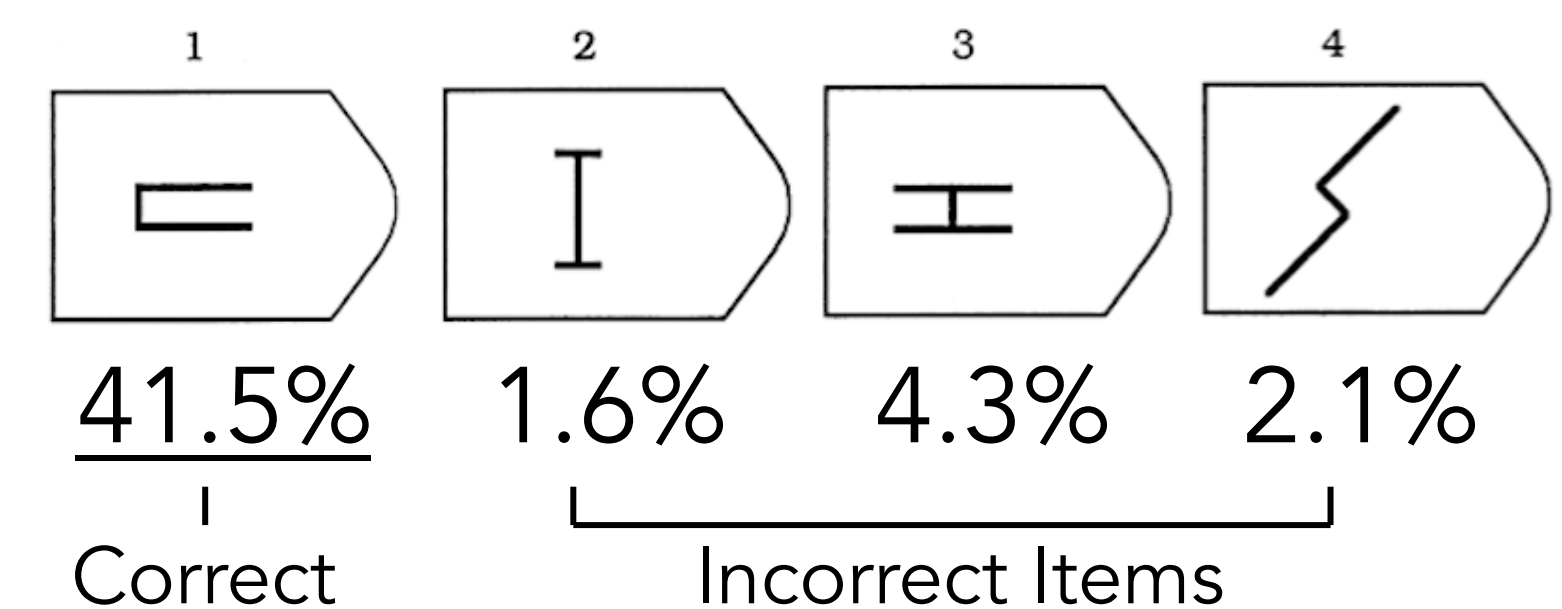
Example Item:



High-Interference Answer Set

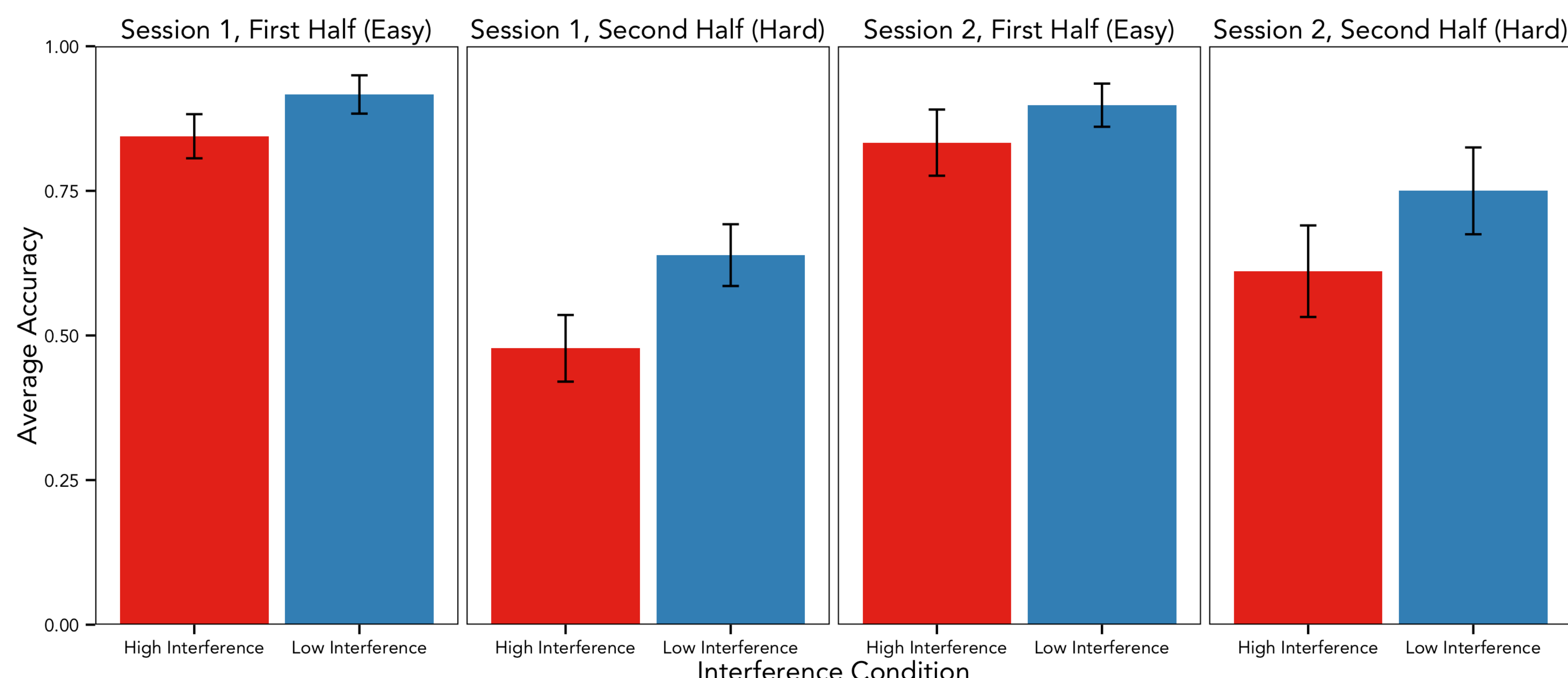


Low-Interference Answer Set



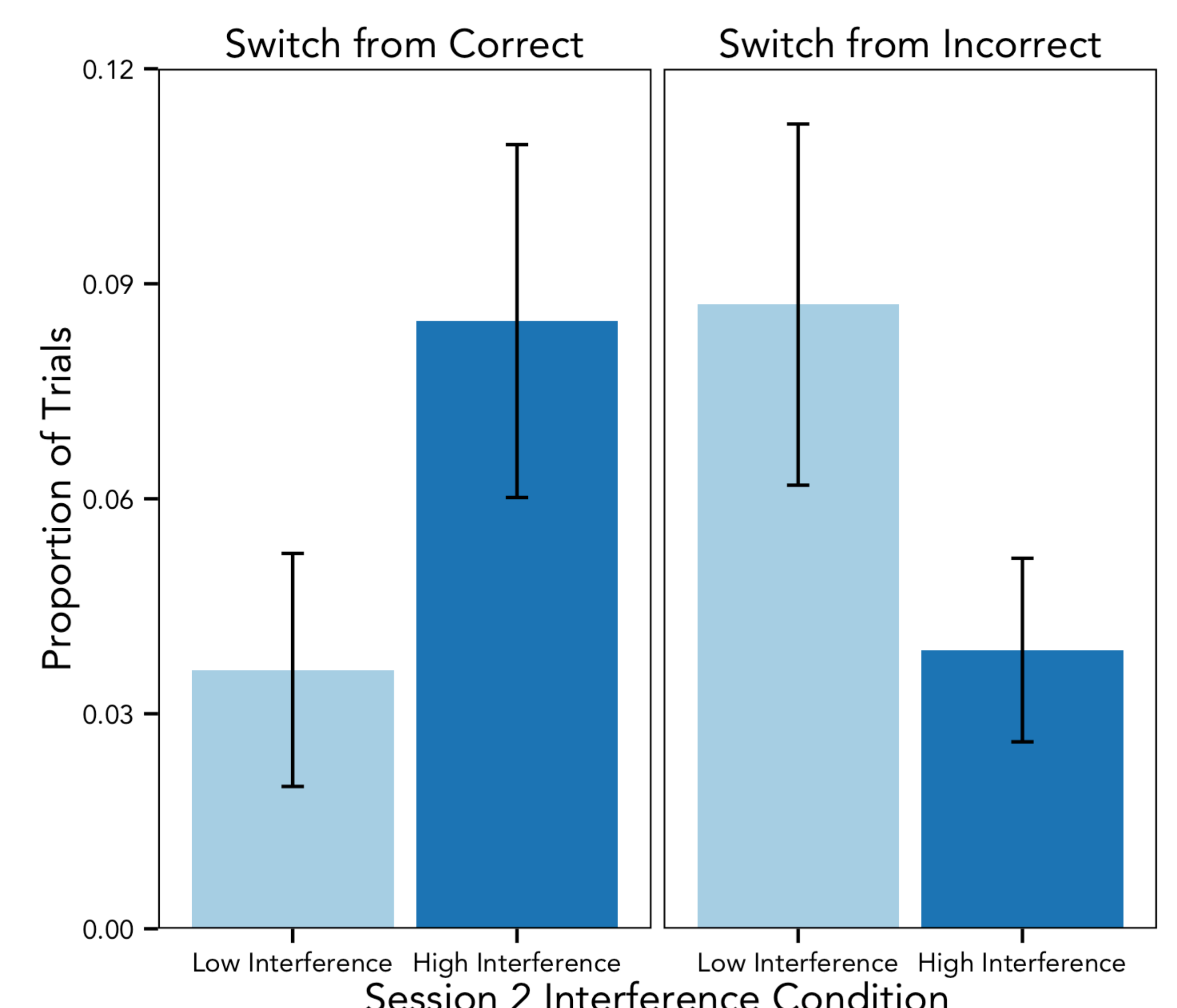
Results

High-interference items lead to worse performance than low-interference items, an effect that is uninfluenced by difficulty or session



GLMER: Main effect of Interference ($\beta=-0.91$, $z=-4.05$, $p<0.001$) and no effect of or interaction with Session ($ps>0.55$); Main effect of Difficulty/Half ($\beta=-1.93$, $z=-5.52$, $p<0.001$) and interaction with Session ($\beta=-0.81$, $z=-2.20$, $p=0.02$).

Interference type influences subjects' responses to the same problem across sessions



LMER: Interaction of Switch Type and Interference ($\beta=-0.09$, $t=-2.95$, $p=0.003$)

Conclusions

- (1) Replicating earlier work,⁶ interference among Raven's answer alternatives negatively influences performance.
- (2) Subjects were willing to abandon a correct response to a problem in session 1 for an incorrect response to the same problem in session 2 when interference was amplified.
- (3) The results suggest a role of interference resolution for Raven's performance, which may have implications for understanding training/transfer effects of fluid intelligence.

References. (1) Raven (1990). (2) Jaeggi, Buschkuhl, Jonides, & Perrig (*PNAS* 2008). (3) Au, Sheehan, Tsai et al. (*Psychonomic Bulletin and Review* 2015). (4) Shipstead, Redick, & Engle (*Psychologica Belgica* 2010). (5) Nee, Wager, & Jonides (*Cognitive, Affective, & Behavioral Neuroscience*, 2007). (6) Jarosz & Wiley (*Intelligence* 2012).

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