

Cognitive Deficits and Math Anxiety

Limited evidence for a causality hypothesis

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Background

Previous math anxiety research has focused on correlational studies that may include: **gender**, **spatial skills**, basic **symbolic number skills**, **working memory** and math performance.

We account for these correlations with a comprehensive model of the inter-relations between predictors. This model addresses claims that deficits in **spatial** and **numeric** foundations may lead to math anxiety.

Hypotheses

H1: Relations between math anxiety and **spatial skills** will be accounted for by shared relations with **symbolic number skills** and **gender**.

H2: Math anxiety will directly predict arithmetic performance after accounting for relations with basic **symbolic number skills**.

H3: **Spatial skills** and **working memory** will predict performance indirectly through **basic number skills**.

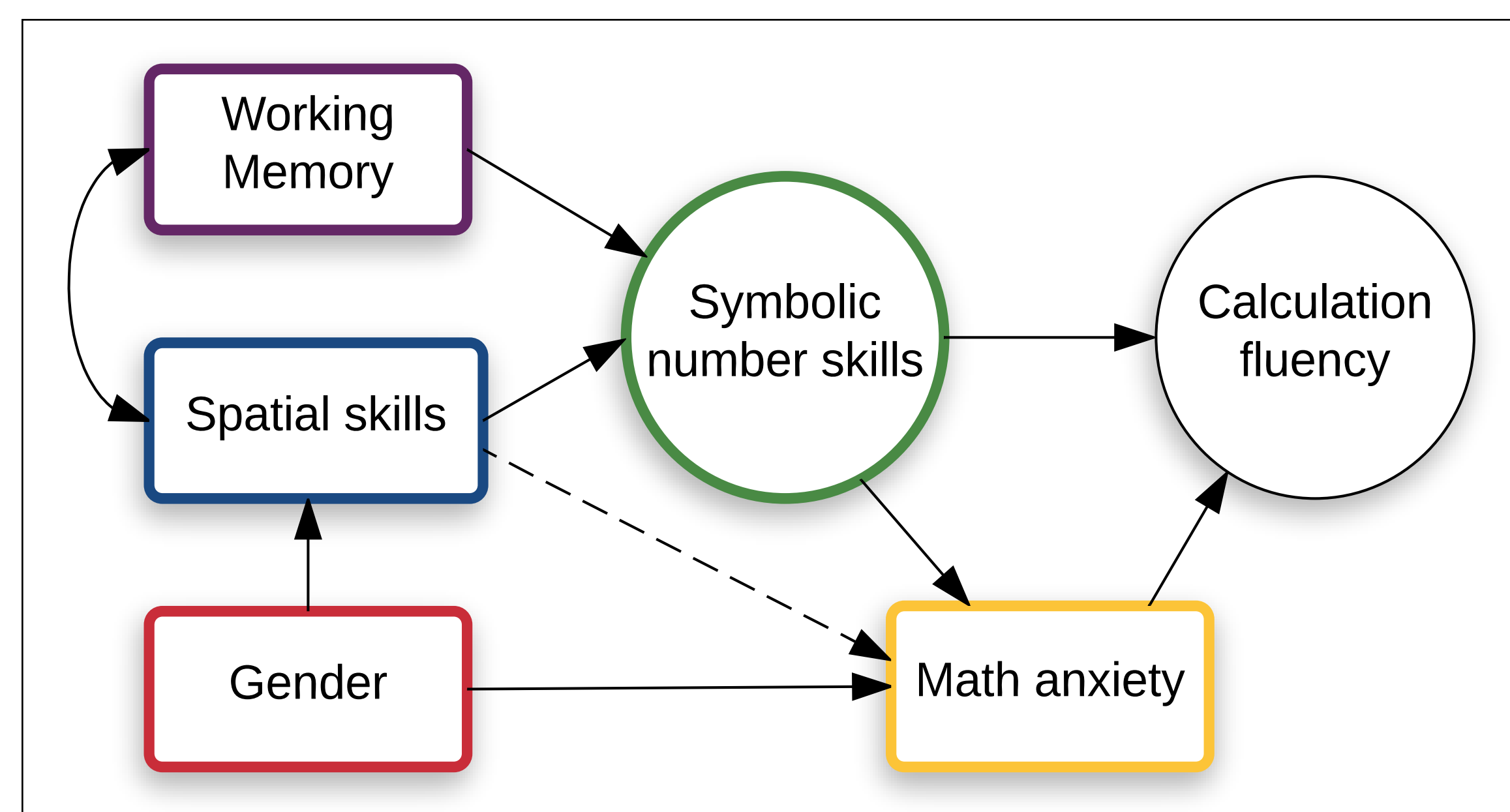


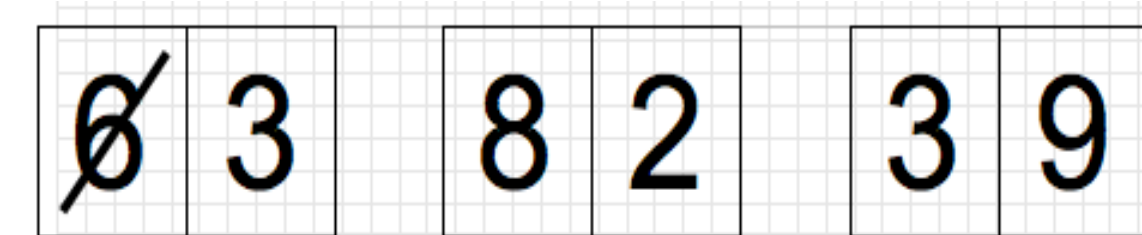
Figure 1: Proposed model outlining relations between cognitive and affective predictors of arithmetic fluency.

Method

Adults ($N=90$) completed measures of math anxiety (AMAS), basic **symbolic number skills**, **spatial skills**, **working memory** (backwards digit span, spatial span), and arithmetic (addition, subtraction, multiplication, and procedural arithmetic)

Symbolic number skills:

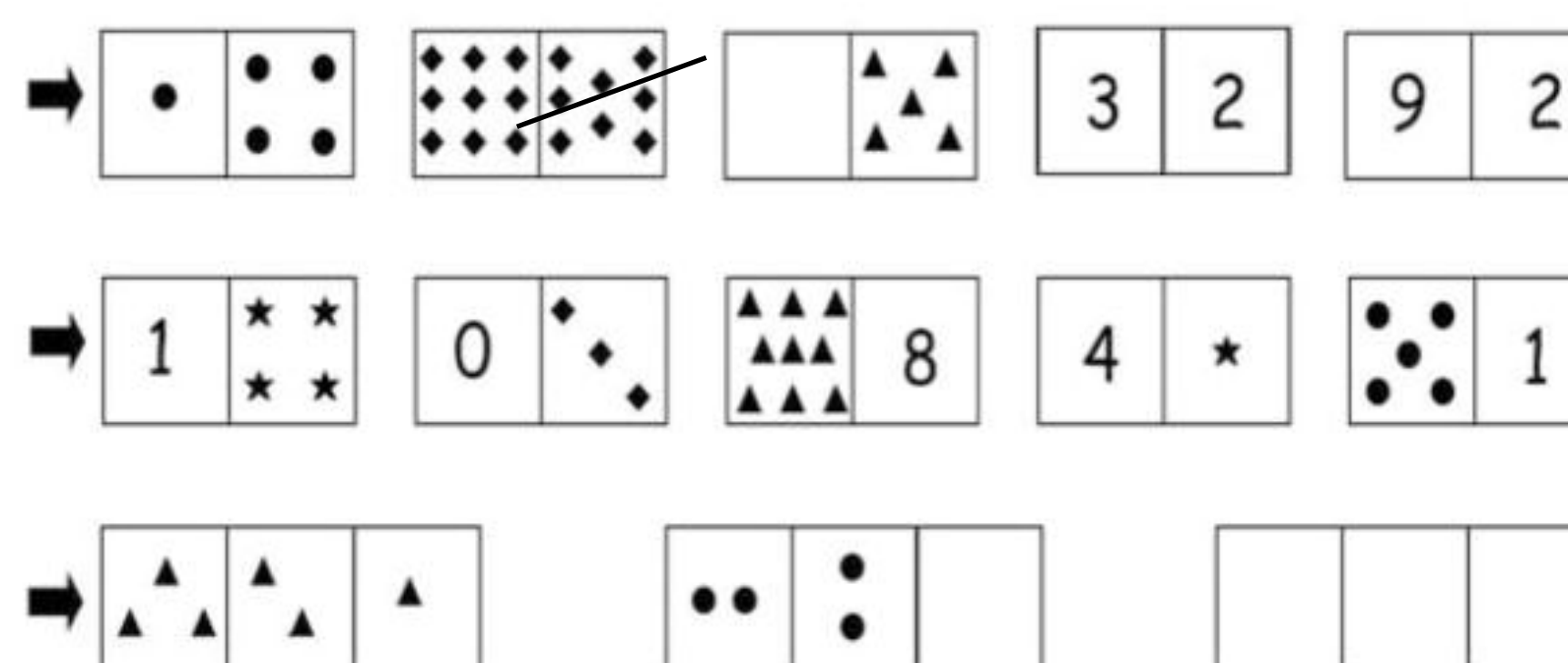
Magnitude comparison



Number ordering

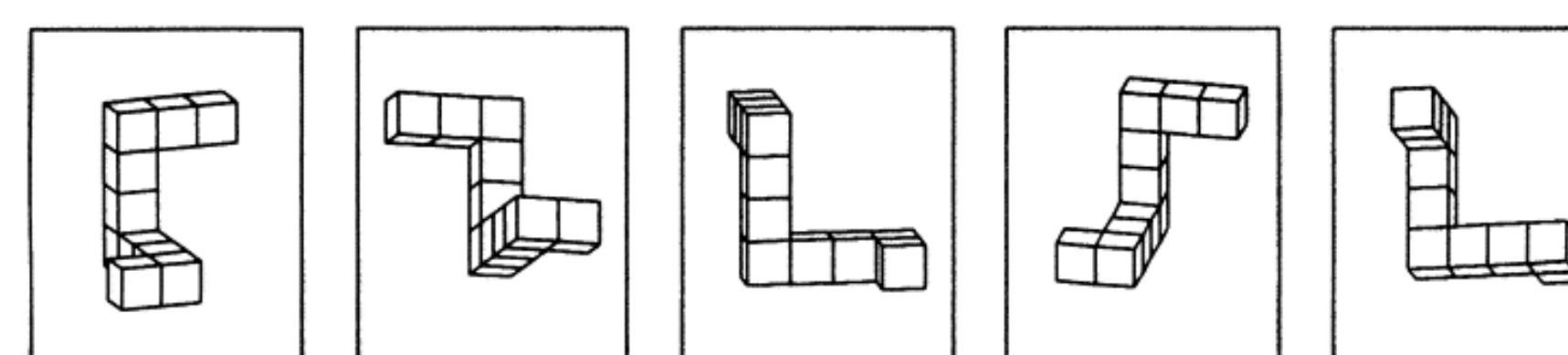


Number sets test



Spatial skills:

Mental rotation



Hidden figures

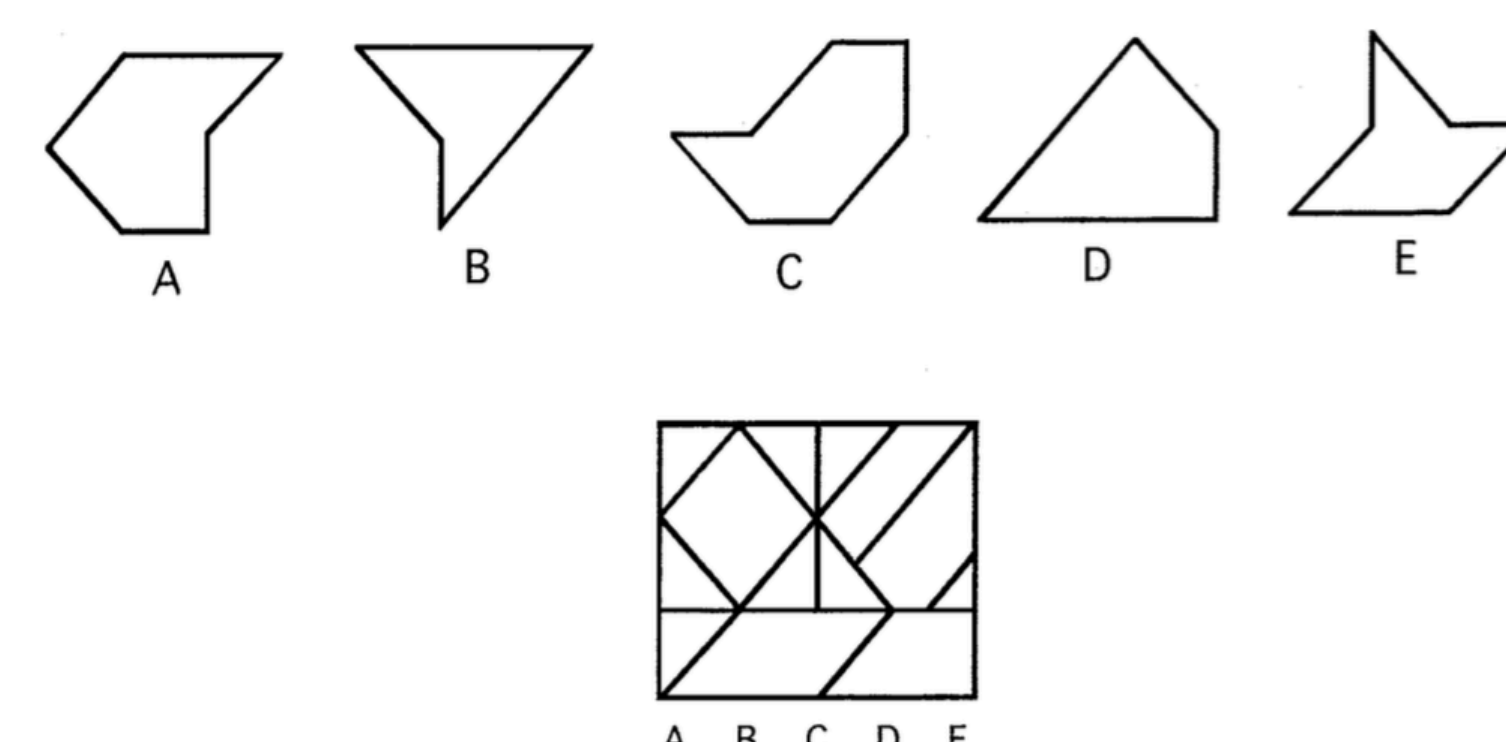


Figure 2: Testing stimuli

Results

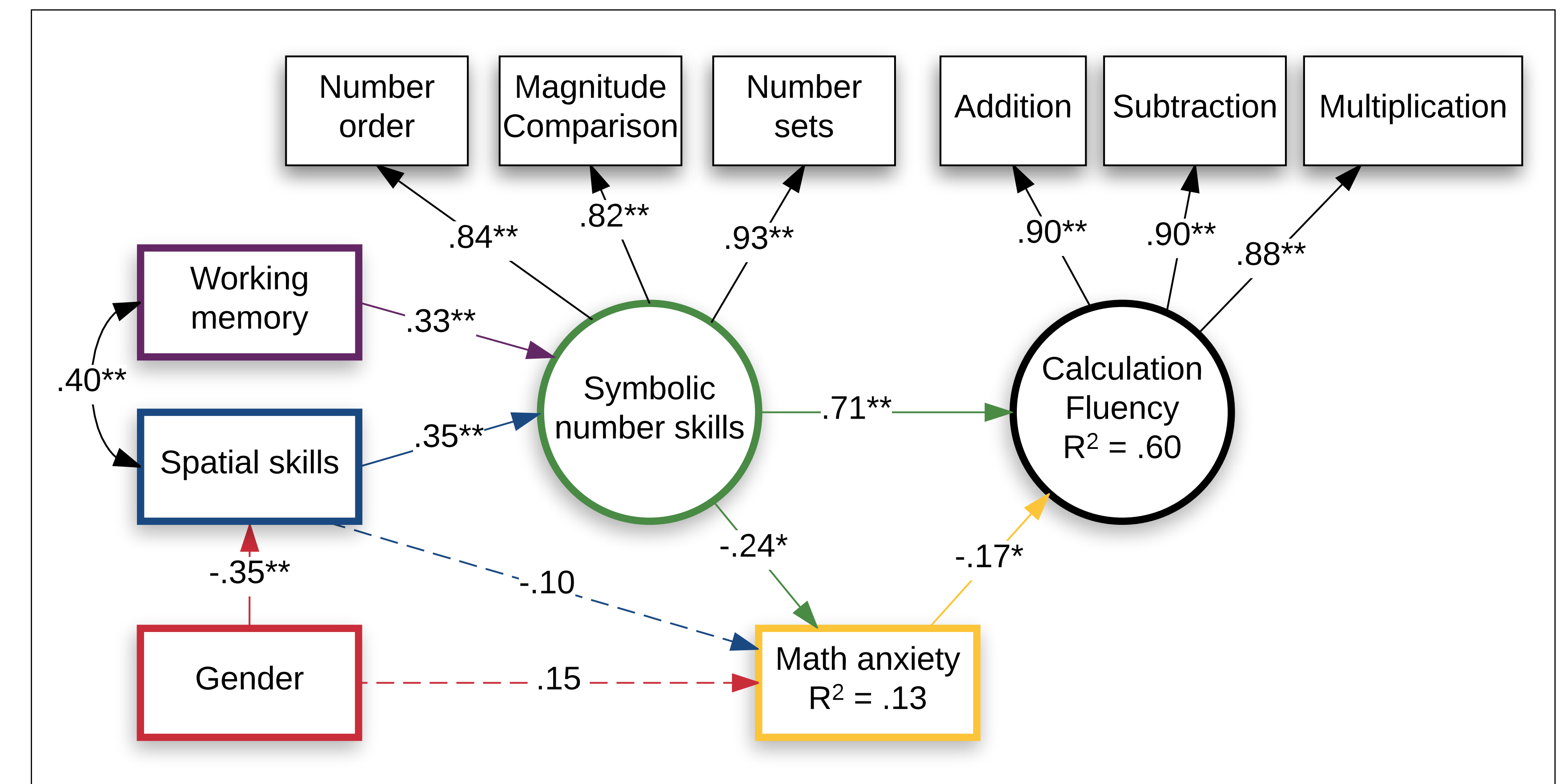


Figure 3: SEM model of relations with cognitive and affective predictors of arithmetic performance.

Solid lines represent significant paths ($*p<.05$, $**p<.01$). Numbers shown are the standardized coefficients.

Model fit was strong (e.g., $\chi^2(30, N=90) = 35.5$, $p = .23$).

Conclusions

- The relation between math anxiety and **spatial skills** is accounted for by **symbolic number skills** (H1).

- Deficits in basic cognitive skills DO NOT fully explain the math anxiety/performance relation (H2).

- Domain-general cognitive skills (**working memory** and **spatial skills**) are related to calculation fluency through **symbolic number skills** (H3).

- The relation between basic **number skills** and math anxiety could be concurrent or causal. Longitudinal research with children is needed to test any causality claims.