

# Supplement: Origins of Disbelief

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## The Preregistration

We preregistered a series of analyses. Here, we lay out models and model summaries for all of these analyses.

Here's what we preregistered:

“We will perform a series of 7 confirmatory tests on the full sample. Each model will be run twice: first with no covariates, then including age, gender, politics, education, & personality as covariates.”

This entails a series of models:

### 1. Does each factor independently replicate?

1. We will replicate mentalizing in a model with mentalizing (linear and quadratic terms) predicting religion.
2. We will replicate motivation in a model with the motivation items predicting religion.
3. We will replicate cultural learning in a model with CREDs predicting religion.
4. We will replicate cognitive style in a model with the CRT predicting religion.

### 2. Relative contributions?

5. We will run a model with all four factors predicting religion.

### 3. Specific hypothesized interactions?

6. To test whether cognitive style's effects differ across cultural learning, we will have a model in which CRT, CREDs, and their interaction predict religion.
7. To test the hypothesis that mentalizing is especially important in the context of cultural learning and motivation, we will have a model with mentalizing, CREDs, motivation and the mentalizing-by-CREDs and mentalizing-by-motivation interaction terms predicting religion.

The main manuscript summarizes: our full model (all four primary predictors plus covariates), a binary full model, the cultural learning-by-cognitive reflection interaction with covariates, and zero-order replication analyses. Here, we spell out preregistered analyses not already included.

## Departure from preregistration

We initially preregistered inclusion of quadratic terms for mentalizing to test for the possibility that mentalizing is a necessary-but-not-sufficient condition for belief in a god, and that the mindblind atheism pattern

might therefore be nonlinear in nature. Specifically, we speculated that advanced mentalizing might not generally be associated with disbelief across the entire range, but rather that people who score quite low on measures of advanced mentalizing might be especially likely to disbelieve. So we ginned up a polynomial prediction and preregistered a potential quadratic trend.

After the preregistration but before data collection and analysis, we realized that the polynomial approach was a very poor test of this idea and invites model overfitting among other ills<sup>1</sup>. The preregistered models including a quadratic for mentalizing were theoretically dubious and statistically naive, so we left them out of main analyses. We checked a few of the primary models to see if inclusion of a quadratic did much. It did not. Information criteria (WAIC) suggested that models were always better without a quadratic term for mentalizing, and the quadratic term itself never predicted much. Additional exploration about a possible low-end mentalizing blip in atheism may warrant future research with a statistically appropriate model.

## 1. Individual Replications

As the models without covariates are already summarized in the main document, here is the summary for each model including covariates. Nothing much changes from the main models reported in the main paper. inCREDulous atheism and analytic atheism still replicate soundly, and mindblind atheism is also fairly evident. Apatheism is still essentially absent. Table 1 summarizes the individual replication results.

Figure 1 displays scatterplots of each individual analysis.

Table 1: Predicting Disbelief: Individual Replication Analyses With Covariates

Variable	Beta	HPDI	Pr
mindblind	0.06	[0, 0.13]	0.98
apatheism	-0.01	[-0.07, 0.06]	0.4
inCREDulous	0.29	[0.23, 0.34]	>0.99
analytic	0.13	[0.06, 0.19]	>0.99

*Note:*

<sup>1</sup> Beta = standardized beta

<sup>2</sup> HPDI = 97% Highest posterior density interval

<sup>3</sup> Pr = posterior probability of Beta > 0

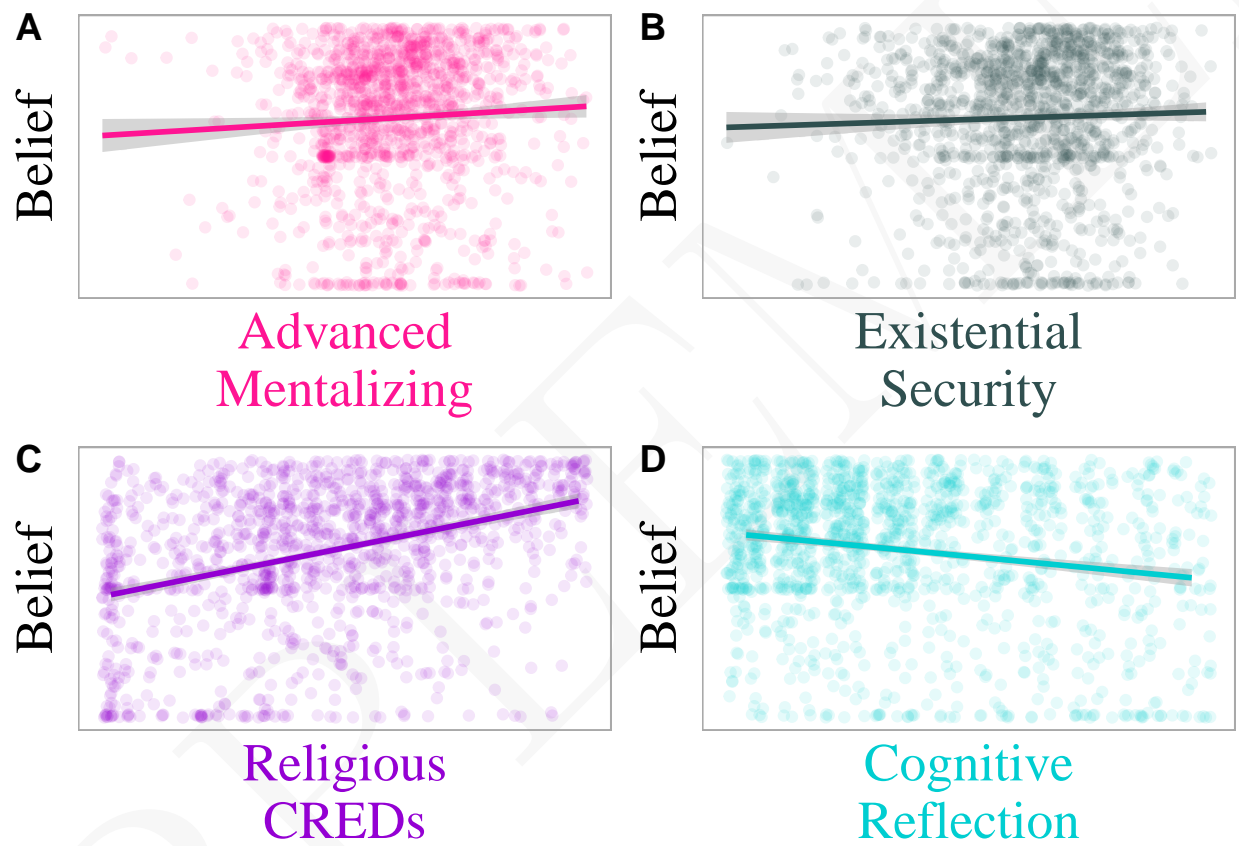


Figure 1: Scatterplots for individual replication models

## 2. Relative Contributions

The main document includes a full model with all key predictors and covariates predicting disbelief. Here, we report the model without covariates for completeness with the preregistration. Again, not much changes. Table 2 summarizes this model.

Table 2: Full Model, No Covariates

Variable	Beta	HPDI	Pr
mindblind	0.03	[-0.03, 0.08]	0.88
apatheism	-0.03	[-0.09, 0.02]	0.09
inCREdulous	0.38	[0.32, 0.44]	>0.99
analytic	0.22	[0.16, 0.27]	>0.99

*Note:*

<sup>1</sup> Beta = standardized beta

<sup>2</sup> HPDI = 97% Highest posterior density interval

<sup>3</sup> Pr = posterior probability of Beta > 0

### 3. Interactions: Mindblind Atheism

We pursued speculation that mindblind atheism might be especially pronounced in contexts in which other pathways to atheism are muted. If this is the case, for example, then we might expect interactions between mindblind atheism and both cultural exposure to religion and existential security, such that mindblind atheism would be more evident among people relatively higher in religious CREDs or lower in existential security. Alternatively, if mentalizing is a necessary precondition for belief, then other factors might matter little when mentalizing is sufficiently low. With this in mind, we re-ran a version of our full model, including mentalizing-by-CREDs and mentalizing-by-security interactions. Alas, we didn't find interactions between mindblind atheism and inCREDulous atheism,  $\beta = 0$ ,  $[-0.05, 0.05]$ ,  $P(\beta > 0 \mid data) = 0.48$  or with apatheism,  $\beta = 0.02$ ,  $[-0.03, 0.07]$ ,  $P(\beta > 0 \mid data) = 0.84$ . The weak association between lower advanced mentalizing and disbelief appeared largely independent of existential security or religious CREDs in this sample.

## References

1. McElreath, R. *Statistical Rethinking: A Bayesian Course with Examples in R and Stan*. vol. 122 (CRC Press, 2016).