Expaining Atheism - Pilot 1: CREDs/CRUDs

INSERT DATE

# Study Information

## Title

EA Preregistration: CREDs and CRUDs

## Description

This preregistration is part of a number of preregistrations for the Explaining Atheism project. Our other registrations can be found on the OSF here [ADD LINK], with copies on our FigShare, and on my GitHub.

This registration is for the testing of the measurement and effect of Credibility Enhancing Displays (CREDs), and Credibility Undermining Displays (CRUDs) on atheism/non-belief. Specifically, this element of our first pilot project will test the scales used for the measurement of CREDs and CRUDs, and the relationship between these measures and measures of non-belief.

Credibility Enhancing Displays are costly displays made by a model, particularly those that reflect a statement made by that model, that would seem costly if the model does not hold their expressed beliefs. Displays that show a model walking the walk, or practicing what they preach, if you will. For example if a model says a blue mushroom is toxic and then avoids eating it even when hungry, or priestly celibacy would be CREDS. A number of studies have shown historical exposure to religious CREDs may predict religiosity (CITES). The present project looks to build upon this, and also update the measures for cross-cultural comparison. Conversely religious CRUDs are behaviours which undermine credibility. They are behaviours where a model contradicts their stated belief, such as breaking celibacy, or eating haram foods, and it is predicted that exposure to religious CRUDs may predict less religiosity.

## Hypotheses

**CREDs**

Lower historic CRED exposure will predict lower:

1. Religious Identification
2. Belief in God (continuous)
3. Belief in God (binary)

**CRUDs**

Greater historic CRUD exposure will predict lower:

1. Religious Identification
2. Belief in God (continuous)
3. Belief in God (binary)

# Design Plan

## Study type

**Observational Study**. Data is collected from study subjects that are not randomly assigned to a treatment. This includes surveys, natural experiments, and regression discontinuity designs.

## Study design

This registration is for the analysis of data collected as part of our first pilot which is comprised of 5 separate surveys, one for each of the explanatory variable clusters noted in the exploratory pre-registration (see here). This specific registration concerns our socialisation survey, and is run in the in the UK and Brazil.

## Randomization

The CREDs and CRUDs questionnaires were not randomised due to order dependencies in the questions within these questionnaires. Both the General Belief and Supernatural Belief questionnaires were randomised within questionnaire.

# Sampling Plan

We will collect representative samples for each nation. This will be done by an independent survey company, and the samples will be representative for the national population by Age, Sex and Geographic Region.

## Existing data

**Registration prior to accessing the data**. As of the date of submission, the data exist, but have not been accessed by you or your collaborators. Commonly, this includes data that has been collected by another researcher or institution.

## Data collection procedures

Participants are recruited by the independent survey company, Savanta Comres, from their pool of participants. Participants will be paid a local rate for their participation, and will be selected to meet representativeness requirements outlined above.

## Sample size

The sample size is 500 participants per nation.

Brazil = 500

UK = 500

## Sample size rationale

Samples are the maximally viable sample for the financial means of the project.

# Variables

## Measured variables

The explanatory variables of primary interest, CRUDs and CREDs are part of a survey with the following explanatory variables. See attached variables document for definitions:

* CREDs
  + CRED Score
  + CRED Score (Parental)
  + CRED Score (Group)
  + CRED Score (Group Leader)
  + CRED Score (Group Members)
  + Sincerity (Group Leader)
  + Sincerity (Group Member)
* CRUDs
  + CRUD Score
  + CRUD Score (Parental)
  + CRUD Score (Group)
  + CRUD Score (Group Leader)
  + CRUD Score (Group Members)
* Non-theistic Socialisation
* Normativity of Religion:
  + Normativity of Religion
  + Normativity (Nation)
  + Normativity (Ethnicity)
  + Normativity (Peers)
  + Normativity (Group)
* Religious Emphasis

Similarly the outcome variables of interest are part of a wide range of response variables that are collected, see the attached codebook for all other variables. The outcome variables by which we will test our hypotheses are as follows. Again, see attached variables document for detailed defintions:

* Belief in God (continuous)
* Belief in God (binary)
* Religious Identification

Details of what comprises each of these measures and scales can be found in the attached codebook.

## Indices

See attached codebook.

# Analysis Plan

We will run confirmatory analyses for each of our response variables noted above, and all the explanatory variables outlined in the “Exploratory Analyses” section below. The confirmatory analyses are as follows:

*Confirmatory Analyses*

| Analysis | Explanatory Variables | Outcome Variable |
| --- | --- | --- |
| CRED 1 | CRED Score | Belief in God (Continuous) |
| CRED 2 | CRED Score | Belief in God (Binary) |
| CRED 3 | CRED Score | Religious Identification |
| CRUD 1 | CRUD Score | Belief in God (Continuous) |
| CRUD 2 | CRUD Score | Belief in God (Binary) |
| CRUD 3 | CRUD Score | Religious Identification |

*Measurement Models*

We will also analyse the factor structure of the CRED measure. In the first instance we will examine whether the full scale can reasonably be split into the distinctive CRED variables we have defined in the variable section above.

## Statistical models

Bayesian Regression Models will be used to make inferences in the first instance.

Model specifications can be found in the attached Excel file.

We will treat outcome variables that are single Likert scale measures as ordinal, and as such will use cumulative probit regression following the following structure:

library("brms")  
  
  
exampleProbitModel <-  
 brm(formula = outcome\_variable ~ explanatory\_variable\_1 +  
 explanatory\_variable\_2 +  
 explanatory\_variable\_3 +  
 explanatory\_variable\_n,  
 prior = priors,  
 data = data,   
 family = cumulative(link = "probit"),  
 chains = 4,  
 cores = 4,  
 threads = 2,  
 iter = 3000,  
 warmup = 1000,  
 seed = 2023,   
 backend = "cmdstanr")

For binary outcomes we will use logistic regression with the following format:

library("brms")  
  
exampleLogisticModel<-   
 brm(formula = outcome\_variable ~ explanatory\_variable\_1 +  
 explanatory\_variable\_2 +  
 explanatory\_variable\_3 +  
 explanatory\_variable\_n,  
 prior = priors,  
 data = data,   
 family = bernoulli(link = "logit"),  
 chains = 4,  
 cores = 4,  
 threads = 2,  
 iter = 3000,  
 warmup = 1000,  
 seed = 2023,   
 backend = "cmdstanr")

And for continuous outcomes we will use gaussian multiple regression:

library("brms")  
  
exampleLogisticModel<-   
 brm(formula = outcome\_variable ~ explanatory\_variable\_1 +  
 explanatory\_variable\_2 +  
 explanatory\_variable\_3 +  
 explanatory\_variable\_n,  
 prior = priors,  
 data = data,   
 family = gaussian(),  
 chains = 4,  
 cores = 4,  
 threads = 2,  
 iter = 3000,  
 warmup = 1000,  
 seed = 2023,   
 backend = "cmdstanr")

We will set the following uninformative priors for our outcome variables:

For betas and intercepts we will set a normally distributed prior with a mean of 0 and a standard deviation of 1.

For ordinal probit models we will set a normal distribution for the thresholds, following [Kurz](https://solomonkurz.netlify.app/blog/2021-12-29-notes-on-the-bayesian-cumulative-probit/).

## Transformations

In some instances response variables are dummy coded binary variables from a categorical response option - see attached codebook for all variable definitions.

As a default we will center likert response scores at the center of the scale, unless the scale has a meaningful interval (e.g. age, n years).

## Inference criteria

In the first instance, inferences about whether a variable has or does not have a theoretically relevant effect will be done based on examination of the posterior distributions of parameter estimates.

More specifically we will examine the extent to which the credible intervals of these posterior distributions overlap with a Region of Practical Equivalence (ROPE), that is, a specified region we consider to be theoretically equivalent to zero. This will be done using the {bayestestR} package (<https://easystats.github.io/bayestestR/articles/region_of_practical_equivalence.html>) in R. For our Gaussian and Cumulative Probit models we will use the default range -0.1 to 0.1 for standardized effect sizes, which equates to a “negligible effect size”, and -0.18 to 0.18 for logistic models.

## Data exclusion

Participants who fail data quality checks are removed and replaced by the survey provider prior to our analysis. In the first instance outliers will not be removed, however sensitivity analysis will be run on any published final models.

## Missing data

The data collection process does not allow missing data.

## Exploratory analyses (optional)

In addition to testing the confirmatory hypotheses outlined above, additional variables will be included, and additional models run, for exploratory purposes.

|  |  |  |
| --- | --- | --- |
| Socialisation 1 | CRUD Score, CRUD Score, Normativity of Religion, Non-theistic Socialisation, Religious Emphasis | Belief in God (Continuous) |
| Socialisation 2 | CRUD Score, CRUD Score, Normativity of Religion, Non-theistic Socialisation, Religious Emphasis | Belief in God (Binary) |
| Socialisation 3 | CRUD Score, CRUD Score, Normativity of Religion, Non-theistic Socialisation, Religious Emphasis | Religious Identification |
| Socialisation 5 | CRUD Score, CRUD Score, Normativity of Religion, Non-theistic Socialisation, Religious Emphasis | Agnosticism |
| Socialisation 5 | CRUD Score, CRUD Score, Normativity of Religion, Non-theistic Socialisation, Religious Emphasis | Atheist Identification |
| CRED 1 | CRED Score, CRED Score (Parental), CRED Score (Group), Cred Score (Group Leaders), CRED Score (Group Members) | Belief in God (Continuous) |
| CRED 2 | CRED Score, CRED Score (Parental), CRED Score (Group), Cred Score (Group Leaders), CRED Score (Group Members) | Belief in God (Binary) |
| CRED 3 | CRED Score, CRED Score (Parental), CRED Score (Group), Cred Score (Group Leaders), CRED Score (Group Members) | Religious Identification |
| CRED 5 | CRED Score, CRED Score (Parental), CRED Score (Group), Cred Score (Group Leaders), CRED Score (Group Members) | Agnosticism |
| CRED 5 | CRED Score, CRED Score (Parental), CRED Score (Group), Cred Score (Group Leaders), CRED Score (Group Members) | Atheist Identification |

We will also run analyses of the psychometric properties of the CRED and CRUD scales, along with measurement invariance analyses.

# Other

## Other (Optional)

This work is part of a larger scale project using the same data. See decription for further information.

# References

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