Pre-Registration Document

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Project working title: Payoff-dependent utility, norm-dependent utility, and political ideology

1 Hypotheses

1. **Hypothesis 1.** The probability of making a non-selfish decision in binary Dictator Games will be positively predicted by (a) the difference in payoffs between non-selfish and selfish decisions (payoff-dependent utility), and (b) the difference in normative ratings between non-selfish and selfish decisions (norm-dependent utility).
2. **Hypothesis 2.** The interaction between payoff-dependent utility and Social Dominance Orientation will be positive.
3. **Hypothesis 3.** The interaction between norm-dependent utility and Right Wing Authoritarianism will be positive.

2 Methods

2.1 Power analysis

Our power analysis method is adapted from this series of blog posts on power analysis for Bayesian regression models. For our power analysis, we first load previous data from Panizza, Vostroknutov, and Coricelli (2019), fit a multilevel Bayesian logistic regression model to this dataset (for model specification, see Analysis Plan: Hypothesis 1), and estimate payoff-dependent utility and norm-dependent utility parameters for each participant. We then set the power analysis sample size N and run 100 simulations. For each simulation:

1. We sample N participants with replacement from previous data.
2. We simulate mean Social Dominance Orientation values for participants that are normally distributed and positively correlated with the payoff-dependent utility parameter ($r = 0.24$). This effect size is estimated from previous research linking Social Dominance Orientation to Dictator Game behaviour (Claessens et al. 2020).
3. We simulate mean Right Wing Authoritarianism values for participants that are normally distributed and positively correlated with the norm-dependent utility parameter ($r = 0.20$). This effect size is estimated from previous research linking Right Wing Authoritarianism to behaviour in a Rule Following Task (Fischer, Chaudhuri, and Atkinson, n.d.) which is related to the norm-dependent utility parameter (Panizza, Vostroknutov, and Coricelli 2019).
4. We then fit a Bayesian multilevel logistic regression model with both interaction effects to this simulated dataset (for model specification, see *e.g.* Analysis Plan: Hypotheses 2 and 3).

We are interested in the two interaction parameters from the 100 fitted models. The proportion of simulations in which these parameters have 95% credible intervals above zero is our measure of statistical power. This power analysis suggested that, to achieve at least 90% power on both interaction parameters, we would require a sample size of 450 participants.

2.2 Data collection

470 participants (450 + 20 buffer for exclusions) from the United States will be sampled from Prolific in a single session of data collection. Participants are required to have a 95% approval rating on the site to be eligible for the study.

2.3 Procedure

The study will be conducted on Qualtrics. In the study, participants can earn "points" which are converted to bonus payment at a rate of 1 point = £0.02. The survey will consist of the following parts (procedure adapted from Panizza, Vostroknutov, and Coricelli 2019):

1. **Mini Dictator Games.** Participants will complete 18 'mini Dictator Games' in which they must choose between two possible distributions of 60 points between themselves and another participant. For example, in one mini Dictator Game they must choose between (1) keeping 30 points for themselves and giving 30 points to the other participant (non-selfish option), or (2) keeping all 60 points and giving nothing to the other participant (selfish option). Each mini Dictator Game will appear in a randomised order. Participants are truthfully told that, after the study, one mini Dictator Game will be randomly chosen for payment, all participants will be randomly matched into pairs, and one participant will be randomly selected as the dictator.
2. **Norm Elicitation.** After completing the mini Dictator Games, participants will evaluate the social appropriateness of each possible Dictator Game split using the Krupka-Weber norm elicitation method (Krupka and Weber 2013). For each possible split, participants will use a four-point Likert scale to rate the social appropriateness level *that they think most other participants will choose for this split*. Participants are truthfully told that, after the study, one split will be chosen at random and, if their rating matched the majority in the session, they will be paid a bonus £0.50.
3. **Rule Following Task.** Participants will complete a task (adapted from Kimbrough and Vostroknutov 2018) in which they must place 30 balls in one of two buckets (randomly counterbalanced). Participants will earn 1 point per ball in one bucket, and 2 points per ball in the other bucket. However, participants are told that the "rule" is to place the balls in the former bucket, earning them less money. The number of balls they place in the former bucket is used as a measure of rule following.
4. **Berlin Estimate AdjuStment Task (BEAST).** Participants will complete a task (adapted from Molleman, Kurvers, and van den Bos 2019) in which they must estimate the number of animals in a briefly presented image. Participants first provide an initial estimate, then see an estimate from a previous participant, and can then update their initial estimate accordingly. Participants' shift towards the social information is captured by a value between 0 (no shift) to 1 (shifted entirely to social information). We pay participants by randomly choosing a round and determining the distance between their estimate and the correct answer: 100 points - (distance * 5).
5. **Questionnaire.** Participants will complete a questionnaire with the following scales: Social Dominance Orientation (Sidanius and Pratto 2001), Right Wing Authoritarianism (Altemeyer and Altemeyer 1996), and Economic and Social Conservatism (Everett 2013). We also ask participants their age, gender, education, and political party support.

The Rule Following Task, BEAST, and Questionnaire blocks will randomly appear before or after the Mini DGs and Norm Elicitation blocks to control for order effects.

Participants will be paid a £3.75 base rate for participating (all participants are paid in GBP on Prolific). Since the survey is estimated to take up to 30 minutes, this base rate is more than Prolific's recommended minimum payment of £7.50/hr. After the study, participants will also earn a bonus of between £0.00 - £1.20 for the mini Dictator Games, between £0.60 - £1.20 for the Rule Following Task, between £0.00 - £2.00 for the BEAST, and possibly a bonus £0.50 for the normative evaluations.

2.4 Exclusion criteria

We will exclude participants via listwise deletion if *any* of the following criteria are met:

1. **Inattentive.** Participants who fail either of two attention checks: (1) Please answer the following maths question: 4 + 3 (2) Please type the word 'HELLO' in lower case letters, with a space in between each letter.
2. **Flatliners.** Participants who answer grid questions in the same manner or create patterns in grids.
3. **Speeders.** Participants who complete the survey in four minutes or less.
4. **Bad verbatims.** Participants who answer open-ended questions by way of keyboard banging or typing illogical answers.
5. **Bots.** Participants who fail the CAPTCHA at the start of the survey.

2.5 Variables measured

Variable	Description	Type
DG01	DG splits: 00/60 or 60/00	Binary
DG02	DG splits: 15/45 or 55/05	Binary
DG03	DG splits: 21/39 or 57/03	Binary
DG04	DG splits: 25/35 or 55/05	Binary
DG05	DG splits: 26/34 or 35/25	Binary
DG06	DG splits: 27/33 or 33/27	Binary
DG07	DG splits: 28/32 or 37/23	Binary
DG08	DG splits: 30/30 or 34/26	Binary
DG09	DG splits: 30/30 or 39/21	Binary
DG10	DG splits: 30/30 or 60/00	Binary
DG11	DG splits: 30/30 or 45/15	Binary
DG12	DG splits: 31/29 or 37/23	Binary
DG13	DG splits: 32/28 or 35/25	Binary
DG14	DG splits: 32/28 or 57/03	Binary
DG15	DG splits: 33/27 or 34/26	Binary
DG16	DG splits: 33/27 or 45/15	Binary
DG17	DG splits: 34/26 or 55/05	Binary
DG18	DG splits: 45/15 or 60/00	Binary
Norm01	Normative rating for 00/60 DG split	Ordinal (1-4)
Norm02	Normative rating for 15/45 DG split	Ordinal (1-4)
Norm03	Normative rating for 21/39 DG split	Ordinal (1-4)
Norm04	Normative rating for 25/35 DG split	Ordinal (1-4)
Norm05	Normative rating for 26/34 DG split	Ordinal (1-4)
Norm06	Normative rating for 27/33 DG split	Ordinal (1-4)
Norm07	Normative rating for 28/32 DG split	Ordinal (1-4)
Norm08	Normative rating for 30/30 DG split	Ordinal (1-4)
Norm09	Normative rating for 31/29 DG split	Ordinal (1-4)
Norm10	Normative rating for 32/28 DG split	Ordinal (1-4)
Norm11	Normative rating for 33/27 DG split	Ordinal (1-4)
Norm12	Normative rating for 34/26 DG split	Ordinal (1-4)
Norm13	Normative rating for 35/25 DG split	Ordinal (1-4)
Norm14	Normative rating for 37/23 DG split	Ordinal (1-4)
Norm15	Normative rating for 39/21 DG split	Ordinal (1-4)
Norm16	Normative rating for 45/15 DG split	Ordinal (1-4)
Norm17	Normative rating for 55/05 DG split	Ordinal (1-4)
Norm18	Normative rating for 57/03 DG split	Ordinal (1-4)

Variable	Description	Type
Norm19	Normative rating for 60/00 DG split	Ordinal (1-4)
SDO1	It is OK if some groups have more of a chance in life than others	Ordinal (1-7)
SDO2	Inferior groups should stay in their place	Ordinal (1-7)
SDO3	To get ahead in life, it is sometimes okay to step on other groups	Ordinal (1-7)
SDO4r	We should have increased social equality	Ordinal (1-7)
SDO5r	It would be good if groups could be equal	Ordinal (1-7)
SDO6r	We should do what we can to equalise conditions for different groups	Ordinal (1-7)
RWA1	It is always better to trust the judgment of the proper authorities in government and religion than to listen to the noisy rabble-rousers in our society who are trying to create doubt in people's minds	Ordinal (1-7)
RWA2	It would be best for everyone if the proper authorities censored magazines so that people could not get their hands on trashy and disgusting material	Ordinal (1-7)
RWA3	Our country will be destroyed some day if we do not smash the perversions eating away at our moral fibre and traditional beliefs	Ordinal (1-7)
RWA4r	People should pay less attention to The Bible and other old traditional forms of religious guidance, and instead develop their own personal standards of what is moral and immoral	Ordinal (1-7)
RWA5r	Atheists and others who have rebelled against established religions are no doubt every bit as good and virtuous as those who attend church regularly	Ordinal (1-7)
RWA6r	Some of the best people in our country are those who are challenging our government, criticizing religion, and ignoring the 'normal way' things are supposed to be done	Ordinal (1-7)
RuleFollowing	Number of balls placed in rule following bucket	Numeric (0-30)
BEAST1	BEAST Score (Round 1)	Numeric (0-1)
BEAST2	BEAST Score (Round 2)	Numeric (0-1)
BEAST3	BEAST Score (Round 3)	Numeric (0-1)
BEAST4	BEAST Score (Round 4)	Numeric (0-1)
BEAST5	BEAST Score (Round 5)	Numeric (0-1)
EC1	Positive/negative: Limited government	Numeric (0-100)
EC2r	Positive/negative: Welfare benefits	Numeric (0-100)
EC3	Positive/negative: Gun ownership	Numeric (0-100)
EC4	Positive/negative: Fiscal responsibility	Numeric (0-100)
EC5	Positive/negative: Business	Numeric (0-100)
SC1r	Positive/negative: Abortion	Numeric (0-100)
SC2	Positive/negative: Military and national security	Numeric (0-100)
SC3	Positive/negative: Religion	Numeric (0-100)
SC4	Positive/negative: Traditional marriage	Numeric (0-100)
SC5	Positive/negative: Traditional values	Numeric (0-100)
SC6	Positive/negative: The family unit	Numeric (0-100)
SC7	Positive/negative: Patriotism	Numeric (0-100)
PolParty	Political party support	Categorical
Education	What is the highest level of school you have completed or the highest degree you have received?	Ordinal (1-8)
Age	What is your age in years?	Numeric (18-110)

Variable	Description	Type
Gender	What is your gender?	Categorical

3 Analysis Plan

This entire analysis pipeline has been pre-registered in a *drake* plan (Landau 2018) in an archived Github repository on the Open Science Framework with dummy data (https://osf.io/yk46b/). We use the *brms* R package (Bürkner 2017) running Hamiltonian Monte Carlo estimation in Stan (Carpenter et al. 2017) to fit the following multilevel Bayesian models.

3.1 Hypothesis 1

Building on Panizza, Vostroknutov, and Coricelli (2019), we will fit the following multilevel Bayesian logistic regression model to the data:

$$
\begin{aligned}
\text{nonselfish}_i &\sim \text{Bernoulli}\,(p_i) \\
\text{logit}(p_i) &= \alpha_{\text{part}[i]} + \beta_{\text{part}[i]}(\pi_d^{\text{nonself}} - \pi_d^{\text{self}}) + \gamma_{\text{part}[i]}\text{mo}(N_i^{\text{nonself}} - N_i^{\text{self}}, \delta_j) \\
\begin{bmatrix} \alpha_{\text{part}} \\ \beta_{\text{part}} \\ \gamma_{\text{part}} \end{bmatrix} &\sim \text{MVNorm}\left(\begin{bmatrix} \alpha \\ \beta \\ \gamma \end{bmatrix}, \mathbf{S} \right) \\
\mathbf{S} &= \begin{pmatrix} \sigma_\alpha, 0, 0 \\ 0, \sigma_\beta, 0 \\ 0, 0, \sigma_\gamma \end{pmatrix} \mathbf{R} \begin{pmatrix} \sigma_\alpha, 0, 0 \\ 0, \sigma_\beta, 0 \\ 0, 0, \sigma_\gamma \end{pmatrix} \\
(\alpha, \beta, \gamma) &\sim \text{Normal}(0,1) \\
(\sigma_\alpha, \sigma_\beta, \sigma_\gamma) &\sim \text{Exponential}(1) \\
\mathbf{R} &\sim \text{LKJcorr}(1) \\
\delta &\sim \text{Dirichlet}(1)
\end{aligned}
$$

This Bayesian multilevel logistic regression model estimates payoff-dependent and norm-dependent utility parameters for each participant (β_{part} and γ_{part} respectively) which, along with the random intercept (α_{part}), predict the probability of choosing the non-selfish mini Dictator Game option. In the model, $\pi_d^{\text{nonself}} - \pi_d^{\text{self}}$ refers to the difference in dictator payoffs between the non-selfish and selfish options, and $N_i^{\text{nonself}} - N_i^{\text{self}}$ to the difference in normative evaluations between the non-selfish and selfish options. Since normative evaluations are measured on four-point Likert scales, these differences are not metric and so are estimated using monotonic effects for ordinal predictors (Bürkner and Vuorre 2019). For notational convenience, the *monotonic transform* is defined as $\text{mo}(x, \delta) = \sum_{i=1}^{x} \delta_i$.

Here is the *brms* code for this model:

```
brm(nonself ~ 0 + Intercept + diffP + mo(diffN) + (1 + diffP + mo(diffN) | id),
    data = d, family = bernoulli,
    prior = c(prior(normal(0, 1), class = b),
              prior(exponential(1), class = sd)))
```

Once this model is fitted, we will test Hypothesis 1 in two ways. First, we will use leave-one-out cross-validation to determine whether this model improves model fit over a null intercept-only model. Second, we will determine whether the 95% credible intervals for the β and γ parameters are above zero, replicating Panizza, Vostroknutov, and Coricelli (2019).

3.2 Hypotheses 2 and 3

We will expand the first model to include interaction effects between (a) the payoff-dependent utility parameter and Social Dominance Orientation, and (b) the norm-dependent utility parameter and Right Wing Authoritarianism:

$$
\begin{aligned}
\text{nonselfish}_i &\sim \text{Bernoulli}\,(p_i) \\
\text{logit}(p_i) &= \text{intercept} + \text{payoff} + \text{norm} \\
\text{intercept} &= \alpha_{\text{part}[i]} \\
\text{payoff} &= \beta_{1,\text{part}[i]}(\pi_d^{\text{nonself}} - \pi_d^{\text{self}}) + \beta_2 \text{SDO}_{\text{part}[i]} + \beta_3 \text{SDO}_{\text{part}[i]}(\pi_d^{\text{nonself}} - \pi_d^{\text{self}}) \\
\text{norm} &= \gamma_{1,\text{part}[i]}\text{mo}(N_i^{\text{nonself}} - N_i^{\text{self}}, \delta_{1,j}) + \gamma_2 \text{RWA}_{\text{part}[i]} + \gamma_3 \text{RWA}_{\text{part}[i]}\text{mo}(N_i^{\text{nonself}} - N_i^{\text{self}}, \delta_{2,j}) \\
\begin{bmatrix} \alpha_{\text{part}} \\ \beta_{1,\text{part}} \\ \gamma_{1,\text{part}} \end{bmatrix} &\sim \text{MVNorm}\left(\begin{bmatrix} \alpha \\ \beta_1 \\ \gamma_1 \end{bmatrix}, \mathbf{S} \right) \\
\mathbf{S} &= \begin{pmatrix} \sigma_\alpha, 0, 0 \\ 0, \sigma_\beta, 0 \\ 0, 0, \sigma_\gamma \end{pmatrix} \mathbf{R} \begin{pmatrix} \sigma_\alpha, 0, 0 \\ 0, \sigma_\beta, 0 \\ 0, 0, \sigma_\gamma \end{pmatrix} \\
(\alpha, \beta_1, \beta_2, \beta_3, \gamma_1, \gamma_2, \gamma_3) &\sim \text{Normal}(0,1) \\
(\sigma_\alpha, \sigma_\beta, \sigma_\gamma) &\sim \text{Exponential}(1) \\
\mathbf{R} &\sim \text{LKJcorr}(1) \\
(\delta_1, \delta_2) &\sim \text{Dirichlet}(1)
\end{aligned}
$$

where SDO_{part} and RWA_{part} refer to mean averages across all SDO and RWA items for each participant.

Here is the *brms* code for this model:

```
brm(nonself ~ 0 + Intercept + diffP*sdo + mo(diffN)*rwa + (1 + diffP + mo(diffN) | id),
    data = d, family = bernoulli,
    prior = c(prior(normal(0, 1), class = b),
              prior(exponential(1), class = sd)))
```

To test Hypotheses 2 and 3, we first check whether this model has improved model fit from the model without any interaction effects using leave-one-out cross-validation. We then check whether the interaction effects of interest (β_3 and γ_3) have 95% credible intervals above zero.

We will determine whether these interaction parameters remain positive when additionally controlling for age and gender in the model.

References

Altemeyer, Robert A, and Bob Altemeyer. 1996. *The Authoritarian Specter*. Harvard University Press.

Bürkner, Paul-Christian. 2017. "brms: An R Package for Bayesian Multilevel Models Using Stan." *Journal of Statistical Software* 80 (1): 1–28. https://doi.org/10.18637/jss.v080.i01.

Bürkner, Paul-Christian, and Matti Vuorre. 2019. "Ordinal Regression Models in Psychology: A Tutorial." *Advances in Methods and Practices in Psychological Science* 2 (1): 77–101. https://doi.org/10.1177/2515245918823199.

Carpenter, Bob, Andrew Gelman, Matthew D Hoffman, Daniel Lee, Ben Goodrich, Michael Betancourt, Marcus Brubaker, Jiqiang Guo, Peter Li, and Allen Riddell. 2017. "Stan: A Probabilistic Programming Language." *Journal of Statistical Software* 76 (1).

Claessens, Scott, Chris G Sibley, Ananish Chaudhuri, and Quentin Atkinson. 2020. "Cooperative Phenotype Predicts Economic Conservatism, Policy Views, and Political Party Support." PsyArXiv. https://doi.org/10.31234/osf.io/t7rqb.

Everett, Jim A. C. 2013. "The 12 Item Social and Economic Conservatism Scale (Secs)." *PLOS ONE* 8 (12): 1–11. https://doi.org/10.1371/journal.pone.0082131.

Fischer, Kyle, Ananish Chaudhuri, and Quentin D. Atkinson. n.d. "Rule Following and Social Conservatism: Unpublished Manuscript."

Kimbrough, Erik O, and Alexander Vostroknutov. 2018. "A Portable Method of Eliciting Respect for Social Norms." *Economics Letters* 168: 147–50.

Krupka, Erin L., and Roberto A. Weber. 2013. "Identifying Social Norms Using Coordination Games: Why Does Dictator Game Sharing Vary?" *Journal of the European Economic Association* 11 (3): 495–524. https://doi.org/10.1111/jeea.12006.

Landau, William Michael. 2018. "The Drake R Package: A Pipeline Toolkit for Reproducibility and High-Performance Computing." *Journal of Open Source Software* 3 (21). https://doi.org/10.21105/joss.00550.

Molleman, Lucas, Ralf H. J.M. Kurvers, and Wouter van den Bos. 2019. "Unleashing the Beast: A Brief Measure of Human Social Information Use." *Evolution and Human Behavior* 40 (5): 492–99. https://doi.org/https://doi.org/10.1016/j.evolhumbehav.2019.06.005.

Panizza, Folco, Alexander Vostroknutov, and Giorgio Coricelli. 2019. "Meta-Context and Choice-Set Effects in Mini-Dictator Games." WorkingPaper 010. GSBE Research Memoranda. Netherlands: Maastricht University, Graduate School of Business; Economics; Maastricht University, Graduate School of Business; Economics. https://doi.org/10.26481/umagsb.2019010.

Sidanius, Jim, and Felicia Pratto. 2001. *Social Dominance: An Intergroup Theory of Social Hierarchy and Oppression*. Cambridge University Press.