Pre-Registration Document

Project working title: Cooperation and Social Dominance Orientation: A Cross-Lagged Analysis

Date: 28th September 2020

A. Hypotheses

Hypothesis 1: As in Wave 1, cooperation games in Wave 2 will all load onto a single underlying latent variable (the "cooperative phenotype").

Hypothesis 2: Using Wave 2 data only, Social Dominance Orientation will negatively predict the cooperative phenotype latent variable.

Hypothesis 3: The cooperative phenotype latent variable will have at least scalar measurement invariance across the two waves.

Hypothesis 4a: In a cross-lagged panel model, Social Dominance Orientation at Wave 1 will predict cooperative phenotype at Wave 2 (supporting the *cooperation-as-outcome* model).

Hypothesis 4b: In a cross-lagged panel model, cooperative phenotype at Wave 1 will predict Social Dominance Orientation at Wave 2 (supporting the *cooperation-as-antecedent* model).

Hypothesis 4c: In a cross-lagged panel model, cooperative phenotype will covary with Social Dominance Orientation within waves, but there will be no cross-lagged effects (supporting the *common-cause* model).

B. Methods

Variables measured

The following table lists the variables from the New Zealand Attitudes and Values Study (NZAVS). A full data dictionary can be found here: https://www.psych.auckland.ac.nz/en/about/our-research/research-groups/new-zealand-attitudes-and-values-study/nzavs-tech-docs.html.

Variable	Wave	Variable name	Item text	Range
SDO1	1 & 2	Social Dominance Orientation	It is OK if some groups have more of a chance in life than others.	1-7
SDO2			Inferior groups should stay in their place.	1-7
SDO3			To get ahead in life, it is sometimes okay to step on other groups.	1-7
SDO4			We should have increased social equality.	1-7
SDO5			It would be good if groups could be equal.	1-7
SDO6			We should do what we can to equalise conditions for different groups.	1-7

INCATT		Income attribution	If incomes were more equal, people would be less motivated to work hard.	1-7
INCRED		Income redistribution	Redistributing money and wealth more evenly among a larger percentage of the people in New Zealand through heavy taxes on the rich.	1-7
NATIONAL		Support for National Party	Support for The National Party.	1-7
RWA1		Right Wing Authoritarianism	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.	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.	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.	1-7
RWA4			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.	1-7
RWA5	1		Atheists and others who have rebelled against established religions are no doubt every bit as good and virtuous as those who attend church regularly.	1-7
RWA6			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.	1-7
AGE		Age	What is your date of birth?	NA
GEN		Gender	What is your gender?	NA
ETHCAT		Ethnicity	Which ethnic group do you belong to? (NZ census question)	NA
NZREG		Education	*Ordinal-rank measure of level of attainment*	0-10
NZSEI		Socio-economic status	*Ordinal-rank measure of socio-economic status based on occupational categories*	10-90
NZDEP		Local deprivation	*Ordinal-rank deprivation score for each meshblock in New Zealand*	1-10
RELIG		Religiosity	Do you identify with a religion and/or spiritual group?	Yes/No

We will also measure the following behavioural variables from one-shot economic games. Possible ranges are given, but these will all be standardised (0-1) across games before analysis. These are

measured alongside the Ultimatum Game, Third-Party Punishment Game, Second-Party Punishment Game, Rule Following task, and BEAST task.

Variable	Wave	Variable name	Operationalised	Range
DG	1 & 2	Dictator Game	Number of points given to Player B	0 – 100 points
TG1		Trust Game (Give)	Decision to give to Player B	Yes / No
TG2		Trust Game (Return)	Number of points returned to Player A	0 – 150 points
PGG		Public Goods Game	Number of points contributed	0 – 100 points

Planned sample

Participants will be sampled from the 1007 participants from the New Zealand Attitudes and Values Study who completed the first wave of economic game data collection and stated that they would like to be invited to participate in additional similar online studies. All 1007 participants will be contacted. We expect a retention rate of around 80% for the second wave. We will analyse data only for participants who complete both waves.

Exclusion criteria

As with the first wave, a participant's data will be excluded if the participant takes less than 5 minutes or more than 50 minutes to complete all the games.

Procedure

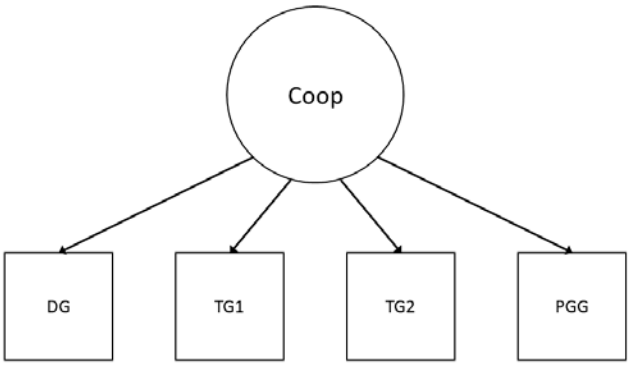
In the second wave of data collection, we replicate the pre-registered procedure from the first wave (https://osf.io/swkqc/). Participants play a series of one-shot economic games in oTree (Chen, Schonger, & Wickens, 2016), using the strategy method and presented in a random order with real-time post-hoc matching. However, we replace the two Stag Hunt games from Wave 1 (Stag Hunt Game and Stag Hunt Game with Punishment) with two different tasks. The first task is a rule following task (adapted from Kimbrough & Vostroknutov, 2018) which asks participants to click to place balls into one of two buckets, with each ball placement earning money. They can either follow an exogenously imposed rule (*e.g.* "place the balls in Bucket A") or break this rule for greater profit. The second task is a social learning task (adapted from Molleman, Kurvers & van den Bos, 2019) which asks participants to estimate the number of animals in a brief presentation of an image, and then revise their estimate based on social information from another previous participant. We do not pre-register any predictions for these new tasks in this document.

C. Analysis Plan

Replicating our approach in Wave 1, game data will be standardised to vary between 0 and 1, and dummy variables (0 or 1) will be used for all binary choices.

Analysis 1

To test Hypothesis 1, we will fit a **confirmatory factor analysis** with Wave 2 data only. We load the Dictator Game (DG), Trust Game Give (TG1), Trust Game Return (TG2), and Public Goods Game (PGG) onto a single "cooperative phenotype" latent variable.



Since this dataset contains a binary variable (TG1) and other non-normal continuous variables, we will use diagonally weighted least squares estimation with robust standard errors (Li, 2016). We expect this model to fit the data well, as measured by the following criteria:

- *Comparative Fit Index.* Good fit > .90 (Kline, 2015).
- *Root Mean Square Error of Approximation.* Excellent fit < .01. Good fit < .05. Mediocre fit < .08 (MacCallum, Browne, & Sugawara, 1996).
- *Standardized Root Mean Square Residual.* Good fit < .08 (Hu & Bentler, 1999).

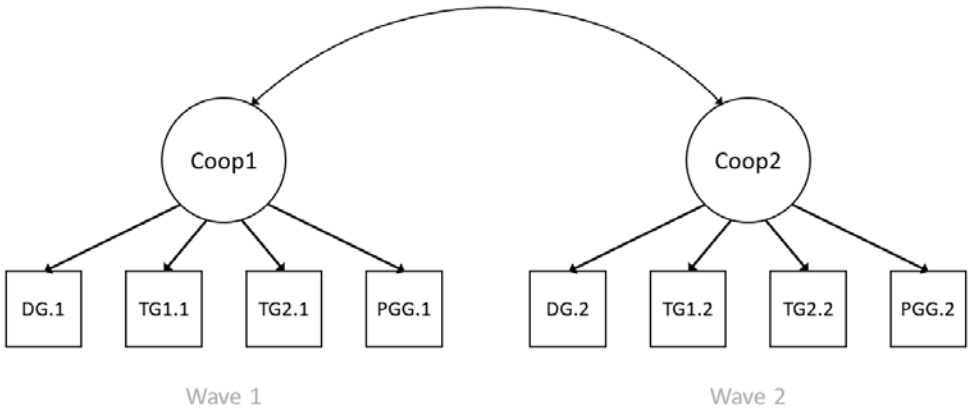
Analysis 2

To test Hypothesis 2, we will fit a **structural equation model** with Wave 2 data only. We will use Social Dominance Orientation to predict the cooperative phenotype. If possible, we will use individual Likert-scale indicators for Social Dominance Orientation to estimate an underlying latent variable, treating those indicators as ordinal and imputing any missing data with multiple imputation methods (Buuren & Groothuis-Oudshoorn, 2010). If this is not possible or these models do not converge, we will resort to using mean scores for SDO. We expect the regression coefficient for SDO -> Cooperation to be significantly negative ($p < .05$).

Analysis 3

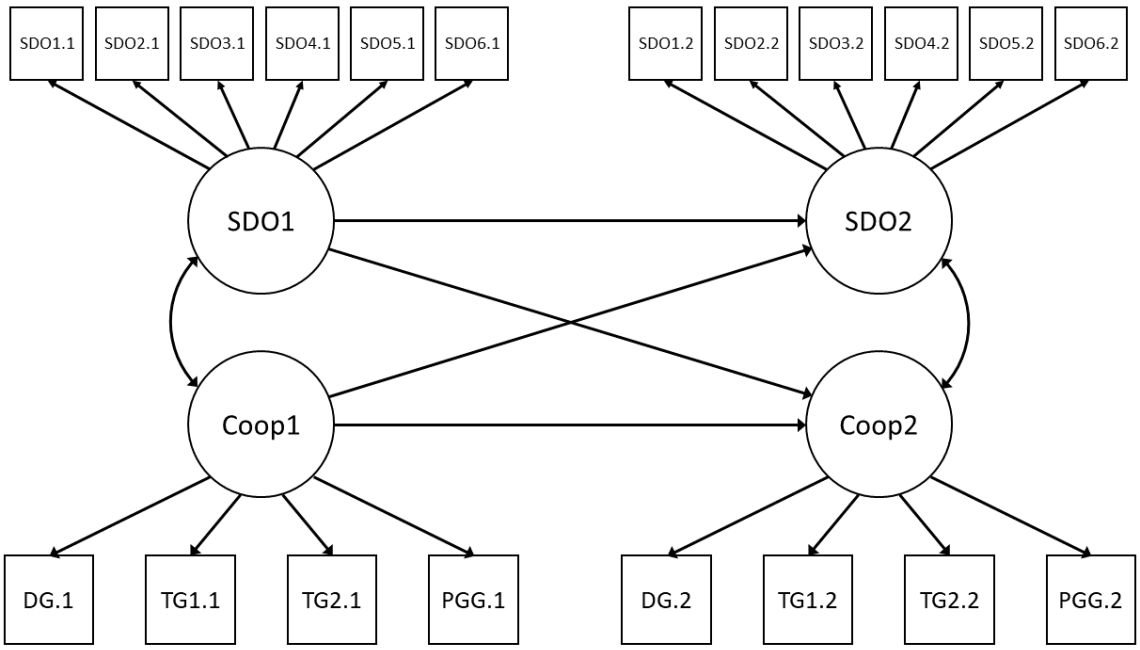
To test Hypothesis 3, we will then determine the **measurement invariance** of the cooperative phenotype factor structure across the two waves, in several steps:

1. *Configural invariance*. If the confirmatory factor model in Analysis 1 fits both Wave 1 and Wave 2 data well according to the fit statistics listed above, and the factor loadings for both models are significantly positive ($p < 0.05$), then configural invariance is achieved.
2. *Metric invariance*. We will fit both waves in a single model (see below) with (1) freely estimated parameters, and (2) factor loadings constrained to equality. If the second model has a CFI reduction of < .01 and an RMSEA increase of < .015 (Chen, 2007), then metric invariance is achieved.
3. *Scalar invariance*. We will then constrain the intercepts and thresholds to equality across waves. As above, if this model has a CFI reduction of < .01 and an RMSEA increase of < .015 compared to the metric invariance model (Chen, 2007), then scalar invariance is achieved.
4. *Strict invariance*. Finally, we will constrain the residual variances to equality across waves. As above, if this model has a CFI reduction of < .01 and an RMSEA increase of < .015 compared to the scalar invariance model (Chen, 2007), then strict invariance is achieved.



Analysis 4

To test between the *cooperation-as-outcome*, *cooperation-as-antecedent*, and *common-cause* models, we will fit a **cross-lagged panel model** to both waves of data. If possible, we will use individual Likert-scale indicators for Social Dominance Orientation to estimate latent variables, treating those indicators as ordinal and imputing any missing data with multiple imputation methods (Buuren & Groothuis-Oudshoorn, 2010). If this is not possible or these models do not converge, we will resort to using mean scores for SDO at both timepoints. We predict that this model will fit the data well, according to the established fit statistic cutoffs listed in Analysis 1.



Based on the previously estimated negative correlation between the cooperation latent variable and SDO in Wave 1, we also expect a significantly negative correlation between the cooperation latent variable and SDO in Wave 2 ($p < 0.05$). We also expect both autoregressive paths to be significantly positive ($p < 0.05$).

Moreover, a significantly negative cross-lagged path from SDO1 to Coop2 ($p < 0.05$) will provide support for the *cooperation-as-outcome* model. A significantly negative cross-lagged path from Coop1 to SDO2 ($p < 0.05$) will provide support for the *cooperation-as-antecedent* model. No cross-

lagged effects, but within-wave negative correlations between the cooperation latent variable and SDO, will provide support for the *common-cause* model.

We will also test this model controlling for several Wave 1 covariates (age, gender, ethnicity, education, socio-economic status, local deprivation, religiosity, and mean RWA), individually and together in a full model.

Finally, we will swap out SDO in the cross-lagged panel model with (1) income redistribution views, (2) income attribution views, (3) support for the National Party. These analyses will provide further support for either the *cooperation-as-outcome*, *cooperation-as-antecedent*, or *common-cause* model.

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