Cooperative phenotype predicts economic conservatism, policy views, and political party support

Scott Claessens[1], Chris G Sibley[1], Ananish Chaudhuri[2,3], & Quentin D Atkinson[1,4]

[1] School of Psychology, University of Auckland, Auckland, New Zealand

[2] Department of Economics, University of Auckland, Auckland, New Zealand

[3] CESifo, Munich, Germany

[4] Max Planck Institute for the Science of Human History, Jena, Germany

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Author Note

Correspondence concerning this article should be addressed to Quentin D Atkinson, Floor 2, Building 302, 23 Symonds Street, Auckland, 1010, New Zealand. E-mail: q.atkinson@auckland.ac.nz

Abstract

Decades of research suggest that our political differences are best captured by two dimensions of political ideology: economic and social conservatism. The dual evolutionary framework of political ideology predicts that these dimensions should be related to variation in general preferences for cooperation and group conformity. Here, we show that, controlling for a host of demographic covariates, a general cooperative preference captured by a suite of incentivised economic games (the "cooperative phenotype") is indeed negatively correlated with two widely-used measures of economic conservatism — Social Dominance Orientation and Schwartz's altruistic vs. self-enhancement values. The cooperative phenotype also predicts political party support and economically progressive views on political issues like income redistribution, welfare, taxation, and environmentalism. By contrast, a second "norm-enforcing punishment" dimension of economic game behaviour, expected to be a proxy for social conservatism and group conformity, showed no reliable relationship with political ideology. These findings reveal how general social preferences that evolved to help us navigate the challenges of group living continue to shape our political differences even today.

Keywords: cooperation, punishment, behavioural economics, political ideology, economic conservatism

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Humans differ profoundly in their views on political issues like income redistribution, taxation, welfare, military spending, and criminal justice. With increasing levels of political partisanship[1,2], understanding the sources of this variation is more pressing than ever. One popular explanation for political differences is that people vary along a unidimensional liberal-conservative spectrum of political ideology[3]. This model is widely referred to in both the popular media and scientific literature[4]. However, attitudinal variation in the modern electorate reveals that the liberal-conservative spectrum fails to capture the full diversity of human political differences. For example, libertarians in the United States support conservative free market and pro-business policies, but often simultaneously hold socially progressive views on abortion, same-sex marriage, and gender roles[5]. In Europe, people are increasingly supporting political parties that promote the welfare state (a "liberal" policy) but also aim to limit immigration (a "conservative" policy)[6]. Examples like these show that a single liberal-conservative spectrum misses important features of the political landscape.

In contrast to the unidimensional view, decades of interdisciplinary work indicate that political ideology is best described along two dimensions[4,7–11]. The first dimension, often referred to as economic conservatism, captures views on issues like taxation, welfare, capitalism, and big business[9]. The second dimension, often referred to as social conservatism, captures views on issues like military spending, patriotism, sexual morality, and criminal justice[9]. These two dimensions have repeatedly emerged from independent lines of research in political psychology[8], moral psychology[12], and cross-cultural psychology[7], though they are often given different labels in different fields[4,8]. While economic and social conservatism tend to positively covary in Western societies[8], they are distinct[8] and are negatively correlated with one another in many societies around the globe[13].

Although previous research has repeatedly identified two dimensions of political

ideology, less work has examined the essential nature of the two dimensions or asked why this particular two-dimensional structure organises political attitudes. An evolutionary approach has the potential to provide answers at this ultimate (rather than proximate[14]) level of analysis[15]. Evolutionary approaches to human political ideology are supported by evidence that the two dimensions of ideology are heritable[16,17], found across cultures[7], and correlated with physiological and neurological differences[18]. These approaches broadly define politics as the process of dealing with the conflicts of interest that arise from human group living[19–21], and align with Harold Lasswell's famous definition of politics as the process of deciding "who gets what, when, and how"[22]. Defined in this way, politics is not a modern phenomenon. Political tensions have characterised human groups throughout our evolutionary history, and have precursors in our group-living primate relatives[23].

We recently proposed two evolutionary foundations of political ideology[4]. In this dual evolutionary framework, we argue that the two dimensions of political ideology reflect two key steps in the evolution of human group living[24–28]. In the first key step, humans developed more egalitarian sharing preferences and began to cooperate across wider interdependent networks. In the second key step, humans created cultural markers to identify members of their group, and began adhering to and enforcing group-wide social norms to enhance group viability. These two fundamental challenges of group living favoured general preferences for cooperation and group conformity in ancestral humans, transitioning human group living from the small kin networks characteristic of great apes to relatively egalitarian, culturally-bound hunter-gatherer communities[26,29,30].

This dual evolutionary framework hypothesises that variation in general preferences for cooperation and group conformity underlie the two dimensions of political ideology in modern humans[4]. Functional variation in general preferences can be maintained either by balancing selection on fitness trade-offs, creating enduring heritable individual differences, or by behavioural plasticity in response to local socio-ecological conditions[4]. This emergent variation in general preferences is predicted to produce differences in political opinion. Under

the dual evolutionary framework, an increased general preference for cooperation beyond close kin results in greater support for economically progressive policies that promote large-scale cooperation, such as income redistribution, taxation, welfare, and pro-environmentalism. By contrast, an increased general preference for group conformity results in greater support for socially conservative policies that promote in-group conformity and norm enforcement, such as military spending, capital punishment, and promoting traditional religious values.

If general preferences do underlie differences in political opinion, such differences should be manifest in social preferences identified by behavioural economics. Behavioural economic games allow researchers to study variation in enduring social preferences[31]. Experimental games model the basic payoff matrices of social interactions, abstracting away from the complexity of the real world to capture variation in "pure" preferences. Decades of work using experimental economic games have revealed that humans are not selfish payoff-maximisers, as predicted by economic theory, but incorporate the payoffs of others into their cooperative decision-making[32–36]. This research also highlights wide variation in social preferences between individuals[37–40].

Previous research has studied the covariation between social preferences in economic games and political ideology. Studies linking gameplay to unidimensional political party support have produced mixed results, with some studies finding that supporters of left-leaning parties are more cooperative in economic games[41–44] and other studies finding no relationship between gameplay and political party support[45,46]. However, a number of studies find support for an association between cooperative preferences and the economic dimension of ideology[47,48]. A recent meta-analysis of the links between personality and prosocial behaviour found that cooperative behaviour in a number of social dilemma games that allow exploitation of others was negatively correlated with Social Dominance Orientation (SDO; a measure of support for inequality and hierarchy, widely used as a proxy for economic conservatism)[49]. In contrast, other research has failed to find a relationship between SDO

and cooperative behaviour in the Prisoner's Dilemma Game, in which two players choose whether to cooperate or defect[46,47], or the Stag Hunt Game, in which two players must coordinate on the same strategy[47]. These findings suggest that the economic dimension of ideology may relate to particular affordances of individual games (e.g., exploitation[49]) rather than to a general cooperative preference that applies across situations with different payoff structures. Furthermore, research exploring the relationship between the social dimension of ideology and general conformist and norm-enforcing preferences remains limited.

To overcome these limitations, we build on previous work that identified general social preferences using a battery of economic games. Peysakhovich et al.[50] asked participants to play three cooperation games and three punishment games. The cooperation games were the Dictator Game (in which players can share their endowment with another player), the Trust Game (in which players can transfer money to another player who may or may not return some of the multiplied amount), and the Public Goods Game (in which multiple players can choose to contribute to a shared public good). The punishment games were the Ultimatum Game (in which players reject unfair offers), the Second-Party Punishment Game (in which players punish defection in a Prisoner's Dilemma), and the Third-Party Punishment Game (in which players punish stealing behaviour as an impartial observer). Factor analysis revealed that the cooperative decisions all positively covaried and could be described by a single underlying latent variable, dubbed the "cooperative phenotype". The study also reported a positive correlation between the cooperative phenotype and a single item measuring support for "an increase in taxes if it were used to help the less well off in society" (an economically progressive view), but the authors did not analyse potential links with political ideology. While subsequent research has replicated the cooperative phenotype factor structure[47,51–53] across several cultures[54], this work has not systematically examined the association between the cooperative phenotype and economic conservatism, policy views, and political party support. In addition, Peysakhovich et al.[50] distinguished the cooperative phenotype from a second latent variable that emerged from the punishment games, labelled

"norm-enforcing punishment"[55,56]. Under the dual evolutionary framework of political ideology, this latent variable could plausibly be linked to social conservatism.

Here, we extend this prior work by combining an expanded set of economic games with comprehensive survey data to test whether and to what extent the cooperative phenotype covaries with widely-used measures of economic conservatism, as well as policy views and political party support. In addition, we examine the relationship between the second latent variable (norm-enforcing punishment) and social conservatism. In our pre-registered study (https://osf.io/dwx8g/), we recruited a diverse nationally-representative New Zealand sample ($n = 926$) from the ongoing longitudinal New Zealand Attitudes and Values Study[57] (see Methods and Figure S1 for sample characteristics). We asked these participants to play a suite of eight real-time anonymous one-shot economic games measuring both cooperation and punishment (see Methods for detailed descriptions of games). Six of these games were identical to those used in Peysakhovich et al.[50], and two were additional coordination games: a version of the Stag Hunt Game, in which multiple players must coordinate on the same strategy, preferably the payoff-dominant equilibrium; and the Stag Hunt Game with Punishment, in which players may punish others for not choosing the strategy commensurate with the payoff-dominant equilibrium. We added these two games to study whether the general preferences for cooperation and punishment extended to coordination problems that do not involve exploitation of others and are arguably better models for the real-world cooperative dilemmas faced by our human ancestors[26]. Participants played the online economic games simultaneously with other participants across New Zealand. Gameplay was incentivised with a fixed \$20 NZD show-up fee plus a bonus payment of between \$10-35 (M = \$25.17, SD = \$2.47) depending on participants' decisions, resulting in \$41,826 overall spent on participant payment.

We pre-registered three hypotheses. First, we hypothesised that a two-factor structure of cooperation and punishment would emerge from this expanded suite of games, replicating and extending previous work. Second, we hypothesised that SDO would negatively predict

variation in the cooperation factor. Third, we hypothesised that, to the extent that punishment in our economic games reflects norm-enforcement, Right Wing Authoritarianism (RWA; a widely-used measure of social conservatism) would positively predict variation in the punishment factor. Beyond these pre-registered hypotheses, we took advantage of the wealth of survey data from the New Zealand Attitudes and Values Study to further explore the relationships between gameplay and additional measures of political ideology, policy views, and political party support.

Results

To test the first hypothesis that gameplay would produce a two-factor structure, we focused on patterns of covariation among the economic games with pre-registered correlational, principal components, and confirmatory factor analyses. Pairwise Spearman's rank correlations between game decisions are visualised in Figure 1a. Replicating previous work[50], we found significant positive correlations between most cooperation decisions (r_s = 0.07-0.33), significant positive correlations between all punishment decisions (r_s = 0.10-0.49), and non-significant or negative correlations between most cooperation and punishment decisions. Principal components analyses suggested that these patterns of covariation could be explained by two underlying factors: cooperation and punishment. When including only games from previous work, principal components analysis supported a two-factor solution. Using orthogonal varimax rotation and retaining factors with eigenvalues above one (Figure S2a), this analysis revealed that cooperative behaviour loads highly onto one factor and punitive behaviour loads highly onto a second distinct factor (Figure 1b). Together, these factors explained 44% of the variance in game decisions. This two-factor structure held when adding our novel coordination games, with the Stag Hunt Game loading onto the cooperation factor and the Stag Hunt Game with Punishment loading onto the punishment factor (Figures 1c and S2b; 41% variance explained).

In addition to the data-driven statistics reported above, the two-factor structure of

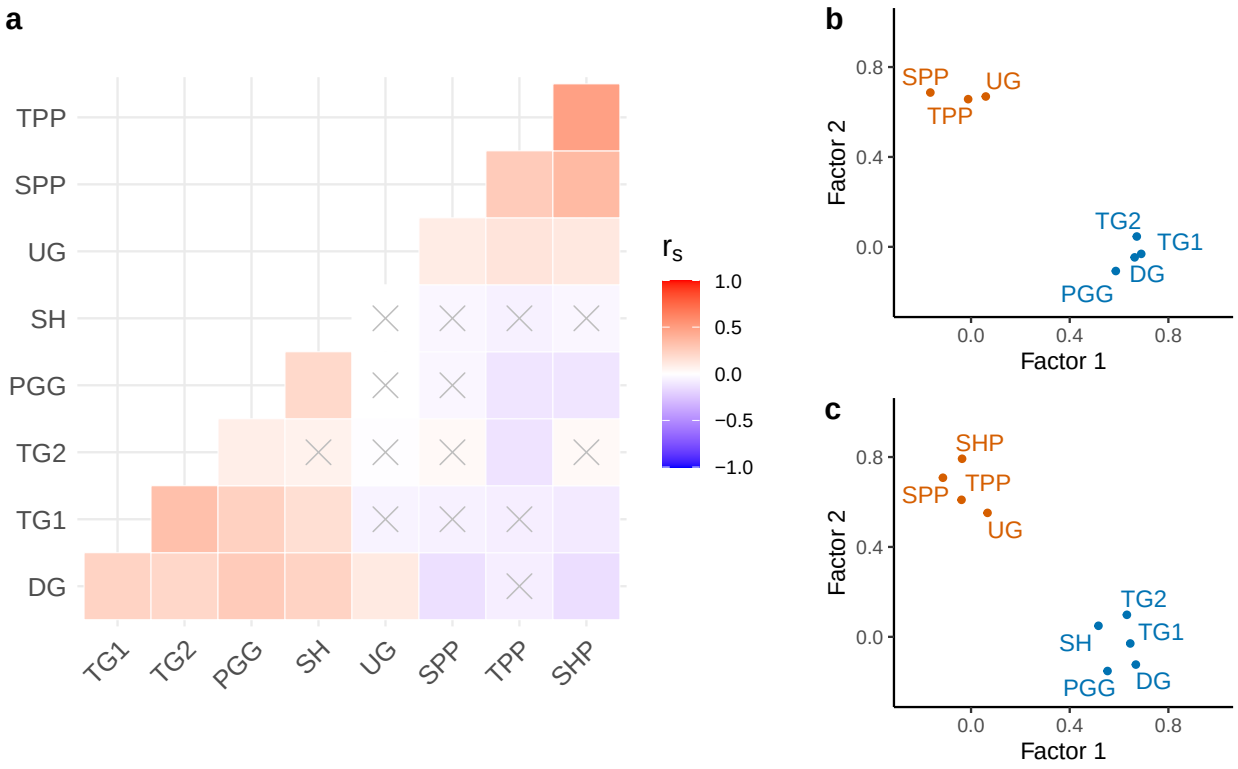

Figure 1. Factor structure of economic games. (*a*) Pairwise Spearman's rank correlations for game decisions. Grey crosses indicate non-significant correlations with Benjamin-Hochberg corrected *p*-values above .05. (*b*) Factor loadings from a principal components analysis with only the game decisions from previous work[50]. (*c*) Factor loadings from an extended principal components analysis including coordination games. DG = Dictator Game, TG1 = Trust Game (Give), TG2 = Trust Game (Return), PGG = Public Goods Game, SH = Stag Hunt Game, UG = Ultimatum Game (Minimum Acceptable Offer), TPP = Third-Party Punishment Game (Punish), SPP = Second-Party Punishment Game (Punish Defector), SHP = Stag Hunt Game with Punishment (Punish Defector).

cooperation and punishment was also supported by confirmatory factor analyses. As with our principal components analysis, we initially restricted our confirmatory factor model to include only the games used in previous work[50]. Controlling for game comprehension, we loaded the Dictator Game, Trust Game (Give), Trust Game (Return), and Public Goods Game onto the cooperation latent variable, and loaded the Ultimatum Game (Minimum Acceptable Offer), Third-Party Punishment Game (Punish), and Second-Party Punishment Game (Punish Defector) onto the punishment latent variable. According to established fit statistic cutoffs[58,59], this model fitted the data well, with a Root Mean Square Error of Approximation (RMSEA) value of 0.06 and a Standardised Root Mean Square Residual (SRMR) value of 0.04. All indicators had significantly positive loadings, and the two latent variables were significantly negatively correlated with one another (r = -0.20, p = .023; Figure S3). Model fit improved further when additionally loading the Stag Hunt Game onto the cooperation latent variable and loading the Stag Hunt Game with Punishment (Punish Defector) onto the punishment latent variable (RMSEA = 0.04; SRMR = 0.04; Figure S4).

Having confirmed the existence of a two-factor structure underlying gameplay, we next fitted pre-registered structural equation models to test the relationships between the two latent variables and political ideology. We simultaneously regressed the cooperation and punishment latent variables onto mean scores of six Likert-scale items for SDO (Cronbach's $\alpha = 0.82$) and RWA ($\alpha = 0.74$; see Methods for details on SDO and RWA items). In line with our second hypothesis, we found that SDO significantly negatively predicted the cooperation latent variable with a small-to-medium effect size (standardised β = -0.24, unstandardised b = -0.03, 95% CI [-0.05, -0.02], $p < .001$, semi-partial r = 0.24; Figure 2a). SDO also significantly positively predicted the punishment latent variable with a small effect size, which we did not hypothesise (β = 0.10, b = 0.003 [0.000, 0.006], p = .029, r = 0.11). In contrast with our third hypothesis, we found no significant relationship between RWA and the punishment latent variable (β = 0.04, b = 0.001 [-0.001, 0.003], p = .301, r = 0.06; Figure 2b). RWA was also unrelated to the cooperation latent variable (β = 0.00, b = 0.00

[-0.01, 0.01], $p = .955$, $r = 0.02$). This pattern of results held when additionally controlling for age, gender, ethnicity, education, and religiosity, though the relationship between SDO and the punishment latent variable was attenuated when controlling for socio-economic status and local deprivation (Table S1).

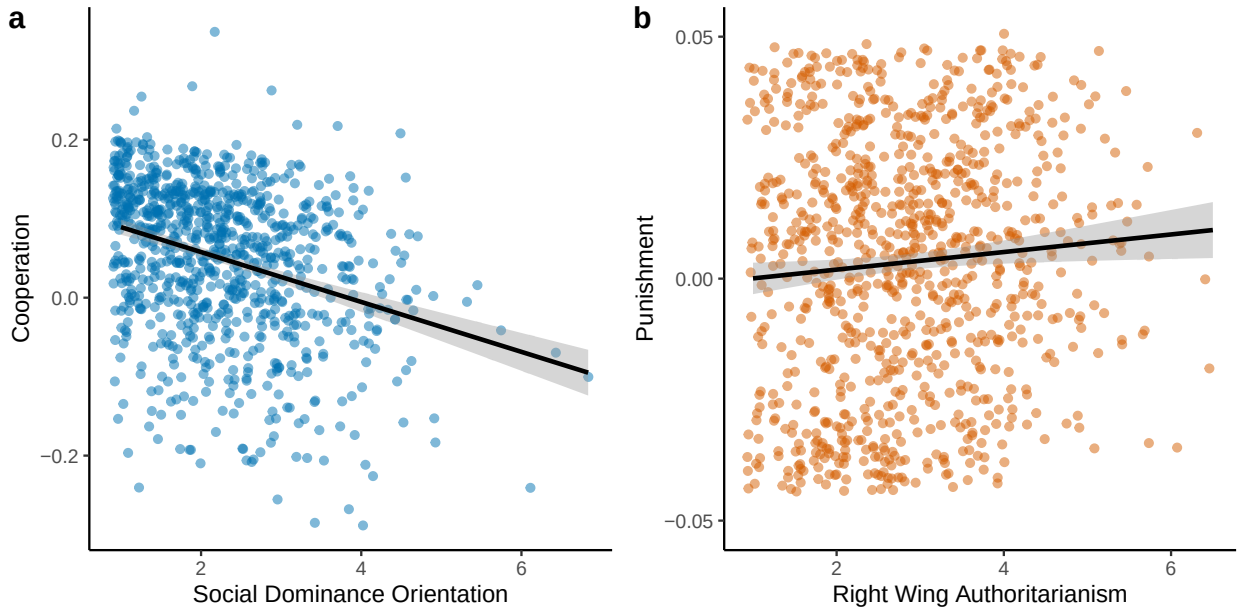

Figure 2. Relationships between model-predicted latent variable scores for cooperation and punishment and the two dimensions of political ideology. (*a*) Social Dominance Orientation (mean score) is negatively related to the cooperation latent variable. (*b*) Right Wing Authoritarianism (mean score) is unrelated to the punishment latent variable. Lines are predictions from linear regressions, shaded areas are 95% confidence intervals.

To ensure that our pattern of results generalised beyond SDO and RWA, we replicated the above analyses with another widely-used measure of the two dimensions of political ideology: Schwartz's values[60]. Schwartz argues that basic personal values vary along two dimensions of altruism vs. self-enhancement and openness vs. conservation[60]. These reflect the economic and social dimensions of political ideology, respectively[4,8]. When we replace SDO and RWA with Schwartz's values, we find the same pattern of results. Controlling for demographics, altruistic values significantly positively predicted the cooperation latent variable ($\beta = 0.14$, $b = 0.02$ [0.01, 0.04], $p = .006$, $r = 0.14$), while self-enhancement values

significantly negatively predicted the cooperation latent variable (β = -0.16, b = -0.03 [-0.05, -0.01], p = .003, r = 0.15). Altruistic and self-enhancement values were unrelated to the punishment latent variable. In contrast, neither openness values (β = 0.06, b = 0.002 [-0.001, 0.006], p = .193, r = 0.06) nor conservation values (β = 0.04, b = 0.003 [-0.004, 0.009], p = .390, r = 0.05) predicted the punishment latent variable. Openness and conservation values were unrelated to the cooperation latent variable.

To further investigate the relationships between political ideology and gameplay, we conducted a series of exploratory linear regressions with mean SDO and RWA scores as outcome variables and individual game decisions as predictors, controlling for demographics and game comprehension. Strikingly, every cooperative decision was negatively associated with SDO (Figure 3). Holding all other variables constant, individuals were predicted to have higher SDO scores if they gave less in the Dictator Game, did not give in the Trust Game, returned less in the Trust Game, contributed less in the Public Goods Game, did not coordinate in the Stag Hunt Game, offered less in the Ultimatum Game, stole in the Third-Party Punishment Game, defected in the Prisoner's Dilemma Game, and did not coordinate in the Stag Hunt Game with Punishment. The effect sizes for these relationships were small, but consistent across all games (semi-partial r = 0.06-0.11). SDO was also positively related to some punishment decisions, including anti-social punishment (punishment of cooperators) in the Second-Party Punishment Game and Stag Hunt Game with Punishment, and punishment of defectors in the latter game. In contrast, fewer individual game decisions predicted RWA (Figure 4). Holding all other variables constant, individuals were predicted to have higher RWA scores if they anti-socially punished cooperators in the Second-Party Punishment Game and the Stag Hunt Game with Punishment, and if they stole in the Third-Party Punishment Game.

The cooperation latent variable also reliably predicted economically progressive views across a wide range of political issues (Figure 5). Controlling for the punishment latent variable, game comprehension, and demographics, exploratory structural equation modelling

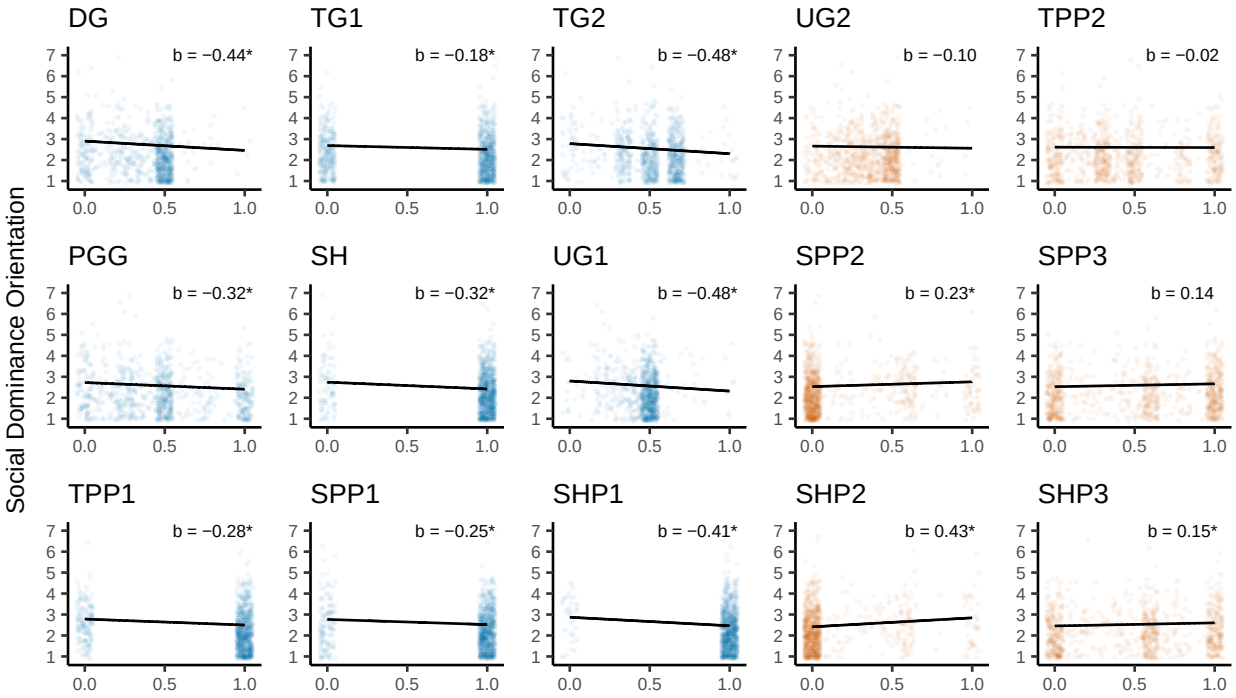

Figure 3. Individual game decisions predicting Social Dominance Orientation. Lines are predictions from linear regressions, controlling for Right Wing Authoritarianism, game comprehension, and demographics. Blue plots are cooperation decisions, orange plots are punishment decisions. Numbers are unstandardised coefficients. $^*p < 0.05$. DG = Dictator Game, TG1 = Trust Game (Give), TG2 = Trust Game (Return), PGG = Public Goods Game, SH = Stag Hunt Game, UG1 = Ultimatum Game (Offer), TPP1 = Third-Party Punishment Game (Steal), SPP1 = Second-Party Punishment Game (Cooperate), SHP1 = Stag Hunt Game with Punishment (Coordinate), UG2 = Ultimatum Game (Minimum Acceptable Offer), TPP2 = Third-Party Punishment Game (Punish), SPP2 = Second-Party Punishment Game (Punish Cooperator), SPP3 = Second-Party Punishment Game (Punish Defector), SHP2 = Stag Hunt Game with Punishment (Punish Coordinator), SHP3 = Stag Hunt Game with Punishment (Punish Defector).

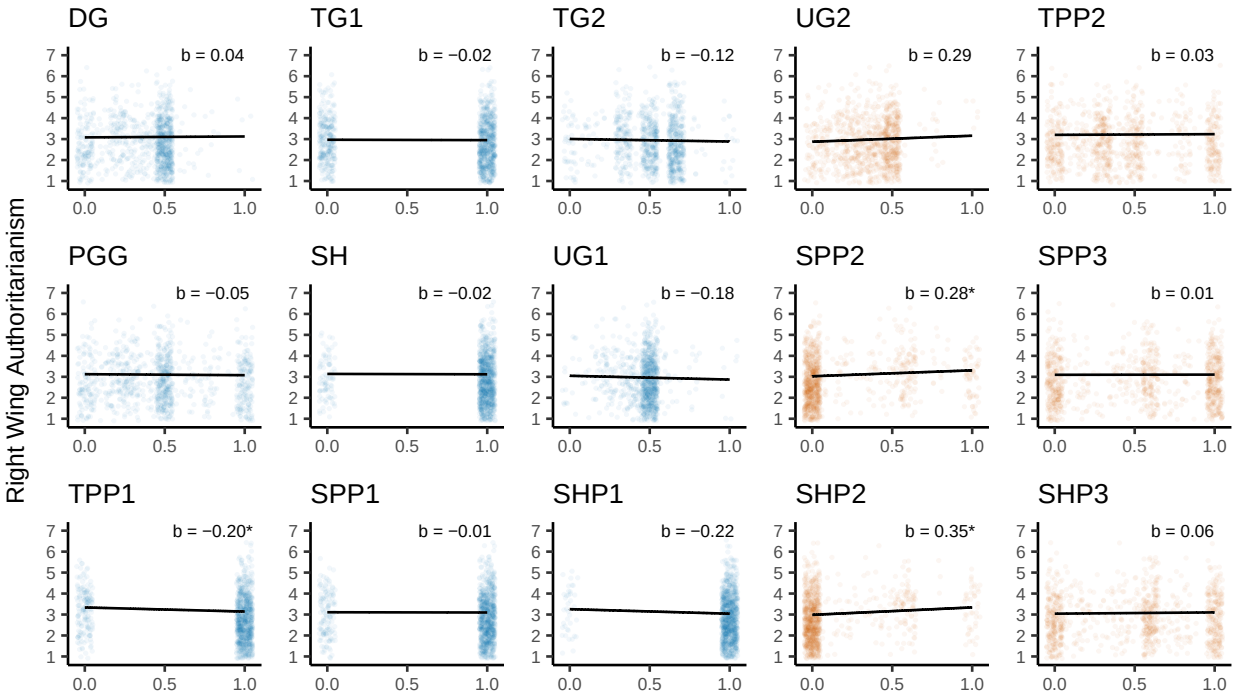

Figure 4. Individual game decisions predicting Right Wing Authoritarianism. Lines are predictions from linear regressions, controlling for Social Dominance Orientation, game comprehension, and demographics. Blue plots are cooperation decisions, orange plots are punishment decisions. Numbers are unstandardised coefficients. $^*p < 0.05$. DG = Dictator Game, TG1 = Trust Game (Give), TG2 = Trust Game (Return), PGG = Public Goods Game, SH = Stag Hunt Game, UG1 = Ultimatum Game (Offer), TPP1 = Third-Party Punishment Game (Steal), SPP1 = Second-Party Punishment Game (Cooperate), SHP1 = Stag Hunt Game with Punishment (Coordinate), UG2 = Ultimatum Game (Minimum Acceptable Offer), TPP2 = Third-Party Punishment Game (Punish), SPP2 = Second-Party Punishment Game (Punish Cooperator), SPP3 = Second-Party Punishment Game (Punish Defector), SHP2 = Stag Hunt Game with Punishment (Punish Coordinator), SHP3 = Stag Hunt Game with Punishment (Punish Defector).

revealed that the cooperation latent variable positively predicted preferences for income redistribution (b = 1.07 [0.41, 1.72], p = .001, r = 0.11), willingness to make sacrifices for the environment (b = 1.21 [0.45, 1.96], p = .002, r = 0.12), endorsement of increased payments for those receiving Jobseeker Support (b = 1.36 [0.60, 2.12], p < .001, r = 0.15), and endorsement of increased payments for those receiving Sole Parent Support (b = 1.42 [0.66, 2.18], p < .001, r = 0.15). Cooperation was also negatively related to support for an economically conservative "flat tax" where everyone pays the same percentage of tax on their income regardless of their wealth (b = -0.97 [-1.69, -0.24], p = .009, r = 0.11) and the belief that people would be less motivated to work hard if incomes were equal (b = -1.50 [-2.17, -0.82], p < .001, r = 0.16). Though these effect sizes are small, the cooperation latent variable explains a comparable proportion of variance to other demographic variables (Figure S5). In contrast, the punishment latent variable did not predict socially conservative views like support for same-sex marriage (b = -0.16 [-3.08, 2.75], p = .913, r = 0.00), support for euthanasia (b = 1.22 [-1.56, 4.01], p = .388, r = 0.04), or support for abortion (b = -0.37 [-3.24, 2.50], p = .800, r = 0.00).

Finally, the cooperation latent variable predicted political party support. In an exploratory Bayesian multinomial regression analysis, we used the model-predicted cooperation and punishment latent variable scores to predict reported support for the main four political parties in New Zealand: the New Zealand National Party, the New Zealand Labour Party, the Green Party of Aotearoa New Zealand, and the New Zealand First Party. Adding the cooperation latent variable to a null model with only demographic predictors improved model fit (difference in expected log pointwise predictive density = 4.18, SE = 1.32). The effect of cooperation on political party support, controlling for demographics and the punishment latent variable, is visualised in Figure 6. Individuals higher in the cooperation latent variable were less likely to support National (New Zealand's primary conservative party; b = -0.74, 95% credible interval [-1.59, 0.12]) and were more likely to support the Greens (b = 0.66 [-0.20, 1.51]), although cooperation did not predict support for

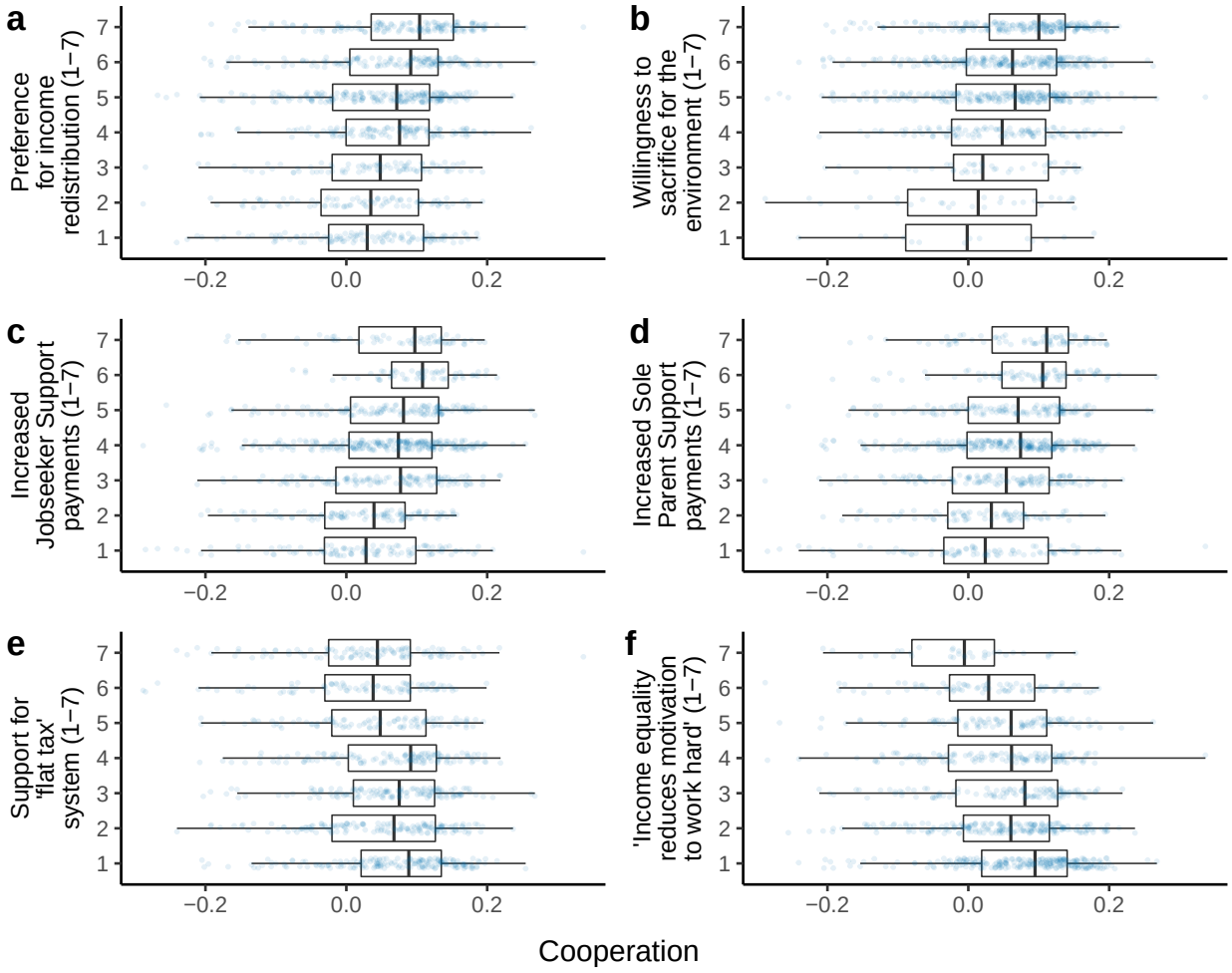

Figure 5. The cooperation latent variable predicts a host of economically progressive views. For every Likert scale, 7 indicates increased support for the policy or agreement with the statement, whereas 1 indicates reduced support for the policy or disagreement with the statement. Boxplots visualise the median, inter-quartile range, and range with outliers removed (+/- 1.5 x inter-quartile range).

Labour or NZ First. In contrast, adding the punishment latent variable did not improve model fit over the null model (difference in expected log pointwise predictive density = 0.03, $SE = 0.12$).

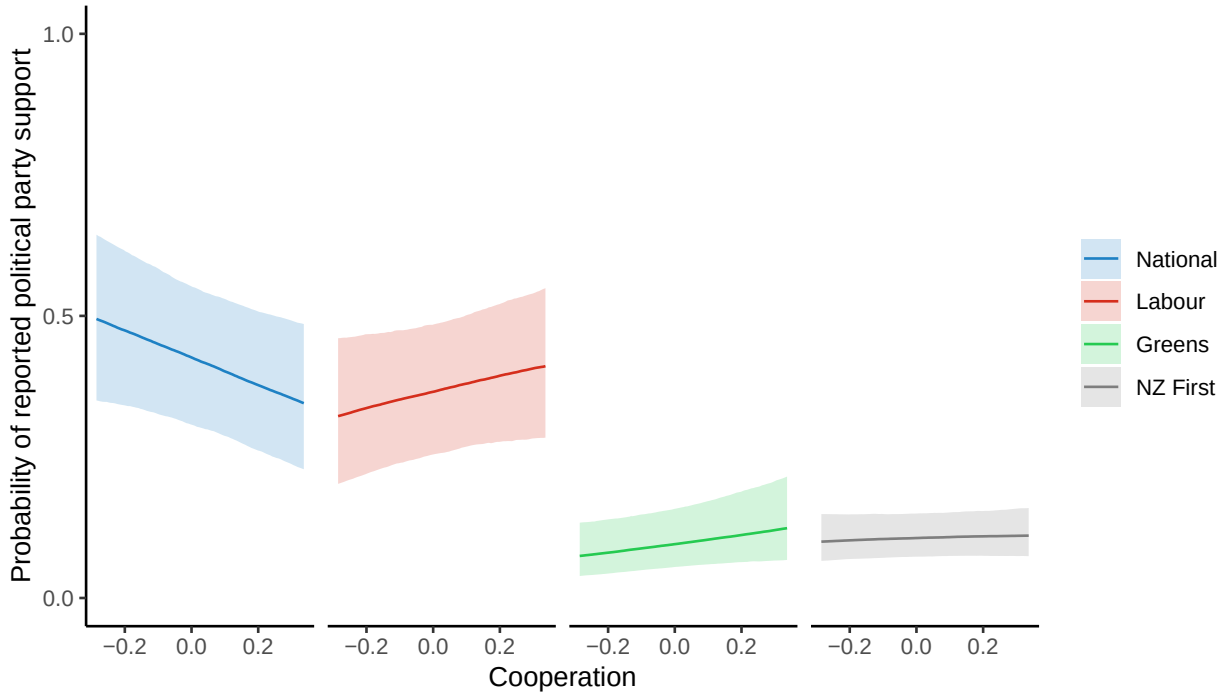

Figure 6. The cooperation latent variable predicts reported political party support. Individuals higher in the cooperation latent variable were less likely to support National and more likely to support the Greens. Lines are median posterior multinomial regression lines, shaded areas are 95% credible intervals.

Discussion

The correlations, principal components analyses, and confirmatory factor analyses we report show that behaviour across a large suite of economic games can be captured by two underlying general preferences: cooperation and punishment. This finding replicates previous work[50,54] and demonstrates that the cooperative phenotype generalises to an English-speaking sample outside the United States and Europe. In addition, the unique combination of substantial monetary stakes, real-time interactive gameplay, and additional

coordination games deployed in our study indicates that the cooperative phenotype reliably emerges with methodologies that may more reliably track real-world social interactions and with games that do not involve exploitation of others[49].

As predicted by the dual evolutionary framework of political ideology[4], we found that the cooperative phenotype captured by our economic games negatively covaried with two widely-used measures of economic conservatism: Social Dominance Orientation and Schwartz's altruistic vs. self-enhancement values. This builds upon previous studies identifying negative correlations between SDO and cooperative behaviour[43,47–49] and between altruistic values and cooperative behaviour[61,62]. The small-to-medium effect size for the relationship between SDO and the general cooperative preference (semi-partial $r = 0.24$) is comparable to the effect size found in a recent meta-analysis of personality traits and economic game behaviour[49]. Our results suggest that previous correlations between measures of economic conservatism and gameplay have emerged because of an underlying relationship between economic conservatism and a general cooperative preference, rather than because of idiosyncratic features of particular conservatism measures or particular games.

The negative association between SDO and the cooperative phenotype suggests that the SDO self-report scale is capturing variation in interpersonal cooperation vs. competition. This claim is at odds with the popular conceptualisation of SDO as a measure of group-based (not interpersonal) dominance[63–65] and the explicit reference to groups in SDO scale items (see Methods). We acknowledge that SDO does predict group-based discrimination and prejudice[8]. However, SDO is also positively correlated with narcissism and Machiavellianism[63,64,66] and negatively correlated with agreeableness[67], all of which are moderators of interpersonal social interactions[66,68]. Individuals higher in SDO also prefer to keep money for themselves rather than benefit the ingroup in order to harm a real, salient outgroup[48], further supporting the claim that SDO reflects interpersonal rather than group-based dominance. Those studying SDO will need to adjust their conceptualisation of the measure to accommodate these findings.

When we separately explored individual economic games, we found negative correlations between SDO and cooperation for every cooperative decision (Figure 3). A recent study hypothesised that SDO should be specifically related to economic game behaviour that involves exploitation of others (i.e., increasing one's own outcome at another's cost)[49]. In this study, we have shown that SDO is indeed related to exploitative behaviour, such as returning less in the Trust Game, but it is also related to cooperative behaviour in games that do not involve a conflict of interest and so do not allow for exploitation of others, such as coordinating to mutual benefit in the Stag Hunt Game. This provides further evidence that economic conservatism is negatively associated with a general cooperative preference that applies across many different situations with different interaction payoff structures, rather than a narrow preference that applies in some situations but not others.

Further exploratory analyses revealed that the cooperative phenotype was related to economically progressive views across a wide range of policy issues, including environmentalism, welfare, taxation, and income redistribution. While the effect sizes for these associations were small, the cooperation latent variable explained a comparable proportion of variance to other demographic variables known to predict economically progressive policy views, such as age, gender, and education[9,69] (Figure S5), and the effects persisted when controlling for these variables. We do not believe that the associations between the cooperative phenotype and economically progressive views simply arose from people mapping their prior political beliefs onto the economic games, since the relationship held for games with different structures and the game descriptions were abstract with no political framing. Instead, we believe that variation in the cooperative phenotype predicts these particular policy views because they all reflect a willingness to cooperate in real-world large-scale social dilemmas. Taxation can be seen as cooperating in a public goods dilemma, where people pay individual costs that provide benefits to all (e.g., public infrastructure, education, healthcare). Making personal sacrifices to protect the environment can be seen as cooperating in a commons dilemma, where people forgo self-interest by refusing to deplete

common environmental resources. Under this view, all other things being equal, the higher the cooperative phenotype, the more willing people will be to cooperate in real-world large-scale social dilemmas like these and thus support economically progressive policies.

We also found that the cooperative phenotype predicted political party support. Specifically, individuals with higher levels of the cooperation latent variable were less likely to support the National Party and more likely to support the Green Party, a party that promotes environmental protection and progressive taxation. This contrasts with studies finding no association between gameplay and support for Republicans or Democrats in the United States[45,46], but aligns with research showing greater cooperative preferences among supporters of left-leaning parties in Europe[41–44]. Previous research in New Zealand has identified key demographic predictors of political party support, such as age, gender, education, ethnicity, and socio-economic status[70]. For example, individuals in highly deprived areas of New Zealand are more likely to support Labour, Greens, and NZ First, presumably because these political parties best serve the economic interests of individuals low in socio-economic status. However, we have shown that the cooperation latent variable predicts party support even after controlling for all of these variables. This suggests that, in contrast to approaches that highlight self-interest as the main determinant of political attitudes[71], the cooperative phenotype underlying the economic dimension of ideology predicts political party support independently of self-interest concerns.

We failed to find the predicted association between the punishment latent variable and RWA or between the punishment latent variable and Schwartz's openness vs. conservation values, nor did we find any link between the punishment latent variable and policy views or political party support. One explanation for this lack of relationship is that the punishment games initially used by Peysakhovich et al.[50] may not be capturing a general group conformist norm-enforcing preference as expected. Instead, it has been suggested that punishment in economic games could provide a competitive function, increasing individuals' relative payoffs over others[72,73]. In hindsight, there are several reasons to favour a

competitive-punishment account over a normative-punishment account in this study. First, this study used one-shot games with anonymous others in which there was no possibility for signalling, reputation building, or future behaviour modification, all supposedly essential factors behind the success of norm-enforcing punishment to enhance cooperation. Evidence suggests that one needs a relatively long horizon for norm-enforcing punishments to increase cooperation beyond what would prevail in the absence of such punishments[74,75]. In our one-shot anonymous games, then, punishment may be a last-ditch attempt to equalise payoffs rather than enforce norms to shape later behaviour. Second, we unexpectedly found a small positive relationship between SDO and the punishment latent variable, indicating that punishment in our games may be related to interpersonal competition rather than norm-enforcement. Third, an additional analysis revealed that, after controlling for demographics and the cooperation latent variable, the punishment latent variable was positively correlated with a view of the world as "a dog-eat-dog world where you have to be ruthless at times" ($b = 2.97$ [0.14, 5.79], $p = .040$). This positive relationship between the punishment latent variable and a competitive worldview in our study suggests that punishment is reflecting a competitive motive, rather than a norm-enforcing motive, at least in this instance. Nevertheless, the competitive-punishment account is difficult to formally test against the normative-punishment account with our data as we did not empirically measure any norms[76] or allow for repeated interactions in our study.

There remain several open questions regarding the dual evolutionary framework of political ideology. First, if the punishment games from Peysakhovich et al.[50] were not sufficient to measure a general group conformist preference, are there more suitable behavioural measures for the social dimension of political ideology? Future studies could make use of repeated games with the opportunity for signalling and reputation building[55], empirically-measured group norms[76], or other measures of norm-adherence to evaluate the hypothesised general preference for group conformity. Second, while this study has provided a snapshot of general preferences and ideology at a particular point in time, the dual

evolutionary framework also hypothesises that changes in general preferences should predict subsequent changes in political views. For example, Universal Basic Income[77], an economically progressive welfare program that aims to provide unconditional regular payments to citizens, has garnered increased support during the COVID-19 pandemic[78]. One explanation for this increased support is that people tend to cooperate more with one another during crises[79], and this increased cooperative preference results in more economically progressive views. Future longitudinal studies will be required to formally test causal pathways like these. Third, it remains unclear to what extent our findings apply to non-WEIRD[80] and small-scale societies. If the two dimensions of political ideology indeed emerge from general cooperative and group conformist preferences that were selected in ancestral humans, then the relationship between general preferences and political ideology should be cross-culturally universal. Future anthropological studies should employ similar behavioural measures in small-scale societies to predict locally-relevant political attitudes.

In sum, the dual evolutionary framework of political ideology predicts that differences in economic and social conservatism are produced by underlying variation in general preferences for cooperation and group conformity. In support of this framework, we have shown that a general preference for cooperation can be estimated from a suite of behavioural economic games, and this cooperative phenotype is related to economically progressive attitudes, policy views, and political party support.

Methods

Participants

Power analysis. The minimum size of our sample was determined by conducting a power analysis on previous data[50]. We used the smallest significant correlation between economic game play and real-world cooperation in that study as the effect size ($r = 0.15$). G*Power[81] suggested a sample of 571 participants to detect this correlation effect size with

statistical power of 0.95. This sample size is also sufficient to conduct exploratory factor analysis[59]. We aimed to sample 1000 participants, substantially above this amount, and eventually report data from 926 participants.

Participants and sampling. Participants for this study were sampled from the ongoing longitudinal New Zealand Attitudes and Values Study[57]. This participant pool is a representative sample of the New Zealand population, contacted through random draws from the New Zealand electoral roll. We included participants in our sample frame who: had completed Wave 4 of the study (n = 12,189); had also completed Wave 9 and/or Wave 10 (n = 8,095); had not subsequently withdrawn from the study at the time of sampling (n = 7,833); had consistently indicated at Wave 9 and 10 that they would be willing to participate in an additional online study (n = 4,181); had a valid email address (n = 4,040); were living in New Zealand (n = 3,955); were younger than 70 at the time of sampling (n = 3,374); and had a valid cell or landline number (n = 3,345). Of these 3,345 participants, we attempted to contact 3,063 about an additional study involving "economic decision-making in groups". We managed to successfully contact 2,731 about the study.

Participants were contacted initially by phone and then, if they agreed to participate, over email in the days leading up to their allocated study session. 1,805 participants either dropped out of the study entirely (before or during the session), spent less than 10 minutes or more than 50 minutes on the games, or did not have SDO or RWA scores for Wave 9. This resulted in a final sample of 926 participants (630 females; age M = 50.5 years, SD = 12 years; see Figure S1 for further sample characteristics).

Materials

New Zealand Attitudes and Values Survey measures. Main variables were taken from Wave 9 of the New Zealand Attitudes and Values Study[57]. These included SDO, RWA, age, gender, ethnicity, education level, socio-economic status, local deprivation, religiosity, and reported political party support. SDO and RWA scores were both mean

averages of six separate Likert-scale items (1 = strongly disagree, 7 = strongly agree). For SDO, the individual items[65] were: "It is OK if some groups have more of a chance in life than others"; "Inferior groups should stay in their place"; "To get ahead in life, it is sometimes okay to step on other groups"; "We should have increased social equality" (reversed); "It would be good if groups could be equal" (reversed); and "We should do what we can to equalise conditions for different groups" (reversed). For RWA, the individual items[82] were: "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"; "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"; "Our country will be destroyed some day if we do not smash the perversions eating away at our moral fibre and traditional beliefs"; "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" (reversed); "Atheists and others who have rebelled against established religions are no doubt every bit as good and virtuous as those who attend church regularly" (reversed); and "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" (reversed). Additional items on Schwartz's values, policy views, and competitive worldview were taken from Waves 5, 6, and 8 of the New Zealand Attitudes and Values Study.

Battery of economic games. All eight economic games were conducted online using oTree software[83]. In an attempt to replicate previous work, these games are largely identical to those from Peysakhovich et al.[50]. All games involved one-shot decisions between multiple players. The strategy method was used to elicit responses in all possible roles. Participants played for points, which were converted to New Zealand dollars (1 point = \$0.035). Code for these games can be found at https://osf.io/dwx8g/.

We included three cooperation games in which individuals decided whether to pay a

personal cost to benefit another player:

- *Dictator Game.* Player A is given 100 points. They must decide how many of these points to transfer to Player B. Player A keeps the remaining points. Player B is passive in the interaction.
- *Trust Game.* Players A and B both start with 50 points. First, Player A decides whether or not to transfer all 50 points to Player B, in the knowledge that the transferred amount will be tripled to 150 points. If Player A transfers, Player B now has 200 points. Player B must then decide to transfer 0 - 150 points back to Player A.
- *Public Goods Game.* Four players begin with 100 points each. They can contribute 0 - 100 points into a shared group project. All four decisions are made simultaneously, and then the amount in the group project is doubled and distributed evenly between all four players. Each player ends the game with their share from the group project, plus the points they initially refrained from contributing.

We also included three punishment games, in which individuals decide whether to pay a personal cost to punish another player for their decisions:

- *Ultimatum Game.* Player A starts with 100 points, and Player B starts with nothing. Player A must decide how many points to transfer to Player B. However, Player B simultaneously specifies their "minimum acceptable offer": namely, the lowest transfer from Player A that they will accept. If Player A's transfer amount is lower than this minimum acceptable offer, both players end the game with 0 points. Otherwise, Player B receives the transfer amount, and Player A keeps the remaining points.
- *Third-Party Punishment Game.* Players A, B, and C all start with 100 points. First, Player A decides whether to "take" from Player B. If Player A takes, Player B loses 50 points and Player A gains 30 points (taking is inefficient). If Player A takes, Player C can then pay 0 - 20 points to remove points from Player A. Each paid point removes 5 points from Player A. Player B is passive in the interaction.

- *Second-Party Punishment Game.* Players A and B start with 100 points. This game has two stages: the transfer stage, and the penalty stage. In the transfer stage, each player decides whether to transfer 30 points to the other player. Any transferred points are doubled before the other player receives them. Decisions are made simultaneously. The transfer stage follows the payoff matrix of a Prisoner's Dilemma. Then, in the penalty phase, both players can pay 0 - 10 points to remove points from the other player, depending on their decision in the transfer stage. Each paid point removes 5 points from the other player.

We replaced the destructive All-Pay Auction Game used in previous work[50] with two coordination games: a Stag-Hunt Game, and a Stag-Hunt Game with Punishment. These games are kept as identical to the Public Goods Game and Second-Party Punishment Game (respectively) as possible:

- *Stag-Hunt Game.* Four players begin with 50 points each. They can either contribute 30 points into a shared group project or contribute nothing. Any points in the group project will be doubled and distributed evenly between all players, *but only if all players contribute.* Otherwise, the points in the group project will be lost. Decisions are made simultaneously. Each player ends the game with their share from the group project, plus the points they initially refrained from contributing.
- *Stag-Hunt Game with Punishment.* Players A and B start with 100 points. This game has two stages: the transfer stage, and the penalty stage. In the transfer stage, each player decides whether to transfer 30 points to a group project. Any points in the group project will be doubled and distributed evenly between both players, *but only if both players contribute.* Otherwise, the points in the group project will be lost. Decisions are made simultaneously. The transfer stage follows the payoff matrix of a Stag Hunt. Then, in the penalty phase, both players can pay 0 - 10 points to remove points from the other player, depending on their decision in the transfer stage. Each

paid point removes 5 points from the other player.

Procedure

Data collection for the study was conducted between 18th February and 25th July 2019 with weekly staggered recruitment. After expressing interest in an initial phone call, participants were emailed further information about the study. In the email, they were asked to complete a Qualtrics survey to specify their availability the following week. This survey removed any ineligible participants who (1) did not have adequate access to the Internet, (2) did not have a quiet place to participate in the study, and (3) did not have a New Zealand bank account (for payment purposes).

Study sessions contained between 14 and 97 participants, and were conducted on midweek evenings (between 6pm and 8pm). Participants knew that they were playing with others recruited from the New Zealand Attitudes and Values Study, but were not aware of how many people were present in any particular session. At the time of their session, participants were emailed with a session-wide oTree link. On the first screen, they were required to enter their unique participant label. This was followed by a consent form, where they were informed of their confidentiality, right to withdraw, payment, and ethical approval. If they agreed to the consent form, participants then read information about the economic games. They learned that they would be playing for points that would be later converted to currency, that they would be matched in real-time with other participants from the New Zealand Attitudes and Values Study, and that every task would count towards their final bonus payment.

The eight economic games were then presented in a random order. For each game, participants read the instructions and answered a comprehension question about the game. Participants then provided responses for all possible roles in the game, following the strategy method. After all the games, participants entered a waiting lobby where they waited for other participants in the session to complete the games. Once all participants in the session

arrived at the waiting lobby, the software calculated payoffs for each game by randomly matching individuals within a session. The accumulated payoffs across all eight games determined the final overall payoff. Once matching was complete, participants saw a payoff screen which summarised the results of each individual game and how much they had earned from the study.

Session sizes were often not strict multiples of four necessary for random matching, either due to unforeseen dropouts or uneven sign-ups. To remedy this, simulated players were used to round up uneven session sizes. These simulated players chose responses in the games based on the median responses from previous research[50]. Participants were made aware that they may be matched with simulated players, but only on the payoff screen *after* all game decisions had been made: "In the rare event that we could not find a participant to match you with, we have instead matched you with average decisions based on previous research."

Participants were paid a fixed $20 NZD show-up fee, plus a bonus payment of between $10 - 35 ($M$ = $25.17, SD = $2.47) depending on the decisions of themselves and others. In total, we spent $41,826 on participant reimbursements. Name and bank account details were collected at the end of the study. For security purposes, this information was encrypted while stored online and later decrypted on a local computer for payment. After providing this information, participants specified if they would like to be contacted again about similar studies and then re-entered their unique participant label.

On average, participants took 22 minutes to complete the eight economic games (SD = 7.39 mins, range = 6 - 47 mins). Participants had a 55 minute limit to complete the games. As the study involved real-time matching between participants, participants could not pause their completion of the questionnaire and return to it later, as other participants would be left waiting to match with them. If participants took longer than 55 minutes, the software skipped them ahead to the waiting lobby and treated them as if they were simulated players (i.e., submitting median responses from past research). Timeouts were still paid the $20

show-up fee, but no bonus payment.

Statistical analysis

Our pre-registered analyses proceeded in two stages (https://osf.io/dwx8g/). In the first stage, we focused on the data from the economic games. Following previous research[50], we limited our analyses to game decisions which were not followed by a subsequent punishment stage: so-called "uncoerced" decisions. These decisions were scaled to vary between 0 and 1 for all analyses. We used a comprehensive set of statistical tests (correlations, principal components analyses, and confirmatory factor analyses) to determine the factor structure of variation in these decisions. We expected that two factors would emerge from and be supported by the data: cooperation and punishment. In the second stage, we used structural equation modelling to determine the extent to which these cooperation and punishment latent variables could be predicted by SDO and RWA, respectively. We also conducted several additional exploratory analyses that were not pre-registered: (1) structural equation models predicting the cooperation and punishment latent variables from Schwartz's values, (2) regressions predicting SDO and RWA from individual game decisions, (3) structural equation models predicting policy views from the cooperation and punishment latent variables, and (4) Bayesian multinomial regressions predicting reported political party support from the cooperation and punishment latent variables. For Bayesian models, we used normally distributed priors ($M = 0$, $SD = 0.5$) for all parameters, and all models converged normally ($\hat{R} = 1$).

All analyses were conducted in R Version 3.6.2[84]. We used the *psych*[85] package for correlations and principal components analyses, the *lavaan*[86] package for confirmatory factor analyses and structural equation modelling, and the *brms*[87] package for Bayesian multinomial regressions. Figures were created with the *ggplot2*[88] and *cowplot*[89] packages, and the manuscript was generated with the *drake*[90] and *papaja*[91] packages.

Competing Interests

We declare that none of the authors have competing financial or non-financial interests.

Data Availability

A copy of the anonymous data reported in each New Zealand Attitudes and Values Study publication is available from Professor Chris Sibley (c.sibley@auckland.ac.nz) upon request from appropriately qualified researchers. Such data will be provided with the explicit understanding that it is used solely for the purposes of replicating or otherwise checking the validity of analyses reported in scientific papers analysing New Zealand Attitudes and Values Study data.

Code Availability

Python code for the economic games and R code for the statistical analyses, figures, and manuscript generation are publicly available at https://osf.io/dwx8g/.

Ethics Statement

Ethical approval for this study was granted by the University of Auckland Human Participants Ethics Committee (ref: 021666).

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Supplementary Materials

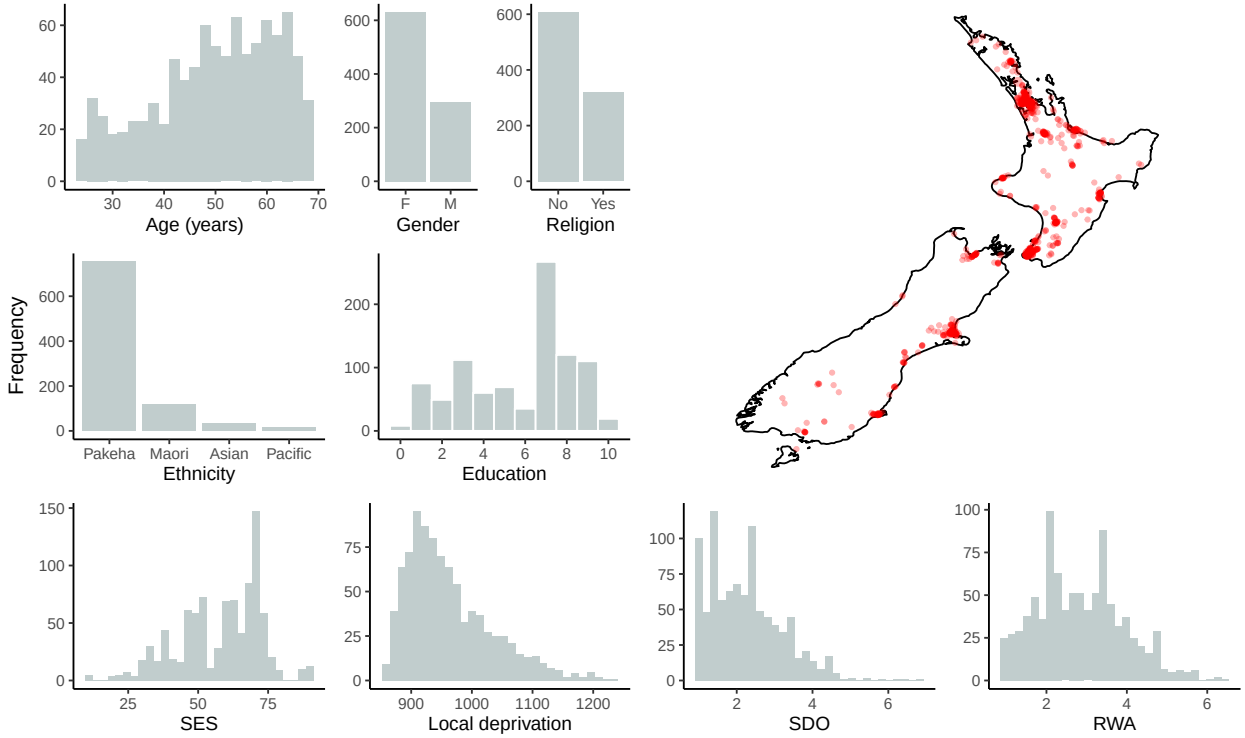

Figure S1. Final sample characteristics (n = 926). Education is measured by NZREG, an ordinal scale measuring level of educational attainment (range = 0-10). Socio-economic status (SES) is measured by NZSEI, an ordinal rank measure based on occupational categories (range = 10-90). Local deprivation is measured by NZDEP, an ordinal rank measure of local deprivation for each meshblock in New Zealand (range = 840-1550). Social Dominance Orientation (SDO) and Right Wing Authoritarianism (RWA) are mean scores from six Likert scales (range = 1-7). The map of New Zealand shows meshblock locations for participants.

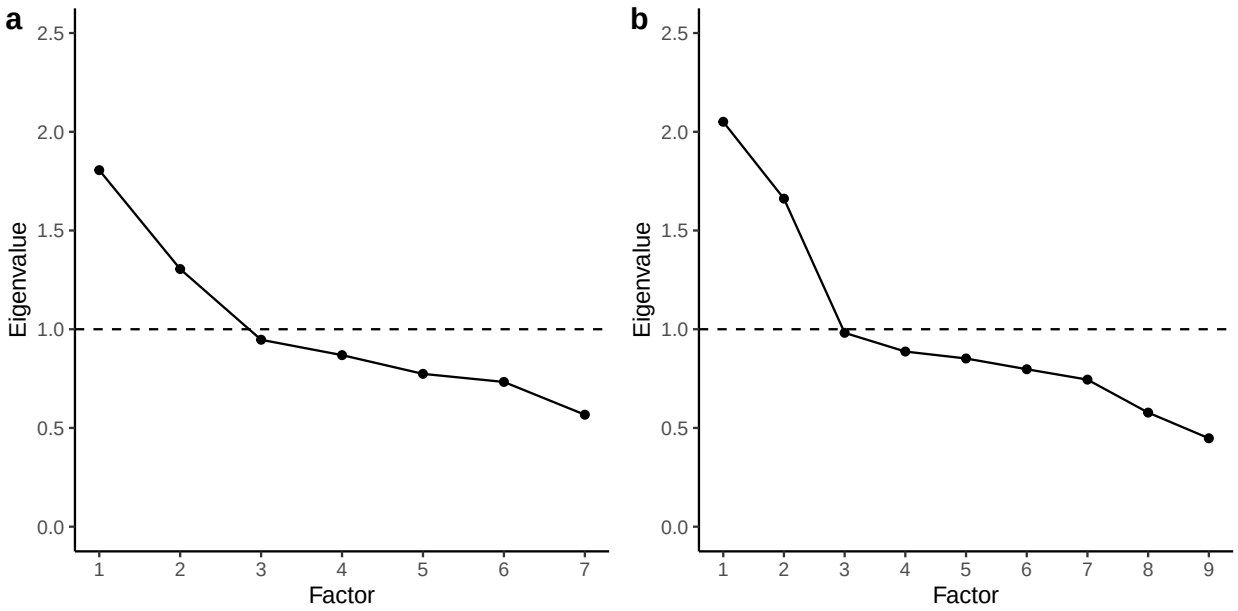

Figure S2. Scree plots for (a) the principal components analysis with only the game decisions from previous work and (b) the extended principal components analysis including coordination games. Principal components analyses initially contained as many factors as there were variables. Both scree plots show that only the first two factors have eigenvalues above 1, indicating a two-factor solution.

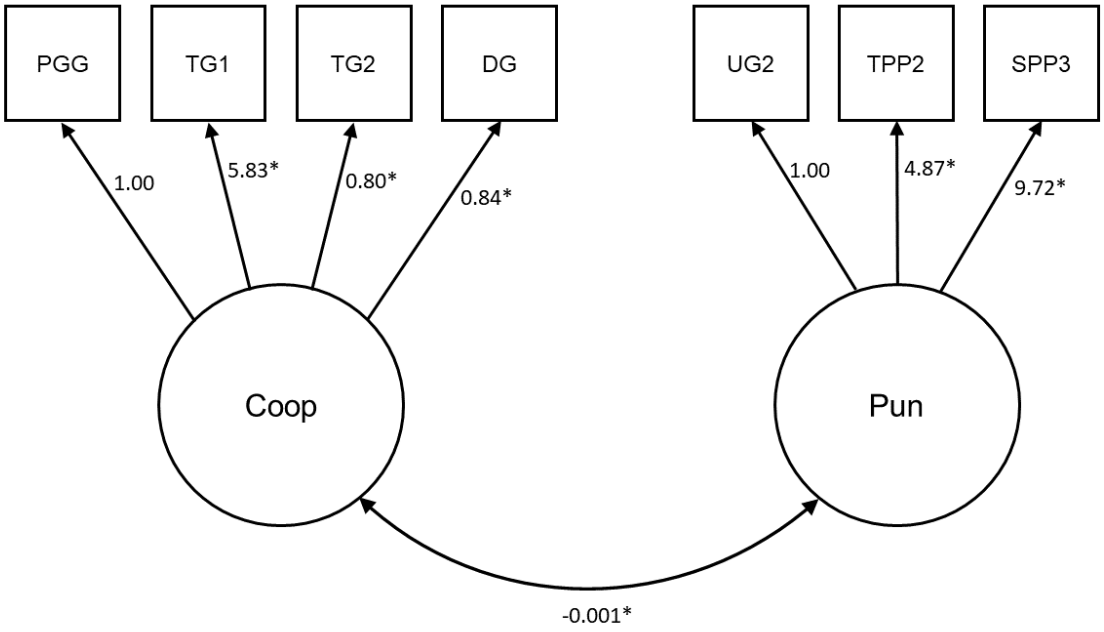

Figure S3. Confirmatory factor model using only the game decisions from previous work. TG1 is treated as a binary endogenous variable, and paths for PGG and UG2 are constrained to 1. Note that the regression paths controlling for game comprehension are not included in this figure. Numbers are unstandardised coefficients. $^*p < 0.05$. PGG = Public Goods Game, TG1 = Trust Game (Give), TG2 = Trust Game (Return), DG = Dictator Game, UG2 = Ultimatum Game (Minimum Acceptable Offer), TPP2 = Third-Party Punishment Game (Punish), SPP3 = Second-Party Punishment Game (Punish Defector).

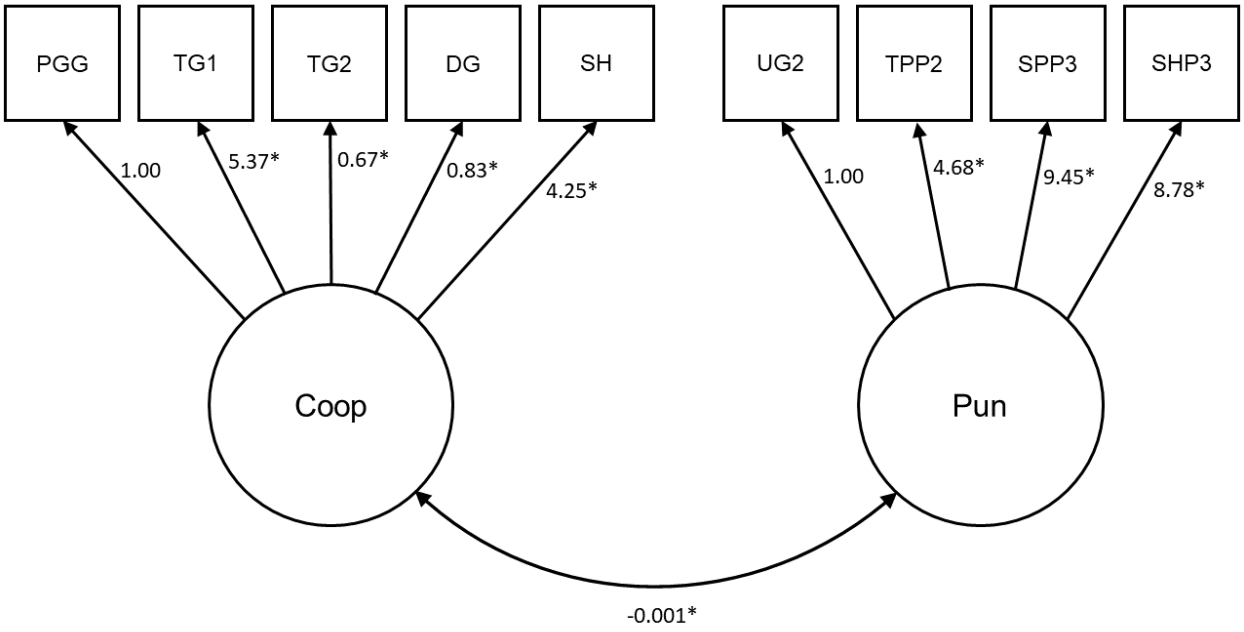

Figure S4. Confirmatory factor model with additional coordination games. TG1 and SH are treated as binary endogenous variables, and paths for PGG and UG2 are constrained to 1. Note that the regression paths controlling for game comprehension are not included in this figure. Numbers are unstandardised coefficients. $^*p < 0.05$. PGG = Public Goods Game, TG1 = Trust Game (Give), TG2 = Trust Game (Return), DG = Dictator Game, SH = Stag Hunt Game, UG2 = Ultimatum Game (Minimum Acceptable Offer), TPP2 = Third-Party Punishment Game (Punish), SPP3 = Second-Party Punishment Game (Punish Defector), SHP3 = Stag Hunt Game with Punishment (Punish Defector).

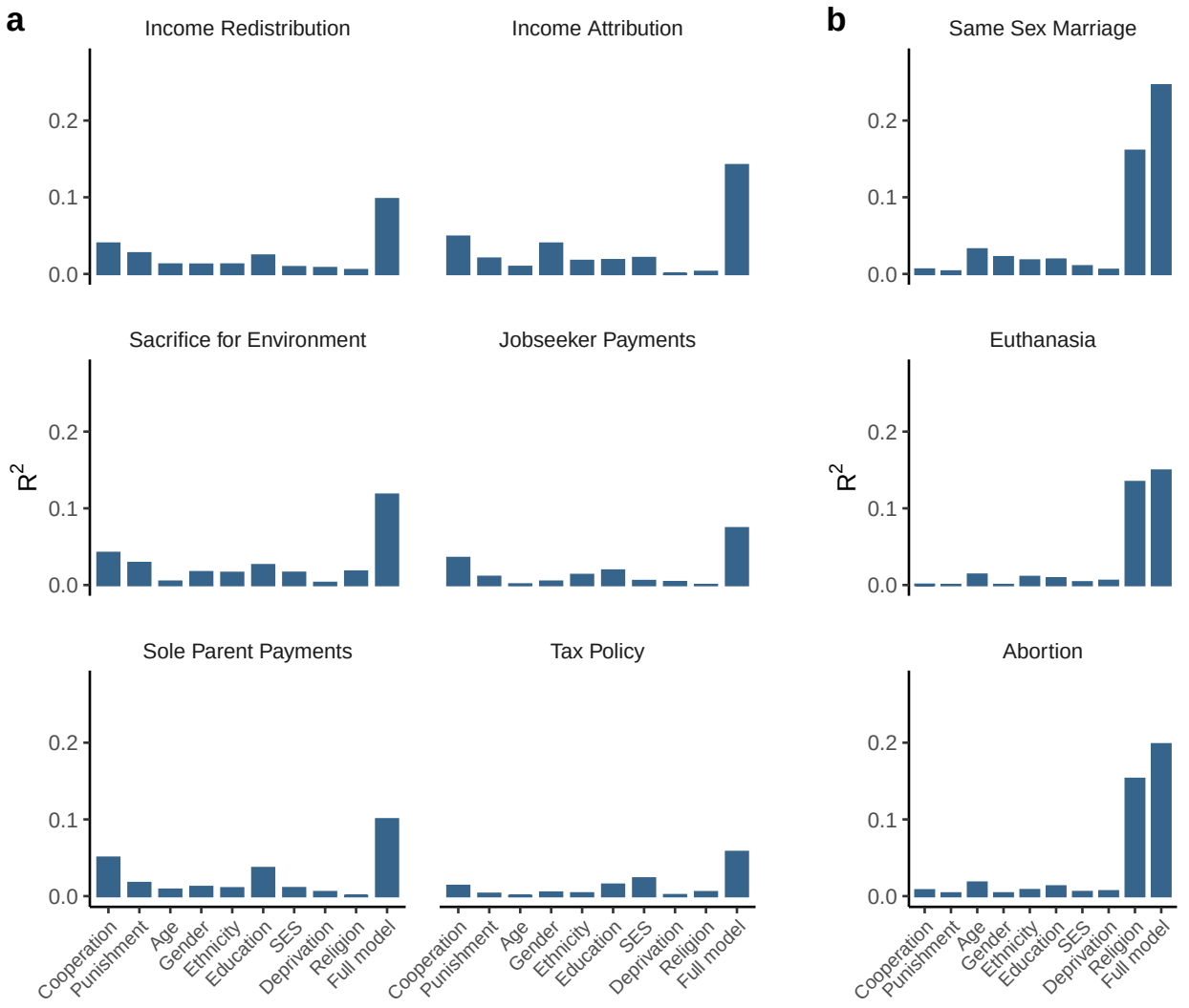

Figure S5. Bar plots for (a) economic and (b) social policy views showing the proportion of variance explained (R^2) by the cooperation latent variable, the punishment latent variable, and various demographic controls individually, and their combination in a full model. The cooperation latent variable explains a comparable proportion of variance in policy views to other demographics.

Table S1

Summary of the regression coefficients predicting the cooperation and punishment latent variables in the full structural equation model. Reference ethnicity category is Pakeha.

DV	IV	Estimate	SE	z	p
Cooperation	SDO	-0.029	0.007	-4.453	0.000
	RWA	-0.001	0.006	-0.216	0.829
	Age	-0.001	0.001	-2.312	0.021
	Gender (Male = 1)	0.006	0.012	0.479	0.632
	Ethnicity (Maori)	-0.006	0.016	-0.348	0.728
	Ethnicity (Pacific)	-0.014	0.060	-0.239	0.811
	Ethnicity (Asian)	-0.076	0.029	-2.654	0.008
	Education	0.002	0.002	0.903	0.367
	SES	-0.002	0.004	-0.581	0.561
	Deprivation	0.018	0.008	2.355	0.019
	Religious (Yes = 1)	0.013	0.013	1.019	0.308
Punishment	SDO	0.003	0.002	1.767	0.077
	RWA	0.001	0.001	0.847	0.397
	Age	0.000	0.000	1.457	0.145
	Gender (Male = 1)	0.000	0.003	-0.111	0.912
	Ethnicity (Maori)	-0.001	0.004	-0.225	0.822
	Ethnicity (Pacific)	-0.008	0.011	-0.804	0.422
	Ethnicity (Asian)	-0.006	0.008	-0.810	0.418
	Education	-0.001	0.001	-0.858	0.391
	SES	0.000	0.001	-0.390	0.697
	Deprivation	0.000	0.002	-0.058	0.954
	Religious (Yes = 1)	0.001	0.003	0.369	0.712

Table S2

Summary of the regression coefficients predicting preference for income redistribution (1-7) in the full structural equation model. Full item: "Redistributing money and wealth more evenly among a larger percentage of the people in New Zealand through heavy taxes on the rich." Dependent variable is treated as ordinal. Reference ethnicity category is Pakeha.

IV	Estimate	SE	z	p
Cooperation	1.066	0.335	3.180	0.001
Punishment	-2.890	1.506	-1.919	0.055
Age	-0.005	0.003	-1.604	0.109
Gender (Male = 1)	-0.204	0.076	-2.671	0.008
Ethnicity (Maori)	0.325	0.102	3.187	0.001
Ethnicity (Pacific)	0.163	0.322	0.505	0.614
Ethnicity (Asian)	0.085	0.192	0.444	0.657
Education	0.055	0.015	3.673	0.000
SES	0.031	0.026	1.188	0.235
Deprivation	0.111	0.057	1.958	0.050
Religious (Yes = 1)	-0.183	0.076	-2.399	0.016

Table S3

Summary of the regression coefficients predicting income attribution (1-7) in the full structural equation model. Full item: "Income equality reduces motivation to work hard." Dependent variable is treated as ordinal. Reference ethnicity category is Pakeha.

IV	Estimate	SE	z	p
Cooperation	-1.497	0.344	-4.359	0.000
Punishment	2.034	1.427	1.425	0.154
Age	-0.012	0.003	-3.666	0.000
Gender (Male = 1)	0.462	0.077	5.966	0.000
Ethnicity (Maori)	-0.103	0.108	-0.959	0.338
Ethnicity (Pacific)	-0.377	0.336	-1.121	0.262
Ethnicity (Asian)	0.574	0.175	3.288	0.001
Education	-0.042	0.015	-2.815	0.005
SES	-0.067	0.026	-2.558	0.011
Deprivation	-0.033	0.053	-0.635	0.525
Religious (Yes = 1)	0.165	0.075	2.204	0.028

Table S4

Summary of the regression coefficients predicting willingness to sacrifice for the environment (1-7) in the full structural equation model. Full item: "Are you willing to make sacrifices to your standard of living (e.g., accept higher prices, drive less, conserve energy) in order to protect the environment?" Dependent variable is treated as ordinal. Reference ethnicity category is Pakeha.

IV	Estimate	SE	z	p
Cooperation	1.205	0.383	3.145	0.002
Punishment	-2.911	1.465	-1.987	0.047
Age	-0.002	0.003	-0.759	0.448
Gender (Male = 1)	-0.304	0.077	-3.950	0.000
Ethnicity (Maori)	0.266	0.110	2.415	0.016
Ethnicity (Pacific)	-0.407	0.294	-1.385	0.166
Ethnicity (Asian)	-0.331	0.204	-1.625	0.104
Education	0.053	0.015	3.500	0.000
SES	0.046	0.026	1.802	0.072
Deprivation	-0.076	0.052	-1.454	0.146
Religious (Yes = 1)	-0.279	0.076	-3.661	0.000

Table S5

Summary of the regression coefficients predicting support for same-sex marriage (1-7) in the full structural equation model. Full item: "Support for same-sex marriage in NZ (The Marriage Amendment Act 2013)." Dependent variable is treated as ordinal. Reference ethnicity category is Pakeha.

IV	Estimate	SE	z	p
Cooperation	0.472	0.411	1.148	0.251
Punishment	-0.162	1.488	-0.109	0.913
Age	-0.012	0.004	-3.398	0.001
Gender (Male = 1)	-0.422	0.086	-4.923	0.000
Ethnicity (Maori)	-0.020	0.122	-0.164	0.870
Ethnicity (Pacific)	-0.859	0.266	-3.223	0.001
Ethnicity (Asian)	-0.268	0.213	-1.259	0.208
Education	0.048	0.017	2.831	0.005
SES	0.030	0.028	1.044	0.297
Deprivation	-0.107	0.057	-1.882	0.060
Religious (Yes = 1)	-0.939	0.085	-11.110	0.000

Table S6

Summary of the regression coefficients predicting support for euthanasia (1-7) in the full structural equation model. Full item: "Suppose a person has a painful incurable disease. Do you think that doctors should be allowed by law to end the patient's life if the patient requests it?" Dependent variable is treated as ordinal. Reference ethnicity category is Pakeha.

IV	Estimate	SE	z	p
Cooperation	0.173	0.379	0.456	0.648
Punishment	1.224	1.419	0.863	0.388
Age	-0.005	0.003	-1.330	0.184
Gender (Male = 1)	-0.020	0.086	-0.231	0.818
Ethnicity (Maori)	0.068	0.118	0.582	0.561
Ethnicity (Pacific)	-0.332	0.262	-1.264	0.206
Ethnicity (Asian)	-0.166	0.198	-0.835	0.404
Education	-0.025	0.017	-1.490	0.136
SES	-0.046	0.028	-1.660	0.097
Deprivation	-0.055	0.054	-1.018	0.309
Religious (Yes = 1)	-0.794	0.080	-9.980	0.000

Table S7

Summary of the regression coefficients predicting support for abortion (1-7) in the full structural equation model. Full item: "Support for legalized abortion for women, regardless of the reason." Dependent variable is treated as ordinal. Reference ethnicity category is Pakeha.

IV	Estimate	SE	z	p
Cooperation	0.736	0.393	1.876	0.061
Punishment	-0.371	1.465	-0.253	0.800
Age	-0.008	0.003	-2.416	0.016
Gender (Male = 1)	-0.189	0.084	-2.261	0.024
Ethnicity (Maori)	0.053	0.115	0.461	0.645
Ethnicity (Pacific)	-0.287	0.285	-1.007	0.314
Ethnicity (Asian)	-0.201	0.204	-0.985	0.324
Education	0.044	0.016	2.742	0.006
SES	0.015	0.028	0.539	0.590
Deprivation	-0.103	0.055	-1.873	0.061
Religious (Yes = 1)	-0.898	0.079	-11.322	0.000

Table S8

Summary of the regression coefficients predicting support for increased payments for those receiving Jobseeker Support (1-7) in the full structural equation model. Full item: "Increase payments for those receiving Jobseeker Support (formerly the Unemployment Benefit)." Dependent variable is treated as ordinal. Reference ethnicity category is Pakeha.

IV	Estimate	SE	z	p
Cooperation	1.360	0.388	3.508	0.000
Punishment	-0.693	1.406	-0.493	0.622
Age	0.005	0.003	1.482	0.138
Gender (Male = 1)	-0.129	0.078	-1.646	0.100
Ethnicity (Maori)	0.210	0.102	2.062	0.039
Ethnicity (Pacific)	-0.358	0.363	-0.985	0.325
Ethnicity (Asian)	-0.577	0.219	-2.634	0.008
Education	0.056	0.014	3.931	0.000
SES	0.016	0.026	0.609	0.543
Deprivation	0.110	0.054	2.038	0.042
Religious (Yes = 1)	-0.015	0.078	-0.191	0.849

Table S9

Summary of the regression coefficients predicting support for increased payments for those receiving Sole Parent Support (1-7) in the full structural equation model. Full item: "Increase payments for those receiving Sole Parent Support (formerly the Domestic Purposes Benefit)." Dependent variable is treated as ordinal. Reference ethnicity category is Pakeha.

IV	Estimate	SE	z	p
Cooperation	1.419	0.386	3.673	0.000
Punishment	-0.940	1.440	-0.653	0.514
Age	-0.005	0.003	-1.570	0.116
Gender (Male = 1)	-0.188	0.078	-2.409	0.016
Ethnicity (Maori)	0.149	0.106	1.401	0.161
Ethnicity (Pacific)	-0.144	0.261	-0.550	0.582
Ethnicity (Asian)	-0.607	0.221	-2.749	0.006
Education	0.071	0.015	4.746	0.000
SES	0.021	0.026	0.800	0.424
Deprivation	0.119	0.054	2.213	0.027
Religious (Yes = 1)	-0.049	0.077	-0.634	0.526

Table S10

Summary of the regression coefficients predicting support for a flat tax (1-7) in the full structural equation model. Full item: "Support for a 'flat' tax rate (everyone pays the same percentage of tax on their income)." Dependent variable is treated as ordinal. Reference ethnicity category is Pakeha.

IV	Estimate	SE	z	p
Cooperation	-0.967	0.371	-2.606	0.009
Punishment	-0.101	1.329	-0.076	0.940
Age	0.000	0.003	0.030	0.976
Gender (Male = 1)	0.154	0.076	2.029	0.042
Ethnicity (Maori)	0.007	0.110	0.061	0.951
Ethnicity (Pacific)	-0.122	0.369	-0.329	0.742
Ethnicity (Asian)	0.279	0.187	1.493	0.135
Education	-0.024	0.015	-1.582	0.114
SES	-0.086	0.026	-3.304	0.001
Deprivation	0.042	0.052	0.807	0.420
Religious (Yes = 1)	0.190	0.077	2.458	0.014

Table S11

Summary of the Bayesian multinomial logistic regression coefficients predicting political party support. The multinomial reference group is NZ First. Reference ethnicity category is Asian.

Group	IV	Estimate	SE	Lower 95% CI	Upper 95% CI
National	Intercept	1.297	0.274	0.764	1.824
	Age	0.026	0.013	0.000	0.051
	Gender (Male = 1)	0.155	0.234	-0.292	0.612
	Ethnicity (Maori)	0.043	0.323	-0.593	0.658
	Ethnicity (Pacific)	-0.249	0.427	-1.068	0.591
	Ethnicity (Pakeha)	0.581	0.278	0.045	1.125
	Education	-0.029	0.062	-0.148	0.091
	SES	0.179	0.102	-0.016	0.379
	Deprivation	-0.320	0.177	-0.663	0.032
	Religious (Yes = 1)	0.051	0.223	-0.382	0.497
	Cooperation	-0.739	0.432	-1.587	0.121
	Punishment	0.142	0.482	-0.824	1.069
Labour	Intercept	1.435	0.271	0.899	1.959
	Age	0.009	0.013	-0.016	0.034
	Gender (Male = 1)	-0.334	0.234	-0.779	0.132
	Ethnicity (Maori)	0.348	0.313	-0.253	0.980
	Ethnicity (Pacific)	-0.186	0.424	-1.025	0.635
	Ethnicity (Pakeha)	0.751	0.277	0.216	1.307
	Education	0.045	0.062	-0.081	0.167
	SES	0.176	0.100	-0.016	0.375
	Deprivation	-0.004	0.171	-0.339	0.340
	Religious (Yes = 1)	-0.337	0.224	-0.779	0.103
	Cooperation	0.229	0.439	-0.625	1.076
	Punishment	-0.013	0.485	-0.973	0.905
Greens	Intercept	0.099	0.297	-0.479	0.688
	Age	-0.025	0.014	-0.054	0.002
	Gender (Male = 1)	0.024	0.266	-0.502	0.542
	Ethnicity (Maori)	-0.101	0.346	-0.773	0.570
	Ethnicity (Pacific)	0.052	0.454	-0.861	0.922
	Ethnicity (Pakeha)	0.791	0.296	0.204	1.375
	Education	0.137	0.076	-0.015	0.287
	SES	0.383	0.123	0.139	0.621
	Deprivation	0.067	0.200	-0.318	0.459
	Religious (Yes = 1)	-0.628	0.268	-1.159	-0.100
	Cooperation	0.660	0.449	-0.202	1.511
	Punishment	-0.168	0.506	-1.119	0.795