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## RESEARCH ARTICLE OPEN ACCESS

# Validation of the Mini-IPIP6 Short-Form Personality Inventory: Honesty-Humility Predicts Cooperation in Economic Games

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## ABSTRACT

This study validated the Mini-IPIP6 short-form measure of Honesty-Humility to predict cooperative behaviour in online economic games. A subsample of participants from the New Zealand Attitudes and Values Study completed four online economic games for money, in addition to the Mini-IPIP6 six-factor personality inventory ( $N=979$ ). Cooperative behaviour was modelled as a latent variable reflecting behaviour across the four games. Honesty-Humility was the sole personality dimension associated with cooperative behaviour, even after adjusting for relevant demographics (including gender, age, ethnicity, socio-economic status, education and religiosity). Consistent with the hypothesised adaptive benefits of Honesty-Humility (i.e., gains from cooperation, mutual help and non-aggression), people higher in Honesty-Humility cooperated more with anonymous others in online economic exchanges for money when there was a risk of exploitation. Given the nature of the games, people higher in Honesty-Humility tended to earn more money if their partner cooperated, but less if their partner defected. These results validate the Mini-IPIP6 measure of Honesty-Humility and support its convergent and discriminant validity. These results highlight the predictive validity of the Mini-IPIP6 measure of Honesty-Humility and show it is reliably associated with cooperative behaviour.

## 1 | Introduction

Predicting behaviour is the gold standard for self-report personality inventories. For example, in the Big-Five model of personality, Extraversion predicts talking more (Nowson and Gill 2014), Conscientiousness predicts less online betting (Palomäki et al. 2021), and Openness predicts having a more diverse music collection (Rawlings and Ciancarelli 1997). Ashton and Lee (2007) identified Honesty-Humility as a sixth fundamental dimension of personality, which reflects individual differences in the tendency to cooperate versus exploit others. There is good evidence for the criterion validity of Honesty-Humility, with research showing individual differences in this

trait predict avoidance of gambling (McGrath et al. 2018), organ donation (Rhoads et al. 2023), and, crucially for our purposes, cooperative behaviour in economic games when money is on the line (Zettler et al. 2013).

In this study, we evaluate the predictive validity of a short-form measure of Honesty-Humility indexed by the Mini-IPIP6 (Sibley et al. 2011). We do so by assessing the extent to which this four-item self-report measure predicts people's tendency to cooperate when playing four economic games online for money: the Stag Hunt Game, the Public Goods Game, the Dictator Game and the Trust Game. This study analyses personality data collected from a subsample of participants from the New Zealand Attitudes and

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Values Study (NZAVS; Sibley et al. 2024) who also completed a series of online economic games (Claessens et al. 2022, 2023, forthcoming).

## 2 | Honesty-Humility

The Big Five framework identifies five broad personality traits: Conscientiousness, Agreeableness, Neuroticism, Openness, and Extraversion. The Big Five model was later expanded to the HEXACO model, which introduces Honesty-Humility as a sixth dimension. With coefficient alphas ranging from 0.89 (Conscientiousness) to 0.92 (Honesty-Humility), items in the HEXACO consistently measure the respective construct (Lee and Ashton 2004). The six personality dimensions are distinct, exhibiting minimal overlap (Lee and Ashton 2004). The HEXACO model has demonstrated consistency across 12 languages and is more widely replicated than the Big Five (Ashton and Lee 2007). Unlike the Big Five, the HEXACO model includes Honesty-Humility, thereby enhancing its predictive capacity and surpassing the traditional model (Ashton and Lee 2007). By including the dimension of Honesty-Humility, the HEXACO model offers a more comprehensive understanding of personality traits.

Honesty-Humility encapsulates a broad spectrum of ethical behaviours and features of interpersonal integrity. Key attributes that define Honesty-Humility include honesty, sincerity, and fairness, coupled with low levels of greed, deceit, and pretentiousness (Ashton et al. 2014). The fairness facet of Honesty-Humility involves avoiding deception and prioritising ethical behaviour, whereas the facet of greed avoidance relates to disinterest in materialism and social status (Ashton et al. 2014). The narrow facets of Honesty-Humility show strong predictive ability. For example, Hilbig et al. (2015) tested the fairness facet by asking participants to redistribute quiz points to reduce or maintain an unequal distribution. People with high Honesty-Humility scores redistributed points more equitably, especially when they were the ones who initially benefited from the unequal distribution. In a separate study by van Rensburg et al. (2018), students were asked about their behaviour during a test that was designed to make cheating easy. Before taking the test, participants completed the HEXACO personality inventory to assess their greed avoidance. High greed avoidance significantly predicted lower cheating behaviour. Thus, narrow facets of Honesty-Humility can predict ethical decision making and behaviour.

Ethical decision-making can be experimentally tested by using economic games. These games involve situations where individuals must choose between self-interest and fairness or exploitation and greed, effectively capturing Honesty-Humility. One example is the Ultimatum Game, which involves two players: the proposer and the responder (Güth et al. 1982). The proposer decides how to split a sum of money, and the responder can either accept or reject the offer. If accepted, both players receive the proposed amounts; if rejected, both players get nothing. A meta-analysis by Thielmann et al. (2020) revealed that Honesty-Humility has the strongest positive correlation with prosocial behaviour in economic games. In contrast, Conscientiousness had a near-zero correlation, whereas Agreeableness showed a weak correlation with prosocial behaviour. Interestingly, Narcissism,

which negatively correlates with Honesty-Humility, has a moderate negative correlation with prosocial behaviour in economic games (Bresin and Gordon 2011; Thielmann et al. 2020). Those high in Honesty-Humility are therefore more likely to engage in behaviours that benefit others and are less likely to act selfishly. Among the HEXACO personality traits, Honesty-Humility has the strongest association with prosocial behaviours in economic games.

Although many studies have validated long-form measures of Honesty-Humility with behavioural outcomes (e.g., see Thielmann et al. 2020), large-scale omnibus surveys often use short-form measures to reduce participant fatigue. For example, Sibley et al. (2011) used the 24-item Mini-IPIP6 to assess the HEXACO personality traits, as well as self-reported data on volunteer hours and willingness to make personal sacrifices to combat climate change, in a large, random sample of New Zealand adults. Individuals high in Honesty-Humility were more inclined to address climate change and participate in volunteer work. These self-reported behaviours were not as strongly predicted by Agreeableness. Honesty-Humility reflects a broader form of altruism that extends to outgroups, distinguishing it from Agreeableness, which primarily involves in-group cooperation. Individuals high in Honesty-Humility are willing to act for the common good beyond their immediate social circles.

Honesty-Humility should show variability within the population as a result of the costs and benefits associated with outgroup altruism. This is especially true when contrasting outgroup altruism with traits like the need to belong, which show much less variability due to its universally adaptive nature (Baumeister and Leary 1995). Table 1, extracted from Sibley et al. (2011), summarises the costs and benefits associated with HEXACO personality traits. Benefits of having high Honesty-Humility include the advantages of cooperation, such as mutual assistance. Costs involve sacrificing potential gains obtained by exploiting others, especially outgroup members. The diverse costs and benefits associated with Honesty-Humility may be a result of different ecological contexts favouring either cooperative or exploitative behaviours. A high level of Honesty-Humility would have been advantageous in especially harsh environments, in which cooperation with outgroup members was crucial for survival. Alternatively, low levels of Honesty-Humility might be more beneficial in situations characterised by intense competition and exploitation of outgroup members. The expected variability within the Honesty-Humility dimension reflects its adaptability in different contexts.

Given the costs and benefits of cooperation and exploitation in different contexts, Honesty-Humility should explain behaviour in multiple domains. For example, Bertl et al. (2019) assessed undergraduate students' personality traits and sense of academic entitlement and found that Honesty-Humility correlated negatively with the tendency to have entitled expectations and blame others for their problems at school. Dăderman and Ragnestål-Impola (2019) also measured personality traits, as well as bullying victimisation and bullying tactics in the workplace. Results indicated that individuals high in Honesty-Humility were less likely than those low in Honesty-Humility to bully others in the workplace. Within

**TABLE 1** | Interpretation of each Mini-IPIP6 factor, including example traits, and likely adaptive benefit and costs resulting from high levels of each personality dimension.

Factor	Interpretation	Example traits	Likely adaptive benefits of high levels (in evolutionary history)	Likely costs of high level (in evolutionary history)
Extraversion	Engagement in social endeavours	Sociability, leadership, exhibition	Social gains (friends, mates, allies)	Energy and time; risks from social environment
Agreeableness	Ingroup co-operation and tolerance; reciprocal altruism in HEXACO model	Tolerance, forgiveness, (low) quarrelsomeness	Gains from cooperation, primarily with ingroup (mutual help and nonaggression)	Losses due to increased risk of exploitation in short-term exchanges
Conscientiousness	Engagement in task-related endeavours	Diligence, organisation, attention to detail	Material gains (improved use of resources), reduced risk	Energy and time; risks from social environment
Neuroticism (low emotional stability)	Monitoring of inclusionary status and attachment relations; kin altruism in HEXACO model.	Anxiety, insecurity, (low) calmness	Maintenance of attachment relations; survival of kin in HEXACO model	Loss of potential gains associated with risks to attachment relations.
Openness to experience	Engagement in ideas-related endeavours	Curiosity, imaginativeness, (low) need for cognitive closure and (low) need for certainty	Material and social gains (resulting from discovery)	Energy and time; risks from social and natural environment
Honesty-Humility	Reciprocal altruism (fairness)	Fairness, sincerity, (low) entitlement and (low) narcissism	Gains from co-operation, (mutual help and non-aggression)	Loss of potential gains that would result from the exploitation of others (and in particular outgroup members)

Source: This table is taken from Table 3 of Ashton and Lee (2007, 156) with minor adaptations by (Sibley et al. 2011) based on their interpretation of neuroticism and agreeableness within a big-five framework. Ashton and Lee (2007) originally developed this framework for describing their HEXACO model of personality structure.

the justice system, Chatzimike Levidi et al. (2024) found that Honesty-Humility was the only personality trait to predict intentions to engage in criminal behaviour within hypothetical scenarios. Finally, a recent meta-analysis of 276 studies found that Honesty-Humility correlated positively with healthy behaviours and psychological well-being (Pletzer et al. 2023). Given the relevance of Honesty-Humility across various domains, it is important to validate a short-form measure of the six dimensions of personality.

Sibley et al. (2011) used exploratory and confirmatory factor analysis (EFA and CFA, respectively) to examine the convergent and discriminant validity of the Mini-IPIP6. All 24 items reliably fit into a six-factor model, with each set of four items corresponding to its respective personality factor. Conscientiousness predicted more hours spent on housework and fewer hours spent playing computer games, providing an excellent example of convergent validity. Support for the discriminant validity of the Mini-IPIP6 subscales is shown by the unique associations between Honesty-Humility and hours spent on volunteer work and between Extraversion and hours spent with friends. A follow-up study by Sibley (2012) using item response theory showed that the Mini-IPIP6 provides reasonably precise assessments of all six personality dimensions.

The purpose of the Mini-IPIP6 is to maintain the core Big Five personality factors and introduce Honesty-Humility in a short-form assessment tool. The Mini-IPIP6 consistently assesses and discriminates between personality traits typical in the New Zealand population (Sibley 2012; Sibley and Pirie 2013). All personality items strongly relate to their intended factors, with Honesty-Humility being the most predictive and able to explain the most variance (Sibley et al. 2011; Sibley and Pirie 2013). Moreover, the Mini-IPIP6 has high test-retest reliability and stability over a year (Sibley and Pirie 2013). We aim to extend this work by validating whether the Mini-IPIP6 measure of Honesty-Humility predicts cooperative behaviour in economic games.

### 3 | Economic Games

Economic games are designed to explore various social dilemmas and cost-benefit trade-offs. Players typically make decisions that can either impose a cost on another player or cooperate for mutual benefit, allowing researchers to evaluate prosocial behaviour (Thielmann et al. 2020). Economists and behavioural scientists favour incentivised economic games for studying cooperative preferences because the use of real costs provides a more accurate measure of behaviour (Chaudhuri 2021). When games involve tangible consequences and rewards, participants are more likely to act authentically and they are less susceptible to biases like social desirability that often affect self-reports (Thielmann et al. 2021). Thielmann et al. 2020 demonstrated that the association between Honesty-Humility and cooperation in economic games is affected by two key features of the games. These features are (a) the type of interaction between players, and (b) the nature of the game (e.g., its rules and strategic context). The association between Honesty-Humility and cooperative behaviour is stronger in games emphasising unilateral generosity (e.g., Dictator Game,  $r = 0.26$ ) or reciprocal trust (e.g., Trust Game, Player B,  $r = 0.22$ ). In contrast, games like the


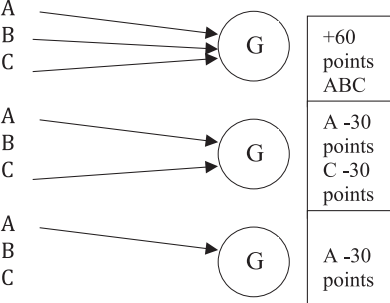
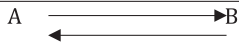

Trust Game (Player A), where decisions hinge on risk tolerance and expectations, show weaker correlations ( $r = 0.11$ ). Social dilemma games (e.g., Public Goods Game) emphasise collective cooperation and shared risk, differing in nature from other one-shot cooperation games. These games yielded a lower meta-analytic correlation ( $r = 0.18$ ) between Honesty-Humility and cooperative behaviour compared to games that do not require collective action.

Peysakhovich et al. (2014) identified a domain-general 'cooperative phenotype' that correlates with behaviour across various economic games. Their analysis included six games, divided into two categories. The first three, the Public Goods Game, the Trust Game and the Dictator Game, involved one-shot cooperation decisions, where players incurred a personal cost to benefit others. The other three, the Ultimatum Game, the Second Party Punishment Game and the Third-Party Punishment Game, focused on punishment, requiring players to bear personal costs to impose costs on others. However, Peysakhovich et al. (2014) do not make any attempt to relate this cooperative phenotype to individual level characteristics such as Honesty-Humility. Here, we validate Honesty-Humility by examining cooperation in a suite of games (the Dictator Game, the Trust Game and the Public Goods Game) as in Peysakhovich et al. (2014) as well as the Stag-Hunt Game (Skyrms 2004). These games are often used to study the evolution of social structures and the ability of societies to coordinate to mutually beneficial outcomes. The data for these games were collected for and reported in Claessens et al. (2022, 2023, forthcoming). Here, we validate Honesty-Humility by examining cooperation in a suite of games based on Peysakhovich et al. (2014) with data collected by Claessens et al. (2022) who added the Stag Hunt Game, a measure of coordination. These games will help test the predicted association between Honesty-Humility and cooperation more generally, as well as the specific patterns identified by Thielmann et al. (2020).

The four economic games analysed in this study are summarised in Figure 1. The Public Goods Game measures collective action and cooperation (Nunn and Watkins 1978). Players each start with 100 points and simultaneously decide how much to contribute to a group project. Contributions are doubled and distributed equally among players. The Stag Hunt Game is a measure of coordination adapted from the Public Goods Game (Skyrms 2004). Players start with 100 points and simultaneously decide whether to contribute 30 points to a group project. If all contribute, points double and are evenly split among players; otherwise, contributors lose points. The Trust Game measures trust and reciprocal giving (Berg et al. 1995). In this game, there are two players: Person A can share a portion of their money with Person B, and whatever is shared gets tripled. Person B then decides how much to return to Person A. The Dictator Game measures altruistic giving (Forsythe et al. 1994). Player A starts with points and can decide how many, if any, to give to Player B. All these games load onto a latent variable capturing cooperative behaviour.

Different economic games provide varying opportunities for exploitation or cooperation, leading to variability in the association between Honesty-Humility and prosocial behaviour. Thielmann et al.'s (2020) meta-analysis highlighted that the type of economic game played significantly impacts the strength of the correlations, explaining a large portion of the



Game	Decision path	Structure
Public Goods Game	 <p>Members of a group (n) transfer <math>x</math> to a group project (G) and <math>x</math> is multiplied by <math>y</math>; the sum of <math>x*y</math> is equally distributed among all members</p>	Each member of a group consisting of (n) members determines an amount of $x$ to transfer from their personal endowment to contribute to a collective project. These contributions are multiplied by a constant ( $z$ ). $z$ is always between 1 and $n$ . This is then distributed evenly among all group members regardless of initial individual contributions.
The Stag Hunt Game	 <p>Members of a group (n) choose whether or not to transfer a set amount of an individual endowment (<math>x</math>) to a group project (G). If all players transfer <math>x</math> then the group <math>x</math> (t) is doubled and equally distributed among all members. If at least one person does not transfer <math>x</math>, t is lost.</p>	Each member of a group consisting of (n) members is given 100 points initially. They are prompted to decide if they want to contribute 30 points for their personal endowment to the collective group project. For all of the points to be doubled and evenly distributed among group members all members must contribute 30 points. If at least one person does not contribute then all members who contributed lose their 30 points.
Trust Game	 <p>A transfers <math>x</math> to B and <math>x</math> is multiplied by <math>y</math> B can return any amount of <math>y*x</math></p>	The trustor, A, determines the allocation of $x$ from an endowment to the trustee, B. This amount $x$ is multiplied by a constant ( $m \geq 1$ ) and added to B's endowment. B has the option to return any amount $m * x$ to A.
Dictator Game	 <p>A transfers <math>x</math> to B</p>	A, acting as the dictator, has the liberty to choose the amount $x$ from an endowment to allocate to B, the recipient. B, however, lacks the authority to veto A's decision and cannot react to it.

**FIGURE 1** | Economic game paradigm.

Source: This figure is adapted from Table 1 of Thielmann et al. (2020, 32) describing the same games.

variance in effects ( $R^2=71.4\%$ ). In games with clear opportunities for exploitation, such as the Trust Game (playing as person B) and the Dictator Game, Honesty-Humility was the strongest positive correlate of prosocial behaviour. The positive correlation was slightly weaker in games with a lower chance for exploitation, such as the Trust Game (as person A) and the Ultimatum Game (as the proposer). Honesty-Humility was not reliably associated with prosocial behaviour in games with no opportunity for exploitation, such as the Ultimatum Game (as the responder). Individuals high in Honesty-Humility are more inclined to act prosocially despite high costs and a strong temptation to act selfishly. This meta-analysis confirms that

Honesty-Humility significantly predicts cooperation in economic games.

Thielmann et al. (2020) explored how different factors moderate the association between personality traits and prosocial behaviour in economic games. Notably, high-conflict situations strengthened the positive association between Honesty-Humility and prosocial behaviour. Different behaviour-contingent incentives (i.e., real rewards or penalties versus hypothetical scenarios) also moderate the association between Honesty-Humility and prosocial behaviour. For individuals high in Narcissism, real incentives increased prosocial behaviour compared to

hypothetical ones, however, Honesty-Humility was unassociated with these incentives. Individuals high in Honesty-Humility maintain their prosocial behaviour across different levels of conflict and incentives.

## 4 | Overview and Guiding Hypotheses

For this study, we leverage existing data from the NZAVS, a national longitudinal probability panel study. Additionally, we utilise economic gameplay data (see Claessens et al. 2022, 2023, forthcoming)<sup>1</sup> to validate the Honesty-Humility scale indexed by the Mini-IPIP6. We use the Mini-IPIP6 Honesty-Humility scale to predict cooperation and exploitation in four online economic games. We used multiple games with slight variations to address how players' behaviour can be influenced by game type and their turn order position, and the game data was collected separately months after the assessment of personality. Given that real stakes are important for measuring accurate behaviour, players could receive between 10 and 35 NZD depending on their gameplay. Responses to the Honesty-Humility subscale of the Mini-IPIP6 should predict individuals' tendency to cooperate when interacting with other people for money. We test this hypothesis using a single Latent variable structural equation model with Bayesian estimation.

We asked the following research question: Does Honesty-Humility (as indexed by the Mini-IPIP6) predict differences in cooperation and exploitation in a series of four economic games online for money? To answer this question, we examined the associations the personality dimensions from the Mini-IPIP6 have with a cooperation factor derived from four economic games: the Stag Hunt Game, the Trust Game, the Public Goods Game, and the Dictator Game. Claessens et al. (2022) derived a cooperation factor from these games that offers excellent external criterion for assessing the predictive utility of Honesty-Humility. Given that Honesty-Humility reflects individual differences in 'the tendency to be fair and genuine in dealing with others, in the sense of cooperating with others even when one might exploit them without suffering retaliation' (Ashton and Lee 2007, 156), we expected that Honesty-Humility would correlate positively with the cooperative gameplay factor. We also expected Honesty-Humility to be a stronger predictor of cooperation than any of the Big Five personality dimensions.

## 5 | Method

### 5.1 | Participants

A total of 979 participants completed the four online economic games, along with all personality and demographic measures included in Time 10 of the NZAVS questionnaire. Time 10 ran from June 18, 2018, to September 30, 2019 (Sibley 2024). In the sample, 63.1% were female: 675 women and 338 men, with a mean age of 52 (SD = 12.11). Among those who provided complete data, 87.8% identified as New Zealand European ( $n = 939$ ), 80% were born in New Zealand ( $n = 815$ ), and 82% of the participants lived in urban areas ( $n = 885$ ). The mean

socio-economic status (SES) was 4.64 (SD = 2.68), 76% were employed ( $n = 813$ ), and the education level had a mean of 6.16 (SD = 2.46). Of the participants, 70.8% were parents ( $n = 757$ ), and 72% had partners ( $n = 770$ ). A total of 347 of the participants (32.5%) were religious.

### 5.2 | Demographics

Gender was assessed using an open-ended format and recoded on a binary scale (0 = male, 1 = female). Age was measured as a continuous variable. SES was captured through a deprivation scale ranging from 1 (low) to 10 (high). Dichotomous variables were created for ethnicity, religious affiliation, parental status, employment status, relationship status, urban residency and whether the participant was born in New Zealand.

### 5.3 | Sampling Procedure

This study reanalysed data from the NZAVS subsample surveyed by Claessens et al. (2022) who completed a series of online economic games for money. Claessens et al. contacted 7833 participants from the NZAVS who were willing to be involved in an additional study. Participants then completed a series of economic games online for money; on average, they won \$25.20 plus a fixed \$20 show-up fee. The economic games were presented in random order, and instructions and comprehension questions were presented before each game. Players were shown a summary screen of individual game payoffs and their total accumulated payoff. Participants took an average of 22 min to complete the eight games, with an overall 50-min threshold for game completion. Economic game data were collected separately in the months following completion of the initial NZAVS questionnaire assessing the Mini-IPIP6. See Claessens et al. for further details about the sampling procedure.

### 5.4 | Economic Games

Claessens et al. (2022) included eight games related to punishment and rule following tasks which were based on the one-shot cooperation games used in Peysakhovich et al. (2014), with the addition of the Stag Hunt Game. Here, we focus solely on decisions made in games associated with cooperation. The games involved multiple players who could make one-shot decisions for points, translating into real-world stakes (1 point = NZD 0.035). The games used for the data in this study are as follows:

### 5.5 | Dictator Game

This is a paired sequential move game. Player A, the first mover, is given 100 points. Each Player A must decide how many of these points to transfer to player B, the second mover. Player A keeps any points not transferred. Player B is passive and has no move in the interaction. Player B receives any points transferred by Player A.

## 5.6 | Trust Game

This is a paired sequential move game. Both players start with 50 points. Player A, the first mover, decides whether or not to transfer all 50 points to the second mover, Player B, in the knowledge that the transferred amount will be tripled to 150 points. If Player A transfers, then Player B has 200 points. Player B must then decide to transfer 0–150 points back to Player A, the first mover. Transfers by Player B are not tripled.

## 5.7 | Public Goods Game

This is a four-player simultaneous move game. All four players begin with 100 points each. They simultaneously decide whether to contribute 0–100 points to a shared group project. The total 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.

## 5.8 | Stag Hunt Game

This is a four-player simultaneous move game. All four players begin with 50 points each. Each player can either contribute 30 points to 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. Each player ends the game with their share from the group project, plus the points they initially refrained from contributing.

## 5.9 | Mini-IPIP6

Sibley et al.'s (2011) 24-item self-report Mini-IPIP6 was administered using the following instructions: 'This part of the questionnaire measures your personality. Please circle the number that best represents how accurately each statement describes you'. Items were rated from 1 (very inaccurate) to 7 (very accurate). Twenty of the items were originally developed by Goldberg (1999) as part of the International Personality Item Pool (IPIP) and were included in the original Mini-IPIP by Donnellan et al. (2006). The four other items included in the Mini-IPIP6 encapsulate the Honesty-Humility trait, which are as follows:

- H01 'Feel entitled to more of everything'
- H02 'Deserve more things in life'
- H03 'Would like to be seen driving around in a very expensive car'
- H04 'Would get a lot of pleasure from owning expensive luxury goods'

Items H01 and H02 were adapted from the Narcissism scale developed by Campbell et al. (2004). Items H03 and H04 were adapted from Ashton and Lee's (2007) HEXACO measure of Honesty-Humility. Although all four of the Honesty-Humility

items are worded in the contrary direction, bias due to shared method variance between Honesty-Humility and cooperative gameplay is unlikely, given that the criterion outcome (gameplay) is based on behaviour and not responses to a second Likert scale.

The mean scores for each of the personality traits assessed by the Mini-IPIP6 are as follows. Extraversion had a mean of 3.97 (SD = 1.21, = 0.789), Agreeableness had a mean score of 5.43 (SD = 0.96, = 0.737), and Conscientiousness had a mean score of 5.11 (SD = 1.02, = 0.722). Neuroticism had a mean score of 3.4 (SD = 1.20, = 0.783), Openness had a mean score of 5.14 (SD = 1.06, = 0.674), and finally, Honesty-Humility had a mean score of 5.43 (SD = 1.17, = 0.767). The Omega values ( ) are broadly consistent with the Mini-IPIP6 short-form measure of personality.

## 6 | Results

### 6.1 | Association With Cooperative Behaviour

A regression model was conducted using Bayesian estimation, assessing the extent to which the Mini-IPIP6 personality scores predicted cooperation in economic games. The model also included and adjusted for a wide range of other demographic factors. Personality was measured using scale mean scores for each personality dimension. Following Claessens et al. (2022), choices made in cooperative economic games were modelled as a latent variable, with five indicators reflecting different cooperative decisions. Two of the indicators were modelled as binary indicators: the Stag Hunt Game (decision to contribute) and the Trust Game (decision for Player A to trust Player B). The other three indicators were modelled as continuous: the Trust Game (amount player B returns to player A), the Public Goods Game (the amount the player transfers from their personal endowment to a collective project), and the Dictator Game (the amount of the endowment player A transfers to player B). The model employed Bayesian estimation with diffuse priors. In addition to 99% credible intervals, we report posterior predictive *p* values and adopt a conservative  $p < 0.01$  to assess statistical significance.

Standardised regression parameters assessing the extent to which demographics and personality predicted the cooperative behaviour are presented in Table 2. As hypothesised, Honesty-Humility was moderately and significantly associated with increased cooperation in economic games ( $\beta = 0.215$ , 95% CI [0.100 0.324],  $p < 0.001$ ). The standardised beta for this effect indicates that it was in the weak range, with roughly a one standard deviation unit increase in Honesty-Humility predicting a 0.215 standard deviation unit increase in cooperation in economic games. This association was more than double the size of any other associations of personality with cooperation. No other dimensions of personality were significantly associated with cooperation in economic games.

Age was significantly associated with less cooperative behaviour ( $\beta = -0.194$ , 95% CI [-0.314, -0.075],  $p < 0.001$ ). The standardised beta indicated that a one standard deviation unit increase in age predicted a 0.194 standard deviation unit



**TABLE 2** | Standardised regression parameters from a Bayesian structural equation model predicting latent cooperative gameplay.

	$\beta$	Post SD	99% credible interval		<i>p</i>
			Lower	Upper	
Gender	0.058	0.044	−0.056	0.171	0.097
Age	−0.194	0.046	−0.314	−0.075	<0.001
Deprivation index	0.042	0.041	−0.065	0.148	0.154
European	0.070	0.040	−0.037	0.172	0.041
Religious	0.001	0.041	−0.104	0.106	0.489
Parent	0.045	0.045	−0.071	0.161	0.160
Partner	0.044	0.043	−0.066	0.152	0.151
Employed	0.020	0.042	−0.090	0.126	0.317
Urban	−0.019	0.040	−0.125	0.082	0.317
Born in New Zealand	0.085	0.041	−0.022	0.190	0.020
Education	0.053	0.042	−0.057	0.159	0.105
Extraversion	0.014	0.042	−0.095	0.121	0.375
Agreeableness	0.099	0.045	−0.017	0.212	0.014
Conscientiousness	−0.084	0.041	−0.195	0.023	0.022
Neuroticism	−0.032	0.043	−0.148	0.077	0.229
Openness to experience	0.039	0.042	−0.070	0.145	0.177
Honesty-Humility	0.215	0.043	0.100	0.324	<0.001

Note: Parameters are reported for the standardised model. The 95% confidence interval for the difference between the observed and replicated  $\chi^2 = 15.269$ , 91.791. Post SD = posterior standard deviation. Gender (0 women, 1 men), deprivation index (1 low deprivation to 10 high deprivation), European (0 no, 1 yes), religious (0 no, 1 yes), parent (0 no, 1 yes), partner (0 no, 1 yes), employed (0 no, 1 yes), urban (0 no, 1 yes), Born in New Zealand (0 no, 1 yes), education (0 none to 10 post-doctoral), personality variables were scale mean scores (1 low to 7 high).

decrease in cooperation in economic games. Gender differences were not observed in economic games, nor were there differences based on ethnicity or whether individuals were born in New Zealand. Additionally, cooperative behaviour did not vary by education level or deprivation index. Overall, the model explained 14.5% of the variance in cooperative behaviour ( $R^2 = 0.145$ , Post SD = 0.024, 95% CI [0.097, 0.199],  $p < 0.001$ ).

## 6.2 | Associations With Specific Economic Games

Thielmann et al. (2020) found positive correlations between Honesty-Humility and choices in economic games. Their strongest significant effects were in the Dictator Game ( $r = 0.26$ ) and the Trust Game as Player B ( $r = 0.22$ ). In our study, however, the Trust Game as Player B showed a near-zero, non-significant correlation ( $r = 0.062$ ) with Honesty-Humility. Although this was not our strongest effect, we also observed a significant positive correlation between Honesty-Humility and cooperation in the Dictator Game ( $r = 0.139$ )—results that corroborate Thielmann et al. (2020). Notably, the strongest significant positive correlations were between Honesty-Humility and cooperation in the Public Goods Game ( $r = 0.162$ ), followed by the Stag Hunt Game ( $r = 0.146$ ). Thielmann et al. (2020) grouped social dilemma games together, such as the Public Goods Game and the Prisoner's Dilemma. They reported a significant meta-analytic

correlation of  $r = 0.18$ , which is consistent with our results (although we did not include the Prisoners Dilemma in our online games). Our study's weakest and non-significant correlation with Honesty-Humility was in the Trust Game, Player A's decision to trust ( $r = 0.021$ ). By comparison, Thielmann et al. (2020) found a significant and stronger effect for this ( $r = 0.11$ ). Overall, Thielmann et al. (2020) reported the strongest effects in the Dictator Game and the Trust Game as Player B, whereas our study's strongest effect was in the Public Goods Game (Table 3).

## 7 | Discussion

This paper extended Claessens et al. (2022) by using participants' performance on four online economic games to validate the Mini-IPIP6 measure of Honesty-Humility. As predicted, variability in Honesty-Humility predicted cooperative behaviour in economic games played months after the initial personality assessment. Individuals with high Honesty-Humility scores were more likely to cooperate in economic games when money was at stake. This tendency allowed them to reap adaptive benefits, as they earned more money on average than those with lower Honesty-Humility scores when paired with cooperative partners. The Honesty-Humility scale in the Mini-IPIP6 was the only personality factor significantly related to cooperative choices. The model also adjusted for a broad range of demographic factors in a sample from the general population, ensuring that the

**TABLE 3** | Bivariate correlations between all demographic variables, Mini-IPIP6 personality scale scores and the five individual gameplay behaviors.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1. Gender																					
2. Age	0.071																				
3. European	0.000	0.058																			
4. Deprivation	-0.078	-0.101*	-0.106*																		
5. Religious	-0.057	0.083*	-0.085*	0.083*																	
6. Parent	-0.025	0.402*	0.017	-0.024	0.056																
7. Partner	0.132*	0.078	0.042	-0.155*	-0.030	0.254*															
8. Employed	0.011	-0.281*	-0.018	0.068	0.015	-0.096*	-0.028														
9. Urban	-0.038	-0.076	-0.050	0.074	0.039	-0.040	-0.088*	0.060													
10. Born in NZ	-0.093*	-0.016	0.107*	0.065	-0.025	-0.020	-0.067	0.035	0.018												
11. Education	-0.071	-0.112*	0.023	-0.115*	0.010	-0.100*	-0.010	0.048	0.068	-0.118*											
12. Extraversion	-0.057	0.054	-0.002	-0.085*	0.013	0.085*	0.067	0.026	0.003	-0.009	0.046										
13. Agreeableness	-0.280*	0.057	0.045	-0.022	0.075	0.089*	0.007	-0.026	0.014	-0.001	0.078	0.206*									
14. Conscientiousness	-0.057	0.083*	-0.038	-0.093*	0.011	0.141*	0.102*	-0.014	-0.009	-0.038	0.010	0.094*	0.137*								
15. Neuroticism	-0.122*	-0.171*	0.007	0.042	0.004	-0.058	-0.043	-0.009	0.052	0.014	-0.058	-0.107*	0.012	-0.240*							
16. Openness	0.075	-0.043	0.038	-0.034	-0.036	-0.071	-0.033	-0.027	0.027	-0.097*	0.160*	0.149*	0.192*	-0.035	-0.059						
17. Honesty-Humility	-0.149*	0.174*	0.047	-0.017	0.005	0.062	0.054	-0.074	0.023	0.049	0.108*	-0.030	0.255*	0.084*	-0.201*	0.038					
18. Stag Hunt Contribute	-0.040	0.020	0.030	0.013	0.002	0.054	0.041	0.007	-0.005	0.030	-0.041	-0.023	0.085*	0.021	-0.049	0.026	0.146*				
19. Trust1 Transfer Points	0.058	-0.142*	0.083*	0.008	-0.018	-0.058	0.002	0.061	0.005	0.047	0.065	0.033	0.040	-0.082*	0.001	0.051	0.021	0.179*			
20. Trust2 Transfer Back	0.006	-0.119*	0.053	0.025	-0.034	-0.049	0.007	0.053	-0.033	-0.006	0.110*	-0.006	0.056	-0.023	-0.013	0.066	0.062	0.115*	0.339*		
21. Public Goods Contribute	0.033	-0.033	0.004	0.021	0.018	0.011	0.037	-0.006	-0.019	0.028	0.065	-0.048	0.026	-0.003	-0.045	0.012	0.162*	0.174*	0.213*	0.139*	
22. Dictator Transfer	-0.119*	-0.030	0.027	0.044	0.014	0.012	0.010	0.003	0.024	0.123*	0.010	0.042	0.093*	-0.056	0.025	0.010	0.139*	0.212*	0.217*	0.252*	0.259*

*Note:* The cooperation decisions made in the economic games are coded in the correlation matrix as follows. Stag Hunt Contribute: the Stag Hunt Game decision to contribute. Trust1 Transfer Points: the Trust Game decision, how much of the endowment trustor A gives to trustee B. Trust2 Transfer Back: the Trust Game decision, how much trustee B returns to trustor A. Public Goods Contribute: the Public Goods Game decision, how much the player transfers from their personal endowment to a collective project. Dictator Transfer: the Dictator Game decision, how much of player A's personal endowment they transfer to player B.

\* $p < 0.01$ .

Honesty-Humility subscale's predictive power was independent of these influences. The results demonstrate the predictive validity of the Honesty-Humility subscale of the Mini-IPIP6 by showing that responses to this short-form measure predict the choice to cooperate or defect in monetized games.

We also observe similarities and differences in the other personality correlates of cooperative behaviour relative to Thielmann et al. (2020). In our study, Agreeableness showed a weak, but significant, positive correlation with cooperation in the Dictator Game ( $r=0.093$ ) and the Stag Hunt Game ( $r=0.085$ ). These values are only slightly lower than the significant correlations reported by Thielmann et al. for HEXACO Agreeableness in the Dictator Game and the Stag Hunt Game ( $r=0.11$  and  $r=0.08$ , respectively). Interestingly, we found a significant negative correlation for Conscientiousness in the Trust Game as Player A ( $r=-0.082$ ), whereas Thielmann et al.'s (2020) meta-analysis reported a weak but significant positive correlation ( $r=0.05$ ). Overall, our findings reveal variations by personality trait, game type and player's role compared to Thielmann et al. (2020). Since the meta-analysis focused on personality as measured by the Five-Factor and HEXACO models, it may highlight differences between these personality assessments.

Our results corroborate previous studies that have established Honesty-Humility as a significant predictor of outgroup altruism, such as organ donation, volunteer hours and willingness to address climate change (Sibley et al. 2011; Rhoads et al. 2023). This broader form of altruism resembles the behaviour observed in the Dictator Game playing as Player A, where the player gives points without receiving anything in return. Our study found a significant positive correlation between Honesty-Humility and Player A's generosity in the Dictator Game ( $r=0.139$ ). However, previous research has shown that high Honesty-Humility also predicts gambling avoidance, indicating a reluctance to take risks (McGrath et al. 2018). Pro-social behaviour in the Trust Game, the Public Goods Game and the Stag Hunt Game leave players vulnerable to the possibility of exploitation. All of these games require trust among players. Collectively, pro-sociality makes everyone better off but individual self-interest argues against pro-sociality. However, those who are able to engage in effective collective action are better off. It appears that being high in Honesty-Humility allows players to enjoy this adaptive benefit. In other words, groups with members high in Honesty-Humility will experience greater success in undertaking collective action for the common good.

## 8 | Conclusion

To conclude, the four-item Mini-IPIP6 measure of Honesty-Humility correlated positively with cooperative behaviours in economic games, demonstrating the predictive validity of the short-form scale. These results corroborate theoretical models defining Honesty-Humility as the tendency to act fairly without greed (Ashton et al. 2014). Discriminant validity is shown by the lack of significant associations between other personality traits and cooperative choices. Although we do not position the Mini-IPIP6 as the gold standard for assessing Honesty-Humility, it offers a reliable alternative when time or survey space is limited. Although we recommend using Ashton and Lee's (2007)

full HEXACO scale when feasible, our results should increase researchers' confidence in using the Mini-IPIP6 as a short-form measure of Honesty-Humility when questionnaire space is limited.

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## Conflicts of Interest

The authors declare no conflicts of interest.

## Data Availability Statement

The data described in the paper are part of the New Zealand Attitudes and Values Study (NZAVS). Full copies of the NZAVS data files are held by all members of the NZAVS management team and advisory board. A de-identified dataset containing the variables analysed in this manuscript is available upon request from the corresponding author, or any member of the NZAVS advisory board, for replication purposes. <https://osf.io/75snb/wiki/home/>.

## Endnotes

<sup>1</sup>The previous papers by Claessens et al. (2022, 2023, forthcoming) focused on distinct research questions unrelated to validating the Mini-IPIP6. Claessens et al. (2022) used economic games to investigate the association between the cooperation factor utilised in this study and beliefs and behaviours related to climate change. Claessens et al. (2023) tested the association between the cooperation factor and political ideology, namely Social Dominance Orientation and Right Wing Authoritarianism. Claessens et al. (forthcoming) measured the association between the cooperation factor and self-reported political views over an 18-month period.

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