Do Psychological Traits Explain Differences in Free Riding? Experimental Evidence

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Abstract

We explore the relationship between common psychological traits, such as Theory of the Mind, Rational-Experiential Inventory, and Big Five Personality styles, and willingness to contribute to public goods. Specifically, we are motivated by research that has indicated a strong relationship between past social interactions and cooperativeness. We show that psychological traits of individuals create both a direct effect on free riding behavior, as well as an indirect effect, as it enhances the correlation between past strategic behavior and public goods giving. Thus, the measurement tools of social psychology and management can be beneficial in understanding individual-level differences in free riding.

Keywords: Big Five, competence, experiment, free riding, personality traits, psychological traits, public goods, Rational-Experiential Inventory, risk preferences, Theory of Mind

1. Introduction

The provision of public goods is a fundamental problem of societies. Whether they are collectively provisioned through a centralized institution or decentralized through individual, voluntary participation, there is much interest in appreciating how to encourage contributions to mitigate free riding, reduce under-provision, and decrease or even eliminate enforcement and monitoring expenses.

Theoretical, empirical, and experimental research all tends to focus on the relationship between institutional features and public goods contributions. Features such as communication (Isaac and Walker, 1988; Bochet, Page, and Putterman, 2006; Cinyabuguma, Page, and Putterman, 2005; Cason and Khan, 1999), punishment (Sefton, Shupp, and Walker, 2007; Fehr and Gächter, 2000; Andreoni and Gee, 2012; DeAngelo and Gee, 2015; Önes and Putterman, 2007), leadership (Potters, Sefton, and Vesterlund, 2005; Duffy, Ochs, and Vesterlund, 2007; McCannon, 2015), and group identity/size (Isaac and Walker, 1988; Cadsby and Maynes, 1998; Andreoni and Petrie, 2004; Page, Putterman, and Unel, 2005; Carpenter, 2007;) all have proven important mechanisms to reduce free riding. These investigations, though, use variation in institutions, rather than direct individual-level metrics, to explain differences in behavior.

Typically, common demographic controls are included to capture some of this heterogeneity. This is for good reason. A robust literature has identified strong relationships between public goods contributions and gender (Brown-Kruse and Hummels, 1993; Nowell and Tinkler, 1994; Sell, 1997, Andreoni and Vesterlund, 2001; Eckel and Grossman, 2008; Perugini, Tan, and Zizzo, 2010), culture (Henrich *et al*., 2001), age (Chaudhuri and Graziano, 2006) and beauty (Andreoni and Petrie, 2007); although this list is in no way exhaustive. One would like, though, to have a more nuanced explanation for individual-level differences. Relatedly, biological differences have been shown to correlate with behavior. Buser (2012) provides evidence that hormone levels, as captured by digit ratios and menstrual-cycles, matter. Mertins, Schoate, and Meyer (2013) find a link between the Monoamine Oxidase A gene and free riding behavior. Barraza, Alexander, Beavin, Terris, and Zak (2015) find a correlation between cardiac and electro-dermal activity and charitable giving in experiments. Biological markers, though, may not be useful in practical applications.

Another common explanation for variation in individual's choice is differences in decision making under uncertainty preferences. Teyssier (2012) and Jing and Cheo (2013) find that risk aversion is negatively correlated with public goods contributions. Along with differences in risk preferences, ambiguity aversion and certainty bias can be expected to affect free riding. For example, Dai, Hogarth,

and Villeval (2014) consider public goods contributions when auditing and, hence sanctioning of free riding, is ambiguous and show that behavior is sensitive to early auditing experiences. Dannenberg *et al.* (2015) show that ambiguity in threshold levels in threshold public goods games lead to reduced contribution amounts.

Similarly, substantial evidence exists that histories of past social interactions spill over into future behaviors. Research has documented that past outcomes of a game affect future decision making in that environment. For example, Hirsch and Peterson (2009) and Kagel and McGee (2014) illustrate this in finitely repeated Prisoner Dilemma Games. Degeneration in public goods contributions over time are commonly observed (Andreoni, 1988; Brandts and Schram, 2001; Andreoni and Croson, 2008; Cooper and Stockman, 2010). Individuals not only adapt their own behavior over time but individual behavior adjusts to past anti- and pro-social decisions made by others. Peysakhovich and Rand (2015) illustrate this by comparing outcomes that arose from a repeated Prisoner's Dilemma environment with a follow-up one-shot decision in a pro-social scenario (either Public Goods, Trust, Dictator, or Ultimatum game).

Research has also explored the consistency of behavior across differing strategic environments. For example, subjects in Blanco, Engelmann, and Norman (2011) play the Ultimatum Game, Public Goods Game, a sequential Prisoner's Dilemma Game, and a modified Dictator Game and show that individual-level behavior is not that consistent across environments. In contrast, Spiliopoulos (2015) finds a significant amount of spillover in behavior across seven distinct games that are played. Similarly, Peysakhovich, Nowak, and Rand (2014) consider decisions across six distinct games. They provide evidence that behavior is consistent, especially across cooperative games. In fact, they argue that there is a domain-general and temporally stable inclination towards a "cooperative phenotype" in their data.

Numerous empirical investigations delve into the relationship between competence and economic outcomes. Prominent in these studies are the role of financial literacy (Lusardi and Mitchell, 2007; 2014; Behrman, Mitchell, Soo, and Bravo, 2012) and the relationship between IQ and education (Plug and Vijverberg 2005) or labor market outcomes (Zax and Reiss, 2002; Lindqvist and Vestman, 2011; Heckman, Pinto, and Savelyev, 2013). The experimental economics literature on competence has focused primarily on the interaction between assessed competence and decision making under uncertainty. A seminal contribution provided by Heath and Tversky (1991) shows that more competent individuals are more willing to accept ambiguous gambles when the payoff depends on their competence. Further experimental investigations of this hypothesis have been done by Grieco and Hogarth (2004) and Di Mauro (2008), and de Lara Resende and Wu (2010). Dohmen, Falk, Huffman, and

Sunde (2010) directly assess the relationship between competence and risk preferences. A rich, complementary literature in economics and finance has investigated the relationship between overconfidence and financial decision making (see, as an example, Biais, Hilton, Mazurier, and Pouget (2005) and Dittrich, Güth, and Maciejovsky (2005) for experimental evidence and literature reviews). Competence need not be restricted to decision making under uncertainty. McCannon, Tokar Asaad, and Wilson (2015) conduct experiments of the Trust Game and administer a financial literacy assessment. They show that conditioning on competence levels, overconfidence in one's knowledge explains much of the trusting and reciprocating behavior. Therefore, outcomes that are typically attributed to social preferences may, in fact, be largely driven by lack of sophistication. Experimental psychology has used cognitive assessments as explanatory variables. Ben-Nur, Kong, and Putterman (2004) and Ben-Nur, Kramer, and Levy (2008) use the Wonderlic assessment as a control in explaining altruistic giving, while Hirsh and Peterson (2009) include it in estimations forecasting cooperation.

Thus, the expansive literature on individual-level differences focuses on background characteristics, historical outcomes of past social interactions, preferences for decision making under uncertainty, and competency disparities to explain variation in free riding behavior. We propose, though, that this understanding is incomplete. We hypothesize that psychological traits, which have a long history of use in social psychology and management training and research, provide improved abilities to forecast individual-level differences in public goods contributions.

There is some evidence that psychological traits can be of value. Perugini, Tan, and Zizzo (2010) identify sizeable gender disparities in contributions.[1] They show that the behavior can be fully explained by personality differences. Their focus, though, is on the decay of contributions in a repeated play framework and not on whether personality has an independent, explanatory effect. Kurzban and Houser (2001) introduce a player "type" algorithm to classify each player as being a cooperator, conditional cooperator, or free-rider. With the use of a personality inventory, they show that player type is explained by personality traits.

Additional work has provided links between personality traits and behavior in other environments. Ben-Nur, Kong, and Putterman (2004) and Ben-Nur and Kramer (2011) conduct experiments of the Dictator Game and assess personality traits. In the former, the salience of gender is investigated, while in the latter giving was to a hypothetical person that related to them as kin, competitors, collaborators, or neutrals. Personality assessments explain some of the differences in

[1] Andreoni and Vesterlund (2001) and Jones and Linardi (2015), amongst others, focus on gender differences in altruism and contributions.

giving in both studies. Similar research illustrating a relationship between cooperation in the Prisoner's Dilemma Game and personality assessments have been conducted by Boone, De Brabander, and van Witteloostuijn (1999), Hirsh and Peterson (2009), and Kagel and McGee (2014). Finally, Becker *et al*. (2012) and Müller and Schwieren (2012) find relationships between personality and investments in the Trust Game.

We believe that the relationship is not limited to personality styles. Assessments in Theory of the Mind, which capture the individual's ability to attribute mental states to oneself and others, and the Rational-Experiential Inventory, which is designed to assess preferences for information processing, are other important psychological measurements. These, though, have not received a considerable amount of attention in economics. Further, given that psychological traits can be expected to influence strategic behavior in environments other than public goods contributions, and pro-social behavior is correlated across these environments, we would like to disentangle the channel through which the effects work. Under the presumption that psychological traits help explain free-riding behavior, we are curious if these relationships work indirectly through the level of cooperativeness experienced in other games, or is there a direct effect on public goods?

To test this hypothesis we conduct experiments where subjects play the Public Goods Game. We collect information on background characteristics, preferences for decision making under uncertainty, competence, and, importantly, psychological traits. The subjects, prior to playing the Public Goods Game, first interact in a number of common, laboratory games (Ultimatum Game, Dictator Game, Minimal Effort Game, and the Prisoner's Dilemma Game). These games are used to assess both the relationship between other-regarding behaviors and free riding, and the influence of past social interactions, either positive or negative, on willingness to contribute to a public good.

We find strong evidence that the psychological traits measured improve the ability to differentiate subjects' free riding behavior. Furthermore, we provide evidence that the explanatory power of the history of past social interactions is enhance when interacted with the psychological traits. Thus, both the direct and indirect channels are prevalent.

The methods employed in the experiment, along with the specific details on the assessments administered and games played are given in Section 2. Section 3 presents the econometric results, while Section 4 concludes.

2. Experiment

We proceed by first describing the methods employed in the experiment. Then, the pre-experiment assessments that were taken and the economic games played are described.

2.1 Methods

We conducted the experiment at Rensselaer Polytechnic Institute (RPI), Union College (Union), and the University of Massachusetts (UMass) during a six-month time frame. In total there were 141 subjects across the three institutions.[2] Subjects were recruited using the online recruitment system ORSEE and were informed that they would be financially compensated for their participation in a two-part survey.

Upon signing up to participate in the experiment, subjects were given immediate access to complete the first part of the experiment. This entailed completing a survey of psychological and economic questions. The questions involved (i) decision making under uncertainty assessments, (ii) competence exams, and (iii) psychological trait inventories. Additionally, background information was collected. Specifically, the decision making under uncertainty assessments included questions intended to elicit the Allais and Ellsberg paradoxes and a measure of risk aversion. The competence examinations included the Wonderlic test, a vocabulary quiz, and an IQ exam. Finally, psychological controls measured involved the *Big Five Personality* traits, a *Rational-Experiential* inventory, and the *Mind in the Eyes* test. The following subsection elaborates on all assessments further. These tests were taken using an online survey format, and subjects were given a 45 minute time limit.

Approximately 1-2 weeks after completing the survey, the subjects were asked to report to a computer lab to participate in the economics games. The subjects were randomly assigned to a computer cubicle and asked to play five, one-shot games. After each game was completed, subjects were randomly re-matched to play the next game in order to eliminate history and reputational effects. The first four economic games were the Dictator, Ultimatum, Minimal Effort, and Prisoner's Dilemma games, while the fifth game was always the Public Goods Game. Section 2.3 describes each in detail. The order of all but the Public Goods Game was randomized across experimental sessions, so that subjects could have seen one of four orders.[3] Since the focus of this study is to appreciate the role of

[2] The distribution of subjects across the three locations is 72, 38, and 32 at RPI, Union, and UMass, respectively.
[3] Thus, four experimental sessions were conducted in total. One location was selected to hold two sessions. In the upcoming econometric investigation, location, rotation, and session fixed effects will be evaluated. The number of subjects per session (and, hence, per rotation/order) is 40, 39, 34, 28.

psychological traits and history of social interactions on free riding behavior, it is necessary to have all games completed prior to making the public good contribution.

After the subjects completed the Public Goods Game, they were then asked how much of $5 they would like to keep. This was done to identify those with nonstandard preferences for money and to provide a sixth payment (along with the payoffs from the five games) to be included in the payment randomization.[4] The earnings from each of the six decision problems were then displayed on the subject's screen and the experimenters walked to each subject's cubicle and asked the subject to roll a six-sided die. The number that was face side up corresponded to game 1-6, which determined the subject's payoff for the economics experiment. The payoff determined by the roll of the die was added to the $15 that the subject was paid for completing the survey. Then, a $5 show-up payment was added to determine each subject's final pay.[5]

2.2 Assessments

As stated, the assessments, administered 1-2 weeks prior to the subjects showing up at the laboratory, can be grouped into three components: decision making under uncertainty, competence, and psychological traits.

Decision Making Under Uncertainty

Three separate assessments were administered to evaluate each subject's preferences for decision making under uncertainty. First, a standard Holt and Laury (2002) risk assessment was administered. A reproduction of the tool is presented in Table A1 in the appendix. Of the nine choices to be made, the number of selections in which the relatively safer option was selected becomes the variable *Safe*.

A risk neutral, expected-utility maximizing individual will select *Safe* = 4. An increase in the value of *Safe* corresponds to a more risk averse individual. A person who selects the safer option less than four times is measured to be risk loving.

The second assessment administered is a test of the Ellsberg Paradox (Ellsberg, 1961). Facing ambiguity, individuals tend to make inconsistent choices, at least inconsistent from the perspective of expected utility theory. Similarly, the third assessment is a test of the Allais Paradox (Allais, 1953).

[4] The average amount requested is $4.94 with 96.5% of the subjects requesting all $5.
[5] Subject earnings averaged $4.16, $2.73, $3.94, $3.42 for the Ultimatum, Prisoner's Dilemma, Minimal Effort, and Public Goods games, respectively. The amount requested is uncorrelated with the decision made in any game.

Individuals often exhibit a bias towards certain outcomes. The specific decision problems are presented in Table A2 in the appendix. Indicator variable controls for the decisions made in the two Ellsberg-related questions, *Ellsberg 1* and *Ellsberg 2*, the two Allais-related questions, *Allais 1* and *Allais* 2, are included along with dummy variables for whether decisions are consistent; *Ells Consistent* = 1 if and only if *Ellsberg 1* = *Ellsberg 2* and *Allais Consistent* = 1 if and only if *Allais 1* = *Allais 2*.

Taken together, the risk preference, ambiguity preference, and certainty preference are used to measure how decision making under uncertainty affects free riding. Drawing from previous research, they are expected to be jointly significant predictors of behavior.

Competence

A number of standard intelligence assessments were administered. Specifically, a ten-question vocabulary quiz and a five-question IQ test were used. Furthermore, the Wonderlic assessment was given. Vocabulary and IQ tests have a long history of use in empirical economics research. For example, Benjamin, Brown, and Shapiro (2013) show that students from a Chilean high school with higher standardized test scores exhibit lower levels of small-stakes risk aversion. The Wonderlic assessment is commonly used in human resources evaluations and is typically divided into sections covering cognitive and behavioral traits.[6] The Wonderlic assessment has been shown to be highly consistent with other well-recognized measures (McKelvie, 1989; Hawkins *et al.*, 1990). The results are aggregated across all questions within each section in order to assess the potential conformity of the subject to a particular set of tasks/job. For example, prior to the annual draft, NFL prospects are given the Wonderlic assessment as a gauge of their decision-making ability (Gill and Brajer, 2012).[7] The Wonderlic has been previously used in experiments (Ben-Nur, Kong, and Putterman, 2004; Ben-Nur, Kramer, and Levy, 2008). A copy of the competence assessment tools administered is available on our online, supplemental appendix.

In addition to these three competency measurements, the risk assessment provides another opportunity to measure suboptimal decision making. Regardless of the type of risk preference, an

[6] The IQ test is an extended version of the Cognitive Reflection Test by Frederick (2005). The vocabulary questions used in our assessment come from General Social Survey (Smith *et al*., 2015). The Wonderlic questions used in our assessment come from Wonderlic (1992).

[7] For example, the pro football quarterback Ryan Fitzpatrick, an economics major when at Harvard, scored a 48 on the Wonderlic, which is the third highest recorded in NFL history (http://harvardmagazine.com/2011/09/ryan-fitzpatrick-buffalo-bills-quarterback-harvard-graduate), while the NFL average is a 20 (http://espn.go.com/page2/s/closer/020228.html).

individual maximizing expected utility will choose a single switching point between the two options. While *Safe* measures the number of selections of the safer choice, the variable *Irrational Switch* is an indicator variable equal to one if and only if more than one switch occurring between the two options.

Psychological Traits

The field of social psychology has developed numerous assessment tools to measure individual traits. Three of the most popular inventories are administered: the *Big Five Personality* test (Big Five), *Rational-Experiential Inventory* (REI), and *Theory of Mind* (ToM).

The Big Five inventory (Costa and McRae, 1992; Goldberg, 1999) determines an individual's openness, conscientiousness, extraversion, agreeableness, and neuroticism.[8] Use of the Big Five Personality test has generated volumes of research that explore the behavioral differences between individuals exhibiting various traits. The use of the Big Five in economics experiments is not new, as they started appearing in experiments such as Deck, Lee, Reyes, and Rosen (2012), using it to understand risk taking in groups, Müller and Schwieren (2012), comparing the traits to behavior in the Trust Game, Becker *et al*. (2012), correlating them with a variety of economic preferences, and Kagel and McGee (2014), matching them with cooperation in the Prisoner's Dilemma.[9] However, the impact of personality, as measured by the Big Five, on free riding has been unexplored. Borghans, Duckworth, Heckman, and Weel (2008) discuss at length their potential relevance in human resources economics.

Second, the Rational-Experiential Inventory captures the relation of rational and experiential information processing styles to personality, basic beliefs, and the ratio-bias phenomenon (Pacini and Epstein, 1999). It was designed to assess preferences for information processing. The REI tool distinguishes between two cognitive styles: a rational style and an experiential style. The rational style person has a need for cognition, emphasizing a conscious, analytical approach. A person with an experiential style emphasizes a pre-conscious, affective, holistic approach. Sub-scales are produced, which differentiate rational ability – the ability to think logically and analytically – from rational engagement – with a reliance on and enjoyment of thinking in an analytical, logical manner. Also, experiential ability – the ability with respect to one's intuitive impressions and feelings – and experiential engagement – a reliance on and enjoyment of feelings and intuitions in making decisions –

[8] We use the 44 question version of this assessment (John *et al*., 1991).
[9] McCannon and Stevens (2015), Schmitt *et al*. (2008), and Swope *et al*. (2008) present results showing a relationship between personality and experimental outcomes, but study the Myers-Briggs personality style inventory rather than the Big Five.

are assessed. Differentiating the decision-making "style" has not previously been done in economics research.

Furthermore, an assessment intended to measure Theory of Mind (ToM), known as the *Mind in the Eyes*, was administered. In the assessment, subjects see a photo of a person's face zoomed in on their eyes. Subjects are given four options of the emotion of the person photographed. The number of scenarios in which the subject accurately identifies the facial reaction, out of the 34 questions, becomes the subjects *Eyes* score. An individual that has higher *Eyes* is thought to be more capable of attributing mental states (beliefs, desires, intents, etc.) to oneself and others, while understanding that other people might have mental states that differ from their own (Baron-Cohen, 1991). Subject's that record lower *Eyes* can be associated with mental disorders (such as autism), while higher *Eyes* is thought to enable one to understand that mental states can be the cause of—and thus be used to explain and predict—the behavior of others (Premack and Woodruff, 1978). Theory of the Mind assessments have been used in previous research in experimental psychology. For example, using an alternative measurement tool, Sally and Hill (2006) show how behavior of autistic children, who score substantially lower on their ToM assessment, differ from normally-developed children in Prisoner's Dilemma, Dictator, and Ultimatum games; while Takagishi *et al*. (2010) show that differences from a ToM assessment correlate with behavior in an Ultimatum Game in preschoolers. An example of an assessment used that is intended to measure a subject's ToM is provided in the appendix. A copy of this entire survey is included in a supplemental, online appendix.

While personality traits have received some, albeit limited attention, the other psychological inventories have been relatively neglected. Thus, we are attempting to fill this void by focusing on their ability to explain differences in public goods giving.

2.3 Economic Games

The objective of our research is to assess the relationship between strategic behavior in social situations, using information on psychological traits and the history of play. Five popular economic games are introduced into the laboratory to appreciate strategic decision making. They are the Prisoner's Dilemma, Minimal Effort, Dictator, Ultimatum, and Public Goods Game. The following describes the instructions presented to the subjects.

Prisoner's Dilemma

A one-shot Prisoner's Dilemma Game was implemented in the laboratory. Subjects were randomly and anonymously paired and informed that they had a choice between action "Up" or action "Down", while their opponent selected either "Left" or "Right". They were informed they were playing a one-shot game.

Along with the instructions, a payoff matrix was shown on the computer screen (Figure A1 in the appendix provides the matrix seen by the subjects). If the outcome <Up, Left> is selected, then both players would receive $4. Thus, Up and Left are the cooperative choices. If <Down, Right> arises, then they both receive $1. Furthermore, as is standard in the Prisoner's Dilemma, if <Up, Right> or <Down, Left> occurs, then the player selecting the cooperative strategy receives $0, while the other earns $5. Thus, the dominant strategy for a subject, interested in maximizing monetary wealth in the one-shot environment, is to select Down. A subject attempting to cooperate on the social welfare maximizing outcome selects Up.

The game was played once. If the individual selected the cooperative action Up, then the variable *Prison* equals 1. Otherwise, it is zero. This captures a person's willingness to act cooperatively, even without history-dependent, repeated play. The variable *Prison Other* is the choice of *Prison* = 1 for the player the subject was paired with.

Thus, including *Prison* in the analysis allows us to gauge whether cooperativeness is universal between the two environments (i.e., serial correlation in play), while introducing *Prison Other* allows us to identify whether positive/negative social interactions spill over into future willingness to free ride.

Minimal Effort Game

Subjects were informed that they would be randomly paired with another person from the group and that, "the two of you are working on a project and the payoff for the project depends on both your performance and effort. However, a project is only as good as the effort that the weakest group member contributes. Hence, the minimum effort of either you or your partner determines the payoff from the project."

With these instructions, each player was prompted to select an effort level of 0, 10, 20, 30, or 40. A payoff matrix was presented on the screen (and is presented in Figure A2 in the appendix). The payoffs are such that, given the effort selected by the opponent, a player's payoff is greatest when not providing more effort. For example, if the opponent selects 20, then the selections of 0, 10, and 20 all

generate $4, while selections of 30 and 40 produce $3.75 and $3, respectively. Therefore, the Nash Equilibria in the one-shot game with expected-wealth maximizing individuals are to match effort levels and, thus, there are five Nash equilibria. Thus, the Minimal Effort Game is a coordination game. The equilibria can be Pareto-ranked. The payoff dominant outcome is for both players to select maximal effort, <40, 40>, while the stable one (trembling-hand perfect and risk dominant Nash equilibrium) is minimal effort, <0, 0>.

From this game the variable *Minimal* equals the effort selected in the game by the subject: 0, 10, 20, 30, or 40. This captures the subject's willingness to work towards the payoff dominant equilibrium in the coordination game. The variable *Minimal Other* is the selection by a subject's opponent in the game.

Dictator Game

One-half of the subjects were randomly selected to be the "sender" in the Dictator Game. In it, they were given ten dollars. The senders had a two-stage decision problem to solve. Like a standard Dictator Game, they were given the opportunity to "divide" the money with the randomly-selected "receiver" in any way they saw fit. The subjects were also shown the instructions the receiver will see and informed that no one else could give the receiver money. The senders were informed that the receivers would learn what they received, but would not have any action to take.

Alternatively, the selected proposers were allowed to opt out of the decision problem, as seen in Dana *et al.* (2006). If they chose to opt out, then they would lose one dollar, keeping nine dollars for themselves, but the subject that they were randomly paired with would never learn that the decision problem was present. The opting out was presented as a choice to "exit". Alternatively, they could select to "split" and, if chosen, a second screen asked them to make the dividing decision.

The opt-out option is novel in that it allows individuals, at a cost, to avoid the guilt they may feel by not sharing. It is an anti-altruistic motive. Additionally, if the proposer did not opt out, he or she still has the option to give nothing. This would be revealed to the receiver. Thus, this augmented version of the Dictator Game allows one to differentiate altruistic giving, standard selfishness, from guilty selfish behavior.

The indicator variable *Opt Out* equals one if and only if the subject, randomly selected to be the sender, chooses to opt out. The variable *Dictator* is the amount given to the receiver, conditional on *Opt Out* = 0.

Ultimatum Game

As in the Dictator Game, one-half of the subjects were randomly selected to play the role of the sender (ultimator) and one-half of the subjects were randomly selected to be the receiver (ultimatee).

The ultimator begins with ten dollars and chooses how to "divide" these funds. The ultimatee sees the ultimator's instructions, learns the proposed division, and makes a binary accept or reject decision. The subjects are informed that if the ultimatee accepts the offer, then the amount offered is how much s/he keeps and the residual is kept by the ultimator. Furthermore, if the offer is rejected, then both subjects receive zero.

The variable *Ultimatum* is the amount offered by the sender. The indicator variable *Accept* is equal to one if and only if the offer is accepted by the receiver. Depending on which subsample is being considered, these two variables capture the common, other-regarding behavior of the subject and the spillover of past social interactions on free riding.

Public Goods Game

As discussed in the presentation of the methods, the four sessions conducted differ in the sequence in which the previous four games were played. All sessions, though, ended with a fifth game, known as the Public Goods Game.

In it, subjects were prompted to decide how much of their $1 endowment to invest in a public good. They were informed that the public good will give fifty cents to each player for each dollar invested. Each subject selected how much of the dollar to contribute. The amount given is recorded as the variable *Public Invest*. A selfish, wealth-maximizing individual will select to invest nothing, which captures the decision to free ride. An individual who is interested in maximizing social welfare gives the entire dollar. The amount invested, then, measures the amount of free riding chosen and is the primary variable of interest in the investigation.

Table 1 provides the description of the variables used in the analysis, along with the full sample means.[10]

[10] Background controls for the three locations, four sessions/rotations/orders of play, gender, and five year-in-school variables are all included in the analysis but not presented in the table. The mean values for Year 1 – 5 are 0.121, 0.184, 0.255, 0.397, and 0.043. The mean value for *Male* is 0.610. The Dictator Game outcomes are on the

Table 1: Descriptive Statistics – Full Sample

Label	Description	Mean	(σ)
Independent Variable			
Public Invest	amount given in the Public Goods Game (min = 0; max = 1)	0.505	(0.39)
Variables			
Prison	= 1 if the subject selected the cooperative strategy in the Prisoner's Dilemma Game	0.596	(0.49)
Prison Other	= 1 if the opponent selected the cooperative strategy in the Prisoner's Dilemma Game		
Prison Only	= 1 if both *Prison* = 1 and *Prison Other* = 0	0.312	(0.46)
Minimal	selection by subject in Minimal Effort Game	30.43	(10.41)
Minimal Other	opponent's selection in Minimal Effort Game		
Minimal Less	= 1 if *Minimal* > *Minimal Other*	0.333	(0.37)
Opt Out	if the subject opted out of the Dictator Game	0.380	(0.49)
Dictator	amount given in the Dictator Game (conditional on *Opt Out* = 0; max = 10)	1.447	(2.19)
Ultimatum	amount offered in the Ultimatum Game (max = 10)	3.859	(1.34)
Accept	= 1 if the offer is accepted	0.829	(0.38)
Risk Controls (see Table A2 for details)			
Ells Consistent	= 1 if *Ellsberg 1* = *Ellsberg 2*	0.582	(0.50)
Allais Consistent	= 1 if *Allais 1* = *Allais 2*	0.567	(0.50)
Safe	# of safe choices made (see Table A1)	5.40	(1.61)
Competence Controls			
Wonderlic	score on Wonderlic assessment (max = 45)	35.23	(4.71)
Vocab	score on vocabulary assessment (max = 10)	7.65	(1.43)
IQ	score on IQ assessment (max = 5)	2.56	(1.59)
Irrational Switch	= 1 if there is not a unique switching point (see Table A1)	0.184	(0.39)
Psychological Trait Controls (out of 5)			
Big Five: Extraversion	# in which the extraversion option is selected	2.55	(0.66)
Big Five: Agreeableness	# in which the agreeableness option is selected	2.45	(0.60)
Big Five: Cons	# in which the conscientiousness option is selected	2.37	(0.61)
Big Five: Neuroticism	# in which the neurotic option is selected	2.62	(0.64)
Big Five: Openness	# in which the openness to option is selected	2.39	(0.60)

relevant subsample with *N* = 71. Similarly, the ultimator and ultimatee means are from their respective subsamples with *N* = 71 and *N* = 70, respectively.

Rational Ability	score on the rational ability assessment	3.29	(0.70)
Rational Engage	score on the rational engagement assessment	3.38	(0.72)
Exp Ability	score on the experiential ability assessment	3.60	(0.53)
Exp Engage	score on the experiential engagement assessment	3.63	(0.51)
Eyes	# of correct choices in the *Mind of the Eye* assessment (max = 34)	27.12	(3.68)

On average, subjects in the sample contribute one-half of their endowment to the public good with 33.3% of the subjects contributing strictly more than three-quarters of their endowment and 31.9% giving strictly less than one-quarter of it. These results are quite similar to those found in the literature. For example, contributions in McCannon (2015) were 50.2% of the endowment, on average, while 22% gave all and 19% gave nothing.

Regarding the other economic games, the opt out strategy was quite popular in the Dictator Game in that well over one-third of the subjects confronted with the choice preferred to keep most of the money for themselves, but were willing to forgo a dollar so that the other person does not learn that this selfish choice was made. This compares well to the findings of Dana, Cain, and Dawes (2006) where 28% took the exit option. Of those that did not opt out, the average amount given is low. In fact, 25% of the subjects who choose not to opt out gave nothing. Approximately 60% of the subjects played the cooperative (non-Nash equilibrium) strategy in the Prisoner's Dilemma, which resulted in just over 30% rate of failure to cooperate. This compares to a 49% rate of cooperation in Hirsch and Peterson (2009). In the Minimal Effort Game the average amount of effort is quite high. In fact, over 55% of the subjects attempted to coordinate on the Pareto Dominant equilibrium. Approximately one-third of the subjects, though, choose more effort than the person they were paired with, reducing their payoff. In the Ultimatum Game subjects offered, on average, just less than 40% of the endowment. In only 8.5% of the pairings did the ultimator offer strictly less than one-fifth of the endowment and in 40.9% of the pairings the ultimator offered at least half of the endowment. These results are in line with previous literature. For example, Schmitt *et al*. (2008) reports that first-movers offer 44% of their endowment in the Ultimatum Game, and rejections occur only 10.5% of the time.

Regarding the decision making under uncertainty assessments, the population consists of, on average, risk averse individuals. The variation in choices is high ($\sigma = 1.6$) with 77% of the subjects classified as risk averse. For both the Allais Paradox and the Ellsberg Paradox, over 40% of the subjects

exhibited the inconsistent decisions. Consequently, only 27% of the subjects do not exhibit inconsistent preferences in either.

While the full sample means for the competence assessments are presented in Table 1, it is worth pointing out the high level of correlation between these measurements. For example, the correlation coefficient between the Wonderlic score and the vocabulary quiz, irrational switching, and IQ score is 0.38, -0.43, and 0.54, respectively. Thus, there strong correlation suggests that each are valid measurements of competence.

The sample considered is similar to those previously studied when it comes to the standard psychological traits. For example, the sample of Hirsch and Peterson (2009) finds means values of the Big Five traits as 3.39, 3.78, 3.18, 3.00, and 3.50 for extraversion, agreeableness, conscientiousness, neuroticism, and openness, respectively.

III. Results

The hypothesis we are interested in exploring is whether psychological traits, which are commonly measured and researched in social psychology and make up the foundation of many management education and training activities, actually help explain differences in individual's willingness to contribute to a public good.

Our approach is to forecast the amount invested in the Public Goods Game using the standard arguments and methods employed in the literature. We then add in the trait assessments, as a group, and compare the goodness of fit differences in the specifications. Thus, the econometric model to be estimated is

$$Public\ Invest_i = \alpha_0 + G_i\gamma + P_i\pi + B_i\beta + R_i\rho + C_i\kappa + \epsilon_i$$

where G_i, P_i, B_i, R_i, and C_i are vectors of past game outcomes, psychological traits, background controls, risk and uncertainty measurements, and competence measures discussed previously. Each vector of coefficients will be evaluated based on their (collective) value in explaining individual differences in

public goods contributions. The specification restricting $\pi = 0$ will be compared to that without the restriction to assess the impact of including psychological traits.

Table 2 presents the main results. Each specification, rather than list every explanatory variable used, puts them into groups and reports the F-statistic if they were collectively omitted from the specification. The F-statistics are in brackets. Goodness of fit measurements - adjusted R^2, Akaike Information Criterion (AIC), and Hannan-Quinn Information Criterion (HQC) - are presented to further appreciate the value of including the sets of explanatory variables.

Table 2: Public Goods Investments – Full Sample
(dependent variable = *Public Invest*, N = 140)

	I	II	III	IV	V
Variables					
Prison		0.311 ***	0.281 ***		
		(0.093)	(0.093)		
Prison Other		-0.119	-0.136		
		(0.123)	(0.127)		
Prison Only		-0.228	-0.194		
		(0.151)	(0.154)		
Minimal				0.007 *	0.002
				(0.004)	(0.004)
Minimal Other				-0.011 **	-0.007
				(0.005)	(0.005)
Minimal Less				-0.316 **	-0.168
				(0.127)	(0.133)
		[4.0**]	[3.5**]	[2.3*]	[0.7]
Controls:					
Background	[1.3]	[1.6]	[1.5]	[1.5]	[1.3]
Risk	[0.4]	[0.2]	[0.5]	[0.5]	[1.0]
Competence	[1.0]	[1.5]	[2.0]	[1.0]	[1.0]
Psychology	NO	NO	[2.6***]	NO	[2.2**]
adj R^2	0.008	0.077	0.180	0.040	0.112
AIC	155.6	147.9	132.8	153.4	143.5
HQC	182.0	177.9	174.1	183.3	184.9

*** 1%, ** 5%, * 10% level of significance
Standard errors reported in the parentheses.
F-stats for the joint null hypothesis of zero coefficients are provided in the brackets.

The specifications in Table 2 differ in which sets of explanatory variables are included. Column I presents the specification with only the standard measurements used in previous experimental work, namely background controls (age, gender, fixed effects, etc.), decision making under uncertainty controls, and competence (rather, $\gamma = 0$ and $\pi = 0$). Each of these categories, though, are jointly insignificant and the goodness of fit measurements are poor.[11]

Column II includes as explanatory variables the decisions made previously in the Prisoner's Dilemma. The variable *Prison* accounts for inertia in play, that is, whether cooperative behavior in the Prisoner's Dilemma is a general pro-social behavior that is also expressed in the Public Goods Game. The positive and statistically significant coefficients indicates that, indeed, a common cooperative behavior links the two games.[12]

The variable *Prison Other* records whether or not the subject experienced cooperative behavior out of its partner in the Prisoner's Dilemma. Finally, the variable *Prison Only* is equal to one when the subject engaged in cooperative behavior in the Prisoner's Dilemma, but did not experience cooperation out of the opponent. The inclusion of these two variables tests for whether subjects respond in the Public Goods Game to adverse outcomes caused by anti-social behavior of others. The insignificant coefficients on these two variables suggest that there is not a strong relationship between negative past experiences and behavior. The F-test of the joint null hypothesis of past play (in the Prisoner's Dilemma Game) correlating with public goods contributions, though, reveals that collectively they have explanatory power. Additionally, the goodness of fit measurements, specifically the adjusted R^2, AIC, and HQC measurements, all record improved fit. Thus, including past behaviors and experiences improves our ability to explain individual-level differences in free riding.

[11] Some individual control variables are significant. For example, year in school controls are statistically significant. Also, whether the subjects made irrational switches and rotation/session fixed effects are calculated.
[12] With the inclusion of the interaction term *Prison Only*, the coefficient on *Prison* should be interpreted as the effect of cooperation in the Prisoner's Dilemma Game when the opponent also cooperates. Dropping the interaction term does not affect the sign or statistical significance of the coefficient on *Prison*. Thus, it is the cooperative behavior of the individual in the past game, and not the decisions of the opponent, which are spilling over onto the free-riding decision. Furthermore, the results in Table 2 present unadjusted standard errors. If heteroscedasticity-robust standard errors or standard errors clustered by rotation or session are calculated, then the statistical significance of the *Prison* coefficient remains while the statistical insignificance of the *Prison Other* coefficient persists.

The third column adds the psychological trait assessments. The five Big Five metrics, the four rational and experiential assessments, and the Mind in the Eyes score are all included. Jointly the trait measurements provide explanatory power, as revealed by the highly significant F-test. Additionally, the adjusted R^2, AIC, and HQC improve. This provides evidence supporting our hypothesis that psychological features help explain individual-level differences.

The fourth and fifth columns include, alternatively, the outcomes of the Minimal Effort Game. Just as cooperative behavior correlates with free riding, one would expect coordinating behavior to relate as well. As to be expected, the coefficient on the variable *Minimal* is positive and statistically significant in specification IV.

The variable *Minimal Other* again captures whether an experience of pro-social behaviors in previous interactions spills over into the decision to free ride. The negative and statistically significant coefficient suggests that it does. When a subject experiences shirking out of his/her partner in the Minimal Effort Game, s/he responds with more free riding. The variable *Minimal Less* adds an interaction effect. It is equal to one if the opponent contributed less effort than the subject did. The negative and statistically significant coefficient on this variable further suggests that adverse, anti-social past experiences persists into future economic interactions.

Comparing Column I and IV shows that the inclusion of the results from the Minimal Effort Game improves the goodness of fit. The variables are jointly significant and the adjusted R^2 and AIC both improve.

Finally, Column V adds, again, the psychological trait assessments. Collectively, they are highly significant. Again, the adjusted R^2 and AIC improve. This is further evidence that psychological traits contribute to the identification of individual-level differences in public goods contributions.

Interestingly, when the psychological traits are included, the results from the Minimal Effort Game lose their significance. This implies that the correlation in play between these two games can be explained by the characteristics of those players. This was not the case for the Prisoner's Dilemma Game. This suggests that behavior in the Minimal Effort Game and the Public Goods Game are coming from the same motivation, and that this motivation can be measured, to a degree, by the common psychological trait inventories popular in social psychology and management training/research. Cooperative behavior in the Prisoner's Dilemma Game is a separate behavior that is not fully captured by these assessments.

The results of Table 2 strongly suggest that both measureable, individual-level differences in mental "style" and overall other-regarding behavior both explain free riding. The natural question to ask is whether these are independent factors. Table 3 presents results with interaction effects between the various measurements of psychological traits and the prevalence of pro-social behaviors in the games (i.e., cooperation in the Prisoner's Dilemma and effort coordination in the Minimal Effort Game[13]). If the interaction terms are insignificant, then psychological traits and pro-social behaviors are independent drivers.

[13] Since the subject's behavior is correlated with public goods contributions, and not the decision of the opponent, only the interaction terms with *Prison* and *Minimal* are presented. If the psychological traits are interacted with *Prison Other* or *Minimal Other* each interaction term is insignificant, but they are jointly insignificant and the goodness of fit measurements worsen. Thus, these results are not presented here.

Table 3: Public Goods Investments – Interactions

(dependent variable = *Public Invest*, N = 140)

	I	II	III
Variables			
Prison	1.424 *		0.220 ***
	(0.822)		(0.075)
Prison Other	-0.135		
	(0.141)		
Prison Only	-0.214		
	(0.165)		
Minimal		0.014	-0.002
		(0.017)	(0.004)
Minimal Other		-0.008	
		(0.005)	
Minimal Less		-0.176	
		(0.133)	
Bad			0.002
			(0.005)
	[2.1**]	[0.8]	[3.1**]
Controls:			
Background	[1.9*]	[1.4]	[1.6]
Risk	[1.0]	[1.0]	[0.5]
Competence	[1.3]	[1.1]	[1.8]
Psychology	[2.2***]	[2.0**]	[2.6***]
Psychology x *Prison*	[1.7*]	NO	NO
Psychology x *Minimal*	NO	[0.9]	NO
adj R^2	0.232	0.111	0.171
AIC	129.8	145.0	134.3
HQC	182.9	188.6	175.6

*** 1%, ** 5%, * 10% level of significance

Standard errors reported in the parentheses.

F-stats for the joint null hypothesis of zero coefficients are provided in the brackets.

The F-stat for the psychology controls and historical choices include the interaction terms.

The result further highlights the relationship between psychological traits and social behavior. The first column includes interaction effects between the psychological types and the decision to cooperate in the Prisoner's Dilemma. The interaction terms are collectively significant predictors of contributions. Also, comparing the results to column III of Table 2, the adjusted R^2 and AIC improve with their inclusion. It does not diminish the significance of the relationship between cooperation and public goods contributions. The positive and statistically significant coefficient on *Prison* suggests an intercept shift in the relationship between psychological traits measurements and public goods giving. Regardless of one's psychological profile, willingness to cooperate in the Prisoner's Dilemma is correlated with unwillingness to free ride. Psychological traits influence the size of the relationship.

The results presented suggest that individuals are not responding to adverse outcomes inflicted upon them by other players, but rather their own preferences. The third column tests the hypothesis that numerous anti-social outcomes selected by others matters. The variable *Bad* = 1 is the interaction term between *Prison Other* = 0 and 40 – *Minimal Other*. Positive values of *Bad* capture an individual who experienced selfish behavior out of his/her partner in the Prisoner's Dilemma and larger values of *Bad* captures less effort in the Minimal Effort Game (i.e., "bad" outcomes). The statistically insignificant coefficient points to, again, no spillover effect of other's behavior in past rounds with free riding decisions.

The results of Tables 2 and 3 are revealing, using two prominent economic decision problems to illustrate the value of psychological traits. As stated in the previous section, subjects also participated in the Dictator Game and the Ultimatum Game. In our experimental design, subjects were randomly selected into one of the two rolls in these games. Thus, understanding the relationship between choices in these games and public goods requires considering the subsamples that made the choices in each game.

Consequently, Table 4 considers only the subjects who were randomly selected to take the roll of the decision maker in the Dictator Game.

Table 4: Public Goods Investments – Dictator Subsample
(dependent variable = *Public Invest*)

	I	II	III	IV	V
Variables					
Opt Out		-0.042	-0.203 *	-0.299 **	1.546
		(0.102)	(0.109)	(0.127)	(2.382)
Dictator		0.024	0.020	-0.039	-0.007
		(0.025)	(0.025)	(0.168)	(0.031)
		[0.5]	[1.9]	[0.9]	[1.0]
Controls:					
Background	[1.5]	[1.4]	[1.7]	[0.8]	[1.2]
Risk	[1.3]	[1.1]	[1.4]	[0.8]	[0.9]
Competence	[0.1]	[0.1]	[0.3]	[0.2]	[0.2]
Psychology	NO	NO	[2.0*]	[1.3]	[1.3]
Psychology x *Dictator*	NO	NO	NO	[0.8]	NO
Psychology x *Opt Out*	NO	NO	NO	NO	[0.8]
adj R^2	0.071	0.053	0.212	0.155	0.162
AIC	76.3	78.7	66.7	67.8	67.3
HQC	96.1	100.3	96.6	106.5	106.0

*** 1%, ** 5%, * 10% level of significance
Standard errors reported in the parentheses.
F-stats for the joint null hypothesis of zero coefficients are provided in the brackets.

The results in Table 4 support the previous findings. The primary control variables (background, risk, and competence) provide little explanatory power in the Public Goods Game. The variable *Opt Out* is equal to one if the dictator chooses to opt out of the game and not involve the other player. Since opting out requires the dictator to lose money simply to avoid the other player from knowing nothing is being offered, such a choice can be viewed as anti-social. The variable *Dictator* is, conditional on not opting out, how much is offered to the other subject and, hence, is a pro-social choice.

Interestingly, the altruistic behavior in the Dictator Game is uncorrelated, jointly, with contributions to public goods. This can be due to the experimental design. A subject who chooses not to opt out can do so either to claim all ten dollars for themselves, unwilling to pay a dollar to avoid the other player from knowing, or not opt out because they have a strong altruistic drive to give. Again,

what does provide explanation for individual-level differences in free riding is the measured psychological traits. They are jointly significant and their inclusion improves all three goodness of fit measurements. The decision to opt out does correlate, to a degree, with free riding.

Including interaction terms between the amount given in the Dictator Game and psychological traits does not reveal any alternations in behavior. All three goodness of fit measurements (adjusted R^2, AIC, and HQC) record worse fits and both sets of interaction terms are statistically insignificant. Thus, it is the choice to opt out and the psychological traits that, independently, explain behavior.

The remaining game to consider is the Ultimatum Game. Subjects are randomly selected to be either the one making the offer, which we call the ultimator, or the one receiving the offer making the acceptance/rejection decision, which we call the ultimatee. Table 5 considers the behavior. Within each column the first set of results is the subsample of ultimators, while the second is the subsample of ultimatees.

Table 5: Public Goods Investments – Ultimatum Game
(dependent variable = *Public Invest*)

	I		II		III	
Variables						
Ultimatum	0.071	-0.071	0.081	-0.201 **`	-0.783	-0.175 **
	(0.062)	(0.061)	(0.058)	(0.075)	(0.930)	(0.073)
Accept	-0.396	0.346	-0.464	0.586	-0.154	-19.866
	(0.433)	(0.383)	(0.393)	(0.409)	(0.530)	(20.983)
Ultimatum	-0.150	0.125	-0.233	0.157	0.014	-0.143
x *Reject*	(0.146)	(0.139)	(0.138)	(0.143)	(0.190)	(1.055)
	[0.6]	[0.5]	[1.4]	[2.5*]	[1.7]	[2.7**]
Controls:						
Background	[1.1]	[1.1]	[1.7]	[1.1]	[1.5]	[1.4]
Risk	[0.8]	[0.9]	[1.6]	[1.4]	[1.0]	[2.3*]
Competence	[0.2]	[1.1]	[1.9]	[1.3]	[0.8]	[1.9]
Psychology	NO	NO	[2.7**]	[1.8*]	[2.5**]	[2.5**]
Psy. x *Ult.*	NO	NO	NO	NO	[2.5**]	NO
Psy. x *Accept*	NO	NO	NO	NO	NO	[2.5**]
adj R^2	-0.087	-0.056	0.182	0.109	0.334	0.390
AIC	95.7	90.0	74.6	76.4	56.0	45.9
HQC	118.2	112.3	105.4	106.9	95.6	85.1

*** 1%, ** 5%, * 10% level of significance
Standard errors reported in the parentheses.
F-stats for the joint null hypothesis of zero coefficients are provided in the brackets.

Again, the common explanatory variables do little to forecast public goods contributions. Inclusion of past behaviors and outcomes individually and jointly do not provide any more explanatory power. In fact, all three goodness of fit measurements worsen.[14] This suggests that the generosity of the offer in the Ultimatum Game is unrelated to willingness to contribute to the group's wealth.

[14] The adjusted R^2 presents adjustments to the RSS and TSS in $R^2 = 1 – RSS/TSS$ and, thus, negative values are possible. Also, the specification with the social history variables is not presented. In it, the adjusted R^2, AIC, and HQC are -0.059, 92.3, 112.1, respectively, for the ultimator subsample and -0.023, 86.3, and 105.9, respectively, for the ultimatee subsample.

Yet again, the psychological traits improve the explanatory power. They are jointly significant and their inclusion improves the adjusted R^2, AIC, and HQC.

Column III includes the interaction terms. They are collectively significant. Furthermore, the size of the offer is correlated with later free riding. While not presented, if the interaction term *Ultimatum* x *Reject* is omitted, then both the F-stat for the interaction terms, along with the social history variables, are statistically significant in the first column of III.

A consistent story emerges. Background, risk, and competence explain little about individual differences in economic choices. Behavior of others, in the form of pro-social or anti-social choices, also do not have a substantial influence on the decision to contribute to the public good versus free riding. The past play and psychological traits provide independent explanatory value.

The goal of the study is to illustrate that psychological traits, collectively, matter. It is not one trait in particular that matters, but the group. For example, consider the popular Big Five. Regressing them against *Public Invest* generates *Big Five: Cons* as having statistically significant t-statistics. This suggests that more conscientious individuals contribute less. Social psychology descriptions support this. Conscientious individuals exhibit control and motivation in goal directed behavior who have a tendency for deliberation, thinking things through before acting (Costa and McRae, 1992). In experiments of the Trust Game, both Becker *et al*. (2012) and Müller and Schwieren (2012) find a strong, negative correlation between *Big Five: Cons* and trusting investments. In the full sample, those in the lowest decile of *Big Five: Cons* contributes 79% more than subjects in the highest decile (about three-fourths of a standard deviation). The correlation between these personality dimensions is strong (see Table A3 in the appendix). If *Big Five: Cons* is dropped, then the p-values of *Big Five: Extraversion* and *Big Five: Openness* improve. Thus, introverted, less conscientious, and those less open to new experiences free ride less. Additionally, including the interaction terms, the variable *Prison* x *Big Five: Cons* is negative and statistically significant (the coefficient in the specification presented in column I of Table 3 is -0.268).[15] Thus, while a subject who is willing to cooperate in the Prisoner's Dilemma contributes more to the public good (with a marginal effect of 1.424 from Table 3), the size of this effect reduces with the conscientiousness of the subject.

[15] A similar analysis can be done on the REI. Regressing the four REI categories against *Public Invest* including background, decision making under uncertainty, and competence assessments reveals that *Rational Ability* and *Rational Engagement* as statistically significant at the 1% level where the first is negative and the second coefficient is positive. Dropping them improves the p-value of *Exp Ability* (which has a negative coefficient). The *Eyes* coefficient is consistently insignificant across the specifications.

IV. Conclusion

Kaplan (2003) hypothesized that preference-based explanations for economic behavior are scientifically meaningful and empirically important. We have contributed to this research program focusing on an important economic problem: free riding in public goods environments. We hypothesized that psychological traits both provide independent explanatory power as to individual-level differences in contributions and they clarify the impacts of social history on behavior. To do this, we conducted experiments where subjects completed numerous assessments and engaged in a battery of common games prior to making a public goods contribution decision.

Our results indicate that while background characteristics, decision making under uncertainty preferences, competence, and social histories have received attention in the literature as factors that explain differences in free riding decisions, psychological traits provide substantial, independent explanatory value. Additionally, we show that the impact of history on behavior depends on the traits of the individual. Thus, psychological trait differences are important metrics to understanding free riding behavior.

Our paper makes three unique contributions. First, we establish that common psychological trait measurements provide an explanation of free riding behavior in public goods environments. Second, we show that traits other than the standard personality types, namely the Rational-Experiential inventory and Theory of Mind, matter. Third, and most importantly, there are both direct and indirect channels in which psychological traits matter. The relationship between behaviors in other environments is impacted by a person's type, but also the psychological traits directly correlate with free riding.

There are a number of directions for future research. For example, previous work in public goods has shown the value of institutional features such as communication, leadership, and sanctioning impact public goods contributions. In addition to explaining the channel of psychological traits through social history, future work can look for forecasts of differing behavior expressed by types responding in heterogeneous ways to institutional designs. Furthermore, while we investigate the correlation between play of different games, psychological traits presumably can explain evolution and adaptation over time.

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Appendix

Table A1 provides the Holt and Laury (2002) risk assessment used in the laboratory session.

Table A1: Risk Assessment

	Option A		Option B	
1.	$6	if 1	$11.55	if 1
	$4.80	if 2, 3, 4, 5, 6, 7, 8, 9, 10	$0.30	if 2, 3, 4, 5, 6, 7, 8, 9, 10
2.	$6	if 1, 2	$11.55	if 1, 2
	$4.80	if 3, 4, 5, 6, 7, 8, 9, 10	$0.30	if 3, 4, 5, 6, 7, 8, 9, 10
3.	$6	if 1, 2, 3	$11.55	if 1, 2, 3
	$4.80	if 4, 5, 6, 7, 8, 9, 10	$0.30	if 4, 5, 6, 7, 8, 9, 10
4.	$6	if 1, 2, 3, 4	$11.55	if 1, 2, 3, 4
	$4.80	if 5, 6, 7, 8, 9, 10	$0.30	if 5, 6, 7, 8, 9, 10
5.	$6	if 1, 2, 3, 4, 5	$11.55	if 1, 2, 3, 4, 5
	$4.80	if 6, 7, 8, 9, 10	$0.30	if 6, 7, 8, 9, 10
6.	$6	if 1, 2, 3, 4, 5, 6	$11.55	if 1, 2, 3, 4, 5, 6
	$4.80	if 7, 8, 9, 10	$0.30	if 7, 8, 9, 10
7.	$6	if 1, 2, 3, 4, 5, 6, 7	$11.55	if 1, 2, 3, 4, 5, 6, 7
	$4.80	if 8, 9, 10	$0.30	if 8, 9, 10
8.	$6	if 1, 2, 3, 4, 5, 6, 7, 8	$11.55	if 1, 2, 3, 4, 5, 6, 7, 8
	$4.80	if 9, 10	$0.30	if 9, 10
9.	$6	if 1, 2, 3, 4, 5, 6, 7, 8, 9	$11.55	if 1, 2, 3, 4, 5, 6, 7, 8, 9
	$4.80	if 10	$0.30	if 10

The variable *Safe* equals the number of selections, out of the nine, in which option A was selected. The variable *Irrational Switch* equals zero if the there exists a unique switching point where option B is selected for choices before and option A is selected for all choices later. *Irrational Switch* equals zero otherwise.

Table A2 presents the assessments used to identify the Ellsberg and Allais paradoxes.

Table A2: Ellsberg and Allais Paradox

Suppose that an urn contains 300 balls and three possible colors: red, green, and blue. You know the urn contains exactly 100 red balls, but are given no information on how many green or blue balls are among the remaining 200 balls.

E1: You win if you guess which color will be drawn. Do you prefer to bet on
Red
Green

E2: Now suppose that you win if you guess that either of the two colors will be drawn. Do you prefer to bet that green or blue will be drawn or that red or blue will be drawn?
Green or Blue
Red or Blue

Choose either:
A1: A Chance of winning $4000 with probability 0.2
A2: A chance of winning $3000 with probability 0.25

Choose either:
B1: A chance of winning $4000 with probability 0.8
B2: A chance of winning $3000 with certainty.

In the previous assessment, the variable *Ellsberg 1* = 1 if Red is selected for E1 and *Ellsberg 2* = 1 if Green or Blue is selected for E2. A subject has *Ells Consistent* = 1 if and only if *Ellsberg 1* = *Ellsberg* 2. In the second assessment, *Allais 1* = 1 if A1 is selected, *Allais 2* = 1 if B1 is selected. A subject has *Allais Consistent* = 1 if and only if *Allais 1* = *Allais* 2.

Table A3 provides the correlation coefficients between the Big Five Personality traits.

Table A3: Correlations

	Extra.	Agree.	Cons.	Neur.	Open.
Extraversion	1.0	0.33	0.33	0.34	0.37
Agreeableness		1.0	0.32	0.35	0.30
Conscientiousness			1.0	0.35	0.37
Neuroticism				1.0	0.32
Openness					1.0

Figure A1 provides a screenshot of the Prisoner's Dilemma .

Figure A1: Prisoner's Dilemma

Figure A2 presents the screenshot of the Minimal Effort Game.

Figure A2: Minimal Effort Game

Your choice \ Their choice	0	10	20	30	40
0	$3				
10	$2.75	$3.5			
20	$2	$3.25	$4		
30	$0.75	$2.5	$3.75	$4.5	
40	$-1	$1.25	$3	$4.25	$5

Figure A3 presents an example from the Mind of the Eye assessment.

Figure A3: Example

***Which emotion are the eyes showing?**

- Playful
- Comforting
- Irritated
- Bored