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Essays on Cognition and Cooperation

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To my beloved Ivano and Manuela

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Publications

Peer reviewed publications

1. Bilancini E, Boncinelli L, Capraro V, Celadin T, Di Paolo R (2020) The effect of norm-based messages on reading and understanding COVID-19 pandemic response governmental rules. *Journal of Behavioral Economics for Policy* **4**, 45-55
2. Bilancini E, Boncinelli L, Capraro V, Celadin T, Di Paolo R (2020) "Do the right thing" for whom? An Experiment on Ingroup Favouritism, Group Assorting and Moral Suasion. *Judgment and Decision Making* **15**, 182-192

Pre-prints and working papers

1. National identity predicts public health support during a global pandemic (Van Bavel et al.)
2. The effect of time pressure and motivated delay on cooperation and social norms in the online one-shot public goods game (with Bilancini E., Boncinelli L., Capraro V.)
3. Social Value Orientation and Conditional Cooperation in the online one-shot public goods game (with Bilancini E., Boncinelli L.) [*R&R*]

Presentations

1. ASSET VIRTUAL MEETING. 30th October 2020, Department of Economics and Business of University of Padova, Italy. *Altruism and reciprocity in the online one-shot public goods game*
2. 1st Interim PROCOPE Workshop. 28th September 2020, IMT School for Advanced Studies Lucca, Italy. *Using the Cognitive Reflection Test to Validate Cognitive Manipulation*
3. Seminar. 14th September 2020, Middlesex University London, UK. *The Effect of Time Pressure and Motivated Delay on Cooperation and Social Norms in the Online One-Shot Public Goods Game*. [online seminar]
4. SABE 2020 Annual Conference. 22-26 July 2020, HSE University, Moscow, Russia. *The effect of norm-based messages on reading and understanding COVID-19 pandemic response governmental rules*
5. Young Economists of Tuscan Institutions conference. March 2020, Pisa, Italy [Cancelled because of COVID-19 pandemic]
6. AISC Annual Conference. 11-13 December 2019, University of Roma Tre, Roma, Italy. *'Do the right thing' for whom?' An experiment on ingroup favouritism, assortativity and moral suasion*
7. Research Symposium. 18-19 November 2019, IMT School for Advanced Studies Lucca, Italy. *"Do the Right Thing" for Whom? An Experiment on Ingroup Favouritism, Group Assortativity and Moral Suasion*
8. Research Symposium. 6-7 June 2019, IMT School for Advanced Studies Lucca, Italy. *Does cognition mediate how social value orientation and reciprocity affect cooperation?*
9. AISC Midterm Conference. 22-24 May 2019, IMT School for Advanced Studies, Lucca, Italy. *Does Cognition Mediate How Social Value Orientation and Reciprocity Affect Cooperation?*

Abstract

In the last decade, scholars have studied cooperation in one-shot anonymous interactions under a dual-process perspective to understand whether it is more likely to be the result of decisions made relying on an intuitive process or whether it requires deliberation. The Social Heuristic Hypothesis predicts that, in one-shot anonymous interactions, cooperation is the result of an intuitive process. Although there is empirical evidence in favor of this hypothesis, many experiments failed to replicate such results. In this Dissertation, we try to reconcile the mixed evidence by exploring additional aspects of the causal link between the modes of cognition and cooperation, such as possible moderator factors, and by exploring the reliability of cognitive manipulations. In Chapter 1, we investigate the role of altruism and reciprocity in the online one-shot Public Goods Game, both with and without the cognitive manipulations. In Chapter 2, we explore the role of social norms and altruism in the online one-shot Public Goods Game under cognitive manipulations. In the last Chapter, we develop an experimental design to validate the treatments used to induce intuition and deliberation. As a proxy of the effectiveness of the cognitive manipulations, we use the Cognitive Reflection Test. This is a measure of the ability of individuals to resist intuitive responses and to engage in further reflection. In Chapter 1, we find that altruism goes with larger contribution levels under both treatments; reciprocity predicts contribution levels only under treatment designed to foster deliberation. In Chapter 2, we find that contributions and descriptive norms are higher whereas injunctive norms are more extreme under an experimental manipulation designed to foster deliberation. Finally, in the last Chapter, we find that the treatment designed to foster deliberation increases the likelihood to provide correct answers, while the treatment designed to foster intuition increases the likelihood to provide non-intuitive incorrect answers.

Introduction

Cooperation is a situation where two or more individuals have to decide whether to pay a cost to make another agent or the society as a whole better off without an immediate benefit. Humans live and are organized in large societies where cooperation is a crucial factor for their stability. Understanding why some individuals cooperate and while others do not, or why some individuals cooperate in some circumstances but do not in others is still heavily debated (see Rand and Nowak, 2013, for a review).

Cooperative behavior has been observed both in repeated situations and in one-shot anonymous interactions. In the former, cooperation has been explained by means of the five rules for the evolution of cooperation by Nowak (2006). For example, an individual may use the tit-for-tat strategy (Axelord, 1984) in repeated interactions: they start with cooperation, and they behave according to what the other has done in the previous interaction, thus the individual will cooperate if the other cooperates as well (Milinski, 1987). In in one-shot anonymous interactions, the motives are not trivial and to explain them scholars have focused on social preferences (Ledyard, 1995; Fehr and Schmidt, 1999; Bolton and Ockenfels, 2000) and moral preferences (Aguiar, Branas-Garza, and L. M. Miller, 2008; Capraro and Rand, 2018; Capraro and Perc, 2021). Another approach that has emerged in the last decade is the study of the determinants of cooperative behavior through a dual-process perspective. Dual-Process theories posit that decisions result from the interplay between two cognitive systems: System 1 and System 2. The former is fast, au-

tomatic, and related to intuition, while the latter is slow, controlled, and related to deliberation. Following the Dual-Process approach scholars have tried to understand whether cooperative behavior in one-shot interactions is the result of a default predisposition or whether such behavior can be reached by exerting self-control to override selfishness, and thus through more deliberation. Rand, Peysakhovich, et al. (2014) proposed a theory that allows to provide an answer: the Social Heuristics Hypothesis. The Social Heuristics Hypothesis (that we are going to explain in deeper detail in the next Section) predicts that intuition favors cooperation, but the experimental evidence has shown mixed results which we will review in the next Sections.

In this Dissertation, we combine tools from behavioral economics, experimental economics and social psychology to investigate some potential determinants of cooperation and how they interact with intuition and deliberation. Before getting into the Dissertation core, we give an overview of the main findings in this line of research. Section 1 briefly introduces the Dual Process approach and a brief literature review of the main findings. In Section 2, we introduce the determinants of cooperative behavior. In Section 3, we outline the Dissertation and the contribution to the literature of each Chapter.

1 Cognition and Cooperation

Following the Dual Process theories, individuals' decisions result from the interplay of two cognitive systems. System 1 can be considered as a rapid, effortless, and automatic process that produces default choices, and it is related to intuition, while System 2 is slow, effortful, controlled, and it leads to more reasoning (Evans and Stanovich, 2013).

Many experimental conditions have been designed to manipulate the modes of cognition to increase the possibilities of observing responses driven by System 1 or System 2. Some of these cognitive manipulations are: time constraints, motivated delay, cognitive load, conceptual priming, ego depletion, and neurostimulation (they are reported in a nutshell in Table 1). Notice that it has never been tested whether these treatments

foster intuition and deliberation. Given that it would be noteworthy to validate the effect of these treatments, we develop a new experimental design aimed at studying whether they foster intuition and deliberation.

Scholars have focused their attention on whether cooperation in one-shot anonymous interactions results from an intuitive process or whether it requires deliberation, and this has led to a fruitful debate. Rand, J. D. Greene, and Nowak (2012), in their seminal work, implemented an experimental design aimed at fostering intuition and deliberation. Individuals had to decide how much to contribute to the Public Goods Game; they were randomly divided into two treatments: time pressure and time delay. In the time pressure condition they had to provide their contribution within a short amount of time. In the time delay condition they had to provide their contribution after a given amount of time. The authors found that cooperation is higher under intuition with respect to deliberation. To explain these results, Rand, Peysakhovich, et al. (2014) presented the Social Heuristics Hypothesis (SHH). According to the SHH, humans internalize those behaviors that are successful in their everyday life, and they use them as default strategies in new environments. Since daily interactions are often repeated, they may lead cooperation to evolve thanks to the five rules of cooperation (Nowak, 2006), and therefore people can internalize cooperation as a heuristic. Humans might use cooperation as a default strategy in new interaction settings, e.g., the lab environment and when they are asked to make a decision in a short amount of time. While, when individuals deliberate, they can calculate and understand that defection is the pay-off dominant strategy in the one-shot interactions. The SHH thus predicts that intuition favors cooperation in one-shot anonymous interactions. Moreover, the SHH has been applied for other prosocial behaviors such as altruism (Rand, 2016), honesty (Capraro, 2017), and altruistic punishment (Hallsson, Siebner, and Hulme, 2018). The predictions of the SHH were successfully tested by several studies (Cone and Rand, 2014; Rand, Peysakhovich, et al., 2014; Rand, Newman, and Wurzbacher, 2015; Capraro and Cococcioni, 2015; Rand, 2016; Everett et al., 2017; Isler, Maule, and Starmer, 2018; Bird et al., 2019). However, other studies failed in the attempt to replicate the

SHH's predictions (Tinghög et al., 2013; Verkoeijen and Bouwmeester, 2014; Stromland, Tjotta, and Torsvik, 2016; Bouwmeester et al., 2017), or yet other studies even found that intuition favors selfishness (Capraro and Cococcioni, 2016). In a meta-analysis with 67 studies Rand (2019) found that overall intuition favors cooperation, but this finding is at odds with a subsequent meta-analysis (87 studies) by Kvarven et al. (2020); for a complete review refer to Capraro (2019). To conclude, there is mixed evidence in the literature for what concerns the causal link between the modes of cognition and cooperation.

Table 1: Treatments designed to manipulate cognition

Manipulation	System being Promoted	Method
Time Constraint: Time Pressure	Intuition	Subjects are asked to answer within a short amount of time (e.g., 5-10s)
Time Constraint: Time Delay	Deliberation	Subjects are asked to answer after a given amount of time (e.g., 10s)
Motivated Delay	Deliberation	Subjects are asked to motivate their decisions before making their actual choice
Cognitive Load: Working Memory	Intuition	Subjects are asked to solve an unrelated task, before the main one, that uses the working memory
Conceptual priming	Intuition & Deliberation	Subjects are asked to complete an exercise that prime them to rely on intuition or deliberation
Ego depletion	Intuition	Subjects are asked to complete unrelated tasks that deplete their self-control
Neurostimulation	Intuition & Deliberation	Activation or deactivation of brain areas using electric or magnetic stimulation tools

Note: we present here some of the main cognitive manipulations that are currently used in the literature.

2 The determinants of the cooperative behavior

Scholars have recently tried to reconcile the mixed evidence by taking into account potential determinants of cooperation. Indeed humans are heterogeneous, and such heterogeneity should be taken into account. To reconcile this mixed evidence, scholars have started to study factors that may act as potential moderators of the effect of cognition on cooperation. Characteristics such as experience, trust, and social value orientation (that is a proxy of altruism) may affect choices under cognitive manipulations. Rand, Peysakhovich, et al. (2014) found that participants who have no previous experience with experimental settings cooperate more under treatments designed to foster intuition than those who have experience. Rand and Kraft-Todd (2014) found that intuition increases cooperation among those who are inexperienced and trust other people. Alós-Ferrer and Garagnani (2020) found that subjects with higher (lower) social value orientation tend to cooperate more (less) in both treatments, but the effect is stronger for more altruist (selfish) individuals under time pressure with respect to time delay.

In this Dissertation, we are going to investigate the role of some of the potential moderators of the effect of cognition on cooperation, and specifically we focus on altruism, reciprocity, and social norms.

An individual is considered an altruist if she is willing to pay a personal cost to increase the pay-off of another individual. Altruism is considered as a behavior of unconditional kindness (Fehr and Schmidt, 2006; Andreoni, 1989; Andreoni and J. Miller, 2002; Charness and Rabin, 2002). This disposition has been widely used in economics to explain the charitable and voluntary behavior (Andreoni and Payne, 2013; List, 2011). Specifically social value orientation (Murphy, Ackermann, and Handgraaf, 2011) has been used to capture this disposition. It seems noteworthy to study whether altruism might mediate the role of the cognitive manipulations on cooperation in one-shot anonymous interactions. Indeed, there is evidence that individuals do not care only about their own pay-off (*self-regarding preferences*), but they also care about others' pay-off (*other-regarding preferences*), and such preferences might be at work when

individuals make decisions in one-shot anonymous interactions under the cognitive manipulations. Specifically, individuals might be more altruistic when intuition is fostered because they do not have time to understand what is the decision that leads them to the highest pay-off.

Reciprocity embodies the idea that an individual will cooperate if and only if she believes the others will cooperate as well (Fehr and Schmidt, 2006; Rabin, 1993; Segal and Sobel, 2007; Fischbacher, Gächter, and Fehr, 2001; Kurzban and Houser, 2005; Falk and Fischbacher, 2006; Boosey, 2017; T. O. Weber, Weisel, and Gächter, 2018). A key aspect of reciprocity is the belief about others' likelihood to cooperate, but individuals are heterogeneous both in their disposition to reciprocate (Fischbacher, Gächter, and Fehr, 2001; Fischbacher and Gächter, 2010; Fischbacher, Gächter, and Quercia, 2012) as well as in their expectation about others' level of cooperation (Fischbacher, Gächter, and Quercia, 2012). Reciprocity and the formation of beliefs about others' behavior are experienced daily by individuals, and thus it would be of interest to understand whether and how they impact cooperation under cognitive manipulations. The disposition to reciprocate might have a greater role when deliberation is prompted because individuals have time to form beliefs about others' behavior.

Social norms are classified as descriptive and injunctive norms. The former embodies the idea that individuals tend to behave according to what they believe other people will do. The latter embodies the idea that individuals tend to behave according to what they believe other people would approve or disapprove of. It is important to notice that descriptive norms differ from reciprocity. In fact, the first leads individuals to follow and conform to the average behavior of the peers and the context (Muldoon et al., 2014), while reciprocity is the disposition to cooperate conditionally on expected cooperation by others. It has been shown that individuals tend to follow what they think are the norms in a given context (Schwartz, 1977; Cialdini, Reno, and Kallgren, 1990; Bicchieri and Xiao, 2009). Moreover, Capraro, Jagfeld, et al. (2019) have shown that nudging the injunctive norms increases cooperation in the prisoner's dilemma. Injunctive norms might be at stake when individuals have to make a choice when Systems 2 is fostered, because individuals might rationalize

what the others would approve. Similarly descriptive norms might be at stake when Systems 2 is fostered, because individuals might need time to form expectations about others' behavior.

3 Dissertation outline

In the first Part of the Dissertation, we study the effect of possible factors on the role of cognition on cooperation, i.e., altruism, reciprocity and social norms. In the second Part, we provide a useful tool to experimenters that are interested in cognition. Specifically, we try to validate the Time Delay and Time Pressure treatments by means of the Cognitive Reflection Test (Frederick, 2005).

We contribute to the literature on cognition and cooperation mainly by:

(i) Trying to reconcile the mixed evidence in the literature (Chapter 1 - Chapter 2).

(ii) Exploring the role of potential moderators of the effect of cognition on cooperative behavior (Chapter 1 - Chapter 2).

(iii) Proposing a novel experimental design aimed at validating the treatments designed to foster intuition and deliberation (Chapter 3).

Below we present the research questions of each Chapter, and the main results.

In the first Chapter, we explore the role of social value orientation and reciprocity in online setting, and their dependency on the modes of cognition, using a strategic game (the Public Goods Game) to detect the level of cooperation:

> **RQ1:** ***What is the role of altruism and reciprocity in determining the level of cooperation in a Public Goods Game, and how they moderate the effect of the cognition?***

Our contribution to the literature provides experimental evidence suggesting that in the online one-shot Public Goods Game, altruism positively affects contribution levels, irrespective of the cognitive modes, and reciprocity predicts contribution levels only when deliberation is fostered.

In the second Chapter, we explore the role of social value orientation and social norms in the online setting, and their dependency on the modes of cognition, using a strategic game (the Public Goods Game) to detect the level of cooperation:

> **RQ2:** ***What is the role of altruism and social norms in determining the level of cooperation in a Public Goods Game, and how they moderate the effect of cognition?***

Results show that contributions to the Public Goods Game are higher under deliberation with respect to intuition; moreover we find that descriptive norms and injunctive norms are endogenous. Indeed descriptive norms are higher for those participants that are under deliberation, and injunctive norms are more extreme for those participants who are under deliberation. Results suggest that the modes of cognition affect the contributions to the Public Goods Game and the relevant social norms.

In the last Chapter, we study whether treatments designed to manipulate cognition actually induce greater reliance on intuition and deliberation. Specifically, we focus on time manipulations where the experimenter manipulates the response time available to the subjects: Time Pressure and Time Delay treatments (see Table 1). As a proxy of the effectiveness of the cognitive manipulations, we use the Cognitive Reflection Test (CRT) by Frederick (2005) in the version of Primi et al. (2016) (CRT-L). The CRT indeed is a proxy of a person's ability to resist intuitive responses, and to engage in further reflection to reach the correct responses. CRT allows for correct answers, and two types of incorrect answers: intuitive but incorrect answers and non-intuitive incorrect answers that include all the other possible answers. Our research question is:

> **RQ3:** ***Are time manipulations effective in fostering reliance***

on intuition and deliberation?

Our contribution to the literature provides experimental evidence that Time Delay increases the likelihood to provide correct answers, and thus it leads to more deliberation. On the other side, Time Pressure increases the likelihood to provide non-intuitive incorrect answers. Notice that we cannot easily conclude the CRT does not induce intuition. Indeed there is evidence that CRT does not capture intuitive predisposition (Pennycook et al., 2016), and therefore further research should be conducted.

All the studies have been run in online settings, and we think this is an important additional aspect because this has allowed us to collect a non-standard pool, to reach a wide, heterogeneous and more representative sample, and to easily randomize individuals in different conditions.

Table 2: Dissertation outline

Chapter	Research Question	Method	Results
Introduction			
Chapter 1	What is the role of altruism and reciprocity in determining the level of cooperation in a Public Goods Game and how they moderate the effect of the cognition?	Online one-shot anonymous Public Goods Game under two treatments designed to manipulate cognition	Contributions to PGG are not different in the two treatments. Altruism goes with larger contribution levels under both treatments, while reciprocity predicts contribution levels only under the treatment designed to foster deliberation
Chapter 2	What is the role of altruism and social norms in determining the level of cooperation in a Public Goods Game, and how they moderate the effect of the cognition?	Online one-shot anonymous Public Goods Game under two treatments designed to manipulate cognition	Contributions to PGG and descriptive norms are higher under treatment designed to foster deliberation, and injunctive norms are more extreme under the treatment designed to foster deliberation
Chapter 3	Are time manipulations effective in fostering reliance on intuition and deliberation?	Subjects have to answer the Cognitive Reflection Test in an online setting under the cognitive manipulations based on time constraints	Time Delay increases the likelihood to provide correct answers online, while Time Pressure increases the likelihood to provide (non-intuitive) incorrect answers online
Conclusions			

Chapter 1

Altruism, Reciprocity and Cooperation

It is still a matter of investigation why some individuals cooperate, especially when we consider one-shot anonymous interactions. Individuals are heterogeneous, and identifying which are the factors that may act as potential moderators of the effect of cognition on cooperation is relevant.

In this Chapter, we explore two possible determinants of cooperation that are altruism and reciprocity. Moreover, we study their dependency on the modes of cognition. To the best of our knowledge, we are the first who address this issue by taking into account their joint role. Moreover, we do it through an online experiment that allows us to collect a non-standard pool and reach a wide and heterogeneous sample.

Reciprocity embodies the idea that one's decision to cooperate is conditional on expected cooperation by others. Available experimental evidence on cooperation in social dilemmas suggests that individuals respond to expected behavior with like behavior (Fischbacher, Gächter, and Fehr, 2001; Kurzban and Houser, 2005; Falk and Fischbacher, 2006; Boosey, 2017; T. O. Weber, Weisel, and Gächter, 2018), possibly forming expectations on observed past behavior (Brañas-Garza and Espinosa, 2011). In particular, models of reciprocity postulate that the belief about

This Chapter is based on Bilancini, Boncinelli, and Celadin (2020).

others' likelihood to cooperate is the key determinant of the extent of one's willingness to cooperate. Also, it has been observed that individuals are typically heterogeneous in both their disposition to be conditional cooperators (Fischbacher, Gächter, and Fehr, 2001), and their belief about others' likelihood to cooperate (Fischbacher, Gächter, and Quercia, 2012).

Altruism embodies the idea that the decision to cooperate is unconditional on expected cooperation by others. The Social Value Orientation (SVO) consists of a series of points allocation tasks that are a variant of the dictator game. SVO is often used as a measure of altruism (Van Lange et al., 1997; Murphy, Ackermann, and Handgraaf, 2011; Murphy and Ackermann, 2014; Dolton, Tol, et al., 2019). Available experimental evidence suggests that SVO provides information on the extent to which an individual is cooperative (Pletzer et al., 2018; Bogaert, Boone, and Declerck, 2008; Balliet, Parks, and Joireman, 2009; Emonds et al., 2014; Kuss et al., 2015; Bieleke et al., 2017; Alós-Ferrer and Garagnani, 2020).

Although many studies have investigated the role of either altruism or reciprocity, most have considered them separately. An important exception is the approach proposed by Kurzban and Houser (2005) to classify altruists (unconditional cooperators) and reciprocators (conditional cooperators) using actual cooperative behavior in a social dilemma. Kurzban and Houser (2005) provide experimental evidence of a substantial role of both conditional and unconditional cooperators. This classification, which aims to identify a stable set of behavioral types, implies that reciprocal and altruistic behaviors are mutually exclusive. Here instead, we try to consider their joint role for explaining cooperation in a social dilemma. For this reason, we use one source of information for measuring altruism (SVO) and another source of information for measuring the disposition to conditionally cooperate (referred to as dCC hereafter), both distinct from actual behavior in the social dilemma.

To the best of our knowledge, only Ackermann and Murphy (2019) have tried so far to shed light on the joint role of the disposition to donate, and the disposition to reciprocate, and they do so in a laboratory setting. Their findings point to the fact that SVO and dCC can be two separable predictors of cooperation in the Public Goods Game (PGG),

but their interplay with cognition is not explored.

In this Chapter, we report two studies, implemented using the software oTree (Chen, Schonger, and Wickens, 2016), based on incentivized online experiments where individuals play a one-shot anonymous PGG. The PGG is widely used to measure cooperation (Bogaert, Boone, and Declerck, 2008; Dolton, Tol, et al., 2019; Kocher et al., 2017; Vives and FeldmanHall, 2018) with the one-shot anonymous version allowing to minimize strategic considerations. The existing literature studying behavior in the one-shot PGG has focused on the following determinant of contributions: internal and external returns to contributions (Goeree, Holt, and Laury, 2002), rewards and sanctions (Walker and Halloran, 2004), reciprocity (Fischbacher and Gächter, 2010), public disclosure of contributions (Filiz-Ozbay and Ozbay, 2014), group size (Barcelo and Capraro, 2015), and social uncertainty and SVO (Alós-Ferrer and Garagnani, 2020). We differentiate from these by jointly considering SVO and reciprocity.

The first study measures dCC, beliefs about others' contributions and SVO, to see whether dCC and SVO are distinct sources of explanation for the contributions to the one-shot PGG. We found that a higher level of SVO predicts a greater contribution in the PGG, in line with the results of Balliet, Parks, and Joireman (2009), while dCC seems not to play a substantial role. This latter finding suggests a reduced role for reciprocity with respect to previous findings obtained in laboratory experiments on PGGs, which measure conditional cooperation using the method of Fischbacher, Gächter, and Fehr (2001) or some related algorithm (Fischbacher, Gächter, and Quercia, 2012; T. O. Weber, Weisel, and Gächter, 2018; Fallucchi, Luccasen, and Turocy, 2018). Actually, our finding is not directly comparable with the previous ones because we adopt a different specification that allows the inclusion of SVO. To the best of our knowledge, the only study in this literature which employs a regression specification similar to ours is Gächter, Kölle, and Quercia (2017), where dCC is found to have a substantial role.

In a second study, we want to understand whether altruism and reciprocity are potential moderators of the role of cognition on cooperation,

indeed we ran another online experiment, almost identical to the one in the first study, where the only difference is that we manipulated cognition by means of two conditions: a time pressure treatment (TP) to induce less deliberative decisions (following Alós-Ferrer and Garagnani, 2020), and a motivated delay treatment (MD) to induce more deliberative decisions (following Bilancini, Boncinelli, and Luini, 2020). We found that the role of SVO is, as in the first study, basically unaffected by the TP and MD treatments, while dCC predicts a greater level of contribution in the PGG but only under the MD treatment. The lack of treatment effects on the role of SVO roughly replicates, in an online setting, the finding in Alós-Ferrer and Garagnani (2020) for the one-shot PGG. The presence of treatment effects on the role of dCC has instead no terms of comparison in the literature, but it may actually help reconciling the apparent contrast with previous results found in the first study: dCC has the potential to account for contributions but, in order to do so, it requires that participants exert a sufficient degree of cognitive effort, which seems to be often the case in laboratory experiments and it might not be the case in online experiments; in the latter case, the MD treatment may allow raising the cognitive effort enough to make dCC capable of explaining contributions.

In sum, our addition to the literature is the provision of experimental evidence suggesting that in the online one-shot PGG: (i) a higher SVO score goes with higher contribution levels, irrespective of the manipulation of the extent of deliberation; (ii) measures of reciprocity obtained with the strategy method predict contribution levels only when deliberation is prompted.

The Chapter is organized as follows: Section 1 presents the first study, Section 2 presents the second study, and Section 3 discusses the results. Supplementary information on collected data, experimental instructions, and alternative analyses can be found in the Supplementary Material for Chapter 1.

1 Study 1

In the first online experiment, we study how individual measures of SVO and dCC predict contributions in an online one-shot PGG, taking into account beliefs about others' contributions.

The SVO (Murphy, Ackermann, and Handgraaf, 2011) is an incentivized continuous measure that captures individuals' altruism. It consists of a series of points allocation tasks that are a variant of the dictator game (Forsythe et al., 1994), that captures how much an agent is willing to renounce to make another agent better off (or worse off).[1] Each individual gets a score that is an angle between -16.26 and 61.39, resulting from the choices in the allocation tasks. An angle between -12.04 and 22.45 is defined as individualistic predisposition; in particular, an angle of 0 is interpreted as caring for own pay-off only. An angle between 22.45 and 57.15 is defined as prosocial predisposition; in particular, an angle of 45 gives equal weights to own and others' pay-off. An angle below -12.04 is defined as competitive predisposition. Finally, an angle above 57.15 is defined as purely altruistic predisposition.

Our measure of dCC is binary, and captures the willingness to cooperate conditionally on the belief that an individual has about others' contributions. Specifically, an individual classified as dCC has a predisposition to contribute, which on average, grows in her expectation about others' contributions (as in Fischbacher, Gächter, and Quercia, 2012). To elicit dCC we use a variant of the strategy method (Selten, 1967; Fischbacher, Gächter, and Fehr, 2001). Given our focus on reciprocity, and not on an exhaustive classification of behavioral types, we group together all individuals who are not dCC and we refer to them as nCC. More articulated classifications have been used in the literature, distinguishing among free riders, hump shaped and unconditional cooperators (Fischbacher, Gächter, and Fehr, 2001; Thöni and Volk, 2018). We report in Supplementary Material for Chapter 1 the analysis employing such finer classifications as a robustness check of our results.

[1] See (Engel, 2011) for a meta-study on dictator game experiments.

1.1 Method

We recruited 120 participants using the online platform Prolific[2]. Our participants were mainly from UK and US (UK=73.3%, US=17.5% mean age=30.02, males=37.5%, females=62.5%).

The experiment took place online on April 1, 2019. Participants were randomly assigned to groups of four individuals to play a one-shot anonymous PGG. Each participant was endowed with 20 points, and they had to decide how many points to contribute to a common pool. The sum of contributions to the common pool was then doubled and redistributed evenly among the group members. No feedback was provided.

After the one-shot PGG, we elicited an incentivized measure of participants' beliefs about the average contribution of the other three group members. Participants obtained a bonus of 10 points if they guessed correctly the average level of contribution (rounded to the closest integer) by the other group members. Subsequently, we elicited, using the strategy method, an incentivized measure of the disposition to conditionally cooperate: participants had to indicate how much they wanted to contribute to the public good conditionally on different (integer) values of average contribution by the other group members. More precisely, participants had to choose a contribution level for 21 different values of the average contribution by the other group members (from 0 to 20). We incentivized the strategy method following Fischbacher, Gächter, and Fehr (2001): for each group, a member was randomly selected and her pay-off calculated using the choice she made under the strategy method for the average contribution value that matched the actual one in her group (rounded to the closest integer), whereas for the other three group members the pay-off was computed according to the decisions made in the one-shot PGG. This method allows to assess how individuals would like to condition their decision on the behavior of the other group members (in Supplementary Material for Chapter 1, we report the maps of conditional cooperation strategies at the individual level obtained from actual

[2]www.prolific.co; Palan and Schitter, 2018

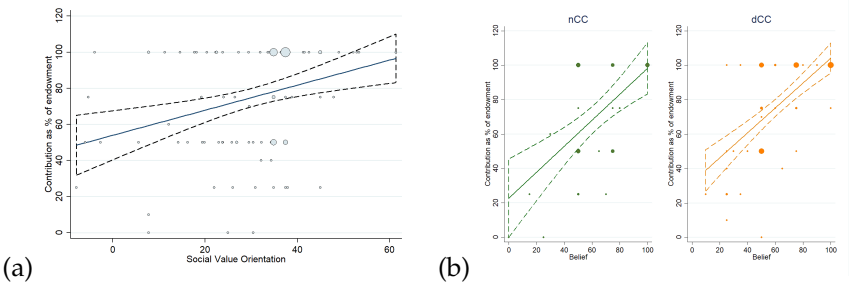
choices). Individuals are classified as dCC either if they show a monotonic pattern of contributions, with at least one increase, or if they have a positive Spearman rank correlation that is significant at the 1%-level (see Fischbacher, Gächter, and Quercia, 2012, for the details of this definition); otherwise, individuals are classified as non-conditional cooperators (nCC). In the literature, the belief elicitation comes after the Strategy Method elicitation (Fischbacher and Gächter, 2010; Fischbacher, Gächter, and Quercia, 2012; T. O. Weber, Weisel, and Gächter, 2018); we opted to ask for beliefs about others' behavior before the Strategy Method in order to avoid potential confounding effects due to the Strategy Method. In this part of the experiment 10 points corresponded to 0.10 GBP.

Subsequently, we elicited an incentivized measure of SVO using the task in the version of the six primary items by Murphy, Ackermann, and Handgraaf (2011). Participants were randomly assigned to interact with a new participant (different from those with whom they were playing the PGG). All the participants completed the SVO task. Payments were determined by randomly assigning participants to the role of decision-maker or receiver, and one of the decision-maker's choices was randomly selected to determine the pay-offs of both participants involved. In this part of the experiment 10 points corresponded to 0.05 GBP.

We opted to pay for all tasks, in particular both the one-shot PGG and the belief elicitation. Admittedly, this increases the room for potential biases due to hedging motives. However, as pointed out by Blanco et al. (2010), in order for such biases to be a major issue the hedging problem should be fairly transparent and the gains from hedging substantial. In our setup it is quite difficult to figure out what is the guess that optimally insures against the risk of low contributions by others and, moreover, the payment for a correct guess is rather small. Randomizing payments across tasks would have helped in reducing hedging motives, but it could have also generated some confusion about the payment mechanism, especially in the online setting where participants tend to spend little time on screens and they cannot ask for clarifications during the experiment.

The average earnings in this study were 1.38 GPB including 0.40 GPB

of show-up fee (which translates into an average hourly wage of 10.91 GBP).



(a) (b)

Figure 1: (a) Linear prediction of the level of contribution in the PGG as a function of SVO. (b) Linear prediction of the level of contribution in the PGG as a function of the individual belief about others' average contribution, distinguishing between participants classified as conditional cooperators (dCC) and non-conditional cooperators (nCC). Scatter plots identify the relative frequencies of the observations in the sample. Confidence intervals are at 95%.

1.2 Results

Our analysis focuses on how much SVO and dCC can account for actual contributions in the one-shot PGG.

In Table 3, we report the fraction of participants that we classified as dCC and nCC, together with the fractions for the finer classifications by Fischbacher, Gächter, and Fehr (2001) and Thöni and Volk (2018) (see Supplementary Material for Chapter 1 for details on the classification rules). Notably, slightly less than two-thirds of participants are classified as dCC. Overall, our coarser classification does not depart very much from the one obtained following Fischbacher, Gächter, and Fehr (2001) (only about 6% of participants are not classified as either dCC or Other), while the difference with the classification obtained following Thöni and Volk (2018) is more pronounced (about 21% of participants are not classified as either dCC or Other).

In Figure 1a contributions are plotted against the SVO score, which

Classification	Fischbacher et al., 2001	Thöni and Volk, 2018	Our Contribution
Conditional Cooperators	63.33%	62.50%	63.33%
Free Riders	0.83%	0.83%	–
Hump Shaped	5%	7.50%	–
Unconditional Cooperators	–	12.50%	–
Other	30.83%	16.67%	36.67%

Table 3: Classification of behavioral types in Study 1 following Fischbacher, Gächter, and Fehr (2001), Thöni and Volk (2018), and our classification.

turns out to be a good predictor: participants with a higher SVO score contributed more to the PGG. This finding is confirmed by the Tobit regression reported in Table 4 (Model 1); the result holds even when controls for gender, familiarity with the task, and comprehension of the task are included as regressors (Model 2), suggesting that SVO positively affects contributions to the PGG.

To investigate the role of the disposition to conditionally cooperate, we look at how being classified as dCC, as opposed to nCC, affects the relation between beliefs and contributions (Figure 1b). Comparing the relation in the two cases, we see that beliefs seem to matter in the same way for participants classified as dCC and participants classified as nCC. This insight is confirmed by the Tobit regressions reported in Table 4 (Models 3 and 4), even when we examine the impact of SVO and dCC simultaneously (Models 5 and 6). Such evidence may be reconciled with the estimates provided by Fischbacher, Gächter, and Quercia (2012, Table 4) by considering the fact that applying their finer classification of types we have only less than 1% of Free Riders (Table 3), who are the only types for which beliefs seem to matter substantially less.

For completeness and as robustness checks for our results, in Supplementary Material for Chapter 1, we report alternative regressions using the finer classification of types applied in Fischbacher, Gächter, and Fehr (2001) and the one in Thöni and Volk (2018). We find that results obtained under these alternative specifications are very similar to those presented here.

In sum, our results confirm that a higher SVO predicts higher contributions. Instead, being a dCC seems not to predict contributions and

be more reactive to beliefs about others' contributions. However, beliefs seem to matter *per se*. This fact is not straightforward to interpret. For instance, it could be because of the "false consensus effect" (Ross, D. Greene, and House, 1977), or it could be because other kinds of other-regarding preferences matter (we refer the reader to the discussion in Section 3 on this point).

To investigate a possible explanation of our results we conducted a second study where we attempt to manipulate the cognitive modes of participants playing the PGG, following the idea that SVO and dCC might play a different role under different cognitive modes.

Perc. Contribution	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
SVO	1.11***	1.14***			0.49**	0.51**
	(0.31)	(0.31)			(0.24)	(0.25)
Belief			1.45***	1.46***	1.30***	1.31***
			(0.30)	(0.29)	(0.32)	(0.31)
dCC			4.59	6.13	-3.13	-1.55
			(23.64)	(23.50)	(24.74)	(24.82)
Belief×dCC			0.21	0.18	0.30	0.27
			(0.39)	(0.39)	(0.40)	(0.41)
Controls:						
Familiarity		-4.15		1.67		-0.73
		(11.50)		(9.47)		(9.39)
Gender		3.61		6.99		7.49
		(11.43)		(9.23)		(9.00)
Understood		-20.14*		-13.14		-13.35
		(11.58)		(9.19)		(8.96)
N	120	120	120	120	120	120
pseudo R^2	0.015	0.020	0.085	0.088	0.089	0.093

Table 4: Tobit regressions on the level of endowment contributed in the one-shot PGG. *SVO* is individuals' social value orientation; *Belief* is the individuals' belief about others' contributions; *dCC*=1 if an individuals is considered as a conditional cooperator, 0 otherwise; *dCC*×*Belief* is the interaction between being and conditional cooperator and the level of belief about others' contributions; *Gender*=1 if female, 0 otherwise (1=24,17%); *Familiarity* = 1 if individuals have seen "nothing like this scenario" before, 2 if they have seen "somewhat this scenario" and 3 if they have seen "exactly this scenario" (1=65%, 2=35%); *Understood*=1 if individuals answered correctly to all the control questions, 0 otherwise (1=24.17%). Robust standard errors in parentheses, where: * denotes $p < 0.10$, ** denotes $p < 0.05$, *** denotes $p < 0.01$.

2 Study 2

This second study is similar to Study 1 with the only difference that we randomly assign experimental subjects to two distinct treatments: a time pressure treatment (TP) and a motivated delay treatment (MD). We aim to see if the treatments alter how SVO and dCC predict contributions in the one-shot PGG under the two cognitive manipulations. As in Study 1, we do so by contrasting dCC with nCC (see Supplementary Material for Chapter 1 for an analysis with finer classifications according to Fischbacher, Gächter, and Fehr, 2001, and Thöni and Volk, 2018).

2.1 Method

In this second experiment we recruited 248 participants using the online platform Prolific (www.prolific.co). Our participants are mainly from UK and US (UK=84.68%, US=10.08% mean age=29.74, males=38.31%, females=61.69%).

The experiment took place online on May 6, 2019. Individuals were randomly assigned to one of the two conditions, 128 participants to the TP treatment and 120 participants to the MD treatment. In the TP treatment material incentives were provided to answer in a short amount of time. Specifically, we applied costly waiting as introduced by Alós-Ferrer and Garagnani (2020): participants were endowed with 15 additional points and 1.5 points were detracted from this amount for each second taken by the subject to make the decision. After 10 seconds participants could still make their decisions, though they earned no bonus in this case. In the MD treatment, following Bilancini, Boncinelli, and Luini (2020), participants had to write a motivation for their level of contribution before they actually inserted how much they wanted to contribute; they were rewarded with 5 additional points if they gave a meaningful motivation of at least 40 characters.[3]

[3]In order to minimize potential demand effects, in the instructions – rather than asking for a meaningful motivation, which could in principle generate the expectation of a high contribution – we exemplify what we mean by *non-meaningful* as follows: "If you give a non-meaningful motivation (e.g., "aaaaaaaaa...") you will not obtain the bonus" (see Supplementary Material for Chapter 1, Screenshots of Study 2).

The average earnings in this study were 1.46 GPB including 0.40 GPB of show-up fee (which translates into an average hourly wage of 10.99 GBP).

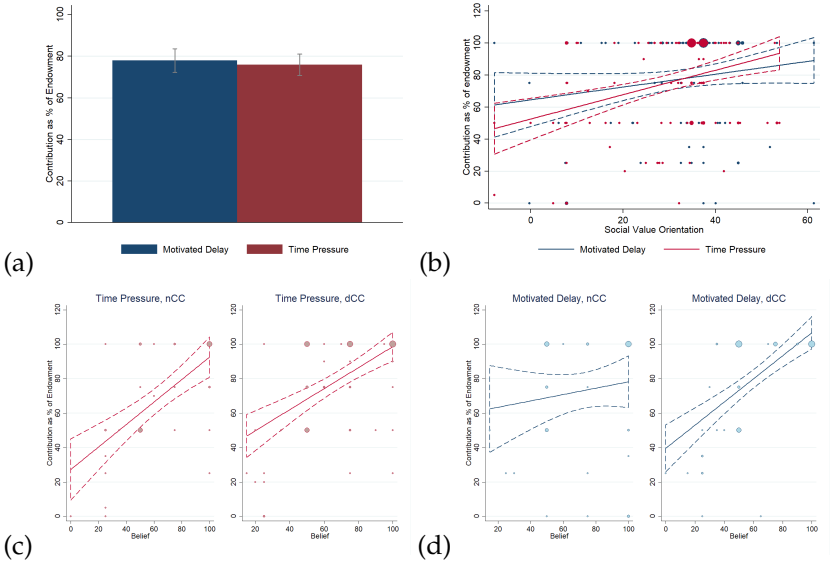


Figure 2: (a) Mean of the level of contribution between treatments in the PGG. Wilcoxon rank-sum test, N=248, z=0.977, p=0.329. Epps-Singleton test, N=248, $W2$=4.083, p=0.395. (b) Linear prediction of the level of contribution in the PGG as a function of SVO in both treatments. (c) Linear prediction of the level of contribution in the PGG as a function of the individual belief about others' average contribution, distinguishing between participants classified as conditional cooperators (dCC) and non-conditional cooperators (nCC), under the Time Pressure treatment (TP). (d) Linear prediction of the level of contribution in the PGG as a function of the individual belief about others' average contribution, distinguishing between participants classified as conditional cooperators (dCC) and non-conditional cooperators (nCC), under the Motivated Delay treatment (MD). Scatter plots identify the relative frequencies of the observations in the sample. Confidence intervals are at 95%.

2.2 Results

In the TP treatment 88.28% of the participants (113 out of 128) complied with the time incentive structure (compliance means that the response time did not exceed the threshold after which zero extra points are obtained). In the MD treatment, all participants complied with the request to provide a meaningful motivation for their choice. We included all participants in the analysis (results are robust even excluding participants that did not comply with the time manipulations). In Table 5, we report the fraction of participants that we classified as dCC and nCC in each treatment, together with the fractions for the finer classifications by Fischbacher, Gächter, and Fehr (2001) and Thöni and Volk (2018) (see Supplementary Material for Chapter 1 for details on the classification rules). As in Study 1, slightly less than two-thirds of participants are classified as dCC. Overall, our coarser classification is close to the one obtained following Fischbacher, Gächter, and Fehr (2001) (only about 10% of participants are not classified as either dCC or Other), while the difference with the classification obtained following Thöni and Volk (2018) is more substantial (about 25% of participants are not classified as either dCC or Other).

	Fischbacher et al., 2001		Thöni and Volk, 2018		Our Contribution	
	TP	MD	TP	MD	TP	MD
Conditional Cooperators	64.84%	60%	64.06%	60%	64.84%	60%
Free Riders	3.13%	0.83%	3.13%	0.83%	–	–
Hump Shaped	4.69%	8.33%	4.69%	11.67%	–	–
Unconditional Cooperators	–	–	14.06%	15.83%	–	–
Others	27.34%	30.83%	14.06%	11.67%	35.16%	40%

Table 5: Classification of behavioral types in Study 2 following Fischbacher, Gächter, and Fehr (2001), Thöni and Volk (2018), and our classification, for each treatment. For each of these classifications we cannot reject the null hypothesis that the distribution of types is equal in the TP and MD treatments (p-values for the Fischer's exact test are, $p = 0.354$, $p = 0.219$, and $p = 0.256$, respectively).

Figure 2a shows that both the average level of contributions that are not statistically different in the two treatments (Wilcoxon rank-sum test, N=248, z=0.977, P=0.329; Epps-Singleton test, N=248, $W2$=4.083,

P=0.395). A Tobit regression (see Table 6, Model 1) confirms that the cognitive manipulations had no significant effect, and this holds even when controls for gender, familiarity with the task, and comprehension of the task are included as regressors (see Table 6, Model 2). The lack of any clear effect of the treatments on cooperative behavior can be placed into a lively debate which is still to be settled (see the meta-analyses in Rand, 2016, Bouwmeester et al., 2017 and Kvarven et al., 2020, and also Capraro, 2019, for a recent review).

In Figure 2b contributions are plotted against the SVO score. As in Study 1, a higher SVO goes with higher contributions, on average. Specifically, this happens in both treatments with no substantial difference. These findings are confirmed by a Tobit regression (see Table 6, Model 3), also controlling for gender, familiarity with the task, and comprehension of the task (Table 6, Model 4). Model 5 in Table 6 shows that the interaction between SVO and MD is not significant. Overall the estimated coefficients for SVO are consistent across our two studies and substantially in line with those obtained by Alós-Ferrer and Garagnani, 2020.

Figure 2c shows that in the TP treatment the relationship between one's belief about others' contributions and one's contribution does not depend much on being classified as dCC or nCC, similarly to what we found in Study 1. In particular, higher beliefs go with higher contributions. Figure 2d shows that in the MD treatment the average relationship between beliefs and contributions depends on whether the participant is classified as dCC or nCC. In particular, the fitted line for dCCs is much steeper than the fitted line for nCCs, indicating that for dCCs beliefs may be better predictors of contributions than for nCCs. The Tobit regressions in Table 6 confirm these results (Models 3 and 4) and, moreover, show that the distinction between dCC and nCC plays a role only when participants are in the MD treatment (Models 5 and 6). Notice that, as in Study 1, beliefs seem to matter *per se*, which remains a fact that is not straightforward to explain (a more detailed discussion on this point can be found in the following Section 3).

Finally, as done for Study 1, in Supplementary Material for Chapter

Perc. Predicted Contribution	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
MD	8.55	10.32	11.87	13.31*	83.52	82.19*
	(9.86)	(9.80)	(7.73)	(7.52)	(50.87)	(49.20)
SVO			0.71**	0.68**	0.92**	0.88***
			(0.29)	(0.29)	(0.29)	(0.29)
Belief			0.80***	0.80***	1.10***	1.10***
			(0.24)	(0.24)	(0.31)	(0.31)
dCC			-26.63	-22.48	-9.69	-4.70
			(19.63)	(19.62)	(25.89)	(26.86)
Belief×dCC			0.84**	0.83**	0.35	0.32
			(0.33)	(0.33)	(0.41)	(0.42)
SVO×MD					-0.71	-0.67
					(0.59)	(0.57)
Belief×MD					-0.64	-0.64
					(0.50)	(0.49)
dCC×MD					-64.53	-66.31
					(41.19)	(40.84)
Belief×dCC×MD					1.59**	1.62**
					(0.69)	(0.69)
Controls:						
Familiarity		-9.14		-0.87		-0.26
		(9.935)		(8.05)		(7.84)
Understood		-10.25		-12.18		-11.89
		(12.31)		(10.87)		(10.30)
Gender		2.16		0.05		2.00
		(10.28)		(8.46)		(8.45)
Constant	104.1***	126.3***	-13.47	-9.742	-36.47	-34.41
	(7.525)	(26.09)	(22.48)	(29.66)	(23.81)	(32.70)
N	248	248	248	248	248	248
pseudo R^2	0.001	0.002	0.066	0.068	0.074	0.075

Table 6: Tobit regressions on the level of endowment contributed in the one-shot PGG. *MD*=1 if individuals are under the motivated delay condition, 0 otherwise; *SVO* is the individuals' social value orientation; *Belief* is the individuals' belief about others' contributions; *dCC*=1 if an individuals is considered as a conditional cooperator, 0 otherwise; *dCC*×*Belief* is the interaction between being and conditional cooperator and the belief about others' behavior. *Gender*=1 if female, 0 otherwise (1=61,69%); *Familiarity* = 1 if individuals have seen "nothing like this scenario" before, 2 if they have seen "somewhat this scenario" and 3 if they have seen "exactly this scenario" (1=55.65%, 2=43.15%, 3=1.2%); *Understood*=1 if individuals answered correctly to all the control questions, 0 otherwise (1=21.77%). Robust standard errors in parentheses, where: * denotes $p < 0.10$, ** denotes $p < 0.05$, *** denotes $p < 0.01$.

1 we report alternative regressions analysis using the finer classification of types applied in Fischbacher, Gächter, and Fehr (2001) and the one in Thöni and Volk (2018). Again, we find that results obtained under these alternative specifications are very similar to those presented here.

3 Discussion

We have run two experiments to explore how altruism and reciprocity affect contributions in an online one-shot PGG, trying to understand if they might act as potential moderators of the effect of cognition on cooperation. Specifically, the experimental evidence that we collected suggests that both the disposition to donate and the disposition to reciprocate are sources of explanation of contributions, but while the disposition to donate accounts for contributions regardless of our cognitive manipulations, the disposition to reciprocate does so only when we prompt deliberation by requesting to wait and write a motivation for the decision.

In more detail, in our first experiment there was no cognitive manipulation, while in the second experiment cognition was manipulated by means of a time pressure treatment and a motivated delay treatment. Comparing the data of the two experiments we found that in the time pressure condition participants roughly behaved as in the first experiment. If one assumes that deliberation has been more likely in the motivated delay treatment than in the time pressure treatment, then our results can be interpreted as suggesting that in the online setting experimental subjects are less prone to deliberation and thus behave more intuitively.

At any rate, it is natural to ask why the disposition to reciprocate should have a greater role under deliberation. One possibility is that conditional cooperation requires to mentalize others' behavior, and that this, in turn, requires a greater understanding of the strategic situation and, therefore, greater reflection (Alós-Ferrer and Buckenmaier, 2020; Bilancini, Boncinelli, and Mattiassi, 2019; Zonca, Coricelli, and Polonio, 2020). This argument definitely deserves attention, but it is not the only

possible explanation of our findings. Another explanation has to do with the way in which the disposition to reciprocate is measured: the use of the strategy method to elicit reciprocal behavior is structurally prone to deliberation as it requires participants to consider several different hypothetical situations and choose what to do in each of them. Maybe, the strategy method only captures the disposition to reciprocate that is deliberative in nature, while a more intuitive disposition to reciprocate is not captured. We think that this can be tested experimentally, possibly avoiding the strategy method to measure the disposition to reciprocate and focusing instead on actual reciprocal behavior.

Another issue is related to the classification between conditional cooperators and non-conditional cooperators. Recent work by Fallucchi, Luccasen, and Turocy (2018) suggests to use hierarchical clustering analysis to construct a typology of behavior in the Public Goods Game. This is an interesting methodology to deal with the classification of behaviorial types in the Public Goods Game, which imposes less restrictions than more traditional ones (Fischbacher, Gächter, and Fehr, 2001; Thöni and Volk, 2018). It seems worth exploring the possibility of applying this methodology considering both conditional cooperation strategies and altruistic choices, possibly advancing on what has been attempted by Kurzban and Houser (2005) and what we have done here.

Finally, one may wonder the reasons why beliefs – i.e., elicited expectations about others' contributions in the Public Goods Game – apparently matter *per se* and not only in relation with the disposition to reciprocate. This could be due to the "false consensus effect" (Ross, D. Greene, and House, 1977): participants who like to contribute more tend to have more optimistic beliefs about others' contributions (e.g., because of introspection). If the role of beliefs is entirely due to the false consensus effect and the false consensus effect is entirely driven by one's own disposition to donate, then such role should vanish when controlling for the disposition to donate. Actually, we find that the role of beliefs is reduced when controlling for the disposition to donate but it does not disappear, suggesting that the false consensus effect depends at least in part on some other preference and/or the role of beliefs is not entirely

driven by the false consensus effect. Another possibility, which does not rest on the false consensus effect, is that contributions are conditional on beliefs due to other-regarding preferences different from the disposition to donate (e.g., positional concerns, compliance to social norms). In this case beliefs would capture the effect of such preferences when controls for them are omitted (Cooper and Kagel, 2016). Unfortunately, this is not testable with our data as we lack proper measures of such other-regarding preferences. Given the quantitative relevance of beliefs as a positive predictor of contributions, we think that further experimental research in this regard is very much needed.

Supplementary Material for Chapter 1

4 Distribution of response times

In Figure 3 we report the distribution of the decision times in Study 1 and Study 2.

5 Main analyses with finer classifications of nCC

In this section we provide replications of our main analyses in Study 1 and in Study 2 using the finer classifications of behavioral types described in Fischbacher, Gächter, and Fehr (2001) and Thöni and Volk (2018).

According to Fischbacher, Gächter, and Fehr (2001) participants are classified as Conditional Cooperators if they either show contributions that are non-decreasing in others' contributions, with at least one increase, or show a positive Spearman rank correlation (between contributions and others' contributions) that is significant at the 1%-level. Participants are classified as Free Rider if they choose to contribute zero irrespective of others' contributions. Participants are classified as Hump Shaped if they show contributions that are increasing in others' contributions up to some maximum and then contributions that are decreasing, and both trends have a Spearman rank correlation (between contribu-

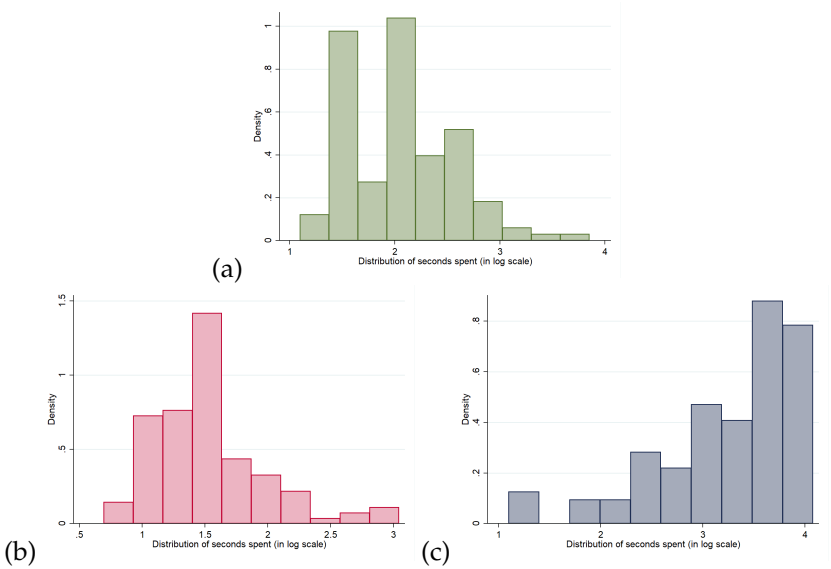


Figure 3: (a) Distribution of response times in Study 1; (b) distribution of response times in Study 2, under the Time Pressure treatment; (c) distribution of response times in Study 2, under the Motivated Delay treatment.

tions and others' contributions) that is significant at the 1%-level. The remaining participants are classified as Other.

According to Thöni and Volk (2018) participants are classified as Conditional Cooperators if they either show contributions that are non-decreasing in others' contributions, with at least one increase, or show a Pearson correlation of least $1/2$ (between contributions and others' contributions). Participants are classified as Free Rider as done in Fischbacher, Gächter, and Fehr (2001). Participants are classified as Unconditional Cooperators if they contribute a given amount irrespective of others' contributions. Participants are classified as Hump Shaped (also called Triangular cooperators) if their contributions reach a maximum at a given level (k) of others' contribution and they either show a strong positive (negative) correlation to the left (right) of k (using at least three contributions), or show contributions that are monotonically increasing

(decreasing) to the left (right) of k (using at least two contributions). The remaining participants are classified as Other.

Tables 7 and 8 report the regression analysis for Study 1, while Tables 9 and 10 report the regression analyses for Study 2, respectively using the classification in Fischbacher, Gächter, and Fehr (2001) and the one in Thöni and Volk (2018). The estimates for the coefficients of the relevant variables (SVO, Cond.Coop., MD) largely confirm our main findings, both in Study 1 and in Study 2. We opted not to include a dummy for Free Riders, due to the small number of subjects classified as such. However, we do not exclude Free Raiders from the analysis, leaving them into the residual omitted category of Other.

Perc. Contribution	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
SVO	1.111***	1.135***			0.492**	0.506**
	(0.314)	(0.306)			(0.240)	(0.245)
Belief			1.300***	1.342***	1.152***	1.197***
			(0.299)	(0.295)	(0.333)	(0.331)
Cond.Coop.			-8.055	-4.114	-15.58	-11.23
			(24.85)	(25.17)	(26.50)	(26.80)
Hump Shaped			-27.06*	-21.26	-27.05*	-20.64
			(15.25)	(15.64)	(14.88)	(15.47)
Cond.Coop×Belief			0.350	0.296	0.436	0.378
			(0.391)	(0.394)	(0.415)	(0.418)
Controls:						
Familiarity		-4.149		2.341		-0.0622
		(11.50)		(9.514)		(9.446)
Gender		3.610		6.293		6.815
		(11.43)		(9.176)		(8.933)
Understood		-20.14*		-10.25		-10.56
		(11.58)		(9.655)		(9.525)
Constant	30.02	37.00	7.173	-0.605	-12.52	-18.50
	(19.07)	(22.99)	(19.80)	(23.92)	(19.89)	(23.42)
N	120	120	120	120	120	120
pseudo R^2	0.015	0.020	0.088	0.090	0.092	0.095

Table 7: Tobit regressions on the level of endowment contributed in the one-shot PGG following the classification in Fischbacher, Gächter, and Fehr (2001). *SVO* is individuals' social value orientation; *Belief* is the individuals' belief about others' contributions; *Cond.Coop.*=1 if an individual is considered as a conditional cooperator, 0 otherwise; *Hump Shaped*=1 if an individual is considered as a triangular cooperator, 0 otherwise; Robust standard errors in parentheses, where: * denotes $p < 0.10$, ** denotes $p < 0.05$, *** denotes $p < 0.01$.

Perc. Contribution	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
SVO	1.111***	1.135***			0.487**	0.501**
	(0.314)	(0.306)			(0.235)	(0.236)
Belief			1.357***	1.386***	1.207***	1.240***
			(0.315)	(0.315)	(0.316)	(0.318)
Cond.Coop.			12.96	15.47	4.921	7.597
			(26.73)	(27.21)	(27.01)	(27.62)
Uncond.Coop.			52.71***	51.11***	52.74***	51.05***
			(17.38)	(17.46)	(16.61)	(16.73)
Hump Shaped			-2.011	1.345	-2.913	0.522
			(15.60)	(16.56)	(14.94)	(15.98)
Cond.Coop.×Belief			0.316	0.277	0.401	0.360
			(0.405)	(0.408)	(0.410)	(0.414)
Controls:						
Familiarity		-4.149		1.698		-0.864
		(11.50)		(9.054)		(9.958)
Gender		3.610		3.949		4.628
		(11.43)		(8.887)		(8.727)
Understood		-20.14*		-7.247		-7.440
		(11.58)		(9.820)		(9.624)
Constant	30.02	37.00	-14.73	-19.65	-33.53	-36.37
	(19.07)	(22.99)	(21.82)	(23.63)	(21.56)	(23.58)
N	120	120	120	120	120	120
pseudo R^2	0.015	0.020	0.104	0.105	0.109	0.111

Table 8: Tobit regressions on the level of endowment contributed in the one-shot PGG following the classification in Thöni and Volk (2018). *SVO* is individuals' social value orientation; *Belief* is the individuals' belief about others' contributions; *Cond.Coop.*=1 if an individual is considered as a conditional cooperator, 0 otherwise; *Hump Shaped*=1 if an individual is considered as a triangular cooperator, 0 otherwise; *Uncond.Coop.*=1 if an individual is considered as an unconditional cooperator, 0 otherwise. Robust standard errors in parentheses, where: * denotes $p < 0.10$, ** denotes $p < 0.05$, *** denotes $p < 0.01$.

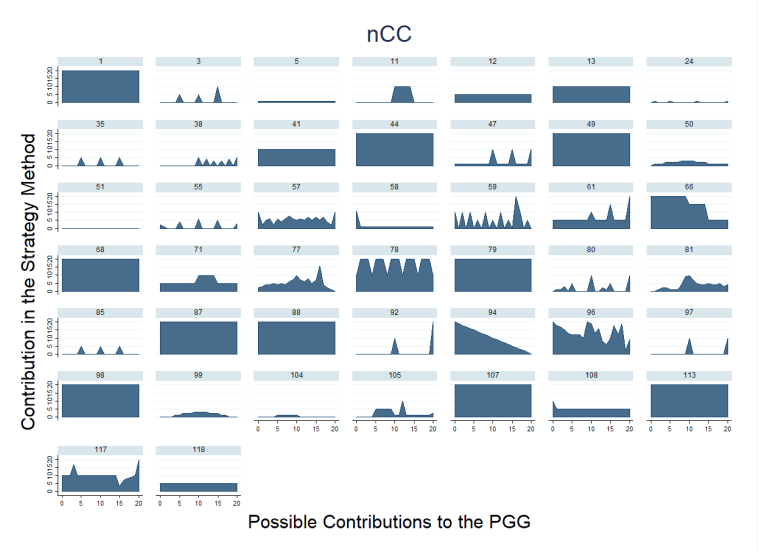
Perc. Contribution	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
MD	8.55	10.32	13.16*	14.58*	93.83*	92.27*
	(9.86)	(9.80)	(7.74)	(7.53)	(52.76)	(51.11)
SVO			0.73**	0.71**	0.90***	0.85***
			(0.29)	(0.29)	(0.29)	(0.29)
Belief			0.73***	0.73***	1.09***	1.09***
			(0.25)	(0.24)	(0.31)	(0.31)
			-37.04*	-33.40	-11.54	-6.90
			(20.58)	(20.81)	(26.05)	(27.02)
Hump Shaped			-28.30**	-28.60**	-12.24	-13.37
			(11.93)	(11.90)	(14.38)	(14.43)
Cond.Coop.×Belief			0.913***	0.90***	0.34	0.31
			(0.34)	(0.34)	(0.41)	(0.42)
SVO×MD					-0.58	-0.53
					(0.61)	(0.59)
Belief×MD					-0.81	-0.81
					(0.52)	(0.52)
Cond.Coop×MD					-81.42*	-83.67*
					(43.93)	(43.74)
Hump Shaped×MD					-24.65	-24.01
					(23.80)	(23.51)
Cond.Coop×Belief×MD					1.71**	1.76**
					(0.70)	(0.70)
Controls:						
Familiarity		-9.14		0.70		1.08
		(9.94)		(8.00)		(7.75)
Understood		-10.25		-12.34		-12.03
		(12.31)		(10.88)		(10.25)
Gender		2.16		0.83		2.97
		(10.28)		(8.42)		(8.37)
Constant	104.14***	126.27***	-5.42	-5.68	-33.03	-34.30
	(7.53)	(26.09)	(23.31)	(29.82)	(24.70)	(32.83)
N	248	248	248	248	248	248
pseudo R^2	0.001	0.002	0.069	0.070	0.077	0.078

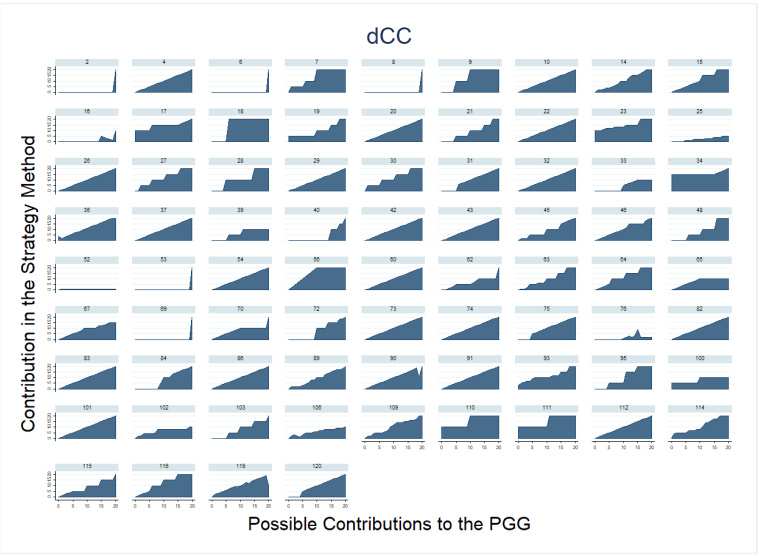
Table 9: Tobit regressions on the level of endowment contributed in the one-shot PGG, following the classification in Fischbacher, Gächter, and Fehr (2001). *MD*=1 if individuals are in the motivated delay condition, 0 otherwise; *SVO* is the individuals' social value orientation; *Belief* is the individuals' belief about others' contributions; *Cond.Coop.*=1 if an individual is considered as a conditional cooperator, 0 otherwise; *Hump Shaped*=1 if an individual is considered as a triangular cooperator, 0 otherwise; *Understood*=1 if an individual answered correctly to all the control questions, 0 otherwise (1=21.77%). Robust standard errors in parentheses, where: * denotes $p < 0.10$, ** denotes $p < 0.05$, *** denotes $p < 0.01$.

Perc. Predicted Contribution	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
MD	8.55	10.32	11.89	13.25*	105.2*	105.4*
	(9.86)	(9.80)	(7.71)	(7.49)	(55.70)	(55.20)
SVO			0.64**	0.63**	0.95***	0.92***
			(0.27)	(0.27)	(0.28)	(0.28)
Belief			0.67***	0.65***	0.95***	0.94***
			(0.25)	(0.25)	(0.29)	(0.29)
Cond.Coop.			-15.53	-11.40	3.50	8.86
			(20.84)	(20.95)	(24.46)	(25.31)
Uncond.Coop.			52.51***	52.56***	40.17**	40.16**
			(15.70)	(15.36)	(16.63)	(16.65)
Hump Shaped			8.85	8.62	21.75	21.55
			(16.19)	(15.88)	(19.51)	(19.43)
Cond.Coop.×Belief			0.94***	0.93***	0.44	0.40
			(0.33)	(0.33)	(0.39)	(0.40)
SVO×MD					-1.06*	-1.03*
					(0.54)	(0.53)
Belief×MD					-0.69	-0.69
					(0.53)	(0.53)
Cond.Coop.×MD					-71.39	-73.70
					(48.51)	(48.71)
Uncond.Coop.×MD					31.84	32.03
					(31.50)	(31.13)
Hump Shaped×MD					-13.85	-14.17
					(32.58)	(32.45)
Cond.Coop.×Belief×MD					1.69**	1.73**
					(0.70)	(0.70)
Controls:						
Familiarity		-9.14		-2.13		-2.57
		(9.935)		(7.77)		(7.531)
Understood		-10.25		-11.21		-10.79
		(12.31)		(10.05)		(9.51)
Gender		2.16		0.94		2.10
		(10.28)		(8.27)		(8.21)
Constant	104.1***	126.3***	-20.29	-14.22	-48.13*	-41.28
	(7.53)	(26.09)	(23.04)	(30.67)	(24.52)	(33.05)
N	248	248	248	248	248	248
pseudo R^2	0.001	0.002	0.078	0.079	0.087	0.089

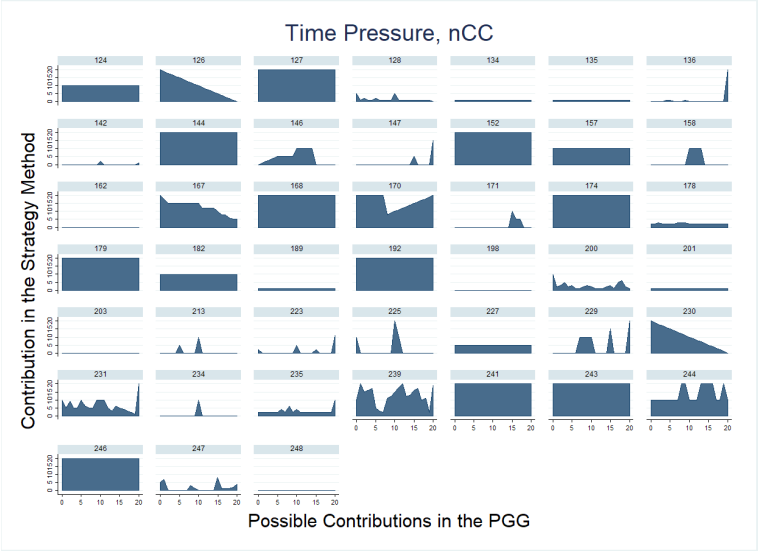
Table 10: Tobit regressions on the level of endowment contributed in the one-shot PGG, following the classification in Thöni and Volk (2018). *MD*=1 if individuals are under the motivated delay condition, 0 otherwise; *SVO* is the individuals' social value orientation; *Belief* is the individuals' belief about others' contributions; *Cond.Coop.*=1 if an individual is considered as a conditional cooperator, 0 otherwise; *Hump Shaped*=1 if an individual is considered as a triangular cooperator, 0 otherwise; *Uncond.Coop.*=1 if an individual is considered an a unconditional cooperator, 0 otherwise. *Understood*=1 if an individual answered correctly to all the control questions, 0 otherwise (1=21.77%). Robust standard errors in parentheses, where: * denotes $p < 0.10$, ** denotes $p < 0.05$, *** denotes $p < 0.01$.

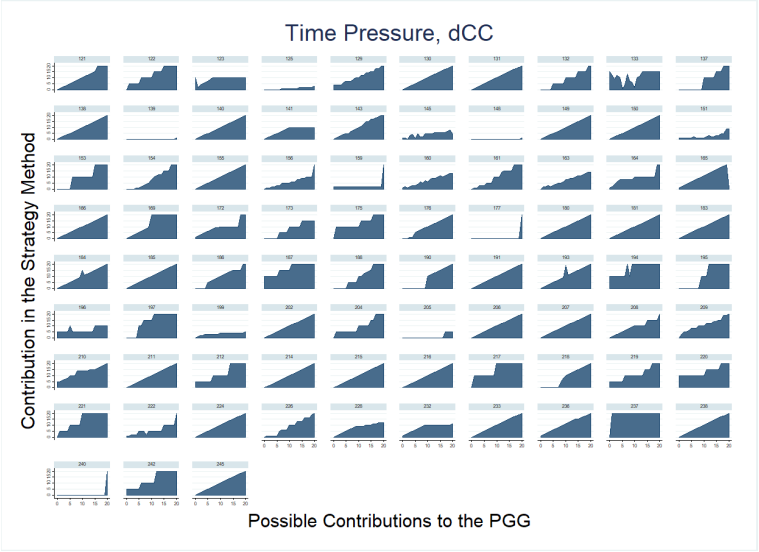
6 Study 1: Conditional Cooperation Strategies

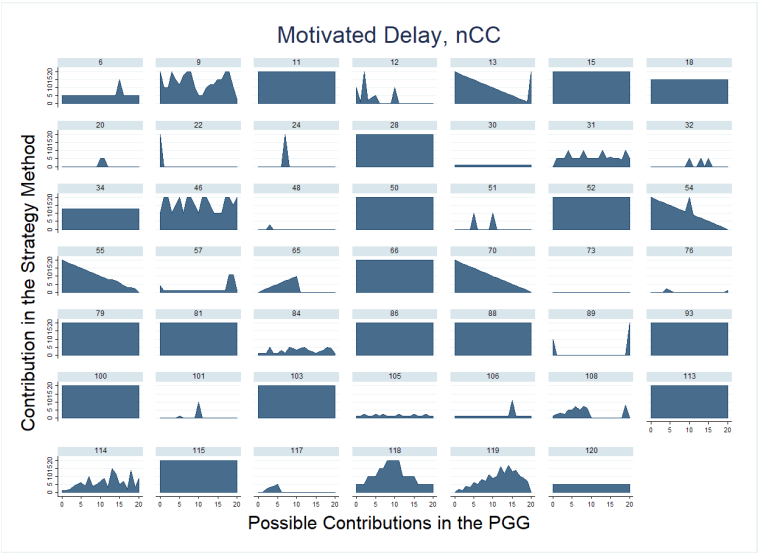


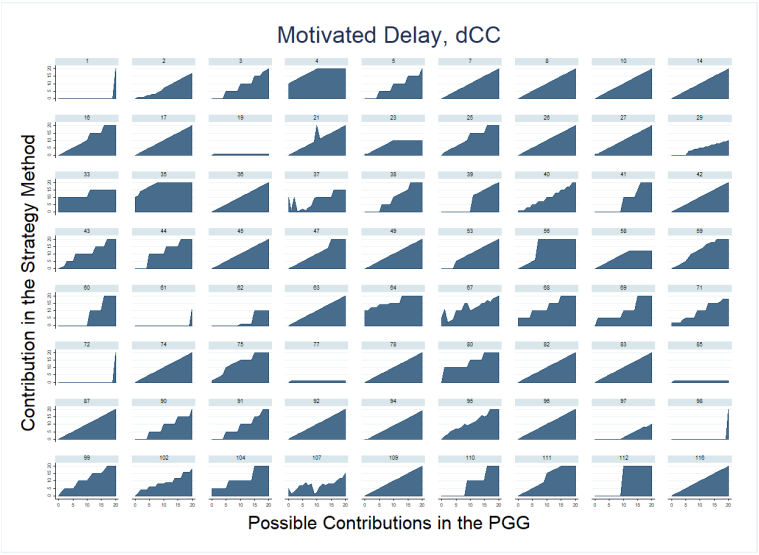


7 Study 2: Conditional Cooperation Strategies






Motivated Delay, nCC
Contribution in the Strategy Method
Possible Contributions in the PGG


Motivated Delay, dCC
Contribution in the Strategy Method
Possible Contributions in the PGG

8 Instructions of Study 1

WELCOME!

Please before starting, enter your **Your Prolific ID**.

Prolific ID:

Please press the button below to continue.

Next

Processing personal data

You will not be asked to provide and personally identifying information during this study.

Your data will be anonymous and confidential (i.e., any information you provide cannot be traced back to you).

Your information may be used in future project closely related to this research.

The results of this study will be published on journal articles and presented at conferences.

The raw data (from which you cannot be identified) will be kept for a minimum period of five years after the publication process is complete and then the data will be destroyed.

We will ask you to complete a quick task and a short questionnaire. We ask you to focus on the study, it should take approximately 4 minutes to complete.

Please try to avoid distractions while taking this study, we would ask you silence your mobile phone and turn off the television/music.

Please note you have the right to withdraw consent at any time.

You can reach out to the researcher (tatiana.celadin@imtlucca.it) if you have any questions related to this study.

Clicking on the **Agree** button below indicates that:

- You have read the above information
- You voluntarily agree to participate
- You are at least 18 years of age

If you do not wish to participate in the research study, please decline participation by clicking on the **Disagree** button, you will be redirected to Prolific main page.

Agree

Disagree

First Part

You have been randomly assigned to interact in a group with 3 of the other participants.

All of you will read the same set of instructions below.

Each person will receive 20 Points at the beginning of the interaction.

Every one of you will decide how many of your 20 Points to keep for yourself, and how many (if any) to contribute to a common pool (from 0 to 20 Points).

All Points contributed to the common pool are doubled and then split evenly among the 4 group members.

If each of you contributes 20 Points, the total amount of the group is 80. The common pool doubles the amount of Points and so your group gets 160 Points that are split evenly among the 4 group members. Each of you gets 40 Points.

If you keep your 20 Points, while every one else contributes 20 Points, the total amount of the group is 60. The common pool doubles the amount of Points and so your group gets 120 Points that are split evenly among the 4 group members. You earn 50 Points (the 30 Points that you earned from the common pool and the 20 Points of your endowment that you kept for yourself) and each of the others will earn 30 Points.

If you and the other group members keep your 20 Points, you do not earn any additional Points and each of you remains with your initial endowment of 20 Points.

The other group members will be asked to make the decision too.

No deception is allowed in this study.

50 Points are equal to 0.5 GBP.

Please press the button below to continue.

Next

First Part

Please enter the number of Points that you want to contribute.

points

Please press the button below to continue.

Next

First Part

You can now earn 10 additional Points.

Please indicate your estimate of average contribution of the other three participants (rounded to the closest integer).

If you give the right answer you will earn the 10 additional Points.

Average contribution of the other three participants:

points

Please press the button below to continue.

Next

First Part

In the table below, you can see all the possible averages of the contributions of the other three participants (rounded to the closest integer).

Please indicate how many Points you wish to contribute in each of the possible scenarios.

Your choices will be used as follows. One of the 4 participants will be randomly selected.

If you are NOT selected, your contribution will be the one you indicated previously.

If you are selected, your contribution will be the one that you will have indicated in the box corresponding to the average contribution of the other three participants (rounded to the closest integer).

Please enter the amount which you want to contribute for every possible average contribution of the other three participants:

Others' Average Contributions	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
You																					

Please press the button below to continue.

Next

First Part

Please answer the following questions:

Question 1: What level of your contribution earns the highest payoff for the group as a whole if all others contribute 20?

Answer:

Question 2: What level of your contribution earns the highest payoff for the group as a whole if all others contribute 0?

Answer:

Question 3: What level of your contribution earns the highest payoff for you personally if all others contribute 20?

Answer:

Question 4: What level of your contribution earns the highest payoff for you personally if all others contribute 0?

Answer:

Please press the button below to continue.

Next

Second Part

You will be randomly assigned to interact with another participant.

On the next pages you will decide how to allocate Points between you and the other participant. You will take six different decisions.

At the end of this second part, you and the other participant will be randomly assigned to the role of Decision Maker or Receiver and one of the six decisions will be selected randomly.

If you are the Decision Maker, the decisions you take are relevant for your and the other participant's payment.

If you are the Receiver, the other participant's decisions will be payoff relevant.

50 Points correspond to 0.25 GBP.

Please press the button below to continue.

Next

Second Part

Please, decide how to allocate Points between you and the other participant.

Decision 1:

You receive:	50	54	59	63	68	72	76	81	85
	○	○	○	○	○	○	○	○	○
Other receives:	100	89	79	68	58	47	36	26	15

Please press the button below to continue.

Next

Second Part

Please, decide how to allocate Points between you and the other participant.

Decision 2:

You receive:	85	87	89	91	93	94	96	98	100
	○	○	○	○	○	○	○	○	○
Other receives:	15	19	24	28	33	37	41	46	50

Please press the button below to continue.

Next

Second Part

Please, decide how to allocate Points between you and the other participant.

Decision 3:

You receive:	100	94	88	81	75	69	63	56	50
	○	○	○	○	○	○	○	○	○
Other receives:	50	56	63	69	75	81	88	94	100

Please press the button below to continue.

Next

Second Part

Please, decide how to allocate Points between you and the other participant.

Decision 4:

You receive:	100	98	96	94	93	91	89	87	85
	○	○	○	○	○	○	○	○	○
Other receives:	50	54	59	63	68	72	76	81	85

Please press the button below to continue.

Next

Second Part

Please, decide how to allocate Points between you and the other participant.

Decision 5:

You receive:	85	85	85	85	85	85	85	85	85
	○	○	○	○	○	○	○	○	○
Other receives:	85	76	68	59	50	41	33	24	15

Please press the button below to continue.

Next

Second Part

Please, decide how to allocate Points between you and the other participant.

Decision 6:

You receive:	50	54	59	63	68	72	76	81	85
	○	○	○	○	○	○	○	○	○
Other receives:	100	98	96	94	93	91	89	87	85

Please press the button below to continue.

Next

Third Part

Questionnaire

Please enter the following information.

- Your age:
- Your gender:
  - M
  - F
- Your level of education:
  - Secondary Education
  - Bachelor
  - Master
  - PhD
  - Other
- Field of study (Economics, Maths...):
- Are you a student now?
  - Yes
  - No
- Are you an employee now?
  - Yes
  - No
- To what extent have you participated in studies like this one before?
  - Nothing like this scenario
  - Somewhat like this
  - Exactly this scenario

Please press the button below to continue.

Next

Thank you!

Thank you for participating.

You will see your earnings on your Prolific profile after the experimenter has confirmed your payment.

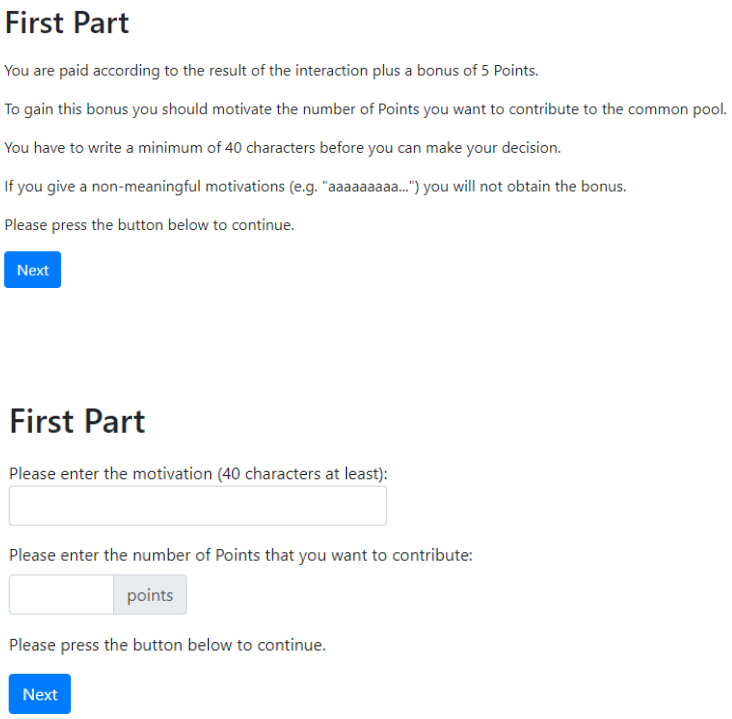
Please press the button below to conclude.

Press to Conclude

9 Instructions of Study 2

Study 2 has the same instructions as Study 1 except for the part of the contribution to the PGG, of which we report below the screenshots for each treatment.

Motivated Delay



Time Pressure

First Part

You have the opportunity to earn additional Points if you make a quick decision.

You start from 15 additional Points and for each second spent in making your decision you renounce 1.5 of these Points.

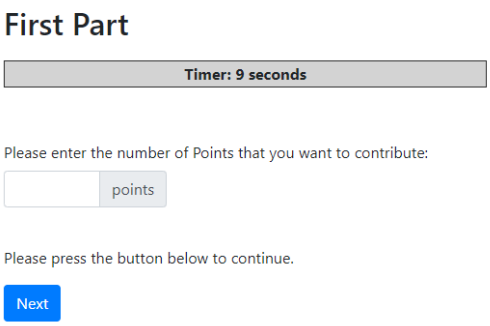
For example, if you make your decision after 4 seconds, you get 9 additional Points.

You will see a timer counting down from 10 to 0 seconds.

If the timer reaches 0 you get 0 additional Point, but you can still make your decision.

Please press the button below to continue.

Next



Chapter 2

Social Norms, Cooperation and Cognition

In the previous Chapters, we have highlighted that there is mixed evidence on the role of cognition on cooperation and such mixed evidence can be reconciled by taking into account different individual characteristics, e.g., altruism and reciprocity.

In this Chapter we consider social norms and altruism, and we show that cognitive manipulation impacts not only cooperation, and specifically contributions in the Public Goods Game but also the associated social norms (Conte, Andrighetto, and Campennì, 2014). Social norms can be classified as descriptive and injunctive norms. The former refers to beliefs about the most common behavior of people, while the latter refers to perceptions about what people would approve or disapprove of (Cialdini, Reno, and Kallgren, 1990). They have been shown to drive people's behavior in several economic games involving prosociality (Aguiar, Brañas-Garza, et al., 2010; Bicchieri and Chavez, 2010; Jachimowicz et al., 2018; Szekely et al., 2021).

We ran an online study, implemented using the software oTree (Chen, Schonger, and Wickens, 2016), where individuals play a one-shot anonymous Public Goods Game. We also measure descriptive and injunctive

This Chapter is based on Bilancini, Boncinelli, Capraro, and Celadin. (2020).

norms associated to the Public Goods Game. Specifically, we use beliefs about others' average contribution to the public good as a proxy for the descriptive norms, and the evaluations of the social appropriateness of all possible contribution levels as a proxy for the injunctive norms (Krupka and R. A. Weber, 2013). We also computed a new measure of norms compliance which is built on social appropriateness, that we call "relative social appropriateness": it captures the individuals' assessment of social appropriateness of their own choices with respect to all other possible choices. Furthermore, we also include the social value orientation (SVO) as a proxy of altruism (Murphy, Ackermann, and Handgraaf, 2011).

Our main results show that motivated delay significantly increases the level of contribution and the descriptive norms, while making the injunctive norms more extreme; instead altruism turns out to be not affected by cognitive manipulation.

The Chapter is organized as follows: Section 1 presents the experiment design, Section 2 presents the results and Section 3 discusses.

1 Method

We conducted a pre-registered online experiment on July 24, 2019, implemented in oTree (Chen, Schonger, and Wickens, 2016). Participants were recruited using Prolific (Palan and Schitter, 2018), and randomly assigned to play a four-player one-shot anonymous Public Goods Game in either of two treatments: the Time Pressure (TP) treatment and the Motivated Delay (MD) treatment. Each experimental subject was endowed with 10 points, and was asked to choose how many points to contribute to a common pool, where all points contributed were multiplied by 2 and then equally split among the four players. In the TP treatment, we incentivized participants to make fast decisions: participants lose money for every second taken to make the decision (Alós-Ferrer and Garagnani, 2020). In the MD treatment we incentivized participants to make deliberative decisions by paying them some money if they write a motivation for their choice (Bilancini, Boncinelli, and Luini, 2020). Subsequently, we

elicited participants' beliefs about the average contribution of the other three group members, the social appropriateness of each contribution level (Krupka and R. A. Weber, 2013), and the SVO (Murphy, Ackermann, and Handgraaf, 2011). Finally, we asked participants comprehension questions and questions about their level of familiarity with the task and their gender. We refer to the Supplementary Material for Chapter 2 for full details about the design, instructions, and the measures. All measures were incentivized. No deception was used. The overall average earning was 0.78 GBP per participant, including 0.40 GBP show-up fee (which translates into an average hourly wage of 5.09 GBP).

1.1 Measures of interest: Social Norms

We use the belief of the average contribution of the others as a proxy of the descriptive norms. Social Appropriateness (SA) is computed by converting participants' guesses about other participants' evaluation of contribution levels into numerical scores (following Krupka and R. A. Weber, 2013). An evaluation of "very socially inappropriate" received a score of -1, "somewhat socially inappropriate" a score of $-1/3$, "somewhat socially appropriate" a score of $1/3$, and "very socially appropriate" a score of 1. Starting from SA we construct a measure of the RSA of the contribution chosen by a participant, aiming at capturing the participant's assessment about the social appropriateness of his own choice with respect to all other possible choices. Let $SA_i(s)$ denote the score given by participant i to the contribution level $s = 0, \ldots, 10$ and c_i denote the contribution chosen by individual i. The RSA of individual i is defined as follows:

$$RSA_i = \left(SA_i(c_i) - \frac{1}{10} \sum_{s \neq c_i} SA_i(s) \right) \frac{1}{2}$$

which provides a normalized value of RSA comprised between -1 and 1. RSA is a measure that captures the social appropriateness of the own contribution provided to the PGG with respect to all the others possible level of contributions. Indeed a participant that evaluate the all the contribution in the same way will get a score equal to 0, while a participant

that evaluate her own contribution as very socially appropriate (inappropriate) will get a score of 1 (-1) that represents how appropriate is her contribution with respect to the others.

1.2 Measures of interest: Social Value Orientation

We follow (Murphy, Ackermann, and Handgraaf, 2011) to build a continuous measure of SVO that captures altruism that is the extent to which an agent is willing to reduce his own pay-off to make another agent better off (or worse off). SVO is computed as follows:

$$SVO = \arctan\left(\frac{(\bar{A}_o - 50)}{(\bar{A}_s - 50)}\right)$$

where $\bar{A}_o$ and $\bar{A}_s$ are the average points allocated in the six tasks, respectively, to the other and to oneself. Each individual gets a score that is an angle between -16.26 and 61.39, resulting from the choices in the allocation tasks. An angle between -12.04 and 22.45 corresponds to individualistic predispositions; in particular, an angle of 0 corresponds to caring only for own pay-off. An angle between 22.45 and 57.15 corresponds to prosociality; in particular, an angle of 45 gives equal weights to own and others' pay-off. An angle below -12.04 corresponds to a competitive attitude (desire to get a higher pay-off compared with others). An angle above 57.15 corresponds to altruistic attitudes (ready to pay a cost to increase others' pay-off).

2 Results

We collected data from N=688 participants, 344 per treatment. Summary statistics are reported in Table 14 in the Supplementary Material for Chapter 2.

The mean contribution is significantly different in the two treatments (Wilcoxon rank-sum test, Z=3.757, p <0.001), with the average being higher under motivated delay, see Figure 4a.

The mean belief about other's average contribution in the two treatments is statistically marginally different (Wilcoxon rank-sum test,

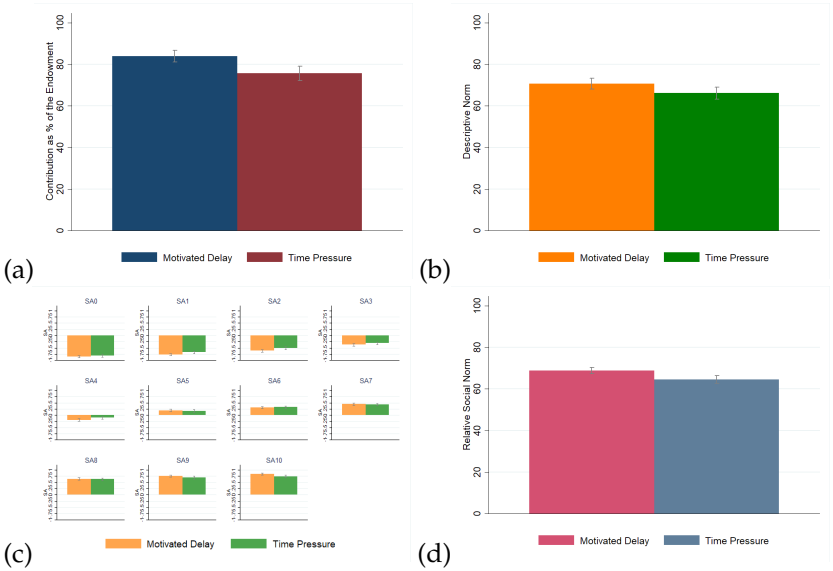


Figure 4: (a) Mean of the level of contribution between treatments in the PGG. (b) Mean of the level of descriptive norms between treatments in the PGG. (c) Mean of the level of injunctive norms between treatments in the PGG. (d) Mean of the level of relative social appropriateness between treatments in the PGG. Confidence intervals are at 95%.

Z=1.950, p=0.051), see Figure 4b. We interpret this as evidence that descriptive norms are affected by cognitive manipulation: under motivated delay individuals expect that others contribute more than they do under time pressure.

Not surprisingly, the social appropriateness increases as a function of the level of contribution, in both treatments. The interesting result is that social appropriateness appears to depend on the modes of cognition. Specifically, contribution levels smaller than 5 tend to be perceived to be less socially appropriate under motivated delay than under time pressure (statistically significant effect at contribution levels 1,2 and 4; trending in the same direction at contribution levels 0 and 5), see Figure 4c. Conversely, contribution levels greater than or equal to 5 tend to be perceived to be more socially appropriate under motivated delay than under time pressure, although the only significant effect is at the level of full contribution. We also measure the consistency between the level of contribution by participant to the PGG and how socially appropriate they perceive that level of contribution. Distributions are reported in Table 11.

Social Appropriateness	**Motivated Delay**	**Time Pressure**
Very Socially Inappropriate	4.65%	7.85%
Somewhat Socially Inappropriate	3.78%	7.85%
Somewhat Socially Appropriate	20.64%	24.13%
Very Socially Appropriate	70.93%	60.17%

Table 11: Distribution of the consistency between the level of contribution by participants to the PGG and how socially appropriate they perceive that level of contribution.

Also our measure of norm compliance, relative social appropriateness, defined as the social appropriateness of one's own choice minus the average social appropriateness of all the other alternatives, appears to depend on the modes of cognition, as it is significantly greater under motivated delay than under time pressure (Wilcoxon rank-sum test, Z=3.135, p=0.002, see Figure 4d). We interpret these results as evidence that our cognitive manipulation affects the injunctive norm, indeed for

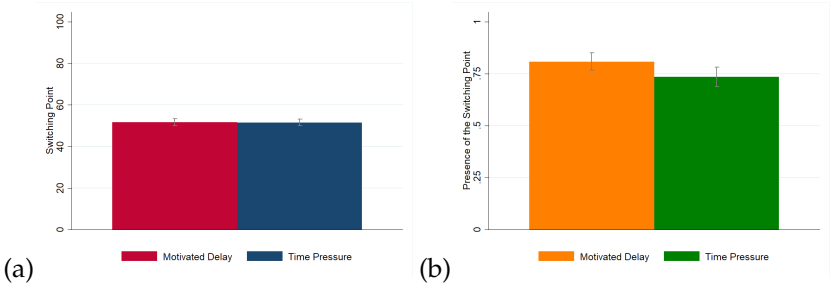


Figure 5: (a) Mean of the switching point between treatments. (b) Presence of the switching point between treatments

lower level of contribution the SA is lower under MD than TP, and for higher level of contribution the SA is higher under MD than TP; this makes the social appropriateness of the available choices more extreme, and the compliance to the injunctive norm stronger.

Additionally, we consider the switching point between those contributions that are perceived as "socially inappropriate" and those that are perceived as "socially appropriate". Such measure has a limitation, indeed it can not be calculated for participants who do not show a monotonic evaluation of the social appropriateness of the contributions. For the participants with a switching point, there is no statistically significant difference between the two treatments (Wilcoxon rank-sum test, Z=-0.096, p=0.924, see Figure 5a). Overall, under MD a higher number of individuals tends to show a switching point with respect to the TP treatment (Wilcoxon rank-sum test, Z=2.269, p=0.023, see Figure 5b). Indeed the 80.81% of the participants under MD shows a switching point against the 73.55% of the participants under TP.

Figure 6 shows the relationship between the RSA and the descriptive norms under the two cognitive manipulations, and those who have higher RSA under both treatments have higher level of descriptive norms, while those with a lower RSA have a lower level of descriptive norms.

Finally, we find no statistical difference in the distribution of SVO scores in the two treatments (Wilcoxon rank-sum test, Z=0.466, p=0.641).

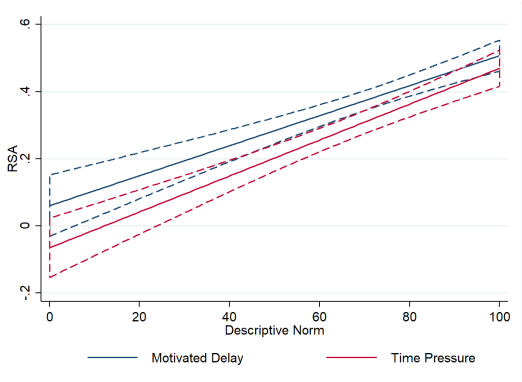


Figure 6: Linear prediction of RSA as a function of Descriptive Norms

We interpret this as evidence that our cognitive manipulations do not affect altruism.[1] Results are reported in Table 12.

3 Discussion

We studied the effect of time pressure and motivated delay on cooperation in a one-shot Public Goods Game and on two social norms associated to this game, the descriptive norm and the injunctive norm. We found that motivated delay, compared to time pressure, increases contributions to the public good as well as the descriptive norm. Moreover, it also affects the injunctive norm by making small contributions less socially appropriate and large contributions more socially appropriate. We also found that a measure of compliance to the injunctive norm increases under motivated delay, suggesting that motivated delay makes people more likely to follow the injunctive norm. Finally, we have also looked at the effect of cognitive manipulation on Social Value Orientation. In line with previous work (Alós-Ferrer and Garagnani, 2020; Bi-

[1]Note that we pre-registered that we would use beliefs and (relative) social appropriateness as independent variables. But, after collecting the data, we noticed that they depend on cognitive manipulation. This is why our analysis differs from the pre-registration in this regard.

	Mean MD	Mean TP	Rank-sum test (Z)	p-value
Contribution	8.390	7.564	3.757	0.000
Belief	7.064	6.613	1.950	0.051
SA 0	-0.855	-0.814	-1.124	0.261
SA 1	-0.775	-0.677	-2.443	0.015
SA 2	-0.614	-0.510	-2.614	0.009
SA 3	-0.370	-0.308	-1.469	0.142
SA 4	-0.919	-0.105	-2.400	0.016
SA 5	0.190	0.169	0.540	0.590
SA 6	0.314	0.320	-0.372	0.710
SA 7	0.440	0.424	0.641	0.522
SA 8	0.643	0.630	0.159	0.874
SA 9	0.756	0.700	0.588	0.556
SA 10	0.845	0.746	2.667	0.008
RSA	0.377	0.290	3.135	0.002
SVO	32.128	30.954	0.466	0.641

Table 12: Mean and Wilcoxon rank-sum test for the level of contribution to the Public Goods Game, beliefs about others' average contribution, social appropriateness (SA) for each level of contribution, relative social appropriateness (RSA), and social value orientation (SVO).

lancini, Boncinelli, and Celadin, 2020), we found no significant effect.

The fact that cognitive manipulation affects both contributions and social norms opens to the possibility that social norms act as mediators of the effect that cognition has on contributions. Our data do not allow us to fully answer this question. However, they do allow us to test a necessary condition of the mediating effect of the descriptive norm, that is, that the residuals of the beliefs positively correlate with public goods contributions. This turns out to be the case (ρ=0.512, p <0.001). Further work should explore this question more in depth.

The fact that motivated delay increases cooperation is *not* inconsistent with Rand's (Rand, 2016) meta-analysis showing that, overall, deliberation decreases cooperation. As mentioned above, there is a lot of heterogeneity across studies and specific manipulations may well have different effects (Capraro, 2019). Future work should explore the psy-

chological path through which motivated delay increases contributions. One possibility is that asking people to write their motivation has the effect that people prefer to write altruistic/cooperative motivations rather than selfish ones, in order to protect their self-image. Future work should explore this as well as other potential motivations. Finally it would be interesting to study the effect of Time Delay on cooperation and social norms compared to Motivated Delay.

The results in this Chapter differ from the results in the first Chapter. In fact, we find that contributions to the Public Goods Game and belief about others' behavior are higher under the treatments designed to foster deliberation than under the one designed to foster intuition in the second study of Chapter 2, while there is no difference in the level of contributions provided to the Public Goods Game under the two cognitive manipulations in Chapter 1. One possible explanation is related to the detectable effect size in the study of Chapters 1 with respect to the sample size in the study of Chapter 2. Indeed the sample size in the first Chapter is half of the subjects collected in the second Chapter. A posteriori sensitivity analysis shows that the detectable effect size for the study in the first Chapter is f=0.37, while the effect size for the study in the second Chapter is f=0.22 with alpha=0.05 and power 0.80. Furthermore, the two Studies differ in the maximum possible level of contribution to the PGG (20 points in the first Chapter and 10 points in the second Chapter). It would be a possible source of variation that can be investigated. Finally, there can be another element of complexity, related to the possible different role of belief that might capture descriptive norms or intuitive reciprocity, but further research is needed to have a better understanding of the role of descriptive norms and beliefs about others' behavior.

Supplementary Material for Chapter 2

4 Experimental Design

Individuals were randomly assigned to one of the two conditions: we collected 344 subjects in each treatment. Participants were randomly assigned to play a four-player one-shot anonymous PGG in either of two treatments. Each participant was endowed with 10 points, and they had to decide how many points to contribute to a common pool. The total group contribution was then doubled and redistributed evenly among the participants of the group. No feedback was provided. In the TP treatment, following (Alós-Ferrer and Garagnani, 2020), participants were endowed with 10 additional points and 1 point was detracted from this amount for each second taken by the subject to make the decision in the PGG. In this way, subjects were incentivized to answer as quickly as possible. After 10 seconds they could still make their decision, but they could not gain the bonus anymore. In the MD treatment, following (Bilancini, Boncinelli, and Luini, 2020), participants had to motivate their level of contribution to the PGG and they were rewarded with 5 additional points if they gave a meaningful motivation of at least 40 characters. In the MD treatment, the 99.42% of the subjects provided a meaningful sentence (342 out of 344) and in the TP treatment, the 85.47% of the subjects (294 out of 344) managed to answer in 10 seconds.

After the one-shot PGG, we elicited an incentivized measure of par-

ticipants' beliefs about the average contribution to the PGG of the other three group members. Participants obtained a bonus of 5 points if they guessed correctly the average level of contribution (rounded to the closest integer).

Following Krupka and R. A. Weber (2013) we elicited individuals' assessment of SA about the level of contribution to the PGG. Participants were asked to guess other participants' evaluation of each possible level of contribution (from 0 to 10) as either "very socially inappropriate", "somewhat socially inappropriate", "somewhat socially appropriate", or "very socially appropriate". To incentivize this measure, one contribution between 0 and 10 was randomly picked and a bonus of 10 points was awarded to the participants whose guesses matched the median response of all the participants. Points awarded up to this stage were converted according to the rate of 50 points $= 0.50$ GBP.

Subsequently, we elicited an incentivized measure of participants' SVO consisting of a series of points allocation tasks that are a variant of the dictator game (DG) (Engel, 2011), in the version of the six primary items by Murphy, Ackermann, and Handgraaf (2011), where participants were randomly assigned to interact with a new participant (different from those whom they were playing with during the PGG). All the participants completed the SVO measure. At the end of the task they were randomly matched in pairs and randomly assigned to the role of decision-maker or receiver. One of the six splits chosen by the decision-maker was randomly selected to determine pay-offs in the pair. Points awarded for the elicitation of SVO were converted according to the rate of 100 points $= 0.10$ GBP. Lastly, participants were asked comprehension and demographic questions.

The overall average earning was 0.78 GPB per participant, including 0.40 GPB of the show-up fee.

5 Further Analysis

Table 13 reports the Wilcoxon rank-sum for the non-incentivized measures about what participants think is the most likely action that other

individuals will take when they face the following situation: your neighbour/colleague/friend/family member finds a wallet in the street. Answers are converted as follow: "S/He brings it to the police station" as a score of 1, "S/He asks people around there" has a score of 2, "S/He leaves it there" has a score of 3 and "S/He takes it for her/himself" has a score of 4.

	Mean MD	**Mean TP**	**Rank-sum test (Z)**	p**-value**
Neighbour	2.401	2.343	0.655	0.512
Colleague	1.805	1.832	-0.354	0.724
Friend	1.709	1.738	-0.279	0.780
Family member	1.584	1.599	0.103	0.918

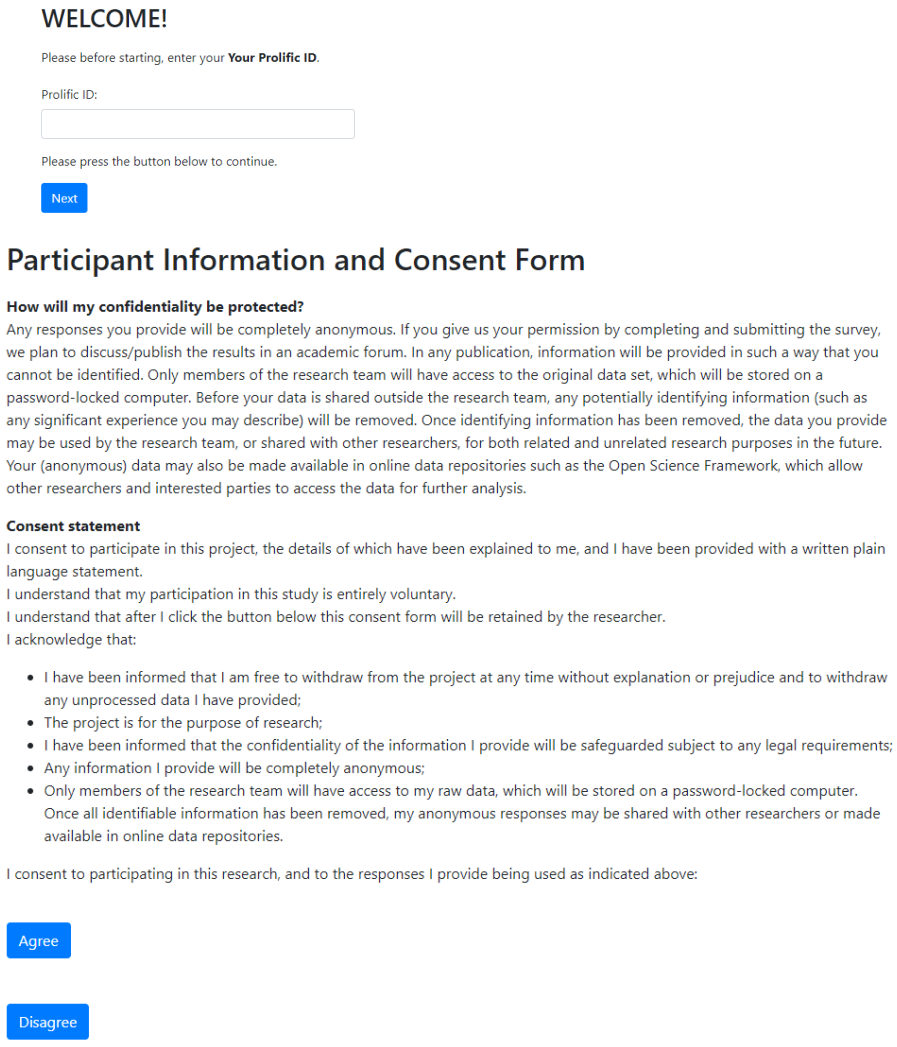
Table 13: Mean and Wilcoxon rank-sum test of what participants think is the most likely action that other individuals will take when they face the following situation: your neighbour/colleague/friend/family member finds a wallet in the street.

Table 14 reports distribution and the Wilcoxon rank-sum for the age and gender.

	Mean MD	**Mean TP**	**Rank-sum test (Z)**	p**-value**
Age	30.34	31.20	-1.543	0.123
Gender	0.398	0.390	0.234	0.815
Nationality			0.942	0.346
UK	0.765	0.829		
US	0.198	0.151		
Ireland	0.029	0.009		

Table 14: Mean and Wilcoxon rank-sum test of age, gender and nationality.

6 Instructions



WELCOME!

Please before starting, enter your **Your Prolific ID**.

Prolific ID:

Please press the button below to continue.

Next

Participant Information and Consent Form

How will my confidentiality be protected?
Any responses you provide will be completely anonymous. If you give us your permission by completing and submitting the survey, we plan to discuss/publish the results in an academic forum. In any publication, information will be provided in such a way that you cannot be identified. Only members of the research team will have access to the original data set, which will be stored on a password-locked computer. Before your data is shared outside the research team, any potentially identifying information (such as any significant experience you may describe) will be removed. Once identifying information has been removed, the data you provide may be used by the research team, or shared with other researchers, for both related and unrelated research purposes in the future. Your (anonymous) data may also be made available in online data repositories such as the Open Science Framework, which allow other researchers and interested parties to access the data for further analysis.

Consent statement
I consent to participate in this project, the details of which have been explained to me, and I have been provided with a written plain language statement.
I understand that my participation in this study is entirely voluntary.
I understand that after I click the button below this consent form will be retained by the researcher.
I acknowledge that:

- I have been informed that I am free to withdraw from the project at any time without explanation or prejudice and to withdraw any unprocessed data I have provided;
- The project is for the purpose of research;
- I have been informed that the confidentiality of the information I provide will be safeguarded subject to any legal requirements;
- Any information I provide will be completely anonymous;
- Only members of the research team will have access to my raw data, which will be stored on a password-locked computer. Once all identifiable information has been removed, my anonymous responses may be shared with other researchers or made available in online data repositories.

I consent to participating in this research, and to the responses I provide being used as indicated above:

Agree

Disagree

You have been randomly assigned to interact in a group with 3 other participants.

All of you will read the same set of instructions.

At the beginning each person will receive 10 Points.

Each one of you will decide how many of your 10 Points to keep for yourself, and how many (if any) to contribute to a common pool (from 0 to 10 Points).

All Points contributed to the common pool are doubled and then split evenly among the 4 group members.

If you keep your **10 Points**, while every one else contributes **10 Points**, the total amount of the group is **30**. The common pool doubles the amount of Points and so your group gets **60 Points** that are split evenly among the 4 group members. In this case, you earn **25 Points** (the **15 Points** that you earned from the common pool and the **10 Points** of your endowment that you kept for yourself) and each of the others will earn **15 Points**.

If each of you contributes **10 Points**, the total amount of the group is **40**. The common pool doubles the amount of Points and so your group gets **80 Points** that are split evenly among the 4 group members. In this case, each of you gets **20 Points**.

If you and the other group members keep your **10 Points**, you do not earn any additional Points and each of you remains with your initial endowment of **10 Points**.

We use no deception in our studies: you and the other group members will be really paid according to your decisions.

50 Points are equal to 0.50 GBP.

Please press the button below to continue.

Next

Motivated Delay

You will also have the opportunity to earn 5 additional Points.

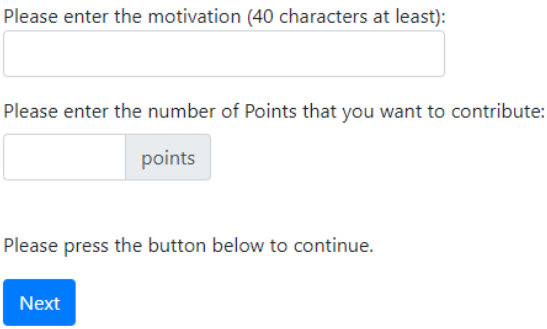
To gain this bonus you have to motivate the number of Points you want to contribute to the common pool.

You have to write a minimum of 40 characters before you can make your decision.

If you give a meaningless motivation (e.g., "aaaaaaaaa...") you will not obtain the bonus.

Please press the button below to continue.

Next



Time Pressure

You will also have the opportunity to earn additional Points if you make a quick decision.

You start from 10 additional Points and for each second spent in making your decision you lose 1 of these Points.

For example, if you make your decision after 4 seconds, you get 6 additional Points.

You will see a timer counting down from 10 to 0 seconds.

If the timer reaches 0 you get 0 additional Point, but you can still make your decision.

Please press the button below to continue.

Next

Please enter the number of Points that you want to contribute:

points

Please press the button below to continue.

Next

You can now earn 5 additional Points.

Please indicate your best guess of the average contribution of the other three participants (rounded to the closest integer).

If you give the right answer you will earn the 5 additional Points.

Average contribution of the other three participants:

points

Please press the button below to continue.

Next

You can now earn 10 additional Points.

On the following screens, you will face all the possible levels of contribution. You will be asked to evaluate how much you believe other participants judge "socially appropriate" or "socially inappropriate" to contribute that level of contribution in the common pool.

By socially appropriate, we mean behavior that most people agree is the "correct" or "ethical" thing to do.
By socially inappropriate we mean a behavior that is inconsistent with moral or proper social behavior.

You will gain Points in the following way.
One level of contribution between 0 and 10 will be randomly selected.
You will get the 10 Points if, for such a level of contribution, your answer is the one most frequently given by the other participants.
Otherwise, you will get nothing.

You will see an example on the next screen.

Please press the button below to continue.

Next

Example Situation

Individual A is at a local coffee shop near campus. While there, individual A notices that someone has left a wallet at one of the tables. Individual A must decide what to do. Individual A has four possible choices: take the wallet, ask others nearby if the wallet belongs to them, leave the wallet where it is, or give the wallet to the shop manager. Individual A can choose one of these four options.

The table below presents a list of the possible choices available to Individual A. For each of the choices, you will be asked to indicate whether you believe Individual A judges that option as very socially inappropriate, somewhat socially inappropriate, somewhat socially appropriate, or very socially appropriate. To indicate your response, you would place a check mark in the corresponding box.

	Very Socially Inappropriate	Somewhat Socially Inappropriate	Somewhat Socially Appropriate	Very Socially Appropriate
Take the wallet	○	○	○	○
Ask others nearby if the wallet belongs to them	○	○	○	○
Leave the wallet where it is	○	○	○	○
Give the wallet to the shop manage	○	○	○	○

Press the button below to continue

Next

The table below gives a list of the possible levels of contribution available to the participants.
For each level of contribution, please indicate whether you believe other participants judge that level as very socially inappropriate, somewhat socially inappropriate, somewhat socially appropriate, or very socially appropriate.

To indicate your response, please place a checkmark in the corresponding box.

Level of Contribution	Very Socially Inappropriate	Somewhat Socially Inappropriate	Somewhat Socially Appropriate	Very Socially Appropriate
0	○	○	○	○
1	○	○	○	○
2	○	○	○	○
3	○	○	○	○
4	○	○	○	○
5	○	○	○	○
6	○	○	○	○
7	○	○	○	○
8	○	○	○	○
9	○	○	○	○
10	○	○	○	○

Please press the button below to continue.

Next

Please answer the following questions:

Question 1: What level of your contribution earns the highest payoff for the group as a whole?

Answer:

Question 2: What level of your contribution earns the highest payoff for you personally?

Answer:

Please press the button below to continue.

Next

You will now be randomly assigned to interact with another participant. This participant is different from those with whom you interacted before.

On the next pages you will decide how to allocate Points between you and the other participant. You will take six different decisions.

At the end of this part, you and the other participant will be randomly assigned to the role of Decision Maker or Receiver.

If you are assigned to the role of Decision Maker, one of your six decisions will be randomly selected, and you and the other participant will be paid accordingly.

If you are assigned to the role of Receiver, one of the six decisions of the other participant will be randomly selected, and you and the other participant will be paid accordingly.

100 Points correspond to 0.10 GBP.

Please press the button below to continue.

Next

Please decide how to allocate Points between you and the other participant.

Decision 1:

You receive:	85	87	89	91	93	94	96	98	100
	○	○	○	○	○	○	○	○	○
Other receives:	15	19	24	28	33	37	41	46	50

Please press the button below to continue.

Next

Please decide how to allocate Points between you and the other participant.

Decision 2:

You receive:	50	54	59	63	68	72	76	81	85
	○	○	○	○	○	○	○	○	○
Other receives:	100	89	79	68	58	47	36	26	15

Please press the button below to continue.

Next

Please decide how to allocate Points between you and the other participant.

Decision 3:

You receive:	100	94	88	81	75	69	63	56	50
	○	○	○	○	○	○	○	○	○
Other receives:	50	56	63	69	75	81	88	94	100

Please press the button below to continue.

Next

Please decide how to allocate Points between you and the other participant.

Decision 4:

You receive:	85	85	85	85	85	85	85	85	85
	○	○	○	○	○	○	○	○	○
Other receives:	85	76	68	59	50	41	33	24	15

Please press the button below to continue.

Next

Please decide how to allocate Points between you and the other participant.

Decision 5:

You receive:	100	98	96	94	93	91	89	87	85
	○	○	○	○	○	○	○	○	○
Other receives:	50	54	59	63	68	72	76	81	85

Please press the button below to continue.

Next

Please decide how to allocate Points between you and the other participant.

Decision 6:

You receive:	50	54	59	63	68	72	76	81	85
	○	○	○	○	○	○	○	○	○
Other receives:	100	98	96	94	93	91	89	87	85

Please press the button below to continue.

Next

Questionnaire

In this part you will be asked some questions.

Please press the button below to continue.

Next

Please answer the following questions.

- How important is it for you to do what is considered to be socially appropriate?
  - Very unimportant
  - Somewhat unimportant
  - Somewhat important
  - Very important
- Suppose someone in your neighbourhood finds a wallet on the street, what do you think is the likeliest action s/he is going to do?
  - S/He brings it to the police station
  - S/He asks people around there
  - S/He leaves it there
  - S/He takes it for her/himself
- Suppose one of your colleagues finds a wallet on the street, what do you think is the likeliest action s/he is going to do?
  - S/He brings it to the police station
  - S/He asks people around there
  - S/He leaves it there
  - S/He takes it for her/himself
- Suppose one of your friends finds a wallet on the street, what do you think is the likeliest action s/he is going to do?
  - S/He brings it to the police station
  - S/He asks people around there
  - S/He leaves it there
  - S/He takes it for her/himself
- Suppose one of your family members finds a wallet on the street, what do you think is the likeliest action s/he is going to do?
  - S/He brings it to the police station
  - S/He asks people around there
  - S/He leaves it there
  - S/He takes it for her/himself
- Your level of education:
  - Secondary School
  - Bachelor
  - Master
  - PhD
  - Other
- Field of study (Economics, Maths...):
- To what extent have you participated in studies like this one before?
  - Nothing like this scenario
  - Somewhat like this
  - Exactly this scenario

Please press the button below to continue.

Next

Thank you!

Thank you for participating.

You will see your earnings on your Prolific profile after the experimenter has confirmed your payment.

Please press the button below to conclude.

Press to Conclude

Chapter 3

Cognitive Reflection Test and Cognition

Dual-Process Theories posit that individuals' decisions are the results of the interplay between two cognitive processes (Evans and Stanovich, 2013), and it has been broadly employed to investigate, not only cooperation (Rand, J. D. Greene, and Nowak, 2012; Rand, Peysakhovich, et al., 2014; Capraro and Cococcioni, 2015; Capraro and Cococcioni, 2016; Bilancini, Boncinelli, and Celadin, 2020; Alós-Ferrer and Garagnani, 2020; Bilancini, Boncinelli, Capraro, et al., 2020), but also the effect that cognition might have in behaving honestly (Gunia et al., 2012; Capraro, 2017; Lohse, Simon, and Konrad, 2018; Capraro, J. Schulz, and Rand, 2019), and according to deontology and utilitarianism (Suter and Hertwig, 2011; D. D. Cummins and R. C. Cummins, 2012; Trémolière and Bonnefon, 2014). To investigate the causal effect of the modes of cognition on the aforementioned behaviors, several experimental conditions aimed at promoting reliance on intuition and deliberation have been developed, and the condition that has been widely used consists in manipulating the response time given to people to make their decisions through two treatments: Time Pressure (TP) and Time Delay (TD). In the TP condition, individuals are forced to answer within a small amount of time

This Chapter is based on Bilancini, Boncinelli, and Celadin (2021).

(e.g., 5-10 seconds), and this should increase the likelihood of observing responses driven by the intuitive process. While in the TD treatment, individuals are forced to answer after a certain amount of time (e.g., 10 seconds), and this should increase the likelihood of observing responses driven by the deliberative process. Albeit many studies have employed these time manipulations, it has never been tested whether such manipulations foster intuition and deliberation.

In this Chapter, we propose an experimental design that allows us to validate the effect of the cognitive manipulations through the Cognitive Reflection Test (CRT) (Frederick, 2005; Branas-Garza, Kujal, and Lenkei, 2019), a measure of the cognitive reflection that is the ability or the disposition of an individual to engage in a more deliberative process and to resist intuitive responses (Frederick, 2005). Our novelty is that we use the responses given CRT as a proxy of the effectiveness of the manipulations.

The original version of the CRT is designed to trigger an intuitive but incorrect answer while the correct answer is provided whether individuals engage in further deliberation. One of the CRT's original questions by Frederick (2005) is: "A bat and a ball cost $1.10 in total. The bat costs $1 more than the ball. How much does the ball cost?", when individuals face this problem, they tend to give the first response that comes to their mind (10 cents), and they do not engage in further reflection to understand which is the correct answer (5 cents). Another interesting feature of the CRT is that it is a proxy of physiological characteristics (Bosch-Domènech, Brañas-Garza, and Espın, 2014; Alonso et al., 2018), and it has the property to predict individuals' performance, decision-makers' choices, and behaviors (Frederick, 2005; Campitelli and Labollita, 2010; Besedeš et al., 2012; Ponti and Rodriguez-Lara, 2015; Andersson et al., 2016; Albano et al., 2018).

We ran a pre-registered online study, implemented using the software Qualtrics, where individuals have to answer the CRT in the long version of six questions (CRT-L) by Primi et al. (2016) under a baseline condition and the two time manipulations: TP to induce less deliberative answers, and TD to induce more deliberative answers. We find that (i) TD increases the likelihood to provide correct answers to the CRT-L, (ii) TP

increases the likelihood to provide more non-intuitive incorrect answers instead of more intuitive answers. In fact, there are two types of incorrect answers: intuitive but incorrect answers and non-intuitive incorrect answers that include all the other possible answers to the CRT. Actually intuitive but incorrect answers have been used as a measure of the disposition to behave intuitively (Cueva et al., 2016), although their reliability has been criticized (Pennycook et al., 2016).

We provide empirical support and evidence of the effectiveness of time manipulations, TD and TP, in inducing more and less deliberation, respectively. Furthermore, through this novel approach, we extend the CRT features that can be engaged not only as a measure of deliberation but also as a proxy of the effectiveness of the cognitive manipulations. Finally, this allows for a scalable and easily implementable measure that can be used as a proxy of the cognitive manipulations' effectiveness.

1 Methods

We recruited 598 participants using the online platform Prolific (www.prolific.co; Palan and Schitter, 2018). The experiment took place on August 4, 2020. Participants were randomly assigned to one out of three conditions: Baseline, Time Pressure, and Time Delay conditions. In each condition, participants had to answer the six questions of the CRT-L (Primi et al., 2016) that were presented in random order. In the baseline condition, participants had to answer each question without any time constraint. In the Time Pressure condition, participants had to answer each question within 30 seconds (Borghans, Meijers, and Ter Weel, 2008). Participants who failed to answer within the time constraint were still able to provide the answer to the questions: after the 30 seconds the question was still shown. Overall the 94.69% of participants were able to answer within the time constraint (in the Supplementary Material for Chapter 3 we report the percentage of compliance for each question and we run the main analysis restricting to those subjects who failed in answering within the 30 seconds). In the Time Delay condition, participants had to wait for one minute before they could insert an answer (Borghans,

Meijers, and Ter Weel, 2008); only after this amount of time, they were allowed to provide the answer. At the end of the experiment, we asked participants their level of reflection in answering the CRT-L. Moreover, we asked participants demographic information and their previous exposure to the CRT-L (full instructions in the Supplementary Material for Chapter 3). The participation fee was 0.63 GBP for a survey 6:46 min long in mean.

2 Results at Question Level

We pre-registered a sample size of N=600. This was based on an a priori power analysis that showed that 200 subjects per condition are enough to detect a small effect size of f=0.25 with alpha=0.05 and power 0.80. After downloading the data file on Qualtrics, we result in 598 observations (the server failed at registering two observations). We collected 207 subjects in the Baseline, 204 in the TP condition and 187 in the TD condition (mean age=27.64, males=53.3%, females=46.7%).

Following our pre-registration, we first make an overall comparison using Kruskal-Wallis at question level to test the difference in the distributions of the correct answers to each question of the CRT-L across all treatment. Specifically, our main variable is a dummy variable that takes value = 1 if the answer is correct, 0 otherwise. We find that the distribution differs significantly across treatments (Kruskal-Wallis tests: χ^2=36.343, p$<$0.001).

The pairwise comparisons of the correct answers between each treatment are statistically significant (see Figure 7a). Indeed the likelihood to provide correct answers is statistically lower in the TP condition than in the Baseline (Wilcoxon rank-sum test: z=3.167, p=0.002), while it is statistically higher in the TD condition than in the Baseline (Wilcoxon rank-sum test: z=-2.959, p=0.003), and *a fortiori* higher in the TD condition than in the TP condition (Wilcoxon rank-sum test: z=-6.027, p$<$0.001). In Table 15 we run Logit regressions with standard errors clustered at the individual level. Model 1 in Table 15 confirms that the TP condition decreases the probability to provide a correct answer to the CRT, while TD

increases such probability. Our results hold even when we control for gender, previous exposure to the CRT, question and order fixed effects (Model 2).

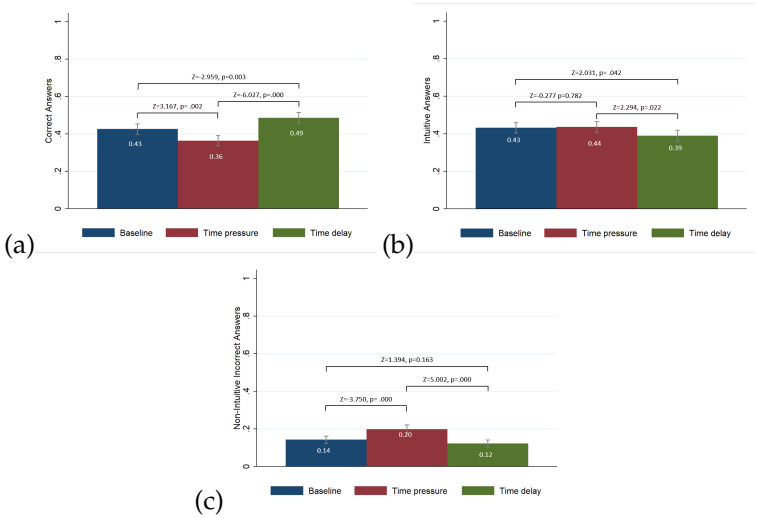


Figure 7: (a) The mean of the correct answers given to the CRT-L across treatments. (b) The mean of the intuitive answers given to the CRT-L across treatments. (c) The mean of the non-intuitive incorrect answers given to the CRT-L across treatments.

We now consider the distribution of the intuitive answers (the main variable = 1 if individuals provided an intuitive response, 0 otherwise), and we find that the distributions are slightly different (Kruskal-Wallis tests: χ^2=6.183, p=0.045). The pairwise comparisons between each treatment is statistically significant, with the exception of the Baseline and the TP condition (Wilcoxon rank-sum test Baseline vs. TP: z=-0.277, p=0.782; Wilcoxon rank-sum test Baseline vs. TD: z=2.031, p=0.042; Wilcoxon rank-sum test TD vs. TP: z=2.294, p=0.022; see Figure 7b). Model 3 in Table 15 confirms that the TP and TD condition does not affect the probability to provide an intuitive answer to the CRT. Our results hold even when we control for gender, previous exposure to the CRT, question and order fixed effects (Model 4).

Finally, when we consider the distribution of the non-intuitive incorrect answers (the main variable = 1 if individuals provided a non-intuitive incorrect response, 0 otherwise) we find that the distributions differ significantly across treatments (Kruskal-Wallis tests: χ^2=28.487, p<0.001). The pairwise comparisons between each treatment and the Baseline are statistically significant, with the exception of the Baseline and the TD condition (Wilcoxon rank-sum test Baseline vs. TP: z=-3.750, p<0.001; Wilcoxon rank-sum test Baseline vs. TD: z=1.394, p=0.163; Wilcoxon rank-sum test TD vs. TP: z=5.002, p<0.001; see Figure 7c). Model 5 in Table 15 shows that TP increases the probability to provide non-intuitive incorrect answers to the CRT, while TD has no effect. Results hold even when we control for gender, previous exposure, question and order fixed effects (Model 6).

For completeness, we also report the Chi-squared test to test whether correct, intuitive, and non-correct incorrect responses differ significantly across treatments, and we confirm previous results (correct: $\chi^2_{(2)}$=36.353, p<0.001; intuitive: $\chi^2_{(2)}$=6.185, p=0.045; non-intuitive incorrect: $\chi^2_{(2)}$=28.495, p<0.001). We run a Fisher's exact test to make the pairwise comparison, and we confirm previous results (see Table 16).

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
					Non-Intuitive	Non-Intuitive
	Correct	Correct	Intuitive	Intuitive	Incorrect	Incorrect
TP	-0.261*	-0.264	0.023	0.054	0.404**	0.334**
	(0.134)	(0.163)	(0.118)	(0.133)	(0.132)	(0.153)
TD	0.245*	0.282*	-0.170	-0.178	-0.170	-0.191
	(0.135)	(0.149)	(0.119)	(0.124)	(0.141)	(0.150)
Female		-0.746***		0.543***		0.296**
		(0.122)		(0.101)		(0.119)
Exposure		0.554***		-0.564***		0.045
		(0.137)		(0.121)		(0.139)
No Compliance		0.025		-0.270		0.362*
		(0.231)		(0.205)		(0.220)
Question FE	No	Yes	No	Yes	No	Yes
Order FE	No	Yes	No	Yes	No	Yes
Constant	-0.298**	-0.300*	-0.275***	-0.326**	-1.795***	-1.749***
	(0.095)	(0.157)	(0.084)	(0.150)	(0.095)	(0.186)
N	3588	3588	3588	3588	3588	3588
pseudo R^2	0.007	0.112	0.001	0.067	0.009	0.087

Table 15: Logit Regression on the likelihood to provide correct, intuitive, and non-intuitive incorrect answers to the CRT-L. *Correct*=1 if the answer is correct, 0 otherwise; *Intuitive*=1 if the answer is intuitive, 0 otherwise; *Non-Intuitive Incorrect*=1 if the answer is non-intuitive incorrect, 0 otherwise; *TD*=1 if an individual is under Time Delay, 0 otherwise; *TP*=1 if an individual is under Time Pressure, 0 otherwise; *Female*=1 if female, 0 otherwise; *Exposure*=1 if individuals have seen someone of the CRT-L questions or all of the CRT-L questions, 0 if individuals have seen none of the CRT-L questions. *No Compliance*=1 if an individual did not comply with the time manipulation, 0 otherwise. Robust standard errors in parentheses clustered at the individual level, where: * denotes $p < 0.10$, ** denotes $p < 0.05$, *** denotes $p < 0.01$.

Fisher's exact test			
	BL-TP	BL-TD	TP-MD
Correct	p= 0.002	p= 0.003	p= 0.000
Intuitive	p=0.807	2p=0.045	p=0.023
Non-intuitive incorrect	p=0.000	p=0.182	p=0.000
N	207	204	187

Table 16: Fisher's exact test. BL=Baseline; TP= Time Pressure and TD= Time Delay.

3 Results at Individual level

Our second pre-registered variables are the number of correct, intuitive and non-intuitive incorrect answers given to the CRT-L at the individual level. Following our pre-registration, we first make an overall comparison using Kruskal-Wallis to test differences in the distributions across all treatments. Figure 8a reports the distribution of the number of correct answers by treatment and the Kruskal-Wallis finds statistically significant differences across treatments (χ^2=13.858, p-value=0.001). Figure 8b reports the distribution of the number of intuitive answers by treatment and the Kruskal-Wallis does not find any statistically significant difference across treatments (χ^2=3.103, p-value=0.212). Figure 8c reports the distribution of the number of non-intuitive incorrect answers by treatment and the Kruskal-Wallis finds statistically significant differences across treatments (χ^2=15.243, p-value=0.001).

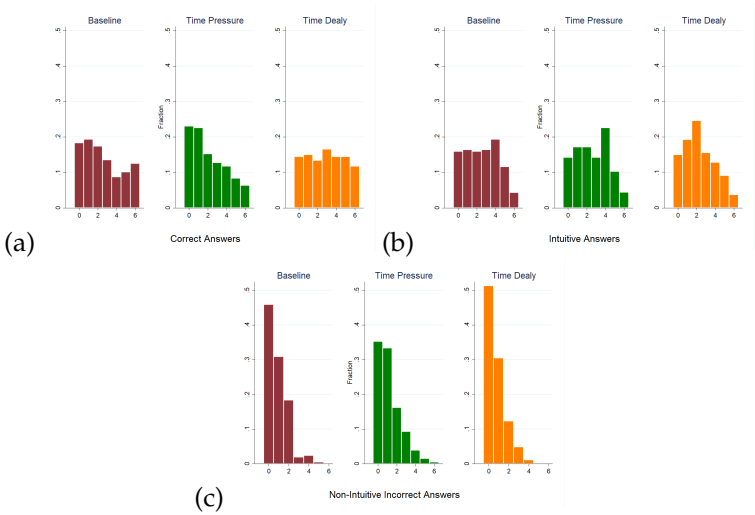


Figure 8: (a) Distribution of the number of correct answers by treatment. (b) Distribution of the number of intuitive answers by treatment. (c) Distribution of the number of non-intuitive incorrect answers by treatment.

We now compare each treatment with the Baseline and both time ma-

nipulations with themselves using the Wilcoxon rank-sum test, see Figure 9.

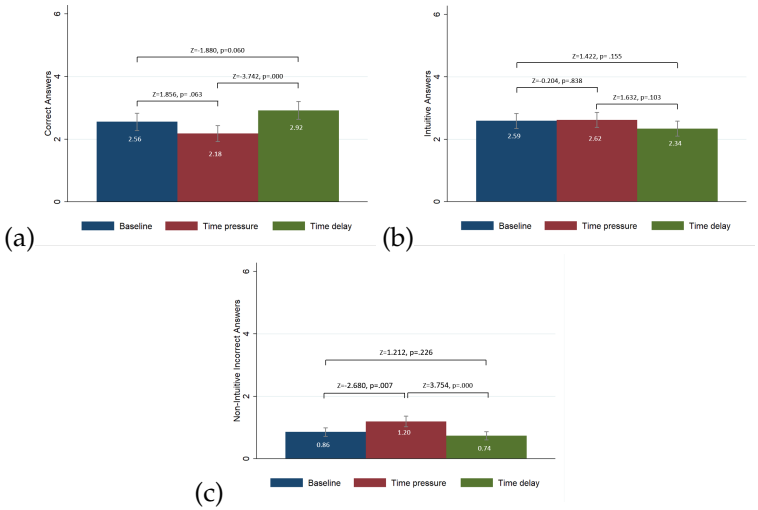


Figure 9: (a) The mean of the correct answers given to the CRT-L across treatments. (b) The mean of the intuitive answers given to the CRT-L across treatments. (c) The mean of the non-intuitive incorrect answers given to the CRT-L across treatments.

We find a slightly significant difference in the number of correct answers given to the Baseline and TP condition (Wilcoxon rank-sum test: z=1.856, p-value=0.063). The difference between the Baseline and TD condition is marginally statistically significant (Wilcoxon rank-sum test: z=-1.880, p-value=0.060), and in the TP and TD condition (Wilcoxon rank-sum test: z=-3.742, p-value=0.000), see Figure 9a. These findings are confirmed by the Tobit regression reported in Table 17; Model 1 suggests that TP decreases the number of correct answers; we control for previous exposure to the CRT-L and gender (Model 2).

The pairwise comparisons between the number of intuitive answers fail to find a statistically significant difference across treatments (all p's $>$ 0.1, see Figure 9b). Indeed there is no significant difference in the number of intuitive answers given to the Baseline and TP condition (Wilcoxon

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
					Non-Intuitive	Non-Intuitive
	Correct	Correct	Intuitive	Intuitive	Incorrect	Incorrect
TP	-0.548**	-0.481*	0.053	0.004	0.535***	0.507***
	(0.269)	(0.258)	(0.212)	(0.204)	(0.183)	(0.181)
TD	0.431	0.422	-0.251	-0.236	-0.226	-0.241
	(0.273)	(0.261)	(0.213)	(0.203)	(0.187)	(0.187)
Female		-1.281***		0.889***		0.446***
		(0.211)		(0.166)		(0.150)
Exposure		0.835***		-0.879***		-0.023
		(0.243)		(0.197)		(0.173)
Constant	2.449***	2.784***	2.464***	2.322***	0.270**	0.081
	(0.194)	(0.219)	(0.152)	(0.172)	(0.135)	(0.165)
N	598	598	598	598	598	598
pseudo R^2	0.005	0.026	0.001	0.023	0.010	0.015

Table 17: Tobit regressions on the number of correct answers given to the CRT-L in Model 1 and 2. Tobit regressions on the number of intuitive answers given to the CRT-L in Model 3 and 4. Tobit regressions on the number of non-intuitive incorrect answers given to the CRT-L in Model 5 and 6. *TD*=1 if an individual is under Time Delay treatment, 0 otherwise; *TP*=1 if an individual is under Time Pressure treatment, 0 otherwise; *Female*=1 if female, 0 otherwise; *Exposure*=1 if individuals have seen someone of the CRT-L questions or all of the CRT-L questions, 0 if individuals have seen none of the CRT-L questions. Robust standard errors in parentheses, where: * denotes $p < 0.10$, ** denotes $p < 0.05$, *** denotes $p < 0.01$.

rank-sum test: z=-0.204, p-value=0.838), in the Baseline and TD condition (Wilcoxon rank-sum test: z=1.422, p-value=0.155), and in the TP and TD condition (Wilcoxon rank-sum test: z=1.632, p-value=0.103). These findings are confirmed by the Tobit regression reported in Table 17; Model 3 suggests that there is no effect of the TP and TD treatments. The result holds even when we control for previous exposure and gender (Model 4).

We find a statistically significant differences in the pairwise comparisons between each treatment for the non-intuitive incorrect answers (see Figure 9c) with the exception of the Baseline and the TD condition (Wilcoxon rank-sum test Baseline vs TP: z=-2.680, p-value=0.007; Wilcoxon rank-sum test Baseline vs TD: z=1.212, p-value=0.226; Wilcoxon rank-sum test TD vs TP: z=3.754, p-value=0.000). These findings are confirmed by the Tobit regression reported in Table 17; Model 5 suggests that TP increases the number of non-intuitive incorrect

answers given to the CRT-L. The result holds even when we control for previous exposure and gender (Model 6).

4 Gender and results at Question level

It the literature there is large evidence that CRT suffers of a strong gender bias, indeed males perform significantly better than females (Frederick, 2005; Hoppe and Kusterer, 2011; Holt, Porzio, and Song, 2017; Cueva et al., 2016; Branas-Garza, Kujal, and Lenkei, 2019). Thus, we look at the effect of the cognitive manipulations in answering the CRT-L for male and female respectively.

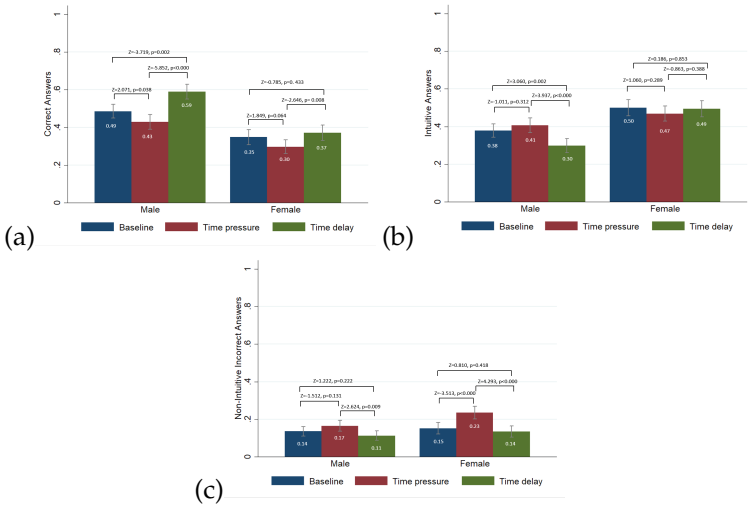


Figure 10: (a) The mean of the correct answers given to the CRT-L across treatments and gender. (b) The mean of the intuitive answers given to the CRT-L across treatments and gender. (c) The mean of the non-intuitive incorrect answers given to the CRT-L across treatments and gender.

The likelihood of providing correct answers is higher for male than female and this is confirmed by the Table 18, Model 1 and this is consistent with the literature. Moreover, when we look at the effect of the two treatments on male and female respectively, we have that the likelihood

of providing correct answers for male is higher under MD with respect to the baseline and TP. Under TP the likelihood is lower with respect to the baseline (see Figure 10a). Results are confirmed by Model 3 of Table 18). There is no difference in the likelihood of providing correct answers for female under MD with respect to the baseline. TP decreases the likelihood with respect to both the baseline and the MD treatment (see Figure 10a). Results are confirmed by Model 2 of Table 18). Overall, on one hand it seems that males are more responsive to the cognitive manipulations with respect to females, while on the other hand it seems that exposure to the CRT increases the likelihood of providing correct answer for females but not for males. Please, for the Wilcoxon rank-sum tests refer to the Figure 10a.

The likelihood of providing intuitive answers is higher for female than male and this is confirmed by the Table 18, Model 4, and our result is consistent with the literature. Again, we look at the effect of the two treatments on male and female respectively, and we have that for males under MD the likelihood of providing intuitive answers is lower with respect to the baseline and TP. There is no difference between in the likelihood of providing intuitive answers the baseline and TP treatment (see Figure 10b). Results are confirmed by Model 6 of Table 18). For females with respect to male there is no difference in the likelihood across treatments (Figure 10b). Results are confirmed by Model 5 of Table 18. Also in this case, it seems that males are more responsive to the cognitive manipulations with respect to females, while it seems that exposure to the CRT decreases the likelihood of providing correct answer for both males and females. Please, for the Wilcoxon rank-sum tests refer to the Figure 10b.

Finally, the likelihood of providing non-intuitive incorrect answers is the same for female and male and this is confirmed by the Table 18, Model 7. When we look at the effect of the two treatments on male and female respectively, we have that for males under MD the likelihood of providing non-intuitive incorrect answers decreases with respect to the baseline and TP (see Figure 10c). Results are confirmed by Model 9 of Table 18). For females, TP increases the likelihood of providing non-

intuitive incorrect answers (Figure 10c). Results are confirmed by Model 8 of Table 18. Please, for the Wilcoxon rank-sum tests refer to the Figure 10c.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
							Non-Intuitive	Non-Intuitive	Non-Intuitive
	Correct	Correct	Correct	Intuitive	Intuitive	Intuitive	Incorrect	Incorrect	Incorrect
TP	-0.252	-0.226	-0.312	0.161	-0.098	0.204	0.184	0.473**	0.199
	(0.212)	(0.235)	(0.217)	(0.178)	(0.193)	(0.181)	(0.222)	(0.201)	(0.230)
TD	0.439**	0.068	0.449**	-0.359**	0.017	-0.367**	-0.221	-0.153	-0.229
	(0.203)	(0.224)	(0.201)	(0.174)	(0.184)	(0.173)	(0.229)	(0.193)	(0.229)
Female	-0.619***			0.508***			0.154		
	(0.211)			(0.175)			(0.199)		
TP×Female	-0.036			-0.218			0.302		
	(0.297)			(0.247)			(0.279)		
TD×Female	-0.355			0.364			0.071		
	(0.297)			(0.248)			(0.298)		
Exposure	0.552***	0.889***	0.298	-0.560***	-0.818***	-0.341**	0.040	0.025	0.063
	(0.137)	(0.200)	(0.183)	(0.121)	(0.180)	(0.162)	(0.139)	(0.181)	(0.210)
No Compliance	0.017	-0.323	0.310	-0.249	-0.061	-0.466	0.350	0.413	0.248
	(0.232)	(0.348)	(0.328)	(0.205)	(0.258)	(0.345)	(0.219)	(0.312)	(0.292)
Question FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Order FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-0.351**	-1.165***	-0.209	-0.312*	0.209	-0.340*	-1.682***	-1.355***	-1.871***
	(0.175)	(0.229)	(0.191)	(0.165)	(0.208)	(0.188)	(0.209)	(0.231)	(0.258)
Gender		Female	Male		Female	Male		Female	Male
N	3588	1674	1914	3588	1674	1914	3588	1674	1914
pseudo R^2	0.113	0.111	0.091	0.070	0.076	0.057	0.088	0.100	0.078

Table 18: Logit Regression on the likelihood to provide correct, intuitive, and non-intuitive incorrect answers to the CRT-L. *Correct*=1 if the answer is correct, 0 otherwise; *Intuitive*=1 if the answer is intuitive, 0 otherwise; *Non-Intuitive Incorrect*=1 if the answer is non-intuitive incorrect, 0 otherwise; *TD*=1 if an individual is under Time Delay, 0 otherwise; *TP*=1 if an individual is under Time Pressure, 0 otherwise; *Female*=1 if female, 0 otherwise; *Exposure*=1 if individuals have seen someone of the CRT-L questions or all of the CRT-L questions, 0 if individuals have seen none of the CRT-L questions. *No Compliance*=1 if an individual did not comply with the time manipulation, 0 otherwise. Robust standard errors in parentheses clustered at the individual level, where: * denotes $p < 0.10$, ** denotes $p < 0.05$, *** denotes $p < 0.01$.

5 Gender and results at Individual level

We now look at the effect of the cognitive manipulations for males and females, taking into account the answers to the CRT-L at individual level.

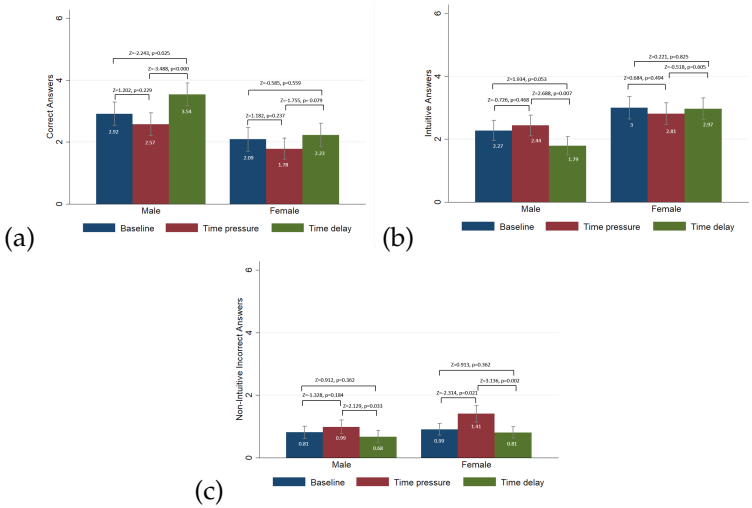


Figure 11: (a) The mean of the correct answers given to the CRT-L across treatments and gender. (b) The mean of the intuitive answers given to the CRT-L across treatments and gender. (c) The mean of the non-intuitive incorrect answers given to the CRT-L across treatments and gender.

Overall, the number of correct answers is higher for male than female and this is confirmed in Table 19, Model 1 and this is consistent with the literature. Moreover, when we look at the effect of the two treatments on male and female respectively, we have that males provide a higher number of correct answers under MD with respect to TP and the baseline (see Figure 11a). Results are confirmed by Model 3 of Table 19). For females, the number of correct answers is the slightly higher under MD with respect TP, but overall there is no difference across treatments. (see Figure 11a). Results are confirmed by Model 2 of Table 19). Overall, one one hand it seems that males are more responsive to the cognitive manipulations with respect to females, while on the other hand it seems

that exposure to the CRT increases the likelihood of providing correct answer for females but not for males. Please, for the Wilcoxon rank-sum tests refer to the Figure 11a.

We now consider the intuitive answers and we have that the number of intuitive answers is higher for female than male and this is confirmed by the Table 19, Model 4, and our result is consistent with the literature. If we look at the effect of the two treatments on male and female respectively, we have that for males under MD the number of intuitive answers is lower with respect to TP and Baseline (see Figure 11b). Results are confirmed by Model 6 of Table 19). For females there is no difference in the number intuitive answers across treatments (Figure 11b). Results are confirmed by Model 5 of Table 19. Also in this case, it seems that males are more responsive to the cognitive manipulations with respect to females, while it seems that exposure to the CRT decreases the likelihood of providing correct answer for both males and females. Please, for the Wilcoxon rank-sum tests refer to the Figure 11b.

Finally, females and males provide the same number of non-intuitive incorrect answers and this is confirmed by the Table 19, Model 7. When we look at the effect of the two treatments on male and female respectively, we have that males under MD provide a slightly lower number of non-intuitive incorrect answers with respect to TP and Baseline (see Figure 11c). Results are confirmed by Model 8 of Table 19), although they are not significant. For females under TP the number of non-intuitive incorrect answers is haigher with respect to MD and the Baseline (Figure 11c). Results are confirmed by Model 8 of Table 19 although they are not statistically significant. Please, for the Wilcoxon rank-sum tests refer to the Figure 11c.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
							Non-Intuitive	Non-Intuitive	Non-Intuitive
	Correct	Correct	Correct	Intuitive	Intuitive	Intuitive	Incorrect	Incorrect	Incorrect
TP	-0.452	-0.536	-0.469	0.218	-0.196	0.227	0.322	0.675***	0.335
	(0.366)	(0.346)	(0.373)	(0.288)	(0.283)	(0.289)	(0.262)	(0.238)	(0.277)
TD	0.713*	0.048	0.747**	-0.498*	0.075	-0.520*	-0.255	-0.206	-0.265
	(0.366)	(0.359)	(0.374)	(0.281)	(0.290)	(0.283)	(0.273)	(0.236)	(0.289)
Female	-1.050***			0.864***			0.298		
	(0.370)			(0.290)			(0.248)		
TP×Female	-0.083			-0.429			0.377		
	(0.511)			(0.407)			(0.359)		
TD×Female	-0.638			0.546			0.042		
	(0.516)			(0.401)			(0.369)		
Exposure	0.833***	1.313***	0.417	-0.871***	-1.332***	-0.474*	-0.030	0.051	-0.130
	(0.242)	(0.336)	(0.341)	(0.195)	(0.287)	(0.263)	(0.173)	(0.218)	(0.272)
Constant	2.685***	1.540***	2.809***	2.332***	3.311***	2.207***	0.152	0.482***	0.096
	(0.269)	(0.248)	(0.282)	(0.209)	(0.204)	(0.218)	(0.195)	(0.186)	(0.221)
Gender		Female	Male		Female	Male		Female	Male
N	598	279	319	598	279	319	598	279	319
pseudo R^2	0.027	0.019	0.009	0.025	0.024	0.009	0.016	0.018	0.005

Table 19: Tobit regressions on the number of correct answers given to the CRT-L in Model 1 and 2. Tobit regressions on the number of intuitive answers given to the CRT-L in Model 3 and 4. Tobit regressions on the number of non-intuitive incorrect answers given to the CRT-L in Model 5 and 6. *TD*=1 if an individual is under Time Delay treatment, 0 otherwise; *TP*=1 if an individual is under Time Pressure treatment, 0 otherwise; *Female*=1 if female, 0 otherwise; *Exposure*=1 if individuals have seen someone of the CRT-L questions or all of the CRT-L questions, 0 if individuals have seen none of the CRT-L questions. Robust standard errors in parentheses, where: * denotes $p < 0.10$, ** denotes $p < 0.05$, *** denotes $p < 0.01$.

6 Discussion

In this Chapter, we have studied the effect of the Time Delay (TD) and Time Pressure (TP) treatments on the likelihood to provide correct, intuitive, and non-intuitive incorrect answers to the CRT-L, respectively. In particular, we have used the CRT-L by Primi et al. (2016) to test whether time manipulations are effective at fostering deliberation.

Results show that TD increases the likelihood of providing correct answers, hence suggesting that TD induces more deliberation. On the other hand, TP increases the likelihood of providing non-intuitive incorrect answers, hence suggesting that TP induces less deliberation.

It is interesting to understand why TP has such an effect on the CRT-L responses. Our results can be interpreted in two ways. One possibility is that when individuals are under TP, they do not rely much on their intuition, but they fail to reason correctly, and this leads to more noise instead of more intuitive responses. Another possibility is related to what CRT captures. Indeed there is evidence that, albeit CRT is a reliable measure of deliberation, it is not a reliable measure of intuition (Pennycook et al., 2016). It has been shown that CRT correlates with the Need for Cognition (Cacioppo and Petty, 1982), a scale that measures the tendency of individuals to engage in complex cognitive tasks, but not with the Faith on Intuition (Epstein et al., 1996), a scale that measures the individuals' tendency in engaging in effortless and intuitive tasks. To distinguish between these two possible interpretations, it seems worth exploring the possibility of constructing a reliable measure of actual intuitive decision making that is able to also capture intuitive thinking.

One might whether our results are driven by numeracy ability that correlates with CRT. It seems reasonable not to worry about such possible confounding effect because our sample is well balanced across treatments with respect to gender, age, student status, employee status, and level of education. Further evidence could be obtained by verifying a new version of the CRT that does not involve numerical abilities has been developed (Thomson and Oppenheimer, 2016).

Overall we confirm previous results on gender bias in answering the

CRT. Indeed females provided a higher number of intuitive responses and a lower number of correct answers with respect to males. Males seems to be more responsive to the cognitive manipulations than females. Moreover, females tend to perform better the more they are exposed to the CRT-L.

Our experiment was run in an online setting, and it would be of great interest to investigate whether our results can be replicated in the lab environment. Moreover, it would be interesting to run a study that is able to detect a small effect, which is f=0.25; this because we cannot exclude that the manipulation actually works although the effect is smaller than we could detect. Finally, if our novel approach is noteworthy, it can be used to test the effectiveness of the other manipulations that have been implemented to induce reliance on deliberation and intuition such as cognitive load (Swann et al., 1990; Gilbert and Hixon, 1991; Gilbert, Tafarodi, and Malone, 1993; J. F. Schulz et al., 2014), conceptual priming (Rand, J. D. Greene, and Nowak, 2012; Cappelen, Sørensen, and Tungodden, 2013; Shenhav, Rand, and J. D. Greene, 2012; Capraro, Everett, and Earp, 2019), motivated delay (Takemura, 1993; Bilancini, Boncinelli, and Luini, 2020; Bilancini, Boncinelli, and Celadin, 2020; Bilancini, Boncinelli, Capraro, et al., 2020; Bilancini, Boncinelli, and Spadoni, 2021), and ego depletion (Muraven, Tice, and Baumeister, 1998; Baumeister et al., 1998; Baumeister, 2002; Achtziger, Alós-Ferrer, and Wagner, 2018; Muraven and Slessareva, 2003; Wang et al., 2017). This experimental setting can be exploited to test and validate these other cognitive manipulations.

Supplementary Material for Chapter 3

7 Group Comparison

In Table 20 we report the percentage of the main characteristics of the sample across treatments. The distribution of individuals' characteristics is well balanced across treatments.

Variable	Mean			MW test, p-values diff=0		
	BL	TD	MD	BL-TP	BL-TD	TP-TD
Female	0.44	0.50	0.74	0.2208	0.4763	0.6285
Age	27.64	28.07	27.19	0,4851	0.5470	0.1878
Student Status	0.30	0.34	0.28	0.4013	0.6495	0.2046
Employee Status	0.67	0.65	0.62	0.7534	0.2857	0.4487
Education	1.67	1.73	1.62	0.8267	0.9834	0.8204
Previous Experience	1.53	1.53	1.45	0.7004	0.1211	0.2521
N	207	204	187			

Table 20: Descriptive Statistics. BL=Baseline; TP= Time Pressure and TD= Time Delay. Female=1 if the individual is a female; Age is the individual's age; Student Status=1 if the individual is a student at the moment of the experiment; Employee Status=1 if the individual is an employee at the moment of the experiment; Education=1 if the individual level of education is Secondary School, 2 if the individual level of education is Bachelor, 3 if the individual level of education is Master, 4 if the individual level of education is PhD, 0 otherwise; Previous Experience=1 if individuals have never seen the study, 2 if individuals have seen a similar study and 3 if individuals have seen exactly this study.

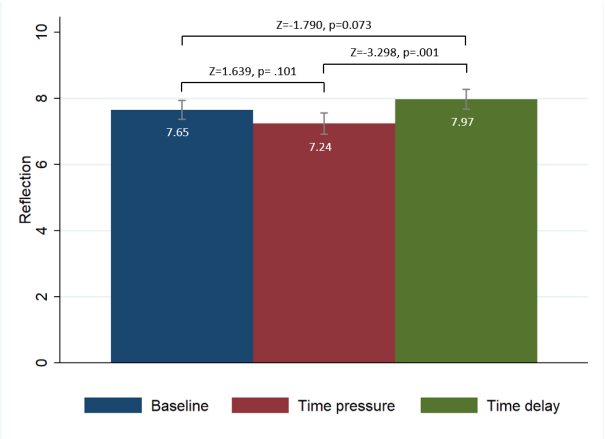


Figure 12: Level of Reflection engaged by the participants in answering the CRT-L across treatments.

As pre-registered, we look at the level of reflection engaged by the participants. Specifically, we asked participants how much they reflected upon the 6 answers of the CRT-L through a scale that goes from 0 (which means "I did not reflect at all") to 10 (which means "I reflected the maximum possible"). The distribution of the level of reflection is different across treatments, indeed the Kruskal-Wallis test finds statistically significant differences across treatments (χ^2=11.073, p-value=0.004). The pairwise comparison between treatments shows that individuals under TP reflected significantly less with respect to those under TD condition (Wilcoxon rank-sum test: z=-3.298, p-value=0.001). Between the TP condition and the Baseline there is no statistical difference (Wilcoxon rank-sum test:z=1.639, p-value=0.101). Finally, individuals under TD reflected significantly more with respect to those under the Baseline (Wilcoxon rank-sum test: z=-1.790, p-value=0.073), see Figure 12.

8 Time Analysis

We now analyse the average time spent by participants in answering the CRT-L questions across treatments. Figure 13 reports that the time spent in the Baseline is significantly higher compared with the time spent in the TP condition (Wilcoxon rank-sum test: z=8.724, p-value=0.000), and significantly lower with respect to the TD condition (Wilcoxon rank-sum test: z=-15.695, p-value=0.000). Individuals spent a greater amount of time under TD condition than under the TP condition (Wilcoxon rank-sum test: z=-17.087, p-value=0.000).

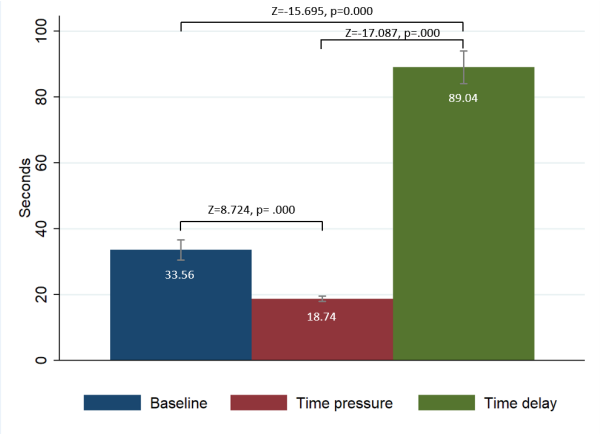


Figure 13: The average time spent in answering the CRT-L questions across treatments.

We report in Table 22 the compliance with the TP manipulations. For completeness, we run the main analysis by excluding those participants who failed in answering the CRT-L questions within the 30 seconds in the TP condition. Results are robust and we confirm the findings that we have obtained in the main analysis.

CRT-L	Answers Within the 30s	Answers After the 30s
CRT 1	96.08%	3.92%
CRT 2	92.65%	7.35%
CRT 3	93.14%	6.86%
CRT 4	99.02%	0.98%
CRT 5	97.06%	2.94%
CRT 6	90.20%	9.8%

Table 21: Percentage of individual that answered within the 30 seconds in the TP time constraint for each question of the CRT. CRT1 corresponds to the first question of the CRT-L presented in the Instruction, CRT2 to the second one, and so on.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
	Correct	Correct	Correct	Intuitive	Intuitive	Non-Intuitive Intuitive	Non-Intuitive Incorrect	Non-Intuitive Incorrect	Non-Intuitive Incorrect
TP	-0.243*	-0.265	-0.318	0.057	0.053	0.207	0.322**	0.340**	0.207
	(0.144)	(0.162)	(0.220)	(0.125)	(0.133)	(0.183)	(0.143)	(0.153)	(0.183)
TD	0.245*	0.280*	0.438**	-0.170	-0.179	-0.361**	-0.170	-0.186	-0.361**
	(0.135)	(0.148)	(0.202)	(0.119)	(0.124)	(0.174)	(0.141)	(0.151)	(0.174)
Female		-0.710***	-0.618***		0.536***	0.509***		0.263**	0.509***
		(0.127)	(0.211)		(0.105)	(0.175)		(0.126)	(0.175)
Exposure		0.551***	0.550***		-0.522***	-0.520***		-0.032	-0.520***
		(0.142)	(0.142)		(0.125)	(0.124)		(0.147)	(0.124)
TP×Female			0.114			-0.316			-0.316
			(0.319)			(0.264)			(0.264)
TD×Female			-0.354			0.363			0.363
			(0.297)			(0.248)			(0.248)
Question FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Order FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Constant	-0.298***	-0.356**	-0.392**	-0.275***	-0.275*	-0.264	-1.795***	-1.745***	-0.264
	(0.095)	(0.160)	(0.178)	(0.084)	(0.153)	(0.167)	(0.095)	(0.195)	(0.167)
N	3318	3318	3318	3318	3318	3318	3318	3318	3318
pseudo R^2	0.007	0.108	0.110	0.002	0.067	0.070	0.006	0.086	0.070

Table 22: Logit regressions on the likelihood to provide correct, intuitive, and non-intuitive incorrect answers to the CRT-L *Correct*=1 if the answer is correct, 0 otherwise; *Intuitive*=1 if the answer is intuitive, 0 otherwise; *Non-Intuitive Incorrect*=1 if the answer is non-intuitive incorrect, 0 otherwise; *TD*=1 if an individual is under Time Delay, 0 otherwise; *TP*=1 if an individual is under Time Pressure, 0 otherwise; *Female*=1 if female, 0 otherwise; *Exposure*=1 if individuals have seen someone of the CRT-L questions or all of the CRT-L questions, 0 if individuals have seen none of the CRT-L questions. Robust standard errors in parentheses clustered at the individual level, where: * denotes $p < 0.10$, ** denotes $p < 0.05$, *** denotes $p < 0.01$.

9 CRT: order effect

We now re-run the main analysis taking into account only the first half of the questions presented to the participants and the second half of the questions presented to the participants respectively. In Table 23 we run logit regressions with standard errors clustered at the individual level. Regressions suggest that the estimated coefficients (although statistical significance changes) are similar for the first and second half of the questions (see Model 1 and Model 4); results hold even when we control for gender, exposure, question and order effects (Model 2 and Model 5). The likelihood to provided intuitive answers is similar under MD, while it seems to be higher in the TP conditions for the second half of the questions of the CRT-L (Model 7 and Model 10); results hold even when we control for gender, exposure, question and order effects (Model 8 and Model 11). The coefficients are stable for the non-intuitive incorrect answers under both TD and TP, but the statistical significance changes (Models from 13 to 16).

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12	Model 13	Model 14	Model 15	Model 16	Model 17	Model 18
	Correct	Correct	Correct	Correct	Correct	Correct	Intuitive	Intuitive	Intuitive	Intuitive	Intuitive	Intuitive	Non-Int Incorrect	Non-Int Incorrect	Non-Int Incorrect	Non-Int Incorrect	Non-Int Incorrect	Non-Int Incorrect
	1-3	1-3	1-3	4-6	4-6	4-6	1-3	1-3	1-3	4-6	4-6	4-6	1-3	1-3	1-3	4-6	4-6	4-6
TP	-0.191	-0.245	-0.278	-0.333**	-0.277	-0.217	-0.114	-0.108	0.022	0.158	0.206	0.291	0.529***	0.568***	0.470*	0.282*	0.095	0.291
	(0.145)	(0.174)	(0.222)	(0.155)	(0.181)	(0.236)	(0.137)	(0.155)	(0.203)	(0.138)	(0.156)	(0.208)	(0.166)	(0.186)	(0.256)	(0.168)	(0.197)	(0.208)
TD	0.285*	0.293*	0.463**	0.205	0.275	0.424*	-0.226	-0.225	-0.399*	-0.115	-0.125	-0.317	-0.146	-0.142	-0.238	-0.192	-0.257	-0.317
	(0.147)	(0.162)	(0.224)	(0.153)	(0.167)	(0.225)	(0.138)	(0.146)	(0.210)	(0.142)	(0.147)	(0.207)	(0.189)	(0.195)	(0.292)	(0.177)	(0.187)	(0.207)
Female		-0.725***	-0.627***		-0.770***	-0.608**		0.523***	0.509**		0.568***	0.509**		0.314**	0.177		0.276*	0.509**
		(0.134)	(0.226)		(0.137)	(0.239)		(0.120)	(0.198)		(0.119)	(0.213)		(0.150)	(0.259)		(0.150)	(0.213)
Exposure		0.542***	0.539***		0.566***	0.566***		-0.530***	-0.525***		-0.591***	-0.587***		-0.004	-0.005		0.072	-0.587***
		(0.151)	(0.151)		(0.151)	(0.151)		(0.141)	(0.141)		(0.136)	(0.136)		(0.172)	(0.172)		(0.169)	(0.136)
No Compliance		0.089	0.076		-0.042	-0.044		-0.106	-0.087		-0.428*	-0.406*		0.030	0.025		0.691**	-0.406*
		(0.274)	(0.273)		(0.267)	(0.269)		(0.255)	(0.255)		(0.232)	(0.230)		(0.277)	(0.278)		(0.277)	(0.230)
TP×Female			0.069			-0.149			-0.262			-0.174			0.202			-0.174
			(0.321)			(0.336)			(0.289)			(0.290)			(0.350)			(0.290)
TD×Female			-0.376			-0.346			0.342			0.391			0.195			0.391
			(0.326)			(0.336)			(0.294)			(0.297)			(0.393)			(0.297)
Question FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Order FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Constant	-0.295***	-0.215	-0.251	-0.302***	-0.294	-0.360*	-0.243***	-0.221	-0.221	-0.308***	-0.340*	-0.311	-1.869***	-2.111***	-2.044***	-1.724***	-1.728***	-0.311
	(0.101)	(0.176)	(0.193)	(0.110)	(0.183)	(0.203)	(0.093)	(0.167)	(0.180)	(0.101)	(0.180)	(0.196)	(0.124)	(0.226)	(0.251)	(0.119)	(0.229)	(0.196)
N	1794	1794	1794	1794	1794	1794	1794	1794	1794	1794	1794	1794	1794	1794	1794	1794	1794	1794
pseudo R^2	0.007	0.108	0.109	0.009	0.117	0.117	0.001	0.065	0.068	0.002	0.073	0.075	0.013	0.077	0.078	0.006	0.107	0.075

Table 23: Logit regressions on the likelihood to provide correct, intuitive, and non-intuitive incorrect answers to the CRT-L. *Correct*=1 if the answer is correct, 0 otherwise;- *Intuitive*=1 if the answer is intuitive, 0 otherwise; *Non-Int Incorrect*=1 if the answer is non-intuitive incorrect, 0 otherwise; *TD*=1 if an individual is under Time Delay, 0 otherwise; *TP*=1 if an individual is under Time Pressure, 0 otherwise; *Female*=1 if female, 0 otherwise; *Exposure*=1 if individuals have seen someone of the CRT-L questions or all of the CRT-L questions, 0 if individuals have seen none of the CRT-L questions. *No Compliance*=1 if an individual did not comply with the time manipulation, 0 otherwise. Robust standard errors in parentheses clustered at the individual level, where: * denotes $p < 0.10$, ** denotes $p < 0.05$, *** denotes $p < 0.01$.

10 The original CRT

We now consider the effect of the time manipulations on the three original questions of the CRT (Frederick, 2005) and the three new questions of the CRT-L (Primi et al., 2016). When we consider the probability to provide a correct answer, we have that the effect of the treatments is stronger for the new CRT-L questions than the three original CRT questions, as shown by the Logit regression in Table 24 (Models 1 and 4); results hold even when we control for previous exposure to the CRT-L, gender, question and order fixed effects (Models 2 and 5). When we consider the probability to provide intuitive answers, we again find that the effect of the treatments is stronger for the new CRT-L questions than the three original CRT questions (Models 7 and 10); results hold even when we control for previous exposure to the CRT-L, gender, question and order fixed effects (Models 8 and 11). Finally, the probability of providing non-intuitive incorrect answers is similar under both treatments (Model 13 and 16); results hold even when we control for previous exposure, gender, question and order fixed effects (Models 14 and 17).

	Model 1 Correct Original	Model 2 Correct Original	Model 3 Correct Original	Model 4 Correct New	Model 5 Correct New	Model 6 Correct New	Model 7 Intuitive Original	Model 8 Intuitive Original	Model 9 Intuitive Original	Model 10 Intuitive New	Model 11 Intuitive New	Model 12 Intuitive New	Model 13 Incorrect Original	Model 14 Incorrect Original	Model 15 Incorrect Original	Model 16 Incorrect New	Model 17 Incorrect New	Model 18 Incorrect New
TP	-0.218	-0.156	-0.242	-0.305**	-0.389**	-0.269	-0.043	-0.056	0.102	0.092	0.163	0.219	0.548***	0.444**	0.350	0.314**	0.262	0.057
	(0.161)	(0.181)	(0.230)	(0.133)	(0.175)	(0.229)	(0.144)	(0.163)	(0.213)	(0.129)	(0.144)	(0.200)	(0.189)	(0.211)	(0.290)	(0.148)	(0.172)	(0.250)
TD	0.134	0.131	0.361	0.356***	0.458***	0.535**	-0.089	-0.078	-0.354*	-0.269**	-0.287**	-0.364*	-0.121	-0.131	-0.098	-0.203	-0.235	-0.306
	(0.162)	(0.165)	(0.220)	(0.137)	(0.168)	(0.227)	(0.149)	(0.153)	(0.209)	(0.136)	(0.142)	(0.199)	(0.200)	(0.204)	(0.290)	(0.169)	(0.184)	(0.271)
Female		-0.755***	-0.647***		-0.746***	-0.595**		0.678***	0.612***		0.407***	0.403**		0.122	0.051		0.413***	0.213
		(0.138)	(0.230)		(0.137)	(0.237)		(0.126)	(0.211)		(0.112)	(0.201)		(0.159)	(0.286)		(0.139)	(0.238)
Exposure		0.797***	0.794***		0.269*	0.272*		-0.836***	-0.834***		-0.269**	-0.267**		0.063	0.059		0.030	0.024
		(0.152)	(0.152)		(0.152)	(0.152)		(0.147)	(0.147)		(0.130)	(0.130)		(0.186)	(0.186)		(0.152)	(0.151)
No Compliance		-0.159	-0.179		0.228	0.240		-0.130	-0.100		-0.409*	-0.398*		0.429	0.420		0.272	0.258
		(0.271)	(0.271)		(0.254)	(0.254)		(0.254)	(0.251)		(0.223)	(0.223)		(0.278)	(0.276)		(0.253)	(0.254)
TP×Female			0.185			-0.281			-0.321			-0.113			0.195			0.407
			(0.331)			(0.325)			(0.299)			(0.271)			(0.383)			(0.323)
TD×Female			-0.536			-0.181			0.581*			0.150			-0.062			0.155
			(0.341)			(0.335)			(0.312)			(0.283)			(0.404)			(0.365)
Question FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Order FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Constant	-0.381***	-0.266*	-0.309*	-0.217**	-0.222	-0.285	-0.029	-0.263*	-0.235	-0.531***	-0.293**	-0.292*	-2.181***	-1.998***	-1.965***	-1.492***	-1.879***	-1.782***
	(0.111)	(0.148)	(0.170)	(0.096)	(0.153)	(0.175)	(0.101)	(0.141)	(0.163)	(0.096)	(0.138)	(0.160)	(0.141)	(0.200)	(0.228)	(0.110)	(0.182)	(0.209)
N	1794	1794	1794	1794	1794	1794	1794	1794	1794	1794	1794	1794	1794	1794	1794	1794	1794	1794
pseudo R^2	0.004	0.061	0.065	0.013	0.166	0.166	0.000	0.068	0.074	0.004	0.053	0.054	0.013	0.042	0.042	0.007	0.102	0.103

Table 24: Logit regressions on the likelihood to provide correct, intuitive, and non-intuitive incorrect answers to the CRT-L. *Correct*=1 if the answer is correct, 0 otherwise; *Intuitive*=1 if the answer is intuitive, 0 otherwise; *Non-Int Incorrect*=1 if the answer is non-intuitive incorrect, 0 otherwise; *TD*=1 if an individual is under Time Delay, 0 otherwise; *TP*=1 if an individual is under Time Pressure, 0 otherwise; *Female*=1 if female, 0 otherwise; *Exposure*=1 if individuals have seen someone of the CRT-L questions or all of the CRT-L questions, 0 if individuals have seen none of the CRT-L questions. *No Compliance*=1 if an individual did not comply with the time manipulation, 0 otherwise. Robust standard errors in parentheses clustered at the individual level, where: * denotes $p < 0.10$, ** denotes $p < 0.05$, *** denotes $p < 0.01$.

11 Instructions

Below we provide full instructions of our Study
WELCOME!
Please before starting, enter your Prolific ID.
next
Processing Personal Data
You will not be asked to provide any personally-identifying information during this study. Your data will be anonymous and confidential (i.e., any information you provide cannot be traced back to you). The information collected may be used in future projects closely related to this research. The result of this study will be published on journal articles and presented at conferences. The raw data (from which you cannot be identified) will be kept for a minimum period of five years after the publication process is complete.

We will ask you to complete a quick task and a short questionnaire. We invite you to focus on the study, it should take approximately 6 minutes to complete it. Please avoid distractions during the study, silence your mobile phone and turn off the television/music. Please note that you have the right to withdraw consent at any time.

You can reach out to the researcher (tatiana.celadin@imtlucca.it) if you have any questions related to this study.

Clicking on the **Agree** button below indicates that:

- You have read the above information;
- You voluntarily agree to participate;
- You are at least 18 years of age.

If you do not wish to participate in this research study, please decline participation by clicking on the **Disagree** button, you will be redirected to Prolific main page.

next

(Individuals under the Baseline condition faced these Instructions)

Instructions

In the following screens you will be asked 6 different questions.
Please choose what you think is the correct answer for each question.

(Individuals under the Time Pressure condition faced these Instructions)

Instructions

In the following screens you will be asked 6 different questions.
Please choose what you think is the correct answer for each question.
Try to answer each question within 30 seconds.

(Individuals under the Time Delay condition faced these Instructions)

Instructions

In the following screens you will be asked 6 different questions.
Please choose what you think is the correct answer for each question.
You have to wait 1 minute before entering your answer.

next

Question

A pen and a paper cost $1.10 in total. The pen costs $1.00 more than the paper. How much does the paper cost?

Only participants in the TD condition faced the following instructions above the box where they were allowed to insert the answer

After one minute has passed, a box will appear here below where you can write your answer.

Only participants under the Time Pressure and only those who failed to answer within 30 seconds faced the same CRT question with the following instructions:

Please try to answer the question in a short amount of time
Time taken to answer the question: *a timer was shown to the participants*

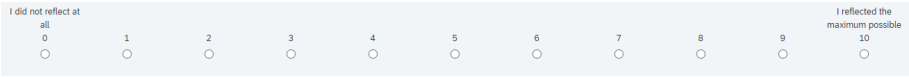
next

Question

If it takes 5 nurses 5 minutes to measure the blood pressure of 5 patients, how long would it take 100 nurses to measure the blood pressure of 100 patients?

next

Question



In a rabbit breeding farm, each rabbit lives in 1 cage. The rabbit population doubles every month. If it takes 48 months to fill all the cages in the farm, how long would it take to fill half of them?

next

Question

If 3 elves can wrap 3 toys in 1 hour, how many elves are needed to wrap 6 toys in 2 hours?

next

Question

Jerry received the 15th highest and the 15th lowest mark in the class. How many students are there in the class?

next

Question

In an athletics team, tall members are three times more likely to win a medal than short members. This year the team has won 60 medals so far. How many of these have been won by short athletes?

next

In this part, you will be asked some questions.

next

QUESTIONNAIRE

Please enter the following information:

Honestly, **how much did you carefully reflect** upon the 6 answers you gave to the questions just faced?

Please, answer by choosing **a level of reflection** in the scale below that goes from 0 (which means "I did not reflect at all") to 10 (which means "I reflected the maximum possible"):

Your age

Your gender (Male, Female)

Your level of education (Secondary School/Bachelor/Master/PhD/Other)

Filed of study (Economics, Maths...)

Are you a student now? (Yes/No)

Are you an employee now (Yes, No)
To what extent have you participated in studies like this one before? (Nothing like this study/ Somewhat like this study/ Exactly this study)
Have you seen the questions presented before in other studies? (Yes, all of them/ Some of them/ No, None of them)
next
THANK YOU!
Thank you for participating.
You will see your earnings on your Prolific Profile after the experimenter has confirmed your payment.

Conclusions

According to the Social Heuristic Hypothesis (SHH), humans internalize as heuristic those behaviors that are successful and experienced daily. Interactions are generally repeated, and thus cooperation may evolve thanks to the 5 rules (Nowak, 2006). Cooperation can be internalized and used as a default strategy in new interaction settings. Likewise, if individuals experience non-cooperation daily, they internalize selfishness as heuristic. While through deliberation, individuals can calculate the pay-off dominant strategy in the one-shot strategic interaction, that is defection. Thus, SHH predicts that cooperation in one-shot anonymous interactions is the result of an intuitive process, while deliberation leads to defection. A series of studies successfully tested the prediction of the SHH, but many other studies failed in the attempt to replicate the result (see the two meta-analyses: Rand, 2019; Kvarven et al., 2020).

The main aim of this Dissertation is to reconcile the mixed evidence and extend the current research on cooperation to explore potential moderators of the effect of cognition on cooperation. In the first Part (Chapters 1 and 2), we look at three potential drivers of cooperation, namely altruism, reciprocity and social norms. While in the second Part (Chapter 3), we develop a novel methodology to validate the treatments designed to manipulate the modes of cognition. In Section 1 we provide an overview of the main contributions of each Chapter, in Section 2 we draw the concluding remarks.

1 Chapters' Contribution

In the first Chapter, we have explored two determinants of cooperative behavior, altruism and reciprocity, and their dependency on the modes of cognition. The research question that we have investigated is:

> **RQ1:** ***What is the role of altruism and reciprocity in determining the level of cooperation in a Public Goods Game, and how they moderate the effect of the cognition?***

To answer this question, we ran two online studies where individuals played a one-shot anonymous Public Goods Game (PGG). In the first study, participants played the PGG without any cognitive manipulations. We measured the disposition to be a Conditional Cooperators as a proxy of reciprocity, beliefs about others' contributions, and Social Value Orientation as a proxy of altruism. The second study was identical to the first one, with the exception that participants played the PGG under two conditions designed to foster intuition and deliberation respectively: Time Pressure treatment and Motivated Delay treatment. We have provided experimental evidence suggesting that, in the online one-shot PGG, a higher Social Value Orientation score goes with higher contribution levels, irrespective of the cognitive modes, while measures of the disposition to be a conditional cooperator predict contribution levels only under treatment designed to foster deliberation. It would be interesting to understand why reciprocity plays such a role under deliberation. The disposition to cooperate may require mentalizing others' behavior, which may involve more deliberation. Another possible explanation is related to how reciprocity is measured. Indeed strategy method may capture only the deliberative disposition to reciprocate, and it might not be able to capture a more intuitive disposition to reciprocate. Future work could explore these potential explanations in more details.

In the second Chapter, we have explored two determinants of cooperative behavior, altruism and social norms, and their dependency on the modes of cognition. The research question that we have investigated is:

> **RQ2:** ***What is the role of altruism and social norms in de-***

termining the level of cooperation in a Public Goods Game, and how they moderate the effect of the cognition?

To answer this question, we ran an online study where individuals played a one-shot anonymous Public Goods Game under two conditions designed to foster intuition and deliberation, respectively: Time Pressure and Motivated Delay treatments. We measured descriptive and injunctive norms. We have used beliefs about others' average contribution to the public good as a proxy for the former and the evaluations of all possible contribution levels' social appropriateness as a proxy for the latter. We computed relative social appropriateness, a new measure of injunctive norm compliance, that captures the individuals' assessment of their own choices' social appropriateness with respect to all other possible choices. Furthermore, we measured the Social Value Orientation. We have provided experimental evidence that Motivated Delay significantly increases the level of contribution and the descriptive norm. Moreover, Motivated Delay treatment makes the injunctive norm more extreme. Social Value Orientation is not affected by cognitive manipulation as in the previous Chapter. This is consistent with the possibility that social norms act as mediators of the effect of the cognitive manipulations on the levels of contribution. It would be of interest to explore how Motivated Delay increases contributions and the associated norms. It is possible that when we ask people to write their motivation, they tend to write cooperative motivations rather than selfish ones, affecting the associated norms.

In the previous Chapter, we found no significant difference in the level of contributions and beliefs under the two treatments, while here we do find a higher level of contribution and beliefs under Motivated Delay with respect to Time Pressure. It is possible that the results are due to the sample size. In fact, in the first Chapter we have collected half of the participants collected in this second one and this can affect the detectable effect size of the two studies.

Finally, in the third Chapter we have studied whether time manipulations are effective in fostering reliance on intuition and deliberation by means of Cognitive Reflection Test (CRT). The research question that we have investigated is:

RQ3: ***Are time manipulations effective in fostering reliance on intuition and deliberation?***

To answer this question, we ran an online study where individuals had to answer the CRT in the long version of six items by Primi et al., 2016 (CRT-L) under three conditions: a baseline, a Time Delay condition to foster reliance on deliberation, and a Time Pressure condition to foster reliance on intuition. We found that the Time Delay condition increases the likelihood to provide correct answers to the CRT-L, while the Time Pressure condition induces more non-intuitive incorrect answers rather than more intuitive answers. Results suggest that Time Delay increases the disposition to deliberate, while Time Pressure seems to reduce the reliance on deliberation. Specifically, Time Pressure increases the likelihood to provide non-intuitive incorrect answers rather than intuitive answers. One possible interpretation is that Time Pressure increases the likelihood of making a mistake rather than the likelihood of relying on intuition. Another explanation is related to what CRT captures; it has been argued that it is not a reliable measure of intuition (Pennycook et al., 2016). Further research should try to clarify this issue by implementing a new version of the CRT that captures the disposition of behaving intuitively to better understand the Time Pressure manipulation's effectiveness. Moreover, it would be of great interest to explore the effect of the other cognitive manipulations (see Table 1 in the Introduction) on the CRT-L to test their effectiveness.

2 Concluding Remarks

A central question in the literature concerns whether cooperation is greater when people make decisions relying on intuitive processes or whether it requires more deliberation, but there is no agreement in the literature. Thus in the last period, scholars have started to take into account humans' heterogeneity by focusing on some factors that may act as potential moderators of the effect of cognition on cooperation.

We have found that contributions to the Public Goods Game under the two cognitive manipulations are not statistically different in Chapter

1, while in Chapter 2 contributions under Motivated Delay are statistically higher with respect to contributions under Time Pressure. Our findings do not suggest that intuition favors cooperation, but this is not necessarily in contrast with the SHH. Notice that we are comparing the effect of the Motivated Delay with respect to the Time Pressure, but there is no comparison between the two treatments with respect to a baseline. Moreover, the results in the third Chapter suggest that the Time Pressure treatment decreases the reliance on deliberation but it is not clear whether it increases reliance on intuition or the likelihood to make mistakes. A potential alternative could be that under deliberation individuals do compute the expected pay-off but they do so with respect to some social preferences instead of selfish preferences, and this may lead to some cooperation under deliberation.

Humans are heterogeneous, and taking into account these factors can have different effects on the level of cooperation and exploring these factors is crucial to have a better understanding of the relationship between the modes of cognition and human behavior. Here we have studied the role of altruism, reciprocity, and social norms. We have found that altruism accounts for contributions regardless of our cognitive manipulations (both in Chapters 1 and 2). The disposition of being a conditional cooperator increases the level of cooperation under Motivated Delay and this seems to suggest that individuals are more reactive to beliefs about others' contributions. We have also found that Motivated Delay impacts the associated social norms. Specifically descriptive norms are higher under Motivated Delay as well as the injunctive norms (i.e., small contributions are perceived as less socially appropriate, while large contributions as more socially appropriate). Our findings suggest that cooperation is sometimes intuitive or sometimes deliberative. The actual cognitive mode is more conducive to cooperation depending on the decision-makers' heterogeneous characteristics and their present and past social environment.

Finally, we have looked at the effectiveness of the cognitive manipulations (Chapter 3). Our results suggest that Time Delay increases reliance on deliberation, while Time Pressure decreases it, but it is not clear

whether it increases reliance on intuition. In fact, Time Pressure treatment increases the likelihood to provide non-intuitive incorrect answers, but we cannot easily conclude that CRT does not induce intuition. Indeed there is evidence that CRT does not capture intuitive predisposition (Pennycook et al., 2016). Further research should be conducted to have a clear view of the role of the Time Pressure treatment, because this can bring new information on the underlying mechanism of this treatment, and thus to have a better understanding of the experimental evidence using such treatment to study the effect of intuition on cooperation.

In Table 25 we provide in a nutshell the Dissertation's main findings and further research that can be conducted.

Table 25: Dissertation's contributions

Chapter	Research Question	Findings	Further Research
Chapter 1	What is the role of altruism and reciprocity in determining the level of cooperation in a Public Goods Game and how they moderate the effect of the cognition?	Contributions to PGG are not different in the two treatments. Altruism goes with larger contribution levels under both treatments, while reciprocity predicts contribution levels only under the treatment designed to foster deliberation	Develop a measure that captures the disposition to reciprocate intuitively in order to test if the role of beliefs is related to intuitive reciprocity
Chapter 2	What is the role of altruism and social norms in determining the level of cooperation in a Public Goods Game, and how they moderate the effect of the cognition?	Contributions to PGG and descriptive norms are higher under treatment designed to foster deliberation, and injunctive norms are more extreme under the treatment designed to foster deliberation	Study the effect of Time Delay compared to Motivated Delay on cooperation and social norms and understand the effect of the Motivated Delay treatment
Chapter 3	Are time manipulations effective in fostering reliance on intuition and deliberation?	Time Delay increases the likelihood to provide correct answers online, while Time Pressure increases the likelihood to provide (non-intuitive) incorrect answers online	Develop a new measure to capture the disposition to behave intuitively. Test the effectiveness of the other cognitive manipulations by means of the answers given to the CRT

Note: the further lines of research illustrated in the Table are just some of the various, possible lines connected to our findings.

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