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Incentives and social preferences impact on pro-environmental behavior : Insights from experimental economics

Mira Toumi

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THÈSE DE DOCTORAT

Etude expérimentale de l'impact des incitations et préférences sociales sur les comportements pro-environnementaux.

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Groupe de Recherche en Droit, Economie et Gestion

**Présentée en vue de l'obtention
du grade de docteur en Sciences
économiques d'Université Côte d'Azur**

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Etude expérimentale de l'impact des incitations et préférences sociales sur les comportements pro-environnementaux.

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Abstract

Incentives and social preferences impact on pro-environmental behavior: Insights from experimental economics.

In the context of growing concern for the environmental challenge, the objective of this thesis is to bring some insights on possible links between incentives, social preferences and the environmental context.

Chapter 1 is a general introduction. Chapter 2 provides a survey of the experimental research disciplines studying Pro-Environmental Behavior both in the discipline of Economics and Psychology. Thanks to a thematic inventory of the published experiments, we identify the main determinants of Pro-Environmental Behaviors investigated in economics and psychology. Moreover, we provide a statistical description of studies evolution in time.

Chapter 3 adapts a public good game to waste management issue. In the context of greenhouse gases emissions reduction, policy makers design different types of incentives to act on individual behaviors. In the experiment, the players have to cooperate in order to reduce the cost of waste sorting treatment. We compare the impact of a sanctioning tax with the impact of a nudge in the form of a third party advice. Results show that advice, sanction and the threat of sanction significantly increase cooperation, with a stronger disciplinary effect for the applied sanction.

Chapter 4 considers the nature of individuals' preferences expression, namely a monetary salient effort and an attentional effort. In this chapter we investigate the relation between social preferences and attentional contribution in a pro-social environment. For this purpose, we present a new experiment where subjects have to invest real attention, then we compare a selfish and pro-social incentives. The results show that both incentives increase allocated attention. Moreover, in contradiction with economic theory, we find that subjects' social preferences failed to explain attentional contribution in pro-social environments.

Keywords: Pro-environmental behavior, Preferences, Incentives, Experiment.

Résumé

Etude expérimentale de l'impact des incitations et préférences sociales sur les comportements pro-environnementaux.

Dans un contexte de préoccupation croissante pour le défi environnemental, l'objectif de cette thèse est d'apporter quelques pistes de réflexion sur les liens entre incitations et les préférences sociales dans un contexte de choix impliquant des conséquences environnementales. Le chapitre 1 constitue une introduction générale au contexte de notre étude. Le chapitre 2 vise à fournir un aperçu de la recherche expérimentale étudiant le comportement environnemental dans les disciplines de l'économie et la psychologie expérimentales. Grâce à un inventaire thématique bibliographique des expériences publiées, nous identifions les principaux déterminants du comportement pro-environnemental et nous décrivons l'évolution de ces études au fil du temps.

Le chapitre 3 adapte un jeu de bien public (PGG) à la question de la gestion des déchets. Poursuivant le but de réduction des émissions de gaz à effet de serre, les décideurs conçoivent différents types d'incitations pour agir sur les comportements individuels. Dans notre expérience, les acteurs doivent coopérer afin de réduire le coût du traitement du tri des déchets, ce dernier modélisé au moyen d'un taux d'imposition variable. Les résultats montrent que le conseil, la sanction et la menace de sanction augmentent considérablement la coopération, avec un effet disciplinant plus fort pour la sanction.

Le chapitre 4 considère la nature de l'expression des préférences des individus. Ce chapitre étudie la relation entre les préférences sociales et la contribution attentionnelle dans un environnement pro-social. A cette fin, nous présentons une nouvelle expérience où les sujets investissent une réelle attention pour exprimer leurs préférences, puis nous comparons une incitation du type égoïste à une autre pro-sociale. Les résultats montrent que les deux incitations augmentent l'attention accordée. De plus, contrairement aux enseignements de la théorie économique standard, nous trouvons que les préférences sociales des sujets n'expliquent pas la contribution attentionnelle dans un environnement pro-social.

Mots clés : Comportement pro-environnemental, Préférences, Incitations, Expériences.

**Incentives and social preferences impact on
pro-environmental behavior:
Insights from experimental economics.**

Mira Toumi

A thesis presented for the degree of
Doctor of Philosophy (PhD)
in Economics



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“Experiment! Make it your motto day and night. Experiment, and it will lead you to the light... If this advice you only employ, the future will offer infinite joy, and merriment... Experiment... And you’ll see!”

Cole Porter (1933) in Friedman and Cassar (2004)

To Sofiane...

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List of abbreviations

- PEB Pro-Environmental Behavior
- PGG Public Good Game
- WTP Willingness To Pay
- RT Response Time
- ER Error Rate
- SD Standard Deviation
- UN United Nation
- CPE Comportement Pro-Environnemental

CHAPTER 1

General Introduction

1.1 The environmental context

“We must act all together. It is not governments only, but also business, civil societies and volunteers. This is our world, this is our planet [...]. If we can not swim together, we all will sink. There is no Plan B because there is no Planet B.”

Ban Ki-moon, New York, 2014

These were the words of the Secretary-General of the United Nations few years ago, at the opening of the climate week in New York. The UN secretary explained that climate concern was a key issue of our time. Moreover, he urged the audience explaining that the change have to happen now, at all levels of the society. His speech had a great echo and the newly elected French President Emmanuel Macron used it to respond to the withdrawal of the United States from the Treaty of Paris on climate signed in 2015. In this agreement, each country had the choice to determine its plan according to its internal conditions in order to mitigate global warming. As recalled by the French president, despite the United States new position, the rest of the countries will continue to join their efforts in order to “Make our planet great again!”.

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In the recent years, The World Health Organization published several reports on climate change and health¹. The conclusions showed the responsibility of humans in global warming. Over the past 50 years, human activities generated enough greenhouse gases to affect the global climate causing irremediable consequences. Among them, the increase in global average temperatures. From the 1960s, the global world temperature did not stop increasing. For France, Baude et al. (2016) present some key figures on climate change and show that 2015 was among the warmest years since 1990. Moreover, the simulations show that expected days with abnormally high temperatures will increase every year. The Lancet Commission on pollution and health report that in 2015, the pollution is involved in 1 out of 6 deaths in the world (Landrigan et al., 2017). Again the predictions on the future are not reassuring as the World Health Organization estimates the distressing number of 250,000 additional deaths per year due to climate change.

To face this situation, policy makers have a key role in designing and implementing effective policies. However, they cannot act alone, as sustaining the effects over the long term requires the individual commitment of citizens, generating with their behaviors positive externalities or at least, limiting the negative ones².

Individual decisions matter!

“One day, says the legend, there was an immense forest fire. All the terrified animals watched the disaster as helpless. Only the little hummingbird was busy, fetching a few drops with his beak to throw them on the fire. After a moment the armadillo, annoyed by this derisive agitation, said to him: “Humming bird, you are not mad, you are not going to put out the fire with these drops of water!” And the hummingbird replied: “I know, but I do my part.” (Rabhi, 2015)

¹ Available on <http://www.who.int/en/>

²The notion of externality (positive or negative) is used in environmental economics and represents the effect on the society due to the consumption or the production of a good (Pigou, 1924). A well known example of negative externality is the air pollution.

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The everyone's contribution matters in averting climate change. Literature shows that various environmental problems are rooted in human behavior and that modification of the human behaviour can be the way to reduce environmental damages (Vlek and Steg, 2007). These behavioral changes might concern the actions of individuals (recycling, saving energy), communities (urban farms), organizations (environmental management system). (Dietz et al., 2009) have shown that in the United states a 7% decrease in carbon emission can be obtained by modifying the individual behaviors in household activities, without sacrificing quality of life. Thus, a better understanding of individual's decision making process might give a substantive contribution to the governments in the design of environmental policies aiming to reduce global warming. Policy makers need to identify the characteristics of both the individuals who are/are not environmental friendly and the roots of their behavior to better target their incentive campaigns.

1.2 Theoretical framework

Public environmental good

The behavioral economics approach routinely measures the range of pro-social behaviors using methods that rely upon the assumption of irrational choice and revealed preferences (Frey and Meier, 2004; Levitt and List, 2007). For instance, the environmental goods such as clean air protection is often described as a social dilemma problem, i.e. a situation of a collective action in which there is a conflict between individual and collective interest. Precisely, researchers considered the Public Good Game (PGG) as a convenient framework to theoretically and experimentally study environmental behaviors and individuals' revealed preferences, as environmental goods provision is a typical public good funding problem influenced by socio-psychological factors (Noussair and van Soest, 2014; Croson and Treich,

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2014; Shang and Croson, 2009). The well-being of the participants to the game increases if all the participants contribute to the common good. Following this logic, Chapter 3 proposes an environmental public good game in which subjects can contribute to the funding of a common dustbin and reduce the level of pollution in their community.

The PGG implies common goods that combine two characteristics, namely the non-rivalry, i.e. individual's consumption of the good does not reduce the availability for the other individuals, and non-excludability, i.e. nobody can be excluded from benefiting from the provided good.

On one hand, these two characteristics of the common goods make them desirable for social planners. On the other hand, individuals are not encouraged to cooperate and contribute to the good funding because the benefit they have from the action of contributing is lower than the cost of contribution. Given that the non-exclusivity holds also if an individual does not contribute to provision of the good, some individuals do not contribute and benefit from others contributions. This individuals are known as *free-riders*. For Samuelson (1954), *free-riding* is the main problem with the voluntary contribution to public goods, since the individuals benefiting from them are incentivized to not contribute. *Free riders* act as predicted by the full rationality assumptions of standard economic models, causing situation of sub-optimality.

Several laboratory experiments use a PGG structure and study the conflict between individual and global interest (see Van Lange et al. (2013) and Chaudhuri (2011) for a review). The literature provides insights to understand how incentives and social preferences can encourage socially advantageous behaviors. Several experimental studies have shown that public goods provision can be influenced by the modification of the game structure through the introduction of information about the behavior of partners (Fischbacher et al., 2001), permitting punishment (Fehr and

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Gächter, 2000; Bowles et al., 2001), implementating nudges, or by giving players the possibility of communication (Chaudhuri et al., 2006).

How to explain individual contribution to public goods? Fehr and Schmidt (1999) explain the contribution to public goods observed in lab experiments by the strength of distributional social preferences like inequity aversion that push individuals to deviate from self-interested behavior assumption. For Bénabou and Tirole (2006), contributing and increasing the group benefit permit to the individual to find in these consequences his own benefit. In a theoretical model, the authors investigate how social norms and reputations concern impact on pro-social behavior. They however show that incentives if not properly designed might interfere in the sens of the behavior, leading to a motivation crowding out.

Introducing incentives and changing the structure of the game might also affect the level of contributions to public goods. For instance, punishing the non-contributors and nudging incentives have shown their effectiveness in increasing public goods provision. In this thesis, we compare a traditional public policy that relies on a monetary incentive (taxation) with a non-monetary incentive relying on a nudge (advice).

Literature has shown that punishment of group members increase cooperation. Moreover, some individuals are willing to engage in a costly punishment in order to enforce a cooperative norm (Bowles et al., 2001; Fehr and Gächter, 2000). A strand of literature investigates the impact of the punishment in the case where the latter is given by a third party, i.e. a player who can not contribute. Gürerck et al. (2006) investigate the impact of a sanction applied by an institution with the objective of creating a contribution norm. This study shows that the contributions of individuals who are incentivized with a third party sanction increase their contribution.

Laboratory experiment show that punishing non-contribution behavior is not the only way to increase contributions, but other elements like allowing communi-

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cation or providing a common knowledge advice increase contributions (Chaudhuri et al., 2006). The more recent economic literature shows an interest in another form of communication by using *nudges*. Introduced by Thaler and Sunstein (2009) as cost-less tools aiming to improve decision making and correcting behaviors, this non-monetary incentive has the particularity of not changing the decision options structure. Nudges became popular being a cost-less alternative tool for policy makers in implementing incentive policies to promote green behavior for instance³. In the environmental field, both psychologists (Schultz et al., 2007; Nolan et al., 2008) and economists (Allcott, 2011; Ayres et al., 2013; Costa and Kahn, 2013) have tested their impact on individual behavior, and validated its efficiency on shaping behaviors, mostly on energy consumption. However, literature shows that the understanding the mechanisms underlying the effects of nudges remains in an exploration phase (Mongin and Cozic, 2018). This new type of incentives based on individuals' limited rationality open a large set of possibilities of looking at the issue of decision making in general and Pro-Environmental Behavior (PEB) in particular. Limited rationality involves the limited cognitive abilities of the individual when she takes a decision, such as her attentional processes.

As seen previously, the contribution in a PGG usually takes the form of an amount of effort (money) decided by the individual. However, when we think about some kinds of PEBs like waste sorting or turning off the light, these actions do not require monetary investment, but rather a cognitive cost such as attention. So a question arises: what would be the investment of the individual if her contribution was not monetary but represented by the attention paid? Can we generalize the results of traditional PGG to all types of investments an individual can do? Does social preferences expression remain the same if we consider an attentional effort?

³We have to notice however the existing debate on the concept of nudge among behavioral researchers like Hansen (2016) and Mongin and Cozic (2018). A brief discussion on the topic is presented in chapter 2.

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Attention becomes an important issue when we consider that many pro-social behaviors require a contribution in the form of attention rather than a monetary effort. For instance, when an individual has to select a dustbin to throw a waste, paying attention increases the probability of choosing the proper dustbins, and thus decreases the waste treatment costs and negative externalities on the environment quality.

The study of attention as an economic concept has gained importance since the late 1990s (Festré and Garrouste, 2015a). To express their preferences, individuals need to pay attention to investigate alternatives' possible outcomes. Paying attention reduces the uncertainty of the choice (Sims, 2003). However, since the available amount of attention is limited, an attention allocation problem appears: the individual may not consider all the available alternatives (Caplin et al., 2011; Masatlioglu et al., 2012; Manzini and Mariotti, 2014; Sitzia et al., 2015; Li et al., 2016).

In this thesis, we contribute to this research strand by investigating to what extent the expression of social preferences is affected by the attentional nature of the contribution.

1.3 Aims and methodology

The general purpose of this thesis is to contribute to the economic literature on decision making involving pro-social and pro-environmental behavior. We aim to answer three questions:

- What are the main determinants of pro-environmental behavior studied in experimental and behavioral literature?
- What is the relative impact of different kinds of incentives, monetary incentive and nudge (advice provision) in encouraging public good provision and pro-environmental behavior?

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- How do subjects express their social preferences according to the nature of the contribution?

To answer to the first question we rely on a bibliometric analysis, while for the second and third questions we rely on laboratory experiments.

Bibliometric analysis

Over the last years, inter-disciplinarity has been regarded as desirable approach which should be encouraged (Gibbons et al., 1994). Interdisciplinarity can be defined as the integration of different disciplines working on a common subject. In the literature review presented in Chapter 2, we describe how articles in the disciplines of experimental economics and psychology study PEB. Bibliometric analyses permit to trace quantitatively the evolution of the research in both disciplines on a specific subject (Van Raan, 2003).

Experimental method in economics

Chapter 3 and Chapter 4 of this thesis use laboratory experiments. Precisely, Chapter 3 uses a standard Public Good Game to study the evolution of individual contributions under two conditions: an *ex ante* advice and an *ex post* punishment from a third party. This study enriches the existing literature on PGG experiments. Chapter 4 relies on an original experimental design elaborated by the authors.

Definition and characteristics

The use of experiments in economics has increased over the last few decades. The methodology has gained legitimacy thanks to Vernon Smith's Nobel Prize in 2002 for having established laboratory experiments as a tool in empirical economic analysis, especially in the study of alternative market mechanisms. More recently, in 2017, a second Nobel Prize has been assigned to Richard Thaler for his work on "Nudges".

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Experimental economics aims to reproduce in a laboratory simplified situations with controlled variables (Roth, 1988). According to Plott (1991), economics is one of the few disciplines having both field and laboratory to conduct its empirical investigations. Several experimental studies has shown that individuals' decision making differs from what predicted by theoretical models. Controlled experiments permit to produce data more compatible with the models that scholars aim to test, contrary to empirically collected data that could be noisy and contain errors in the measured variables.

The experimental method presents three main advantages in decision making study (Roth, 1988; Denant-Boémont et al., 2008). First, testing of the theoretical predictions and finding the irregularities with the real behavior of the individuals. Second, providing recommendations to policy makers to design more efficient policies. Third, searching for facts by exploring situations that are not enough theorized in the literature.

The new methodology rises the concern of the external validity of the laboratory results. Levitt and List (2007) discuss the results of laboratory experiments and provide reliable inferences to describe behavior of individuals in real life. The authors argue that laboratory results do not always reflect the real behavior, not necessary because individuals behave inconsistently, but because there is not sufficient control of relevant aspects of the choice situation during the experiment. However, laboratory experiments might help in understanding qualitative effects, and provide insights on the possible reactions in reality. When properly designed, laboratory experiments provide the great advantage of collecting a large number of data properly controlled and at a lower cost with respect to the price of access to some data-bases.

Experiments in economics and in psychology

Several books and articles describe the experimental methodology (Smith, 2002;

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Guala and Salanti, 2001; Etchart-Vincent, 2007; Denant-Boémont et al., 2008), and its differences with respect to experimental practices in psychology (Serra, 2012; Cassar and Friedman, 2004; Etchart-Vincent, 2006; Ohana, 2004). Experimental economics and psychology present some similarities. According to Smith (1982), the methods applied in both disciplines are based on three key parameters representing the study variables. First, the *environment* representing the characteristics of the participants; second, the *institution* representing the task to accomplish and the experimental instruction. Third, the *behavior* of the participants and their reactions, representing the dependent variable to explain. The *environment* and *institution* represent the independent variables to test ⁴.

Despite the common basis on the experimental procedures for the two methods, economic experiments differ from psychology experiments for three reasons (Ohana, 2004; Schram, 2005; Hertwig and Ortmann, 2001). First, the content of experimental instructions. Economists provide to subjects detailed formal written instructions containing the role of each subjects and how the interactions work and the possible payoffs depending on their decisions. Psychologists describe the experiment and tasks orally. Second, the use of deception during the experiment. Experimental economics ban the use of deception, while experimental psychologists are allowed to mislead the subjects on the true nature of the task. Third, the use of incentives. Economists pay subjects in cash based on their decisions and performance during the experiment. The payment of subjects in psychology experiments is not systematic. When a payment is provided, it is a flat amount unrelated to the performance. Properly designed monetary incentives aim at insuring the salience of individual choices. The individuals have to make real and not hypothetical choices. Finally, to insure the replicability of the experimental designs, experimental economics deals with de-contextualized situations.

⁴ See Ohana (2004) for more details.

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Experiments and environmental economics

Connections between experimental economics and environmental economics are present in the literature. For instance, the studies on Willingness To Pay and PGG experiments (Joireman et al., 2001; Andreoni, 1990) and the research on risk and perception (Daniel Kahneman, 1979; Västfjäll et al., 2008; Treich, 2010). The problem of cooperation has become a prominent focus of enquiry across the social sciences in recent times. In contexts related to the environmental economics, PGG are useful to capture important behaviors patterns likes cooperation and free-riding. For instance, the strategic interactions in the game permit to have insights on the individual's behavior towards negative externalities reduction or contribution to a public utility. Another example of the connections between experimental economics and environmental economics is the finding of Joireman et al. (2001) that individuals with pro-social preferences are more involved in environmental issues than individualistic or competitive individuals.

For the purpose of this thesis, laboratory experiments methodology allows us to create a controlled experimental environment. Laboratory experiment methodology fits the purposes of our research since individuals make real choices, which permits to observe individuals' revealed preferences (Fischbacher and Gächter, 2010). This methodology permits to avoid the potential problems associated with hypothetical responses and simple free statements like in surveys (stated preferences).

In this thesis, we use the principles advised by experimental economics methodology. Subjects decisions are incentivized and the experimental instructions were provided to the subjects avoiding the use of deception. All experimental sessions have been held by the same experimenters and conducted at the Laboratory of Experimental Economics of the University of Nice (LEEN), France.

1.4 Structure of the thesis

Following the general introduction in Chapter 1, Chapter 2 provides a survey of the experimental research studying Pro-Environmental Behavior both in the disciplines of economics and psychology. Chapter 3 presents a laboratory experiment that uses a Public Good Game experiment to study the waste management issue. Chapter 4 offers an experimental study on the role of attention in the expression of the social preferences.

Chapter 2

“The reasons why!

A survey on the literature on Pro-Environmental Behavior based on a bibliometric analysis”

This chapter provides a survey of the experimental research studying PEB both in the disciplines of economics and psychology. We conduct bibliometric analysis of the published experiments using the Scopus (Elsevier) dataset over the time period 1996-2016. We use keyword frequency to identify the most relevant determinants of pro-environmental behavior in psychology and in economics. For each determinant, we discuss its impact on PEB according to the results available in literature.

The bibliometric study shows that experimental research studying pro-environmental behavior is characterized by a lack of inter-disciplinary studies. Precisely, we observe that psychology studies focus on internal factors such as emotions and values, while economic studies focus on external factors such as rewards and nudge. We explain this phenomenon by the methodological differences between the two fields which remain a strong barrier to overcome in order to create more inter-disciplinary studies.

Chapter3

“The pen might be mightier than the sword!

Impact of advice and sanction on pro-environmental behavior”

This chapter presents our research on the waste management issue. We design an experiment in which groups are composed by four contributors and a third-party who has the possibility of applying an incentive to increase cooperation. Two types of incentives are investigated in two separate treatments. In both treatments, third parties' payoff is correlated with the payoff of the members of the group they belong to. The first type of incentives we examine is a communication form based on a free advice given by the third-party in order to increase the average level of contributions inside a group (Advice treatment AT). The second type of incentive is a costly punishment through a group tax implemented by a third-party depending on the average level of contributions in a given group (Sanction treatment ST). In fact, the punishment is costly for the third party as her payoff is directly correlated to group payoff. Thus, the behavioral repercussions (level of contributions in the PGG) to the common good (a shared waste management mechanism) will suggest which is the most efficient incentive to use in order to increase the individuals' cooperation. Furthermore, we control for participants pro-social preferences by taking into consideration four individual profiles (individualistic, pro-social, competitive and altruistic) provided by the Social Value Orientation (SVO) measure proposed by Murphy et al. (2011). Moreover, we investigate wealth effects on contributions by including an effort task in order to increment initial given endowments. This experimental strategy is justified by the existing literature investigating the effect of incentive taxation and advice on individual pro-environmental behavior like waste recycling. In fact, considerable literature exists concerning household recycling be-

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havior but it mainly consists of theoretical (Brekke et al., 2003; 2010), empirical work (Viscusi et al., 2011; Cecere et al., 2014) or field experiments (Schultz, 1999). To our knowledge, no existing lab experiment investigates these questions.

We find that initially, advice, sanction and the threat of sanction significantly increase the average individual contribution level. However, applying a sanction has a stronger disciplinary effect. Also, we find results in line with Becker (1974)'s altruism hypothesis that under both sanction and threat of a sanction, high income individuals contribute more in absolute value than low income individuals.

Chapter 4

“Willingness to pay attention for others

Do social preferences predict attentional contribution?”

This chapter offers a different experimental methodology applied to estimate the social preferences expression of the individual. The amount and the accuracy of the attention invested in the task reflect the nature of social preferences preferences. Specifically, Chapter 4 presents a different social preference elicitation approach in experimental economics. In economics, preferences are measured by the utility resulting from a rational choice. In the case where the utility is expressed as a monetary term for a product choice, we will talk about the individual's willingness to pay. In our experiment, the choice of the individual implies an attentional effort, considering their *willingness to pay attention*.

We propose a new experiment in which participants allocate a real attentional endowment of 45 minutes between reducing the uncertainty in a two-alternative forced-choices task, and enjoying an alternative activity (surfing the internet). Our design could be adapted to investigate a broader range of questions involving attention. It provides the following advantages. Our task reproduces the cost and the

benefit structure of an attentional process, and enables measurement of the amount of attentional resources allocated (through Response Time) and the outcome of such investment (through Error Rate) for each decision. These two measures reveal the input and the output of the individual attentional process rather than impose a particular ad hoc structure. From a practical perspective, the design is easily understandable by subjects, and allows the researcher to gather numerous decisions for each participant, based on an average RT of less than 10 seconds, increasing statistical power. In this framework, players were asked to complete one of three conditions which vary only by incentive manipulation: A baseline without incentives (T0), a self-interest incentive (T1), and pro-social incentives as in a PGG like environment (T2).

These results show that subjects qualified as pro-socials based on the SVO test, although being the most willing to reduce their monetary earnings in order to increase others' payoffs, they are not more willing to pay attention in order to benefit others. It provides evidence that revealed social preferences depend on the nature of their elicitation, with no monotonous relation between attention and monetary contribution. Individuals may reveal pro-social preferences in terms of monetary or effort provision but not in term of attention. This might be explained by the peculiar nature of attention compared to other resources: until individuals pay enough attention, they ignore how their decisions impact on others' welfare.

Introduction Générale

1.5 Le contexte environnemental

“Nous devons agir tous ensemble. Pas seulement les gouvernements, mais les entreprises aussi, les sociétés civiles et les volontaires. C’est notre monde, c’est notre planète [...]. Si nous ne pouvons pas nager ensemble, nous allons tous couler.

Il n’y a pas de Plan B car il n’y a pas de Planète B. ”

Ban Ki-moon, New York, 2014

Tels étaient les mots du Secrétaire général des Nations Unies, il y a quelques années, à l’ouverture de la semaine du climat à New York. Le Secrétaire de l’ONU a expliqué que la préoccupation climatique était une question clé de notre temps. Il a poursuivi en sensibilisant l’opinion publique sur le fait que le changement devait se produire maintenant et à tous les niveaux de la société. Ce discours a fait écho auprès du nouveau Président de la République Française, Emmanuel Macron, qui a repris l’une de ses phrases en réponse au retrait des Etats-Unis du traité de Paris sur le climat signé en 2015. Au sein de cet accord, chaque pays avait le choix de déterminer sa stratégie par rapport à ses propres conditions internes dans le but d’atténuer le réchauffement climatique. Comme l’a rappelé le Président français, et en dépit de la nouvelle position des Etats-Unis, les autres pays continueront à conjuguer leurs efforts pour “Make our planet great again!”.

En 2017, l’Organisation Mondiale de la Santé a publié un rapport sur les change-

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ments climatiques et la santé, dont les principales conclusions ont révélé la responsabilité de l'être humain sur le réchauffement climatique⁵. Au cours des 50 dernières années, les activités humaines ont généré suffisamment de gaz à effet de serre pour affecter le climat mondial, entraînant des conséquences irrémédiables, parmi lesquelles se trouve l'augmentation des températures moyennes à l'échelle planétaire. Depuis les années 1960, la température mondiale n'a cessé d'augmenter. Pour la France, Baude et al. (2016) présentent quelques chiffres clés sur le changement climatique et montre que 2015 figure parmi les années les plus chaudes depuis 1990. De plus, les simulations montrent que les jours prévus avec des températures anormalement élevées augmenteront chaque année. L'année 2015 a, par ailleurs enregistré d'autres sombres records: en effet, la Commission Lancet sur la pollution et la santé rapporte qu'en 2015, la pollution est impliquée dans 1 décès sur 6 dans le monde (Landrigan et al., 2017). Encore une fois, les prédictions sur l'avenir ne sont pas rassurantes car l'Organisation mondiale de la santé estime très préoccupant le nombre de 250 000 décès supplémentaires par an en raison du changement climatique.

Pour faire face à cette situation, les décideurs publics ont un rôle clé à jouer dans la conception et la mise en œuvre de politiques efficaces. Cependant, ils ne peuvent pas agir seuls car le maintien des effets à long terme exige l'engagement individuel des citoyens qui, par leurs comportements, créeront des externalités positives ou, du moins, limiteront les externalités négatives⁶.

L'importance des décisions individuelles

“Un jour, dit la légende, il y a eu un immense feu de forêt. Tous les animaux terrifiés ont regardé le désastre comme impuissant. Seul le petit colibri était occupé,

⁵ Disponible sur <http://www.who.int/en/>.

⁶ La notion d'externalité (positives ou négatives) utilisée en économie de l'environnement représente l'effet sur la société de la consommation ou de la production d'un bien Pigou (1924). Un exemple bien connu d'externalité négative est celui de la pollution de l'air.

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allant chercher quelques gouttes avec son bec pour les jeter sur le feu. Au bout d'un moment, le tatou, contrarié par cette agitation dérisoire, lui dit: " Petit Colibris, tu n'es pas fou, tu n'as pas éteint le feu avec ces gouttes d'eau!" Et le colibri répondit: " je sais, mais je fais ma part." (Rabhi, 2015)

La contribution de tous compte pour limiter le changement climatique. La littérature montre que divers problèmes environnementaux sont enracinés dans le comportement humain et que la modification de ce dernier peut être le moyen de réduire les dommages environnementaux (Vlek et Steg, 2007). Ces changements de comportement concernent les actions des individus (recyclage, économie d'énergie), des communautés (exploitations urbaines) et des organisations (système de management environnemental). Ainsi, une meilleure compréhension du processus décisionnel des individus apporterait une contribution substantielle aux gouvernements dans la conception de politiques environnementales visant à réduire le réchauffement climatique. Les décideurs doivent donc identifier les caractéristiques des individus qui sont / ne sont pas pro-environnementaux et les racines de leur comportement pour mieux cibler leurs campagnes d'incitations.

1.6 Cadre théorique

Bien public environnemental

La protection de l'environnement est souvent décrite comme un problème de dilemme social, c'est-à-dire une situation d'action collective dans laquelle il existe un conflit entre l'intérêt individuel et l'intérêt collectif. En effet, de nombreux économistes considèrent le jeu du Bien Public comme un cadre pertinent pour étudier théoriquement et expérimentalement les comportements environnementaux car la constitution de biens environnementaux est un problème de financement de bien public (Noussair and van Soest, 2014; Croson and Treich, 2014; Shang and Cro-

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son, 2009) le bien-être des participants au jeu augmente si tous les participants contribuent au bien collectif.

Le jeu du Bien Public implique des biens collectifs qui combinent deux caractéristiques, à savoir la non-rivalité, c'est à dire la consommation du bien ne réduit pas la disponibilité pour les autres individus, et la non-exclusivité, c'est à dire personne ne peut être exclu de la consommation ou bénéficier du bien fourni.

D'une part, les deux caractéristiques des biens communs font que le planificateur (l'Etat) souhaite des niveaux élevés de contributions au bien public. Mais, d'autre part, les individus ne sont pas encouragés à coopérer et à contribuer au financement du bien public parce que le bénéfice qu'ils en retirent est inférieur au coût qu'ils encourent. Sachant que la non-exclusivité s'applique également si une personne ne contribue pas, certaines d'entre elles s'abstiennent et bénéficient des contributions des autres. Pour Samuelson (1954), le *free-riding* est le principal problème de la contribution volontaire aux biens publics dans la mesure où les personnes sont incitées à dévier pour maximiser leur bénéfice individuel. Ces individus, appelés *free riders*, agissent comme prévu par les hypothèses de rationalité parfaite associée aux modèles économiques standards et sont à l'origine d'une situation de sous-optimalité.

La littérature présente plusieurs expériences de laboratoire de type jeu de Bien Public qui étudient le conflit entre l'intérêt individuel et global (voir Van Lange et al. (2013) et Chaudhuri (2011) pour une revue). Ces expérimentations fournissent des idées pour comprendre comment les incitations et les préférences sociales peuvent encourager des comportements socialement désirables. Plusieurs études expérimentales ont montré que la modification de la structure du jeu pouvait influencer sur le financement de biens publics. Parmi ces modifications figurent l'introduction d'informations sur le comportement des partenaires (Fischbacher et al., 2001), l'introduction de sanctions des comportements de *Free-riding* (Fehr and Gächter, 2000; Bowles et al., 2001), ou bien la communication entre les joueurs (Chaudhuri et al., 2006).

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Comment expliquer la contribution individuelle aux biens publics? Fehr and Schmidt (1999) expliquent la contribution aux biens publics observée dans les expériences de laboratoire par la présence de préférences sociales distributives telles que l’aversion à l’inégalité qui poussent les individus à s’écarter de l’hypothèse du comportement égoïste. Pour Bénabou and Tirole (2006), contribuer et augmenter le bénéfice du groupe permet à l’individu de trouver son propre bénéfice. Dans un modèle théorique, les auteurs étudient comment les normes et la réputation sociale ont un impact sur le comportement pro-social. Ils montrent cependant que des incitations, si elles ne sont pas correctement conçues, peuvent interférer avec le sens attribué au comportement de l’individu, nuire à la motivation intrinsèque et conduire à un effet d’évitement de la motivation intrinsèque.

L’introduction d’incitations et la modification de la structure du jeu du bien public pourraient affecter le niveau de contribution aux biens publics. Par exemple, punir les non-contributeurs ou les “nudger” peut s’avérer une stratégie efficace pour augmenter les niveaux de contributions aux biens publics.

La punition des membres du groupe augmente la coopération. En effet, certaines personnes sont disposées à engager une punition coûteuse afin de faire respecter une norme de coopération (Bowles et al., 2001; Fehr and Gächter, 2000). Un autre volet de la littérature étudie l’effet de la punition lorsque celle-ci est donnée par un tiers. Gürer et al. (2006) étudient l’effet d’une sanction appliquée par une institution dans le but de créer une norme de contribution. Cette étude montre que les personnes incitées par une sanction d’une tierce personne augmentent leur coopération.

Les expériences de laboratoire montrent que les contributions sont plus élevées en présence de conseils en provenance de connaissances communes et que par conséquent, punir les comportements de non-contribution n’est pas le seul moyen d’augmenter les contributions (Chaudhuri et al., 2006). La littérature économique plus récente montre un intérêt pour une autre forme de communication utilisant les *nudges*. In-

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roduits par Thaler and Sunstein (2009) en tant qu'outils peu coûteux visant à améliorer la prise de décision et la correction des comportements, les nudges ont la particularité de ne pas modifier la structure des options de décision. Ils sont devenus populaires auprès des décideurs publics dans la mise en œuvre de politiques incitatives pour promouvoir le comportement vert par exemple. De plus, les nudges peuvent éviter les effets pervers des incitations monétaires tels que l'effet d'éviction. Sanctions et incitations ont montré leur efficacité dans l'augmentation du financement des biens publics. Dans un contexte environnemental, psychologues (Schultz et al., 2007; Nolan et al., 2008) ainsi qu'économistes (Allcott, 2011; Ayres et al., 2013; Costa and Kahn, 2013) ont testé leur efficacité sur le comportement, en majorité sur la consommation d'énergie.

La littérature montre que la compréhension du mécanisme de l'effet des *nudges* reste dans une phase d'exploration (Mongin and Cozic, 2018). Ce nouveau type d'incitations basé sur la rationalité limitée de l'individu ouvre un large éventail de possibilités de se pencher sur la question du comportement pro-environnemental. Parler de rationalité limitée suggère l'existence de capacités cognitives limitées de l'individu lors de la prise de décision, parmi lesquelles les processus attentionnels méritent que l'on s'y attarde.

Comme on l'a vu précédemment, les contributions lors d'un jeu de bien public prennent habituellement la forme d'une somme d'argent investie par l'individu. Cependant, quel serait le montant l'investissement de l'individu si sa contribution n'était pas monétaire mais plutôt liée à l'attention associée ? L'attention est une question importante si l'on reconnaît que de nombreux comportements pro-sociaux nécessitent une contribution sous forme d'attention plutôt qu'un effort financier. Par exemple, quand une personne doit sélectionner une poubelle pour jeter un déchet, le fait d'y porter attention augmente la probabilité de choisir les bonnes poubelles et ainsi diminue les coûts de traitement des déchets.

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L'étude de l'attention en tant que concept économique a pris de l'importance depuis la fin des années 1990 (Festré and Garrouste, 2015a). Le niveau d'attention accordé devrait être le résultat d'un compromis optimal en fonction des préférences sociales de l'individu.

Pour exprimer leurs préférences, les individus doivent prêter attention à l'étude des conséquences possibles des différentes alternatives. Consacrer de l'attention réduit l'incertitude du choix (Sims, 2003). Cependant, comme la quantité d'attention disponible est limitée, un problème d'allocation de l'attention apparaît. L'individu peut négliger involontairement certaines des alternatives disponibles (Caplin et al., 2011; Masatlioglu et al., 2012; Manzini and Mariotti, 2014; Sitzia et al., 2015; Li et al., 2016). Dans cette thèse, nous contribuons à cette recherche en recherchant dans quelle mesure l'expression des préférences sociales est affectée par la nature de la contribution attentionnelle.

1.7 Objectifs et méthodologie

L'objectif général de cette thèse est de contribuer à la littérature économique sur la prise de décision impliquant un comportement prosocial et pro-environnemental. Nous visons à répondre à trois questions:

- Quels sont les principaux déterminants du comportement pro-environnemental étudié dans la littérature?
- Quel est l'impact relatif d'incitations monétaires et non monétaires sur la contribution individuelle au financement de biens publics environnementaux?
- Comment les sujets expriment-ils leurs préférences sociales en fonction de la nature de la contribution?

Pour répondre à la première question, nous nous appuyons sur une analyse bibliométrique tandis que pour les deuxième et troisième questions, nous nous appuyons

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sur des expériences de laboratoire.

Analyse bibliométrique

Au cours des dernières années, l'interdisciplinarité a été considérée comme souhaitable et devant être encouragée (Gibbons et al., 1994). L'interdisciplinarité est généralement définie comme l'intégration de différentes disciplines s'intéressant à un sujet commun. Dans la revue de la littérature présentée au sein du chapitre 2, nous décrivons comment les articles dans les disciplines d'économie et de psychologie étudient le comportement pro-environnemental (PEB). Une analyse bibliométrique permet de suivre quantitativement l'évolution des relations et de la collaboration entre différentes disciplines sur un sujet précis (Van Raan, 2003).

La méthode expérimentale en Economie

Les chapitres 3 et 4 de cette thèse utilisent des expériences de laboratoire. Précisément, le chapitre 3 utilise un jeu de bien public (PGG) pour étudier l'évolution des contributions individuelles sous deux conditions: un conseil *ex ante* à la contribution, et une punition *ex post* d'un tiers. Cette étude enrichit la littérature existante sur les expériences PGG.

Définition et caractéristiques

L'utilisation des expériences en économie a considérablement augmenté au cours des deux dernières décennies. La méthodologie a gagné en légitimité grâce au prix Nobel de Vernon Smith en 2002 qui l'a inscrite au rang des outils d'analyse économique empirique, en particulier pour l'étude des mécanismes de marchés alternatifs. Plus récemment, en 2017, un deuxième prix Nobel a été attribué à Richard Thaler pour son travail sur les *nudges*.

L'économie expérimentale vise à reproduire dans un laboratoire des situations simplifiées avec des variables contrôlées (Roth, 1988). Selon Plott (1991), l'économie

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est l'une des rares disciplines ayant des terrains et des laboratoires pour mener ses recherches empiriques. Plusieurs études expérimentales ont montré que la prise de décision individuelle diffère de celle prédite par les modèles théoriques. Les expériences contrôlées permettent de produire des données davantage compatibles avec les modèles que les chercheurs souhaitent tester, contrairement aux empiriques traditionnellement recueillies qui peuvent être biaisées ou contenir des erreurs dans les variables mesurées.

La méthode expérimentale présente trois avantages principaux pour l'analyse des processus de prise de décision (Roth, 1988; Denant-Boémont et al., 2008). Premièrement, elle permet de tester les prédictions théoriques et trouver des irrégularités dans le comportement réel des individus. Deuxièmement, elle fournit des recommandations aux décideurs pour concevoir plus efficacement leurs politiques. Troisièmement, il s'agit de rechercher des faits en explorant des situations qui ne sont pas suffisamment théorisées dans la littérature.

Cette nouvelle méthodologie soulève le problème de la validité externe des résultats de laboratoire. Levitt and List (2007) discutent des résultats d'expériences de laboratoire qui fournissent des indicateurs fiables pour décrire le comportement des individus dans la vie réelle. Ces auteurs soutiennent que les résultats de laboratoire ne reflètent pas toujours le comportement réel, non pas parce que les individus se comportent de manière incohérente, mais parce qu'il n'y a pas de contrôle suffisant des aspects pertinents de la situation de choix pendant l'expérience. Cependant, des expériences en laboratoire peuvent aider à comprendre les effets qualitatifs et donner un aperçu des réactions possibles dans la réalité. Lorsqu'elles sont bien conçues, les expériences de laboratoire offrent l'avantage de recueillir un grand nombre de données correctement contrôlées et à moindre coût.

Expériences en économie et en psychologie

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Plusieurs ouvrages et articles décrivent la méthodologie expérimentale (Smith, 2002; Guala and Salanti, 2001; Etchart-Vincent, 2007; Denant-Boémont et al., 2008), et ses différences par rapport aux pratiques expérimentales en psychologie (Serra, 2012; Cassar and Friedman, 2004; Etchart-Vincent, 2006; Ohana, 2004). L'économie expérimentale et la psychologie présentent certaines similitudes. Selon Smith (1982), les méthodes appliquées dans les deux disciplines sont basées sur trois paramètres clés représentant les variables de l'étude. Premièrement, l'*environnement* représente les caractéristiques des participants; deuxièmement, l'*institution* représente la tâche à accomplir et l'instruction expérimentale; troisièmement, le *comportement* des individus et leurs réactions représentent la variable dépendante à expliquer. Les éléments *environnement* et *institution* représentent les variables indépendantes à tester ⁷.

Malgré la base commune sur les procédures expérimentales pour les deux méthodes, les expériences économiques diffèrent des expériences de psychologie pour trois raisons (Ohana, 2004; Schram, 2005; Hertwig and Ortmann, 2001). Premièrement, le contenu des instructions expérimentales. Les économistes fournissent aux sujets des instructions écrites formelles, détaillées contenant le rôle de chaque sujet, la façon dont les interactions fonctionnent et les gains possibles en fonction de leurs décisions. Les psychologues décrivent l'expérience et les tâches oralement. Deuxièmement, la tromperie au cours de l'expérience. L'économie expérimentale interdit l'utilisation de la tromperie tandis que les psychologues expérimentaux sont autorisés à mentir aux sujets sur la véritable nature de la tâche. Troisièmement, les économistes ont systématiquement recours à l'incitation monétaire en rémunérant les sujets en fonction de leurs décisions et de leurs performances au cours de l'expérience. Le paiement des sujets dans les expériences de psychologie, en revanche, n'est pas systématique. Lorsqu'un paiement est fourni, il s'agit généralement d'un montant forfaitaire non lié à la performance. Le paiement vise à assurer la pertinence des choix individuels.

⁷Voir Ohana (2004) pour plus de détails.

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Les individus doivent faire des choix réels et non hypothétiques. Enfin, pour assurer la reproductibilité des plans expérimentaux, l'économie expérimentale crée des situations décontextualisées.

Economie de l'environnement et expérimentations

Comme beaucoup de domaines de l'analyse économique, celui de l'économie environnementale a connu un tournant expérimental. De nombreuses expérimentations de jeux de biens publics en témoignent (Joireman et al., 2001; Andreoni, 1990) ainsi que de nombreux travaux sur le riqe (Daniel Kahneman, 1979; Västfjäll et al., 2008; Treich, 2010). La conclusion de Joireman et al. (2001), selon laquelle les individus ayant des préférences pro-sociales sont plus soucieux des questions environnementales que les ceux individualistes ou compétitifs, est un autre exemple des liens entre l'économie expérimentale et l'économie environnementale.

Dans le cadre de cette thèse, la méthodologie des expériences de laboratoire nous permet de créer un environnement expérimental contrôlé. La méthodologie d'expérimentation en laboratoire correspond aux objectifs de notre recherche parce que les individus font de vrais choix qui maximisent leurs avantages. Dans des études menées avec d'autres méthodologies, par exemple des enquêtes, les individus révèlent leurs préférences à travers de simples déclarations libres.

Dans cette thèse, nous utilisons les principes recommandés par la méthodologie de l'économie expérimentale. Les décisions des sujets sont incitées monétairement et les instructions expérimentales ont été fournies aux sujets en évitant le recours à la tromperie. Toutes les sessions expérimentales ont été administrés par les mêmes expérimentateurs et au sein du Laboratoire d'Economie Expérimentale de l'Université de Nice (LEEN), en France.

1.8 Structure de la thèse

La thèse commence par une introduction générale au chapitre 1. Le chapitre 2 présente un aperçu de la recherche expérimentale étudiant le comportement pro-environnemental dans les disciplines de l'économie et de la psychologie. Le chapitre 3 présente une expérience de laboratoire qui utilise une expérience de jeu de bien public pour étudier le problème de la gestion des déchets. Le chapitre 4 propose une étude expérimentale sur le rôle de l'attention dans l'expression des préférences sociales.

Chapter 2

“Les déterminants des comportements pro-environnementaux. Revue de littérature et analyse bibliométrique d'études en économie et psychologie expérimentales”

Ce chapitre fournit un aperçu de la recherche expérimentale étudiant le comportement pro-environnemental à la fois dans les disciplines de l'économie et de la psychologie. Nous effectuons une analyse bibliométrique des expériences publiées en utilisant l'ensemble de données Scopus (Elsevier) sur la période 1996-2016. Nous utilisons la fréquence des mots-clés pour identifier les déterminants les plus pertinents du comportement pro-environnemental en psychologie et en économie. Pour chaque déterminant, nous discutons son effet sur le comportement pro-environnemental en fonction des résultats relevés dans la littérature.

Nous constatons que la recherche expérimentale, liée au comportement pro-environnemental, est caractérisée par un manque d'études inter-disciplinaires. Précisément, nous observons que les études en psychologie se concentrent sur des facteurs internes tels que les émotions et les valeurs, alors que les études en économie se concentrent

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sur des facteurs externes tels que les *nudges*.

Chapter3

“La plume peut-elle être plus forte que l’épée?”

Impact d’un conseil ou d’une sanction sur le financement d’un bien public environnemental”

Ce chapitre présente nos recherches sur la gestion des déchets. Nous concevons une expérience dans laquelle les groupes sont composés de quatre contributeurs et d’un tiers qui a la possibilité de jouer sur les incitations afin d’augmenter la coopération. Deux types d’incitations sont étudiés dans deux traitements distincts. Dans les deux cas, la rémunération des tiers est corrélée avec la rémunération des membres du groupe auquel ils appartiennent. Le premier type d’incitation que nous examinons est une forme de communication basée sur un conseil gratuit donné par le tiers afin d’augmenter le niveau moyen des cotisations au sein d’un groupe (Traitement Conseil). Le deuxième type d’incitation est une sanction coûteuse par le biais d’une taxe de groupe mise en œuvre par un tiers en fonction du niveau moyen des cotisations dans un groupe donné (Traitement Sanction). La punition est coûteuse pour la tierce partie puisque son gain est directement corrélé à la récompense du groupe. Ainsi, les répercussions comportementales (niveau des contributions au PGG) sur le bien commun (un système partagé de gestion des déchets) suggèrent quelle est la motivation la plus efficace à utiliser pour augmenter la coopération des individus. En outre, nous contrôlons les préférences prosociales des participants en prenant en considération quatre profils individuels (individualistes, pro-sociaux, compétitifs et altruistes) fournis par la mesure d’orientation de la valeur sociale (SVO) Murphy et al. (2011). De plus, nous étudions les effets de richesse sur les contributions en incluant une tâche d’effort afin d’augmenter les dotations initiales données. Cette stratégie

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expérimentale est justifiée par la littérature existante qui étudie l'effet de la fiscalité incitative et des conseils sur le comportement pro-environnemental individuel comme le recyclage des déchets. En effet, il existe une abondante littérature concernant le comportement de recyclage des ménages mais elle se compose principalement de travaux empiriques (Viscusi et al., 2011; Cecere et al., 2014) ou d'expériences sur le terrain (Schultz, 1999). A notre connaissance, aucune expérience de laboratoire existante n'aborde ces questions.

Nous constatons qu'initialement les conseils, les sanctions et les menaces de sanctions augmentent considérablement le niveau moyen de la contribution individuelle. Cependant, appliquer une sanction a un effet disciplinant plus fort. En outre, nous trouvons des résultats conformes à l'hypothèse d'altruisme de Becker (1974) selon laquelle, à la fois sous la sanction et sous la menace d'une sanction, les personnes à revenu élevé contribuent plus en valeur absolue que les personnes à faible revenu.

Chapter4

“Investir son attention pour autrui.

Les préférences sociales prédisent-elles l'investissement attentionnel d'un individu ?”

Ce chapitre propose une méthodologie expérimentale différente appliquée pour estimer l'expression des préférences sociales de l'individu. La quantité et l'exactitude de l'attention investie dans la tâche reflètent la nature des de préférences sociales. Plus précisément, le chapitre 4 présente une approche différente d'élicitation des préférences sociales en économie expérimentale. En économie, les préférences sont mesurées par l'utilité résultant d'un choix rationnel. Dans le cas où l'utilité est exprimée comme un terme monétaire pour un choix de produit, nous parlerons de la disposition à payer de l'individu. Dans notre expérience, le choix de l'individu

implique un effort attentionnel, on parle alors de la *disposition à prêter attention*.

Nous proposons une nouvelle expérience dans laquelle les participants allouent une dotation attentionnelle effective de 45 minutes entre la réduction de l'incertitude liée à une tâche de choix forcé à deux alternatives et la jouissance de temps libre liée à une activité alternative (surfer sur Internet). Ce cadre d'analyse pourrait être adapté pour étudier un plus large éventail de questions qui impliqueraient une allocation de l'attention. Notre tâche fournit certains avantages. Elle reproduit la structure coût et bénéfices d'un processus attentionnel, et permet de mesurer la quantité de ressources attentionnelles allouées (via le temps de réponse) et le résultat d'un tel investissement (par le taux d'erreur) pour chaque décision. Ces deux mesures révèlent l'entrée et la sortie du processus attentionnel individuel plutôt que d'imposer une structure ad hoc particulière. D'un point de vue pratique, la tâche est facilement compréhensible par les sujets et permet au chercheur de recueillir de nombreuses décisions pour chaque participant (sur la base d'un temps de réponse moyen de moins de 10 secondes), augmentant ainsi la puissance statistique. Dans ce cadre, les joueurs ont eu à jouer dans une des trois conditions qui ne variaient que par la manipulation de l'incitation: une base sans incitation (T0), une incitation propre (T1) et des incitations pro-sociales comme dans un environnement PGG (T2).

Ces résultats montrent que les sujets qualifiés de prosociaux sur la base du test SVO, bien qu'ils soient les plus enclins à réduire leurs gains monétaires afin d'augmenter les gains des autres, ne sont pourtant pas plus disposés à prêter plus attention à la tâche. Ce résultat suggère que les préférences sociales révélées dépendent de la nature de leur élicitation, sans relation monotone entre l'attention et la contribution monétaire. Les individus peuvent révéler des préférences prosociales en termes de contribution monétaire ou d'effort mais pas en termes d'attention. Cela peut s'expliquer par la nature particulière de l'attention par rapport aux autres ressources jusqu'à ce que les individus accordent suffisamment d'attention, ils igno-

rent comment leurs décisions influent sur le bien-être des autres.

CHAPTER 2

The reasons why!

A survey of the literature on pro-environmental behavior based on a bibliometric analysis.

“Don’t let us forget that the causes of human actions are usually immeasurably more complex than our subsequent explanations of them.”

Fyodor Dostoevsky

2.1 Introduction

The environmental issue is central in the agenda of the policy makers of many governments around the world, both to assure the human well being and for economic purposes. Their attempt to improve environmental conditions requires a wide range of changes for which multiple approaches are possible. At an international level, the countries that participated to the 2015 Paris climate conference (COP21) agreed on attempting to reduce the global warming due to human activities by setting the goal of a decrease of the temperature by 2 degrees before 2100.

Pro-environmental behavior (PEB)¹ is widely recognized as a key determinant to deal with environmental issues. Several governments have established policies to regulate the impacts of human activity. However, environmental protection depends not only on regulatory campaigns, but also on the individual's daily behavior toward the environment. Therefore, studying PEBs and its determinants is a fundamental part for understanding how to improve the environmental situation. Policy makers need to identify the characteristics of the individuals who are/are not pro-environmental and the roots of their behavior to better target their incentive campaigns. This need for individual information explains the necessity of considering a micro level of analysis in addition to set goals at the macro level. To support the policy makers' decisions, a large amount of public research funds is devoted to PEB.

PEB studies provide an extensive literature published both in Economics and Psychology journals, without reaching a commonly adopted definition (Schultz, 2016). A general definition includes PEB in the subset of the pro-social behaviors which are defined in psychology literature as a broad category of acts that the society consider as generally beneficial to other people (Penner et al., 2005).

Psychology literature proposes two ways to define PEBs, namely: the *impact*

¹In this study, we use the expression PEB that can be also expressed in the literature as *Green behavior* or *Environmental friendly behavior*.

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oriented and the *intention oriented* definition. *Impact oriented* definition focuses on the positive effects generated by PEBs. According to Kollmuss and Agyeman (2002) and Steg and Vlek (2009), PEBs aim to minimize the negative and harmful impacts of individual's behavior on the environment. Practically, it includes citizen action, environmental volunteering, and behaviors concerning the private sphere such as conserving energy and recycling. This orientation permits then to investigate the determinants of the behaviors leading to a large impact on the environment. The *intention oriented* definition defines PEBs either according to its impact and according to the individual's intentions (Stern, 1997; 2000). In this case, the focus is on the effect of individuals' motivations and beliefs to adopt a PEB, despite of the magnitude of PEB impact. This orientation towards the intentions, allows to extend the range of the analysis to situations where a PEB might fail to reach a real impact on the environment.

In economics literature, the definition of PEBs is not straightforward. From an economic perspective, PEB implies an individual's voluntary effort to provide an environmental public good. Public goods are known as being non-rival i.e. an individual's consumption of the good does not reduce the availability for the other individuals; and non-exclusive, i.e. no individual can be excluded from benefiting from the provided good, even if she did not contribute to its provision. Indeed, many of the benefits from PEB, for instance pollution reduction generated by waste recycling, satisfy these characteristics of a public good. Moreover, according to the economic literature, behaving pro-socially means acting on the basis of the social cost associated to the behavior, contradicting the self interest assumption (Bénabou and Tirole, 2006). This interpretation should prevent individuals from adopting pro-social behaviours among which PEBs. However, we observe empirically that individuals adopt PEB not maximizing their own interest, making other people and the environment benefit from their actions (De Groot and Steg, 2009). A possible

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economic interpretation of PEB to reconcile the theory and the empirical results, is through the lens of the social dilemma scheme² in which individual present self-interested behavior generates a collective bad externality in the long run. A trade-off exists between actual individual interest and the improvement of future generations' life environment. This trade-off between actual and future benefits appears in psychology literature, complemented by a geographical dimension as suggested by Steg and Vlek (2009). Acting pro-environmentally entails then a trade-off between quality of the environment of one region with respect to other regions in the world. However, when the trade-off is between an individual and a counterpart that is too far in time and space, it could lead to situations of limited PEB adoption and denial of the environmental consequences (Spence and Pidgeon, 2010; Hart and Nisbet, 2012).

In this review, we consider a large definition of PEBs as a multifaceted concept including psychological and economic aspects, which imply the willingness to contribute to an environmental public good. Contributing to this public good creates positive externalities or at least, limits the negative ones.

The contribution of the paper is to selectively review some of the relevant laboratory experimental research on PEB. The paper focuses on the behavioral perspective considering the non-negligible advantages of observing the behavior free from theoretical restrictions. The evolution of experimental methodology allows nowadays to study behavior of individuals who are not always maximizing their own interest as assumed by standard economics theory (Simon, 1972). A number of the behavior theories and concepts discussed in this review have been explored extensively elsewhere; therefore, this review is not exhaustive, but rather is intended to be broadly describe the experimental literature.

This paper aims to identify findings that can be relevant for both scholars and

² For instance, the social dilemma interpretation of PEB can be observed in decision-making related to saving energy and recycling.

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policy makers. Specifically, it aims to investigate the common grounds of research and the specificities of economics and psychology literature. Moreover, our focus is on the behavioral schemes that contradict the predictions of the standard economic theory, rather than policy instruments such as the Pigouvian taxes (for a review on these instruments, see Carlsson and Johansson-Stenman 2012; Shogren and Taylor 2008). We conduct a bibliometric analysis using the SCOPUS dataset. We identify the determinants influencing PEB by ranking the keywords according to how frequently they are used by economists and psychologists in their publications. Moreover, we map the evolution of the PEB literature in economics and psychology over time by looking at the number of publications in the two disciplines.

The paper is organized as follows: section 2.2 explains the methodology applied to construct the bibliometric dataset, then traces the evolution of the behavioral studies on PEB by discipline; section 2.3 identifies the determinants of PEB assessed in both literatures; section 2.4 concludes and points out some of the methodological aspects that might harm the development of interdisciplinary research between economics and psychology.

2.2 Data and statistics

This section describes the methodology applied to collect and select the scientific articles publishing the results of PEB experiments in economics and psychology. Moreover, it provides quantitative evidence on the growing interest in PEB studies counting the yearly number of publications in the two disciplines and identifying the journals where they appear.

2.2.1 Study sample

We construct our article study sample in four steps.

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First, we select the data source. We choose as the main source the Scopus bibliometric database³ (Elsevier). Scopus shows a good coverage of economics and psychology journals making it a suitable choice for our purpose.

Second, we set the article selection criteria. We consider only articles published on international peer reviewed journals reporting experimental studies. We filter the articles by considering only studies that are conducted adopting an experimental procedure and analyze PEB of individuals or households. Theoretical papers not reporting experimental data are not included.

Third, we apply in Scopus the selection criteria set in the second step. We search for the articles containing in the title, abstract, or keywords the expressions: “experiment” and “pro-environmental behavior”.⁴ We limit our search to the journals in “Economics” and “Psychology” as defined by the Scopus journal classification. We consider the articles reporting the two keywords expressions (or variants) as the ones relevant for our study. We end up with a study sample of 1006 articles. The articles are published from 1996 to 2016, a period that covers the emergence and development of the experimental economics.⁵

Fourth, we classify the 1006 articles of the study sample according to their discipline. We identify the discipline of each article by searching for specific expressions in the title, abstract, and keywords. Precisely, we classify an article in “*Economics*” if it contains the expression “economics” in the title, abstract or keywords, while we classify an article in “*Psychology*” if it contains the expression “psychology”. Through these procedures, we obtained a dataset of 643 articles in economics, 343

³Scopus indexes over 55 million references all over the world and is among the most used database for bibliometric studies.

⁴For each expression, we consider a number of variants such as, “Experimental”, “Laboratory experiment”, “Field experiment”, “Experimental economics”, “Experimental psychology”; for the environmental expressions : “Pro-environmental behavior”, “Ecological behavior”, “Green behavior”, “Environmentally friendly behavior”.

⁵The first classroom experiments was conducted during the 90’ (Holt, 1999). See Villeval (2007) for a description of the contribution and the evolution of experimental economics

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in psychology⁶.

Table 2.1: Descriptive Statistics

Period	Discipline	Number of articles published
1996-2000	Economics	42
2001-2005		89
2006-2011		158
2012-2016		354
Total		643
1996-2000	Psychology	29
2001-2005		62
2006-2011		80
2012-2016		172
Total		343

Source: Scopus - Author calculation.

2.2.2 PEB time trends and journals

Time trends

The total number of articles in both disciplines (blue line in Figure 2.1), is characterized by an increasing trend along all the study period, from the mid 1990s until 2016.

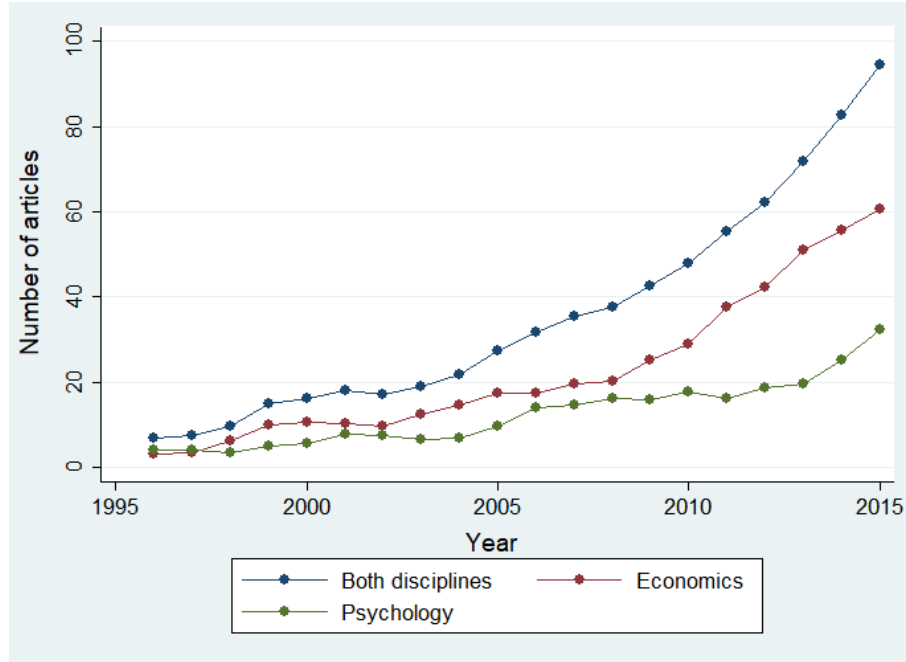
When we distinguish the two fields, economics (red line in Figure 2.1) and psychology (green line in Figure 2.1), we observe two similar growing trends. Precisely, the number of articles published each year in economics remains fairly constant until 2005. After 2005 there is a boost in the number of publications until 2015, when it reaches the maximum of 60 articles. Similarly, the publications in psychology show a growing trend, although less pronounced than the one observed for economics. The maximum number of publications in psychology is in 2015 with about 25 articles⁷.

⁶ Not reported in the table, 20 papers that could be classified both in economics and psychology. The latter category includes the articles that are at the cross of the two disciplines, and representing interdisciplinary group **Economics & Psychology**

⁷By following the inter-disciplinary publications previously cited, we see that it is a limited phenomenon, appearing for the first time in 2005 and counting about one article per year. From

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Figure 2.1: Experimental studies on PEB over time and disciplines



Source: Scopus - Author calculation.

Journals and publication

We identify the journals publishing the experimental articles on PEB. To do that, we rely on the article classification previously presented : “*Economics*”, “*Psychology*”. For each class of articles, we consider four periods, 1996-2000, 2001-2005, 2006-2011 and 2012-2016. For each pair class-period, we report in Table 2.2 the journal with highest number of published articles. We report also the sum of the citations received by these articles.

In the field of *Economics*, before 2000, the “Journal of Environmental Economics

2005 to 2015, they do not show any increasing trend. The publication trends in both fields reflect the increased interest of the scientific communities of economists and psychologists for studying PEB. Their increased interest is the results of the growing attention of the policy makers to the environmental issues and of the growing availability of funds to explore these lines of research.

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Table 2.2: Publications and journals over fields

Period	Field	Journal	Number of articles	Number of citations
1996-2000	Economics	Journal of Environmental Economics and Management	5	233
2001-2005		Ecological Economics	8	345
2006-2011		Ecological Economics	26	875
2012-2016		Ecological Economics	52	439
1996-2000	Psychology	Neurobiology of Learning and Memory	3	67
2001-2005		Learning and Memory	4	310
2006-2011		Physiology and Behavior	9	160
2012-2016		Physiology and Behavior	31	191

Source: Scopus - Author calculation.

and Management” has published the highest number of articles, namely 5 articles receiving 233 citations. For the following three time periods, the journal “Ecological Economics” takes the lead publishing 86 articles that received 1719 citations.

Table 2.2 shows that *Psychology* articles, in the two most recent periods, are frequently published on the specialist journal “ Psychology and Behavior”. This journal hosts 40 articles that received 351 citations⁸.

2.3 Identifying the determinants of Pro-Environmental Behavior

The aim of this section is twofold. First, we aim to identify the trends emerging in economics and psychology. We proceed by counting the occurrence of keywords in both economics and psychology articles, then we rank them in decreasing order of frequency. Table 2.3 lists the ten most frequent keywords in economics and psychology articles⁹. Each keyword corresponds to a determinant influencing PEB that has been investigated by the literature.

⁸ For cross-disciplinary “Economics & Psychology” articles, we find three distinct journals, one for each period. One of these journals is “Ecological Economics”, which support the interdisciplinarity with 2 articles published between 2006 and 2011 and 48 citations received.

⁹A more detailed list of the complete ranking is provided in Appendix

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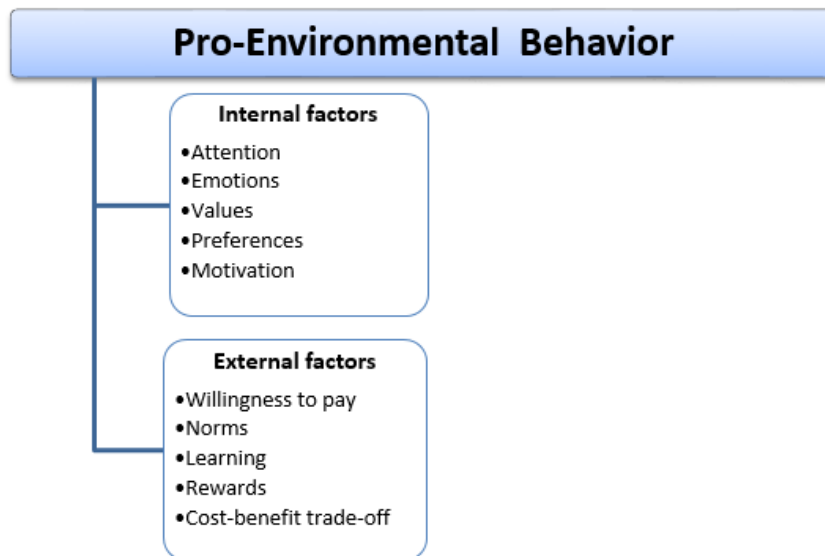
Table 2.3: Keywords ranking by discipline

Top 10 in Economics	Top 10 in Psychology
Choice experiment & Field experiments	Stress
Willingness to pay	Environmental psychology & enrichment
Values	Memory
Preferences	Emotion
Ecosystem services	Attention
Climate change	Learning
Environmental policy	Anxiety
Sustainability	Reinforcement
Risk preference	Affect
Cost Benefit analysis & Benefits transfer	Reward

Source: Scopus - Author's calculation. The ranking is based on the keywords appearance frequency pooled from 1996 to 2016. The keywords are generated from the list of key words referenced on the Scopus platform.

Figure 2.2 shows the two groups of determinants that will be discussed the the rest of the section.

Figure 2.2: Pro-Environmental Behavior determinants



Source: Kollmuss and Agyem (2002), Manolas (2014).

Second, we aim to review these determinants influencing PEB identified in lit-

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erature. To do so, we trace the keywords reported in the articles published in economics and in psychology. For each keyword (or group of keywords) we provide a brief review of the most relevant articles.

To organize the review we proceed in three steps.

- First, we exclude the keywords referring to general concepts, methodologies of analysis, or topics that are too far from the scope of the current review. Precisely, we do not discuss the keywords “Choice experiment & Field experiments”¹⁰, “Ecosystem services”, “Climate change”, “Sustainability”, “Environmental psychology and Enrichment”, “Memory”, and “Reinforcement”.
- Second, we group keywords referring to close concepts that are often studied jointly or that can be considered as specifications of the same general concept. In recent years, both field and experimental studies in economics provided evidence of the close relation between motivation and PEB. Motivation does not appear as frequent keyword in table 2.3. However, the keywords “Risk”, “Affect” and “emotion” can be considered as a specification of the general concept of *Motivation*¹¹. For this reason we will discuss the three keywords in a common section called *Motivation*. The keywords “Values”, “Moral” and “Preferences and Willingness to pay” often appear jointly in literature. For this reason we discuss them in a common section “Values and preferences”. For similar reasons, we discuss in a common section “Norms” and “Cost benefits”. We create a section “Environmental Policy” where we discuss the the keyword “Reward” and other two concepts that do not appear as frequent keyword in

¹⁰These two keywords are gathered to gain a place in the ranking since the review does not discuss the different methodologies. Same logic is applied for the keywords Environmental psychology & Enrichment.

¹¹Th differences between JEL and PsycINFO classifications might be an explanation, since the keyword “*Motivation*” does not appear in the list of referenced keywords. However in psychology, being a too large concept, the keyword “*Motivation*” is coupled with either “*Emotion*” or “*Learning*” in the PsycINFO list.

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our analysis but represent types of environmental policies, namely “Taxes” and “Nudges”. The keywords “Attention and Stress” and “Learning” are discussed in separate sections.

- Finally, we split the keywords in two groups: PEB *Internal determinants* and PEB *External determinants* (in line with the approach of Kollmuss and Agyeman (2002), Steg and Vlek (2009), and Manolas (2014)). The internal determinants are those determinants that concern only the individual, while external determinants are generated by the context and impact on the behavior of the individual.

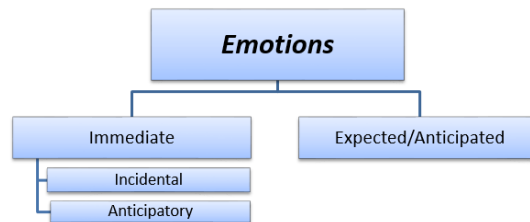
2.3.1 Internal determinants

Emotions, Risk perception and Affect

Individuals are characterized by different motivations that shape their behavior toward the environment. In this section we discuss three specifications of individuals motivation to adopt a PEB: emotion, risk perception and affect.

Emotions

Figure 2.3: Emotions types



Source: Adapted from Lowenstein and Lerner (2003).

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Introducing emotions¹² in the economic behavioral research is challenging. Indeed, standard economic rationality theory ignores the role of emotion in the processes of decision making (Arrow, 1990). However, emotions are among the drivers of decision making, including decisions related to the environment (Lerner et al., 2015). Loewenstein and Lerner (2003) explain that in a general context, each individual through his decisions aims to avoid any negative feeling like guilt or fear; and increasing positive feelings like happiness. The authors precise that this process can even be adopted by each individual without his awareness. For this reason, behavioral economists challenged the standard assumption of not considering emotions and study emotional influences on decision making processes (Camerer et al., 2011).

Psychology literature argues that emotion-based heuristics are at the heart of decision making process. In doing so, they limit the role played by the cost-benefit trade-off reasoning proposed by economists as the driver of the decision making process (Kahneman and Tversky, 2000).

Until the late 1990s, emotions were absent from the economic literature. Elster (1998) observes the absence in economic theory of references to the concept of emotion. Moreover, he observes also that psychologists rarely refer to economic theories. He states that “the two fields seem to exist in near-complete isolation from each other”. According to Elster, this situation is due to the fact that economists focus on explaining the individual behavior, while psychologists focus on explaining emotions.

From our empirical analysis reported in Table 2.3 we confirm this separation of the two fields. The keyword emotion does not appear in the top-10 keyword ranking in economics, while it is ranked fourth in the (top-10) keyword ranking in

¹²Andrade and Ariely (2009) proposes a distinction between the notions of emotions, mood and affect. Emotions are specific and brief subjective feelings for which we can identify the cause. Mood, is described as a weaker feeling state, for wich it is difficult to find the cause. Affect is a general and large concept that includes both emotions and mood.

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psychology. However, with the evolution of behavioral economics, we can see that economists are interested into the role of emotions since it is a social notion that might impact individuals interactions.

Before presenting the studies showing the potential of emotions to modify individuals choices, we classify the different types of emotions. A general classification presents emotions as *positive* or *negative*, according to the fact that they represent an advantage or a disadvantage for PEB (Andrade and Ariely, 2009; Mankad and Tapsuwan, 2011; Alpízar and Gsottbauer, 2015; Ibanez et al., 2017). A more detailed classification is presented by Loewenstein and Lerner (2003). Figure 2.3 represents the view of Loewenstein and Lerner (2003) who distinguish two types of emotions, *immediate* and *anticipated*.

Immediate emotions describe the affect the individual feels during decision making process. It includes incidental emotions, i.e., unrelated to the decision at hand but relevant for the decision, and anticipatory emotions, i.e., emotions experienced immediately concerning the expected consequences of the decision taken. *Anticipated emotions* also called *Expected emotions*, describe situations where the individual does not experience any immediate affect during the decision making process. Rather, the individual taking the decision does predictions on the emotional consequences of a set of possible choices, then she chooses the option maximizing the positive emotions.

Positive emotions enhance the individual willingness to adopt a PEB. An example of positive emotions comes from the study of Ibanez et al. (2017) who investigate the impact of emotions on the intrinsic motivation to donate to an environmental association. The authors find that positive emotions, like wonder¹³, generate higher generosity in donation, especially if the emotion is induced by a stimulus not directly linked to the environment. Moreover, Ibanez et al. (2017) adopt the distinction be-

¹³Wonder describes awe and admiration

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tween *anticipated* and *immediate* emotions, and stress the importance of anticipated emotions in affecting the individual decisions. They use a Dictator game experiment preceded by an anticipated emotions elicitation using pictures related or not to an environmental issue. They find that the elicitation of positive emotion (wonder) does not have any impact on the probability to donate. However, the authors observe an increase of the amount of donations for the individuals who actually donate.

The adoption of a PEB permits the individual to avoid negative emotions such as “shame”. In the context of recycling, Alpizar and Gsottbauer (2015) compare the impact of positive and negative emotions. The authors present a field experiment on household recycling practices comparing “shame” and “pride” effects on the recycling effort. The authors find a significant impact of the reputation in shaping individual PEB. Furthermore, they show that individuals are more likely to adopt PEB to avoid shame rather than acquiring pride and gratitude by PEB adoption. Moreover, PEB permits to reduce the experience of negative emotions. For instance, Sun and Trudel (2017) test in a laboratory experiment the hypothesis that recycling reduces individuals negative emotions generated from wasting resources. The results show that positive emotions associated with recycling can overcome the negative emotions related to wasting.

Following the emotion classification, the literature shows that according to the type of emotion, the impact on decision making is different. In the context of acceptance and adoption of technologies used to manage water, Mankad (2012) investigate the role of emotional reactions of the individuals to the acceptance and adoption of a new water system in urban areas. The author finds two results in the case of a system adoption. First, immediate emotions influence decision making and, second, anticipated emotions lead to wrong beliefs that will affect the future adoption decision.

Experimental evidence argue that emotions can also produce feelings of attach-

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ment and enhance activism. In a general environmental context, Hartig et al. (2001) search for the causes of PEBs in the emotional attachment of the individual to the environment. The authors explain that homes can generate attachment (Low and Altman, 1992), and thus, motivate individuals' activism. In the environmental literature, the statement "Not In My Backyard" illustrates this idea. Precisely, individuals are generally in favour of pro environmental projects, but far from their home.

Risk perception

The individual's perception of the risks can influence her behavior. In recent years, cognitive psychologists have focused their attention on the effect of risk and ambiguity on behavior (Kahneman and Tversky, 1979). In environmental economics, researchers borrow this idea from psychologists and study how risk associated with uncertainty affects PEB (Viscusi and Hamilton, 1999; Kørnø and Thissen, 2000). These works have implications for the regulation concerning the environmental risk (Johansson-Stenman, 2008; Treich, 2010).

For instance, in the case of health risks, individuals might be influenced in their choices related to the environment. For instance, Nancarrow et al. (2008) studied the factors influencing individuals' decision-making in relation to the reuse of waste-water. They investigate why in communities that adopted a waste-water reuse system, individuals remain reluctant to use it. The results show a reduction in the use of recycled water, particularly when it has to be ingested. This result is due to the perception of health risk which influence consumption behavior. Interestingly, the authors find that being a man is a strong predictor of acceptance of the use of recycled water.

Emotions might influence the individual's perception of the environmental risk. On this topic, Böhm and Pfister (2005) show that an individual tends to evaluate the environmental risk according to its consequences or according to its moral im-

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plications. When the individual evaluates the risk according to the consequences, she is likely to feel emotions like fear. This leads to adopt a helpful and constructive behavior. When the individual evaluates the risk according to moral, she feels emotions like anger, leading to non-constructive reactions and aggressive behavior.

Affect

The individuals adopting PEBs can be obstructed by affective considerations or the need for social status. Precisely, psychology literature provides studies on the use of cars and slow adoption of public transport. These studies show that the use of cars is mainly related to affective factors. Furthermore, they propose several psychological factors as explanations. For Steg et al. (2001), it is a matter of sense of freedom, while Mann and Abraham (2006) argue for an affective attachment to the car. According to Aarts et al. (1998), the reason for using cars is the power of habits and the difficulty to change them. For Steg (2005) and Gatersleben (2007), it is a matter of pleasure of driving. Indeed, for some individuals the action of driving is only an instrumental function permitting to move from a point of origin to a final destination, while for others, it is also an enjoyable activity creating feelings like freedom (Gatersleben, 2007). Steg (2005) investigates alternative motivations to the use of cars. The author explains that the increase of the car use is due to social comparison. Using a certain car model permits to individuals to show aspects of their status and identity.

Values, Moral, and Preferences

The likelihood to adopt a PEB depend on values, moral and preferences. These three characteristics might explain the individual concern towards the well-being of others, rather than focusing only on her own well-being. This section starts by discussing the relationship between Values and PEB. We present the classification

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of values that is often adopted in experimental studies and we compare it with the classification of ethics. The concepts of values and ethics are rather close. Then we discuss the relationship between moral and PEB and how moral and PEB interact to generate emotions. We follow by discussing the relationship between preferences and PEB by presenting the Social Value Orientation model that is often used in the experimental studies. Finally, we briefly discuss how attention allocation is considered in the studies on PEB adoption.

Values

Values might be the reason why individuals sometimes weight more the general well-being, rather than their personal interest. In the case of PEBs, individuals adopt a general attitude towards environmental protection because they are concerned about the consequences of their actions on the environment (Hansla et al., 2008). In the early 1970s, values have been defined by methodologists as representations of what an individual believes to be important in life (Rokeach, 1973). More recently, Steg and Vlek (2009) define values as the guiding principles in the life of individuals.

Values can be classified in three types: egoistic, i.e., focusing on self interest only, altruistic, i.e., searching the well-being of others, and biospheric, i.e., focusing on preserving the environment (Stern, 2000). Several empirical studies support the hypothesis that the three types of values explain positive and negative attitudes of the individuals toward the environment. Schultz and Zelezny (1998) present a cross-country study on the relationship between values and PEB. The authors find a positive correlation between biospheric values and PEB and a negative correlation between egoistic values and PEB. De Groot and Steg (2010) constructed an experiment where individuals have to declare their intention to adopt two PEBs, namely to buy an environmental friendly car and to donate to a charity organization supporting the environment. They show that egoistic values are negatively correlated to PEB, while altruistic and biospheric values are positively correlated to PEB.

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Values shaping PEB can result from the level of awareness of the individuals. The more an individual is aware of the consequences his behavior has on the environment, the more concern he is, thus more likely to adopt a PEB. Literature suggests that different values impact on the energy-saving behaviours, and link the values to environmental concern and awareness. For instance, in a study on energy saving, Hansla et al. (2008) argue that adoption of a renewable energy is explained by pro-environmental values. The authors justify this effect by considering that the awareness of consequences of individual behavior on the environment generates positive values. These values will in turn increase the individual's level of concern, leading finally to a PEB.

The PEB literature proposes also three types of ethics that, according to their definitions, are rather similar to the three types of values presented in the previous paragraph (De Groot and Steg, 2008). Merchant (2005) distinguishes between three types of ethics involved in PEB adoption, namely: *homocentric*, *ecocentric*, and *egocentric*. According to Merchant (2005), *egocentric* ethic focuses on the idea that the individual is more important, allowing an unlimited use of natural resources to improve her life conditions. The *homocentric* ethic focuses on the idea that the society well-being is more important, implying the maximization of the well-being of all individuals. And *ecocentric* ethic focuses on the importance of the intrinsic value of the environment implying that the environment existence is a sufficient reason for its protection.

Ethics has been found to have a positive impact on individual awareness, and consequently on PEB. Following the ethic classification, Nordlund and Garvill (2003) propose an experiment based on a social dilemma to study the type of ethic influencing individual PEB. The PEB considered is a reduction in the use of personal. They find that *ecocentric* ethics positively influences the individual awareness of the threats of air pollution and of energy consumption, leading to a reduction of the use

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of personal cars. Moreover, *homocentric* ethic positively increases the awareness of the individual concerning the threat of pollution without influencing the car use.

Moral

Not only individuals can have different perceptions of the condition of the environment. They are also characterized by a different level of moral sense. Ayala (2010) defines “moral sense” as the judgment made on whether certain actions are either right or wrong. Moreover, he qualifies “moral sense” as human universal, namely a characteristic common to all the human beings.

The likelihood of adopting a PEB depends on the perceived condition of the environment with respect to the level of individual moral sense (Ayala, 2010). Ayala finds this result studying individuals who participate to a project of greenhouse gases emissions reduction. Moreover, moral sense interacts with individuals emotions. The environment is often associated with positive and negative emotions like fulfillment and guilt. Adopting a PEB that is compatible with the individual moral sense, stimulates positive emotions. For instance, an individual who consumes a green product will feel an emotion of fulfillment due to the fact that her consumption choice is compatible with her moral sense (Ariely et al., 2008). The positive emotion is the result of the individual’s feeling to participate to something constructive with her consumption choice.

Preferences and Willingness to pay

In the economic literature, it is commonplace to model environmental issues as social dilemma. In an “environmental dilemma”, the willingness to pay means, for instance, investing money searching for an alternative energy source. This kind of behavior represents the “give-some part” of public goods funding. In this context, if the individuals give in a sufficient proportion of money, the public good is provided

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and the impact of the behavior on the environment is reduced. The literature recognizes that individuals differ in their behaviour with respect to their social preferences (Meier, 2006).

Social preferences are preferences that take others into account. When individuals represent their utility as a function of the distribution of players' outcomes we talk about *distributive preferences*. In the case the individual acts relying on his beliefs of the action of others, we talk about *belief-dependent preferences*. These two types of preferences might be present within a same individual (Attanasi and Nagel, 2008). The laboratory studies on the impact of preferences on public good funding (WTP) showed that the individuals are influenced by others' contributions, and are driven by principles of distributional preferences like fairness, reciprocity and inequity aversion (Bogaert et al., 2008; Bowles, 2008; Bohnet and Frey, 1999; Hoffman et al., 1996; Fischbacher and Gächter, 2010).

Andreoni (1990) studies the impact of individuals' preferences on the contributions to public goods. He introduces the concept of "warm-glow" altruism, i.e., the social well-being generated by the public good provision. For the author, the individual contributing to the public good, in his context behaving pro-environmentally, finds a reward in the fact of behaving well.

Other studies showed indeed that individuals WTP depends on their other regarding preferences (Bowles, 2008; Fischbacher and Gächter, 2010; Bohnet and Frey, 1999). Inequality aversion and reciprocity have been investigated as predictors of PGG contribution. Studies show that individuals do not like inequality in a group and their behavior is driven by reciprocity with respect to the behaviors of the other groups' members (Rabin, 1993; Fehr and Gächter, 2000; Charness and Rabin, 2002; Fehr and Schmidt, 1999). Fischbacher et al. (2001) investigate in a lab experiment the preferences in public good games, and distinguishes between different types of preferences, namely inequity aversion and reciprocity. The authors find that half

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of the participants are “conditional cooperators”, meaning that they increase their personal contribution with the increase of the group members’ contributions. They also find that only a small part (one third) of the participants are free riders who express selfish behaviors. Bowles et al. (2001) and Fehr and Gächter (2000) show that punishment in PGGs is provided to the non-cooperating individuals even when the punishment is costly for the punisher. According to the authors, this is due to the strong reciprocity model explaining that the individuals have more than simple predispositions to cooperate, they do not hesitate to punish shirkers in order to enforce a cooperative norm in the group.

Behavioral literature shows that social preferences are of fundamental importance in pro-social behaviors studies predicting behaviors in social dilemma. The model of Messick and McClintock (1968a) and Van Lange et al. (2013) called Social Value Orientation (SVO) is widely recognized as a measure for social preferences. The model assumes that in a situation of interactions, individuals behavior depends not only on her own payoff but also on her preferences for the other individuals’ payoff. Moreover, these preferences remain stable over time. Crosetto et al. (2012) and Murphy et al. (2011) test empirically SVO in laboratory experiments, supporting its validity¹⁴. SVO model measures individual’s preferences with a continuous variable proxing the spectrum of possible behaviors ranging from an individualistic type to a pro-social type.

Among all possible orientations, the majority of individuals behave according to one of the three following categories (Au and Kwong, 2004): pro-social (46%), individualistic (38%) or competitor (12%). Precisely, an individualistic individual acts by giving the higher consideration to her personal payoff, a pro-social individual attempts to maximize the collective payoff, and an competitor individual searches to maximize the relative difference between her payoff and the others’ payoffs. Based

¹⁴SVO measure is applied to measure individual preferences in both chapters 3 and 4 of this thesis.

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on these orientations, several experiments show that individuals contributions and WTP differ according to their SVO. For instance, Van Lange and Liebrand (1989) in a social dilemma show that individuals with pro-social preferences tend to cooperate more than individualists, who cooperate more than competitors. Social value orientation is also predictive in an environmental context. Indeed, Joireman et al. (2001) show that pro-social individuals are more willing to undertake PEB rather than individualistic behaviors. Similarly, Gärling et al. (2003) reach the same conclusion that pro-social individuals are more environmentally concerned, and thus more likely to adopt PEB. Moreover, if the PEB explicitly requires cooperation with other individuals, pro-social individuals are more likely to cooperate than individualistic ones.

Attention

Psychology literature has provided support for the hypothesis that being in contact with the environment increases the attention allocation. For instance, Berto (2005) provides an example of the positive effects of environment on attention. He conducted a laboratory experiment where he provides a visual stimulation with natural or urban environments pictures on the participants in stressful situations. Participants had to perform a task implying attentional effort¹⁵ before and after the pictures view. Participants exposed to natural pictures like mountains performed significantly better on the task compared to those exposed to urban pictures. Similarly, Leal-Galicia et al. (2008) showed a positive effect of environment in the reduction of memory deficits and anxiety.

The psychology studies mentioned in the previous paragraph look at how environment impacts on attention. However, the reverse relation between attention and environment (PEB) can exist. Precisely, some PEBs, such as turning off the

¹⁵Sustained Attention to Response Test (SART)

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light or recycling, require attention. In experimental economics, PEB are studied using social dilemma where the individuals express their preferences by deciding their monetary contribution. However, in many cases the choice of the individual is not related to monetary contribution but rather regards the amount of attention she pays. Current literature lacks studies focusing on individual choices to allocate attention for PEB¹⁶.

2.3.2 External determinants for PEB

Norms and Cost-benefit trade off

In this section we define norms and we distinguish between the descriptive and injunctive norms. Then, we discuss the empirical evidences of the positive and sometimes counter productive impacts of norms types on PEB. Finally, we discuss the interpretation of PEB as a cost-benefit trade off process.

Norms

Norms refer to common and accepted behaviors within a group. PEB adoption can be either voluntary or enforced by social norms. Research published in behavioral economics has shown that individuals tend to conform to what they perceive as being the norm.

Sherif (1965) defines social norm in psychology as the set of explicit or implicit rules describing how individuals should behave.

One line of research in psychology presents the Norm Activation Theory (NAT) as a predictor of PEB. NAT model explains that pro-social behavior is driven by four factors, precisely: the individual's norm according to her moral beliefs about what is the pro-social behavior to adopt, the awareness of the possible detrimental impacts

¹⁶Chapter 4 of this thesis aims to fill this gap in the literature by presenting a study on the allocation of attention as an expression of pro-social behavior.

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of not adopting the pro-social behavior, the attribution of the responsibility of these detrimental impacts and the perceived control the individual has over the problems she faces (Schwartz, 1977; De Groot and Steg, 2010). Empirically, environmental psychology studies adapted this theory in several contexts as nuclear energy protests (De Groot and Steg, 2010) or car use reduction (Abrahamse et al., 2009).

A second line of research focuses on social norms and divides norms in two types: “descriptive” and “injunctive”. The descriptive norm describes the typical behavior of the community in a particular situation. For instance, if an individual believes that the usual behavior is to recycle, then he is likely to recycle. The “injunctive” norm refers to the approval of the suitable behavior (Cialdini et al., 1990).

Experimental literature shows that the individual can be influenced differently depending on the two types of norm even in the case where he is not aware of which of the two types she is experimenting (Nolan et al., 2008).

There is a broad body of works in behavioral literature that examines the use of social norms in promoting PEB. The most influential work in this literature is Schultz et al. (2007)’s field experiment using normative messages to encourage household energy conservation. The authors show the efficiency in reducing energy consumption of descriptive normative messages that allow the consumers to compare their energy consumption to the one of their neighbours. Following Schultz et al. (2007), Goldstein et al. (2008) conducted a field experiment in a hotel, and show that individuals are more likely to reuse their towels when they receive a message describing the behavior of other individuals in the same situation.

In a field experiment on energy conservation, Nolan et al. (2008) used messages informing about the percentage of residents in a community who were engaged in specific actions, for instance using fans rather than air-conditioning in the summer. The results showed a reduction of 10% in electricity consumption for the group of participants who received a normative message. The same positive impact has

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been observed at the household scale, as family and parents pro environmental actions increase children PEB adoption (Gronhoj and Thøgersen, 2012). However, this type of descriptive norms lead also to a non suitable effect, namely *boomerang effect*. The households who were consuming less than the average consumption of the neighborhood increased their consumption to comply with the norm of their neighbourhood. This counter-productive effect can be eliminated by adding approval messages, namely, an injunctive norm.

Allcott and Rogers (2014) investigate the effect of the injunctive norm over time and they show that consumers still respond to the incentives after two years. This effect of injunctive norms can however be harmed in certain cases by the absence of a descriptive norm (Smith et al., 2012). For instance, if an individual does not know that the norm in her community is to adopt a PEB, she experience a reduction of her motivation to adopt the PEB if she observes that her neighbor is not adopting the PEB.

Similarly, Allcott (2011) studied a program to expose residential consumers to the information about their hourly real time energy consumption, using data from more than 600,000 residential households. These households were randomly assigned to two groups. One control group not informed and one treatment group of households informed about their energy consumption and the energy consumption of similar neighbours. The results suggest that receiving information reduce average monthly energy consumption. Moreover, the households reduced their energy consumption during peak hours, without any significant increase in average consumption during off-peak hours.

It might be relevant to briefly discuss two important concepts that help descriptive and injunctive norm to be effective, namely the group of individuals used as reference to define the norm and how the messages concerning the norm diffuse within the group.

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In order to increase the effectiveness of the normative messages, the policy makers should pay attention to the choice of the reference group for the individuals they want to target. In the psychology literature, reference groups are chosen relying on the concept of social identity, for instance house neighbours are often used as control groups. Another possibility is to use as reference group the individuals selected through the use of social media networks.

Social diffusion plays a critical role in determining the behavior. Individuals are more likely to engage in a green behavior if their social neighbours, colleagues or friends already do. With the development of the different social media platforms, this dimension of diffusion is expected to generate more PEB adhesion.

Cost benefit trade-off

The economic literature shows that individual choices can be analyzed in terms of the costs and benefits of adopting a PEB (Carlsson and Johansson-Stenman, 2012; Shogren and Taylor, 2008). The economic approach describes rational individuals as the ones who base their decisions on a trade-off between their efforts (money or time) and some social benefits i.e, the reduction of her impact on the environment. Moreover, according to Arrow et al. (1996) an effective environmental policy is designed relying on the assumption that individual decisions are driven by an assessment of cost and benefit trade-offs. According to this approach, the individual maximises only her well-being and neglects the other individuals' well-being.

In the context of environmental studies, a problem occurs when evaluating the value of nature. The individuals acting according to a cost and benefit trade-off are neglecting the effects of her actions on the environment. Even if we consider as part of the individual well-being the quality of the environment where she lives, a difficulty arises in attributing a value to the environment. This last issue remains a point of debate in the scientific community.

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Kaiser et al. (1999) link norms and the cost-benefit approach. They apply the Theory of Planned Behavior (TPB) (Ajzen, 1985; 1991) to PEBs. The Ajzen (1991)'s model states that individual behavior is determined by the intention to perform the behavior, which is predicted by three beliefs. First, is the belief about the outcomes of the behavior; second, is the belief about the norms and expectations that others have concerning the behavior; and third, is the belief about other factors that can help or obstruct the behavior.

In section 2.3.1 we mentioned the Not In My Backyard (NYMBY) effect. NIMBY effect refers to individuals who are willing to participate to an activity increasing the social well-being. However, their participation is compromised by the important deterioration of the individual well-being they would experience by participating. This counter productive effect could be avoided by the creation of a “win-win” situation that equals costs and benefits. For instance, using a efficient washing machines will reduce both the time and effort dedicated to the washing activities by the individual and the water consumption.

Environmental Policies

Governments, aiming at designing effective environmental policies, have to identify constructive ways to provide incentives to individuals and households characterized by different preferences. As discussed in sections 2.3.1, the individual might react differently depending on his personal characteristics. The environmental literature has focused on how policy instruments can promote PEB. In this review, we will discuss the impact of three types of external factors i.e. incentives, namely “reward” or “taxes” and “nudges”.

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Rewards

Economic factors and budget constraints play an important role in individuals' behavior. For instance individuals take the public transportation instead of personal car for budget constraints.

The literature emphasizes that rewards enhance PEB adoption. However, rewards can have counterproductive effect and harm the motivation of individuals to adopt PEB. NIMBY effect is an example of this harmful impact (Frey and Oberholzer-Gee, 1997). The NIMBY effect, previously mentioned in the discussion about the cost benefits trade-off, has been studied in a field experiment in a local community where monetary compensations were offered in exchange of the individual agreement to a new project (Frey and Oberholzer-Gee, 1997). *NIMBY* effect explains why individuals who are in favour of environmentally volunteering, significantly reduces their intended effort after being paid. Frey and Oberholzer-Gee (1997) show the compliance with experimental evidence in social psychology arguing that financial rewards reduce the intrinsic motivation and effort of individuals motivated by their commitment towards environment protection. Moreover, associated to a cost-benefit trade-off, NIMBY effect shows that individuals see their motivation to participate in social activities decrease if their participation implies an important deterioration of their individual well-being (see section 2.3.2 on cost-benefit trade-off).

The literature has documented some limits of rewards. One limit is that the reward effect might be limited in time. In fact, Deci et al. (1999) show that it exists a positive effect of the reward on a pro social behavior (Festré and Garrouste, 2015b). However, wonce the reward incentive is removed the pro social behavior might disappear or even worst, the new behavior might become less pro social than the initial one.

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Taxes

One incentive widely used by policy makers is the tax system. In PGG experiments, individual contribution to fund the public good increases if a tax system is present. Brekke et al. (2003) show that individuals increase their contribution to voluntary work if a tax for non-participation is introduced. However, implementation of such tax incentive might undermine motivation of the individuals who are already highly intrinsically motivated to adopt PEB. In fact, these individuals might prefer to avoid confusion on the motivation of their action that mainly depend on their intrinsic motivation (Frey and Jegen, 2001a).

Precisely, taxation strategy might not help solving environmental problems. Andreoni (1993) showed through a PGG experiment that the environmental taxes do not promote public good provision and PEB. The authors explains that the taxes create intrinsic motivation crowding out generated by a conflict between the tax and the intrinsic motivation (Deci and Ryan, 1975). Brekke et al. (2003) states that individual self-image is increased when the individual adopts a behavior that is the closest to his own conception of an ideal and moral behavior. If an economic incentive harms her self-image, it leads to a crowding out effect. In a different context, Gneezy and Rustichini (2000b) argue for the importance of beliefs and values of the individual, as certain incentives can create a distortion in her beliefs about the value of the adopted behavior, and lead her to reconsider the value her actions. Gneezy and Rustichini (2000b) studied Israeli parents' reaction to the introduction of a fixed fine for being late in picking up their children kinder garden. Authors an increase in the number of late parents. After facing the disapproval of school employees, the monetary applied changed the relationship between parents and kinder garden. The authors observed a crowding-out of intrinsic motivation to be on time, since the parents were thinking that the kinder garden's employees were now paid for the extra time. As a consequence, we see from these results that some government or

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regulator interventions do not always work as planned, the same when it is a matter of PEB (Noussair and van Soest, 2014).

Nudges

A literature strand shows how non-monetary incentives can push an individual to adopt a PEB. This is the reason why, both policy makers and academics are increasingly interested in the study of *nudges* efficiency in promoting PEBs.

Introduced by Thaler and Sunstein (2009)¹⁷, a nudge is a tool that subtly modifies the decision context with the aim of correcting individual behaviors without changing the set of choices available to the individual. Nudges can be, for instance, information provision or reminders. An example of nudge is a shop where the seller can arrange the articles such as bio healthy food at eye level so that customers buy the more healthy items. To be considered a nudge, it is important that this new framing of the possible choices does not change the available set of choices. According to Thaler and Sunstein (2009), nudges are good complements to traditional incentives. The low cost of these incentives represents an considerable advantage. It made nudges being potentially more popular among the general public compared to the traditional policy tools. If compared to traditional public policies which rely on bans, monetary incentives and taxation, nudges take advantage from the individual's rationality failure and redirect her choices by very slightly altering the choice conditions.

Since the Thaler and Sunstein's book publication, the concept of nudge had however left a room for confusion as it has generated several criticisms among behavioral

¹⁷Richard Thaler to be rewarded by the 2017th Nobel price in economics during the writing of this review. Note that this success had spread to the political sphere as many countries like United States government who set up "nudge units" with the help of Cass Sunstein to apply this new approach in policies.

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researchers. Among these criticisms, the problem of the lack of precision in the definition given in Thaler and Sunstein (2009)'s book. Mongin and Cozic (2018) point out precisely this issue and discuss nudges definition's unity and finally distinguish three different definitions according to nudge intervention proprieties. The first definition describe that a nudge redirects individual's decision by softly changing choice conditions. The second definition focuses on the use of individual rationality limitations and failure. In the third definition, nudges permit to minimize the possible adverse effects of the rationality failures.

Another issue discussed in relation to nudges is the problem of libertarian paternalism. Any government is considered as paternalistic if it limits individual liberties by banning, punishing or influencing the individual's choices in order to reach government's own objectives of increasing general welfare. In literature, we find many authors arguing that nudging and libertarian paternalism are not the same in practice. For instance, Hansen (2016) argues that nudging individuals does not necessarily imply libertarian paternalism. The author explains that both notions however share the idea of individuals who need to be helped to take the right and rational decision, and thus increasing their own interest.

Despite the criticisms, several examples of evidence showed that nudges are an efficient low cost strategy for encouraging PEB. For instance, the field experiment of Allcott (2011) on energy consumption showed that nudging and social norms interact enhancing the energy reduction (see the section 2.3.2 for more detail on this study). On the same topic, Ayres et al. (2013) investigate the impact of nudging information on households electricity and natural gas use. The authors find in line with studies of Nolan et al. (2008) and Allcott (2011) that peer comparison obtained through the use of messages in the form of nudges increases PEB. However, some studies suggest that nudges have to be targeted and not assigned randomly. Precisely, Costa and Kahn (2013) observed that nudges might have different effects depending

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on individual's characteristics. The authors informed about a number of different political orientations of American households and their influence on their relative energy use. On average, the nudge reduced by 2% the energy use. Moreover they show that political orientation of the individuals affects the energy consumption. Liberal households reduce their consumption, while Republicans increase it. The authors explain this by the differences in environmental concerns connected to the political orientation.

Learning

Several studies have investigated the importance of individual learning in promoting PEB. Another strand of literature investigates the role of individual knowledge about the environmental issues on PEB. Learning and knowledge are two related concepts, as learning implies an exchange of knowledge.

Chawla (1999) shows that individuals who have learned pro-environmental values in their families or at school or had direct childhood experiences in nature, are more likely to develop an environmental concern that leads to a PEB. Similarly, Levine and Strube (2012) show that accurate knowledge about the environment is among the personal factors that lead to PEB.

However, as shown by Finger (1994), having the information about the environment does not influence the PEBs. On the contrary, information associated to direct experience in the environment enhances the PEBs.

These results show that the acquisition of environmental knowledge by the individuals lead to PEBs. Policy makers aiming to increase individual PEBs might pursue the strategy of promoting knowledge acquisition, i.e., learning. Learning during childhood can represent a key factor that shapes other determinants of PEB analysed in this paper, such as values, ethics and moral sense. This broad impact on several aspects of the individual might make the investment in campaigns promoting

learning particularly effective.

2.4 Conclusion

The goal of this review is to provide a survey of the behavioral literature on PEB based on a bibliometric analysis. We provide information regarding economists' and psychologists' research on PEB promotion. Our study sample includes 1006 research articles in both Economics and Psychology and shed light on their commonalities, as well as the specificity of each discipline. We use the keywords reported on these articles to identify the main determinants of PEB. In our survey we discuss the impact of each determinant.

Although earlier studies have already reviewed the state of the art in the environmental literature (Steg and Vlek, 2009; Kollmuss and Agyeman, 2002), our analysis extends and complements these findings by using a bibliometric approach and by showing with quantitative evidence the evolution of each discipline.

The statistics we provide show that that psychology research on PEB tends to focus on the relationship between the internal characteristics of the individual and her behavior such as emotions, values and affects, risk perception, moral, preferences and attention.

Economists study PEB as a micro-economic phenomenon based on a maximization of a utility function that can be influenced by social preferences. PEB describes an individual's voluntary effort to provide an environmental public good. Economic studies focus on the external factors that enhance the PEB. Different types of incentives are investigated such as reward, taxes and nudges.

This review presents insights from both economic and psychology disciplines to describe PEB. From our observations, we suggest that the economic approach to the study of PEB should be enriched by considering more the internal factors that are

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concepts frequent in psychology studies. Precisely, if policy makers rely only on the economic approach to predict individuals' reactions, they will neglect a considerable part of the decision making process. Moreover, they will neglect the impact of some psychological motivations to engage in a certain PEB. For instance, the same economic incentive can lead to a different impact on individuals according to their emotions. While the individual values are already well established in PEB economic studies, the role of emotions is neglected.

Finally, we observe a lack of inter-disciplinary studies as shown in the empirical part. This lack of collaboration might be due to the methodological differences between the two fields which limit the real collaboration between experimenters in economics and psychology. Indeed, despite the applied methods similarities, we can cite some points of difference between economics and psychology experimental procedures (Hertwig and Ortmann, 2001), namely the contextualization of the experiments, the use of deception, and the incentivized decisions. As a result, from the one hand, we observe that psychology focusses on the results learned about the actual functioning of agents or society (external validity). On the other hand, for experimental economics, the emphasis is on the experimental consistency (internal validity), with the objective of comparing theoretical predictions of models with the behaviors observed in laboratory (for a methodological discussion on the differences between the experimental economics methodology and experimental practices in psychology, see Ohana 2004; Serra 2012; Cassar and Friedman 2004; Etchart-Vincent 2006). The inter-disciplinarity feasibility seems a question deserving more discussion in the behavioral and experimental community.

CHAPTER 3

The pen might be mightier than the sword! Impact of advice and sanction on pro-environmental behavior.

3.1 Literature review

In essence, pro-environmental behaviors are pro-social. Although their objectives and outcomes may be invisible in the present, their social benefit will become evident and be experienced in the future. Experimental economics as a branch of economics, studies environmental behavior as a social dilemma taking the form of a public good game (PGG) in which the first-best allocation of resources is unachievable because of potential conflict between the immediate interests of the individuals and societies in which they are embedded. This introduces the need for game-theoretic considerations (the well-known free-riding problem) whose resolution may not serve the collective good.

In this paper, we adapt a repeated PGG to the environmental issue of waste management. To simulate this issue at the municipality level, we design an experiment with groups that include four contributors and a third-party that has the possibility to design an incentive system in order to increase cooperation, and therefore, increase social welfare. We designed an environment where the well-being (payoff) of the third-party is correlated to the contributors' well-being or payoff, based on the idea that in the context of a pro-environmental project state (societal) welfare is reduced in the case of low levels of contributions from the population.

We investigate two types of incentives in two separate treatments with random introduction into each group of a third-party player. The first type of incentive is free advice given by the third-party in order to increase the average level of the group's contributions (advice treatment - AT). The second type is a costly punishment implemented by the third-party consisting of a group tax whose level depends on the average level of the group contributions (sanction treatment - ST). The punishment is costly to the third party since its payoff is linked directly to the group's average payoff. Comparison of the behavioral repercussions in the form of

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individual contributions to the common good¹ will reveal the most efficient incentive to foster individual cooperation. We investigate the wealth effects for contributors by including an effort task which provides increments to their initial given endowments which can be perceived as being earned ‘fairly’. We control for participants’ pro-social preferences by considering four individual profiles (individualistic, pro-social, competitor, and altruistic) provided by the social value orientation (SVO) measure (Murphy et al., 2011).

This experimental strategy is in line with the literature on the effect of incentive taxation, and advice on individual pro-environmental behaviors such as waste recycling. There is a large body of work in economics on household recycling behaviors but it consists mainly of theoretical (Brekke et al., 2003; 2010) empirical studies (Viscusi et al., 2011; Cecere et al., 2014), or field experiments (Schultz, 1999). To our knowledge, there are no lab experiments investigating this question. The related environmental literature discusses how to encourage or influence households to sort waste *via* the use of non-monetary (communication, nudges) and monetary (incentive pricing) incentives. For instance, there is discussion in the literature about how to encourage or influence households to adopt pro-environmental behavior. On the one hand, several studies show that incentive pricing, acting like a Pigouvian tax, increases the quantity of recycled waste (Fullerton and Kinnaman, 1996; Dijkgraaf and Gradus, 2004; Ferrara and Missios, 2012). Fullerton and Kinnaman (1996) are interested in the effect of the introduction of unit pricing on the amount of waste recycled, and find it results in a 16% increase in the weight of recyclable materials. Dijkgraaf and Gradus (2004) compare multiple forms of unit pricing (based on waste weights, waste volumes, bag collection and collection frequency), and show that systems based on weight and frequency are respectively 21% and 10% more efficient.

¹ The instructions given to the players inform them that the common good consists of a shared waste management mechanism, and that sharing the good means sharing its tax.

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Since we are drawing a parallel between effective pro-environmental behaviors and social dilemma environments, we focus on the experimental literature on social dilemmas in general, and PGG experiments in particular.

Since the beginning of the 1980s, PGG experiments have been aimed at investigating individual behaviors in diverse institutional settings. Ledyard (1995, p. 116) describes a very simple institution: the *voluntary contributions mechanism* (VCM) which has been tested. It involves each subject contributing (privately – i.e. without any information about others' contributions) an amount of a private good to a common good. In this context, the total amount of the common good equals that which is producible from the total private goods contributed. Many variants of this simple institutional setting can be investigated: e.g., introducing the possibility of *ex-ante* or *ex-post* communication between subjects, rendering the individual contributions public, or allowing punishment in order to enhance cooperation (see Fehr and Gächter (2000)).

As already mentioned, the present paper focuses on two specific variants: a communication mechanism based on advice vs. increased taxation under the contingency of the introduction of a third-party that is informed about the level of the contributions made by the members of its group. The experimental literature on PGGs draws attention in particular to the impact of information provision. For instance, Fischbacher et al. (2001) show that individuals contribute more to the public good if they are informed that their partners' contributions have increased. The information provided by communication in the group has also been studied. For instance, Chaudhuri et al. (2006) investigate communication in a laboratory experiment where the effects of three different forms of advice (private, public and common knowledge) are compared. They demonstrate first that contributions are higher in the presence of common knowledge advice, and second that punishing non-contribution behavior is not the only way to increase contributions. The more recent economics literature

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is showing an interest in another form of communication by investigating what are commonly referred to as *nudges*. In their contribution to what is referred to as choice architecture, Thaler and Sunstein (2009) define nudges as costless tools aimed at improving decision making and correcting behaviors, and note that “to be considered a nudge an intervention must be easy and cheap to avoid”. As a non-monetary incentive, nudges are considered by economists to be an interesting alternative to avoid the perverse effects of monetary incentives such as fiscal crowding out for instance. This type of intervention has been extended to the environmental economics literature resulting in several published studies on waste sorting behavior². As already mentioned, its low cost advantage makes the nudge a popular and especially valued tool for policy makers implementing pro-environmental incentive policies to promote green behaviors.

There is a large literature also on the impact of punishment opportunities as an incentive to maintain high levels of contribution to a public good. This body of work suggests that the opportunity to punish group members is usually helpful even when it is costly, or is implemented by a third-party (see Fehr and Fischbacher (2004) on dictator games or the prisoner’s dilemma). Bowles et al. (2001) following Fehr and Gächter (2000) show that a considerable proportion of community members are willing to engage in a costly punishment in order to enforce a cooperative norm, even in the absence of any reasonable expectation of personal reward for their effort. This behavior is described as *strong reciprocity*, i.e., a predisposition to “co-operate with others and punish non-cooperators, even when this behavior cannot be justified in term of self-interest” Bowles et al. (2001, p. 425). These authors show also that a shirker’s response to punishment by means of an increased level of contribution cannot be explained completely by the desire to avoid the reduced payoff caused by the punishment. Bowles et al. (2001) suggest that the behavior of shirkers is

²See Kirakozian (2016) for a review of behavioral and incentive policies for household waste management.

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motivated also by the shame they experience when punished for violating a norm. Bochet et al. (2006) show that the willingness to impose costly punishments that affect other subjects' earnings applies mainly to low level contributors. In line with previous similar experiments, they conclude that punishment increases the level of contribution but if the cost of this punishment is taken into account, the net effect on efficiency is quite low. The implementation of punishments can also be delegated to third-parties. In a series of experiments, Fehr and Fischbacher (2004) examine the characteristics and relative strengths of second and third-party sanctions as well as the mechanisms of enforcement underlying social norms; they show that 60% of third-party punishments are directed to violation of cooperation norms. Almenberg et al. (2011) study costly punishment by a third-party, allowing the third-party to choose between punishing or rewarding players. Their results show a consistent and intuitive pattern: selfish behavior is punished, and generous behavior is rewarded, and costly rewards are at least as common as – if not slightly more common than – costly punishments. The preference for rewarding over punishing might be explained in part by fear of retaliation.

In this literature stream, the cost of punishment is fixed at an amount representing the cost of applying the punishment. Gülerk et al. (2006) investigate the advantages of a possible sanction applied by an institution with the sole objective of creating a contribution norm which will be adhered to by the contributors inside the group, and therefore, encourage low contributors. Gülerk et al. (2006) allow individuals to choose between operating in a sanction or a sanction free environment. Their results show that the contributions of individuals who switch from sanction free to sanction institution increase – going sometimes from extreme free riding to full contribution. In our experimental design, the third-party evaluates and decides about the need or not to punish the other players, knowing that its own payoff depends on that of its group members.

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The paper is organized as follows. Section 3.2 describes the experimental design; section 3.3 presents the results, and section 3.4 concludes with a discussion.

3.2 The experiment

3.2.1 Experimental procedures

We conducted the computerized experiment in December 2015, at the LEEN laboratory in Nice Côte d’Azur University, France. The 252 participants were mainly undergraduate students recruited using ORSEE (Greiner et al., 2004). Depending on the availability of the participants, the sessions were conducted with three or four groups each. A total of 18 sessions were conducted in three different treatments.

The experimental procedure involved each subject on arrival at the LEEN Lab, drawing a number randomly which corresponded to the number on a computer in the room hosting the experiment. Once all the participants had been allocated to a computer, the experimenter distributed written instructions³, and also read them out loud and responded to any questions. No subject participated in more than one session, which allowed inter-group comparison of the recorded data. The experiment was conducted in French and computerized using the Z-tree software package (Fischbacher, 2007). The subjects were informed that the profits acquired in each step of the experiment would be measured in experimental currency units (ECU), and that their final payoff would be converted into euros at the rate of 1 euro per 10 ECU. Payments were made anonymously after the experiment. The average participant earned 13.6 euros, including a 5 euro show-up fee.

³English translation provided in the appendix .2.2

3.2.2 Treatments and parameters

Participants interact during 10 periods under a once-for-all random group matching protocol, for an average one hour duration. The experiment is based on a repeated PGG with n subjects, $n \geq 2$ ($n = 4$ for *BT*, $n = 5$ for *AT* and *ST*) and is composed of three treatments: baseline treatment (*BT*), advice treatment (*AT*) and sanction treatment (*ST*).

Table 3.1: Session composition (by treatment)

Treatment	Number of groups	Number of players by group	Total players
BT ‘Baseline’	18	4 contributors	72
AT ‘Advice’	18	4 contributors + 1 third-party	90
ST ‘Sanction’	18	4 contributors + 1 third-party	90

Each session conducted for any of the treatments consisted of a series of 10 periods. We obtained a total of 720 observations for *BT* and 900 observations for the other two treatments (*AT* and *ST*).

All treatments include three stages: two preliminary common stages, and one specific stage.

The first stage

consisted of a personal social preferences measure based on “The ring measure of social values” (Murphy et al., 2011; Crosetto et al., 2012). This test, called the social value orientation (*SVO*) test, gives a magnitude measure of people’s concern for others by studying the motivation underlying interdependent decision behavior, and assuming that people have different motivation levels when evaluating allocations between themselves and others. The *SVO* involves the subjects making 15 successive distributive decisions between themselves and an unknown other subject along a continuum of joint payoffs (see figure 1 in the appendix). A profile (altruistic, pro-social, competitor or individualist) was computed at the end of the task but not

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communicated to the subjects. The participants were told that one decision out of 15 would be selected randomly to determine their payoff at the end of the first step, and that the ECUs earned at this stage would be added to those obtained in the other successive steps of the experiment.

The second stage

In this stage the computer randomly assigns groups of four or five subjects depending on the treatment (see below). In the case of groups of five subjects, four are given an initial endowment of 5 ECUs, and the fifth participant is the third-party who does not participate directly in the PGG at this stage. A real effort task is implemented in order to increment the initial 5 ECU endowment of the four participants in the PGG up to a maximum of 10 ECUs depending on their performance. Building on Cherry et al. (2002)'s insights, we are mainly interested in the origin of endowments. This is the reason why we introduced this effortful marginal source of payoff. The rationale was that their endowments should consist of a mix of earned and windfall money which should increase their heterogeneity and induce stronger engagement of the participants in the experiment.⁴

A single screen was displayed with a number of “sliders” programmed in Z-tree (Fischbacher, 2007) (see 2 in the appendix). The screens were identical across runs and subjects. We chose this effort task because of its ease of understanding and lack of randomness and guessing which allowed us to identify the real effort invested by the subjects. The code implementing the slider task was based on that developed by Gill and Prowse (2012). It is presented as a screen of 20 sliders positioned at 0 and going from 0 to 100, where subjects can move the sliders to any integer location

⁴Keser et al. (2017) in a linear public good experiment investigate endowment asymmetry and fair-share norms. They find that public good provision is higher when highly endowed subjects face a higher minimum contribution relative to their endowment than a player with a low endowment. This effect is due to the expressive power of the mandatory minimum of the idea of a fair-share among players.

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between and including 0 and 100, with the possibility to adjust and readjust these locations an unlimited number of periods during the allotted 60 seconds to reach exactly the value 50. The score points for the task are based on the level of effort exerted, with every four sliders correctly positioned being converted to 1 ECU which is added to the initial endowment.

The third stage

In this stage, one of the three treatments described below is allocated to different subjects (between-subject design).

Benchmark treatment In the BT, and to comply with the usual PGG experiments, each subject i decides simultaneously and without communication, how much of her total endowment d_i to contribute to the public good. This amount constitutes the private individual contribution, and is denoted by c_i with $0 \leq c_i \leq d_i$. The total payoff of subject i is defined as the sum of her initial endowment net of the amount of the private individual contribution ($d_i - c_i$), with $d_i \in (5, 10)$, $c_i \in (0, d_i)$ plus a share of the total contributions (including hers) of the members of her group. The instructions given to subjects informed them that the common good is a shared device (a refuse bin) which must be funded by all the group members. They were told also that the higher their contribution, the lower would be the tax applied to this common good. The function form of the utility function for agent i (see equation (1) below) is adapted from Andreoni (1993) and given by the equation below.

$$u_i = (d_i - c_i + (1 - \frac{1}{n}e^{-\beta \sum c_i}))^\alpha (\sum c_i + e^{-\beta \sum c_i})^{1-\alpha} \quad (3.1)$$

In (1), n is the number in the group, and β is the tax parameter which equals 0.5 in the Baseline treatment (BT) and Advice treatment (AT). However, β equals to 0.01 for the (ST) in the case the sanction is applied by the third-party. Note

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that a smaller β equates to a higher tax burden. The term on the left hand side of the utility function corresponds to the utility of agent i 's private consumption. It is equal to the difference between the agent's total endowment net of that agent's contribution to the public good plus the quota-part of the tax burden imposed by the municipality in order to manage household waste collection. Note that 1 is added in order to ensure that the left hand side term is strictly positive. The term on the right hand side of the utility function represents the public externality of the contributions of the group to which the agent i belongs. The parameters α and β are set so as to comply with several Nash equilibria outcomes.

The game is based on the above payoff function although subjects were not provided with this formula in the instructions. Instead, they were given a set of two-way tables corresponding to each possible level of performance in the real effort task k (from $k=5$ to $k=10$), where the level of the private contribution (from 0 to k) is the column variable and the sum of the contributions from the other three active members of the group (from 0 to a maximum of 30) is the row variable (see e.g. figure 1 where $k = 5$). For example, a subject with an endowment of 5 ECUs has to decide about the amount (between 0 and 5 ECUs) that she will contribute, depending on personal preferences and the aggregate amount obtained from her and the other subjects' contributions. In this case, the maximum payoff (13.42 ECUs) for that agent for that period is given by a null personal contribution $c_i = 0$ and the maximum contribution from the other members of the group $\sum c_i = 30$. This third stage is repeated 10 times for the same group of participants with heterogeneous individual endowments fixed once for all after the real effort task performed in the second stage.⁵

⁵Individual endowments remain private information throughout the whole third stage while the average level of endowments is common knowledge in all treatments.

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Advice treatment (AT) The AT is almost identical to the BT with the exception that the common knowledge possibility of receiving advice from a third-party is introduced. This additional subject is called the *advisor* and is now selected randomly within each group of five subjects. The advisor must wait until the other four group participants have finished the effort task. The advisor then is given information about the average endowment of the contributors in her group, following which and thanks to a nudge, the advisor suggests an optional desirable level of individual contribution. The advisor does not contribute to the public good but gets a payoff corresponding to the average earnings of her group. This information is common knowledge. As in the BT, the third stage is repeated 10 times with each group of participants who have heterogeneous individual endowments between 0 and a maximum of 10 ECU. The third-party/advisor can adjust the suggested level of the individual contribution at the beginning of each subsequent round.

Sanction treatment (ST) In the ST, the third-party can sanction (rather than advise) by increasing (decreasing the value of the parameter β) the tax rate if the average level of the group's contributions is considered too low. As in the AT, the third stage is repeated 10 times among the same group of participants with heterogeneous individual endowments. The third-party can adjust the level of the tax rate at the beginning of each subsequent round. Note that our setting implies a costly punishment mechanism since the third-party can sanction by deciding to raise the tax rate. The positive correlation between the contributors' and the third-party's wellbeing seems realistic judging by the reduction in State wellbeing implied by low levels of contributions in a pro-environmental collective project.

3.2.3 Behavioral hypotheses

Our analysis examines the following hypotheses about the behaviors of contributors and third-parties:

Hypothesis 1 Advice and punishment incentives lead to higher rates of individual contributions (Bowles et al., 2001; Sefton et al., 2007; Masclet et al., 2003; Nikiforakis, 2008).

Chaudhuri et al. (2006) predict that a communication mechanism designed as advice or a recommendation will lead to higher levels of cooperation, and especially if the advice is common knowledge. They argue also that punishing free riders is not the only incentive that is efficient to enhance cooperation.

Many experiments show that high levels of public good provision are possible if participants' decisions are monitored, and their misbehaviors are punished by other participants (Fehr and Gächter, 2000; Bowles et al., 2001; Sefton et al., 2007). Bowles et al. (2001) expect that free riders who are punished respond by increasing their contributions in subsequent rounds. The authors develop an experiment in which team production is based on reciprocity which predicts punishment in equilibrium. They show that if some members violate the team contribution norm they are punished which increases the efficiency of team production. The authors provide empirical evidence that transferring residual clemency to the team increases the reciprocator's propensity to punish shirkers, and increases the productive efficiency of the team. Also, in the case of self-interested agents, we should expect costly sanctions to be more efficient compared to advice.

Hypothesis 2 Rich individuals contribute more than poor ones.

Under the altruism hypothesis, Becker (1974) predicts a higher contribution to the common good in absolute terms as individual incomes increase. However, some experimental studies challenge the assumption of altruism, and find no relationship

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between income and contribution. For instance, Buckley and Croson (2006) conducted linear public good experiments with endowment heterogeneity, and hypothesized that wealthier subjects would contribute more than poorer ones. However, they observed that less well-endowed subjects contributed the same in absolute amount as the more wealthy ones. The authors explain this result as an attempt by the former to compensate for the difference in incomes.

Hypothesis 3 Third-parties apply a constant level of punishment on free riders over time.

Following Fehr and Gächter (2000), we expect that allowing costly punishment prevents decreasing levels of cooperation. If it is assumed that advisors are self-interested, then punishment is not the best response because of its cost. In contrast, if the third party is a strong reciprocator as predicted by Bowles et al. (2001), punishing free riders for shirking should be constant over time, despite the consequences for payoffs. Fehr and Fischbacher (2004) hypothesize also that even if sanctioning is costly to the third-party and provides it with no economic benefit, third-parties may be willing to apply egalitarian distribution and cooperation norms.

3.3 Experimental results

In the first part of this section, we report the descriptive statistics of our data. We also provide non-parametric statistics based on STATA. The second part of the section presents the results of the regression analysis.

3.3.1 Descriptive statistics

Main variables

Table 3.2 summarizes the descriptive statistics of the contributions across the three experimental treatments. Considering the mean of the relative contributions (i.e., the absolute level of contributions over the 10 periods, divided by the level of the initial endowments), we observe subjects' average behavior in line with the findings in the literature. According to Ledyard et al. (1997) and Ostrom (2000), the typical level of efficiency of contributions in traditional PGG is between 40% and 60%.

Table 3.2: Statistics on relative contributions (by treatment)

Treatment	Observation	Mean	Standard deviation	Min	Max
BT 'Baseline'	720	0.39	0.27	0	1
AT 'Advice'	900	0.33	0.31	0	1
ST 'Sanction'	900	0.34	0.31	0	1

Table 3.3 synthesizes the general statistical characteristics of main individual variables in our analysis.

Table 3.3: Descriptive statistics

Variable	Mean	Std. Dev.	Min.	Max.
Endowment	6.49	0.98	5	9
Absolute Contribution	2.35	2	0	8
Relative Contribution	0.35	0.3	0	1
Average absolute contribution	3	1.1	0.25	6.67
Average endowment	7.19	0.81	6	9
Payoff	7.12	1.69	2.64	12.73
Pro-social	0.44	0.5	0	1
Individualistic	0.52	0.5	0	1
Competitor	0.04	0.19	0	1
Advice	1.53	2.63	0	10
Sanction	0.19	0.4	0	1

We see that the average amounts of the endowments and absolute contributions are relatively low. The sample is composed of individualists (52%), pro-socials (44%) and a small proportion of competitors (4%). We see also that the average amount of

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the advice is of 1.53 which is far below the average amount of endowment (6.5). We observe that on average, sanction by third-party subjects is imposed in only 19% of the periods.

Evolution of the average absolute contribution over periods

Figure 3.1 shows the average amount contributed to the public good in the three treatments, by period. We observe that the average contribution in the ST exceeds the average contributions for the other two treatments. The average contribution in the ST decreases from 3.6 ECU to 2.5 ECU in the BT. In the AT the average contribution is lower, starting at 3.4 ECU and decreasing in the last periods. The lowest average contribution which is observed in the BT shows a declining trend which is in line with the literature on PGGs. Figure 3.1 shows the endgame effects, from period 8 onwards.

Kruskal-Wallis equality of populations rank tests with means as observations, confirm that the average contribution over the 10 periods differs significantly across the treatments compared. Therefore, we reject the null hypothesis that the contribution is the same for all three treatments ($X^2(3) = 41.492$, $p = 0.0001$). It seems that the possibility of a sanction from the third-party (ST) has a stronger effect than the provision of advice on participants' contributions. In sum, both advice and the threat of sanction enhance the average level of the contributions to the public good, with a stronger effect of threat of sanction.

Evolution of payoffs over periods

Figure 3.2 shows the average payoffs for the three treatments and their trend over periods. It seems that the possibility of punishment has a significant impact on average payoffs, and that higher payoffs are observed in the case of the ST (Kruskal-Wallis test p-value = 0.0001). We have highlighted that the average contribution is

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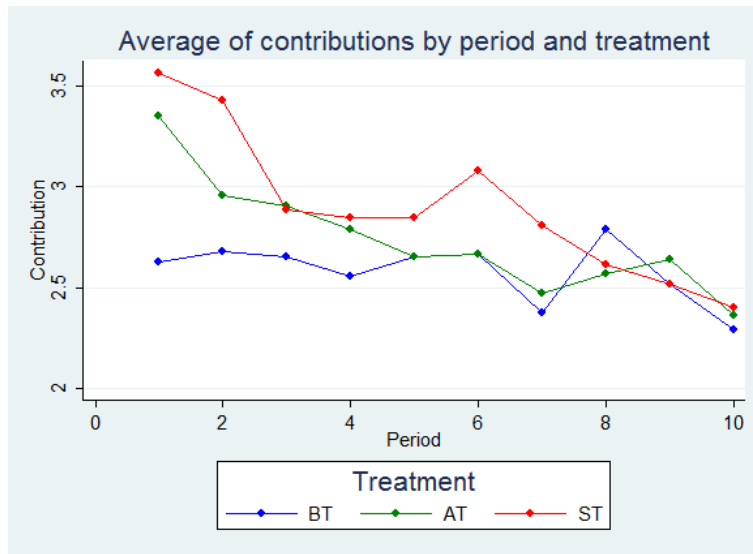


Figure 3.1: Mean of absolute contributions by periods

higher for ST, and higher contributions lead to higher payoffs. However, in the case of the AT between the 5th and 9th periods, payoffs decrease to a lower level than in the BT.

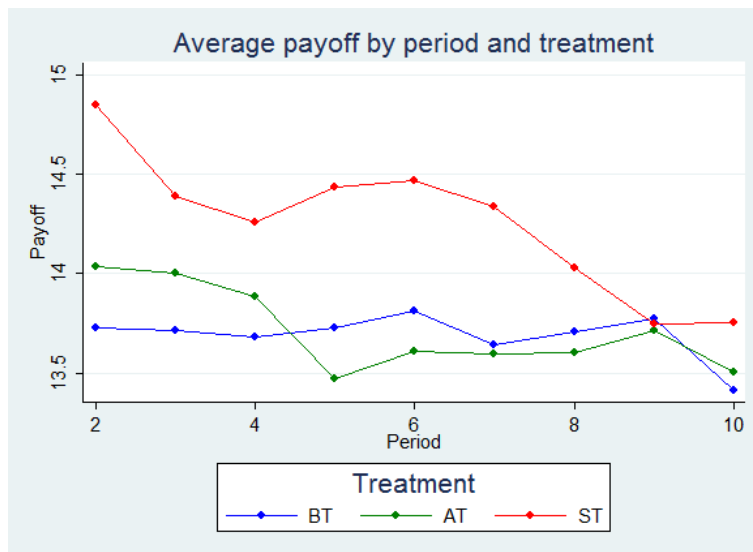


Figure 3.2: Payoff evolution by periods

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Wealth effects on contributions

In contrast to PGGs where all subjects are provided with the same initial endowment, in our experimental design, the relative proportions of windfall and earned money, and therefore the total amounts of initial endowments vary across subjects (Kroll et al., 2007). This creates the potential for wealth effects. Figure 3.3 displays the absolute contributions depending on the wealth (endowment level), using a dummy variable *high wealth* (*low wealth*) for subjects with bigger (smaller) endowments than the average for their group. Individuals with relatively less wealth (compared to wealthier group members) contribute the same amount to the public good in the BT, contribute less in the ST, and contribute more in the AT. By splitting the sample between *high wealth* and *low wealth*, we can investigate whether the altruism hypothesis Becker (1974) holds. This hypothesis states that wealthier individuals contribute more in absolute value than poorer individuals. We test this hypothesis by comparing average contributions of the *high wealth* vs. the *low wealth*. Our results corroborate Becker's hypothesis in ST, thus contradicting the findings in Buckley and Croson (2006), according to which better-off individuals contribute the same as worse-off individuals. In a related work, Ledyard (1995) investigates the effect of heterogeneous endowments, and shows they have a negative effect on the group contribution. However, there is no consensus in the literature on this issue.

Evolution of contributions depending on social preference profiles

An interesting question to investigate is whether different SVO profiles impact differently on absolute and relative contributions. We hypothesize that pro-social individuals are likely to contribute a larger percentage of their income to the public good compared to individuals who are individualists or competitive. Figure 3.4 shows the average absolute and relative contributions for each social profile. It shows that

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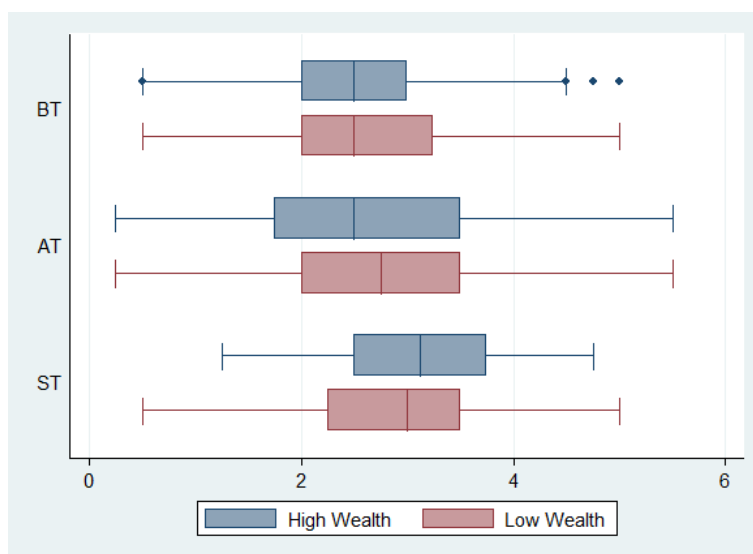


Figure 3.3: Wealth effect on absolute contributions

competitive individuals contribute less in both absolute and relative terms than pro-socials and individualists. The data indicate also that relative contributions levels do not differ significantly for individualistic and pro-social profiles. However, it appears that pro-socials tend to contribute more in absolute value.

In looking at SVO profiles across treatments (see figure 3.5), we observe that pro-socials contribute more than individualists and competitors in all three treatments. In the AT, competitors contribute slightly more than individualists but less than pro-socials. In the ST where there are no competitors, we find again that pro-socials contribute only slightly more than individualists.

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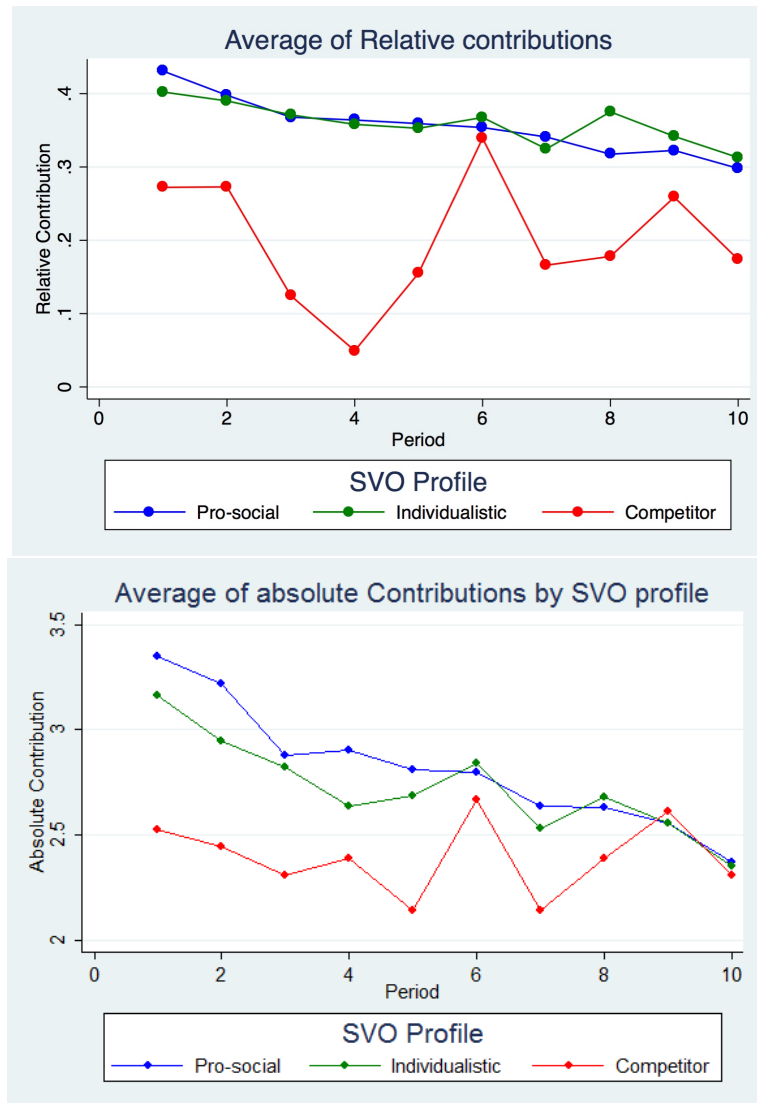


Figure 3.4: Absolute and relative contributions

3.3.2 Regression analysis

A negative binomial model of contributions

To confirm the interpretation in terms of aggregate numbers in the previous section, we conduct econometric analysis of individual decisions. Our experiment uses panel

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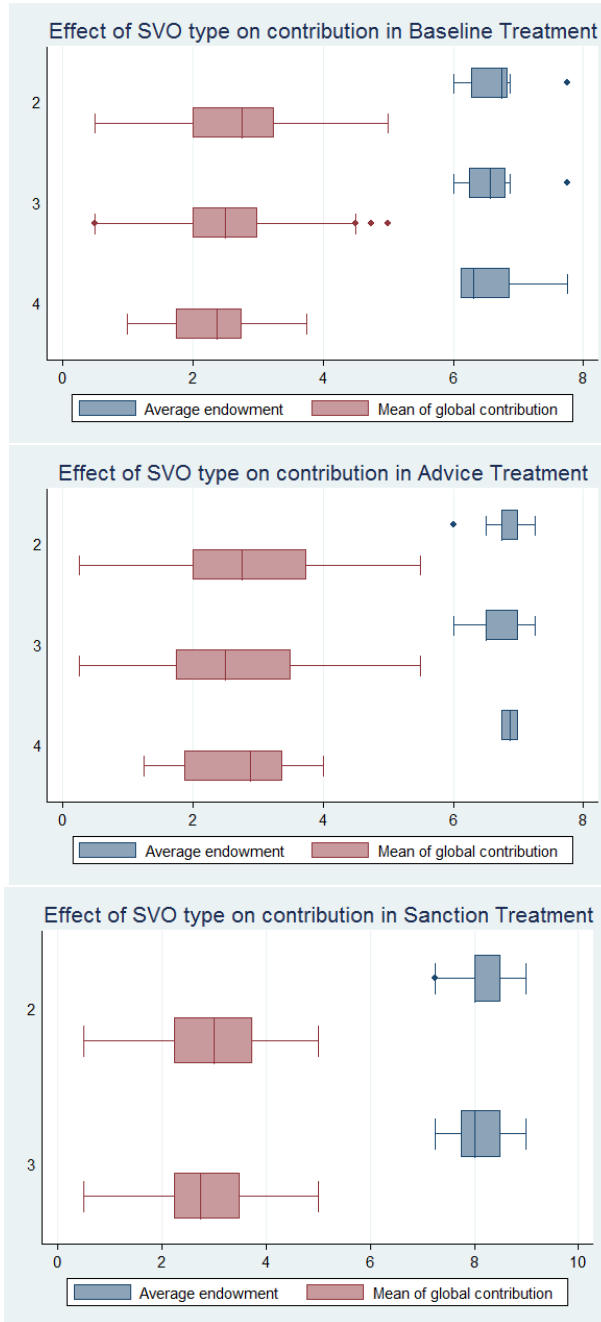


Figure 3.5: Social Value Orientation impact on contributions

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data for the decisions of participants over 10 periods. We want to estimate the impact of the AT and ST on individual contributions. We employ two estimation strategies. First, given the count nature of our dependent variable, we estimate a negative binomial model (NBM)⁶, Second we conduct an ordinary least square (OLS) regression. In both models, we control for individual characteristics, and cluster the standard error around subjects⁷. Table 3.4 presents the variables used in the econometric analysis.

Table 3.4: Variables of the econometrics models

Symbol	Definition
Dependant variables	
Contribution ¹	The amount of individual contribution to public good, from 0 to 10
Advice ²	The amount of advice, from 0 to 10
Sanction ³	1 if sanction, 0 otherwise
Independent variables	
Average contribution in $t - 1$ ¹²³	The amount of group's contribution in the previous period
Average endowment in $t - 1$ ¹²³	The amount of group's endowment in the previous period
High Wealth	1 if the endowment is greater than the average group endowment, 0 otherwise
Pro-social ¹²³	1 for pro-social, 0 otherwise
Individualistic ¹²³	1 for individualistic, 0 otherwise
Competitor ¹²³	1 for competitor, 0 otherwise
Payoff in $t - 1$ ¹²³	The amount of individual's payoff in previous period
Advice ¹	The third-party amount of advice, from 0 to 10
Sanction ¹	1 if the third-party punishes, 0 otherwise
No sanction in T_2 ¹	1 if the third-party do not punish in treatment 2, 0 otherwise
No advice in T_1 ¹	1 if the third-party advice of zero in treatment 1, 0 otherwise

¹see table 3.5, ²see table 3.6, ³see table 3.6

⁶The Poisson distribution has a few restrictive properties, one being that the mean and the variance of the process are equal. In our case $mean = 2.35$ and $variance = 4.02$. The NBM is a generalization of the Poisson model which allows for over-dispersion

⁷Given the qualitative nature of the variables in our estimation, the Hausman test cannot be used to choose between the fixed-effect (FE) and the random-effect (RE) methods for NBMs. If the Hausman test is rejected, this does not allow RE to be used (Baum, 2006). At the same time, the FE method is not appropriate because it drops important qualitative variables which are fixed along periods and among individuals.

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Contributors' behavior

Table 3.5 reports the results of the two estimations. Column 1 (NBM) shows that the average level of the contribution in $t - 1$ has a significant effect on the amount of the individual contribution: An increase of 1 point in the level of the group contribution at period $t - 1$ is associated with an increase by a factor of 1.21 in the individual contribution to the public good. The payoff at period $t - 1$ is also significant. However, the sign is negative which means that an increase of 1 point in the individual's payoff at period $t - 1$ decreases the individual contribution by a factor of 0.87, while holding all other variables in the model constant. As already emphasized, a novel contribution of the present paper is that it introduces a measure of individual SVO in order to investigate its impact on the individual contribution to the public good. Our results show that a pro-social and an individualist orientation are expected to have respectively a rate 2.048 and 1.88 times greater for individual contribution if compared to a competitive orientation. We highlight also that individuals with greater wealth endowments (*highwealth* = 1) contribute more than less well-endowed individuals: by estimating the the rate ratio comparing High and Low wealth. Well-endowed individuals compared to less-endowed, while holding the other variable constant in the model, are expected to have a rate of 1.25 times greater for the individual contribution. For an increase of one point of the third-party advice, individual contribution increase by a factor of 1.04, while holding all other variables in the model constant.

Economists generally advocate use of monetary sanctions to enforce cooperation. They argue that punishment, by reducing the expected payoffs of non-cooperative individuals, makes cooperation more profitable. However, experimental findings highlight the effect of motivation crowding out (Frey and Jegen, 2001b) due to a non-monotonic relation between incentives and motivation (Gneezy and Rustichini,

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2000a; Fehr and Fischbacher, 2002; Festré and Garrouste, 2015b). Our experimental results show that both the effects of sanctions and its threat are positively significant since sanctioned subjects see their contribution increase by a factor of 1.30 while non-sanctioned ones by a factor of 1.23. These results run counter to the economic literature which assumes monotonicity of the relation between monetary incentives and efforts, and therefore, highlights the benefits of mainly tax policies (Masclot et al., 2003). In our case, by contrast, we do not rule out the crowding-out effect of monetary incentives (Andreoni, 1993).

Even more convincing, our results indicate that the threat of sanction exerts a disciplinary effect. The effect of the ‘No sanction’⁸ variable shows that the threat of being sanctioned while not being punished induces participants in the BT to contribute significantly more (20% more than non-threatened individuals). In their PGG experiment, Galbiati and Vertova (2008) argue for the power of punishment for enhancing cooperation, independent of the incentive mechanism. Similar to Masclot et al. (2013), we assume that the threat of sanction on its own, has a positive effect on contributions. In other words, *The pen might be mightier than the sword*.

Third-party behavior

Table 3.6 reports the results of two estimated regressions - NBM and marginal effects Probit models - to explain respectively the *advice* (in the AT) and the *sanction* (in the ST) issued by the third-party introduced into each group of participants in the PGG.

The results show that the individual profile does not affect the behavior of the third-party. However, the level of the advice is significantly affected by the average level of endowment of group members at period $t - 1$. This means that an increase of 1 point in the average level of contributions and endowments translates into increases

⁸variables Sanction and No sanction in ST considered at period t-1.

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Table 3.5: Estimated models of the contributions

	NBM	IRR	OLS Model
Avg. group contribution in $t - 1$	0.192***	1.21	0.586***
Avg. group endowment in $t - 1$	0.0583	1.06	0.193
Avg. group payoff in $t - 1$	-0.136***	0.87	-0.406***
Advice in t	0.0394***	1.04	0.121***
Null advice	-0.113	0.89	-0.228
Sanction $t - 1$	0.265***	1.30	0.734***
No sanction	0.209**	1.23	0.565**
Baseline Treatment	<i>ref</i>	<i>ref</i>	<i>ref</i>
High Wealth	0.224***	1.25	0.607***
Pro-social	0.717***	2.04	1.203***
Individualistic	0.635***	1.88	0.981***
Competitor	<i>ref</i>	<i>ref</i>	<i>ref</i>
Constant	0.0137	1.01	0.674
R-squared			0.20
Number of observation	1944	1944	1944

Legend: * $p < .1$; ** $p < .05$; *** $p < .01$

Coefficients of NBM are expressed in Incidence Rate Ratio (IRR) that corresponds to the exponential of obtained with initial NBM's coefficients.

in the level of advice by a factor of 2.27. In the case of sanctions (ST), there is no significant effect on the decision to sanction.

Table 3.6: Estimated models of Advice and Sanction

	Advice		Sanction		
	NBM	IRR	OLS	Probit (ME)	OLS
Avg. group contribution in $t - 1$	-0.148	0.86	-0.589	-1.349	-0.531
Avg. group endowment	0.824***	2.27	3.418***	-0.096	-0.0361
Avg. group payoff in $t - 1$	0.136	1.14	0.588	0.903	0.355
Pro-social	0.213	1.23	0.824	-0.206	-0.0814
Individualistic	<i>ref</i>	<i>ref</i>	<i>ref</i>	<i>ref</i>	<i>ref</i>
Constant	-4.949***	0.007	-22.36**	-2.740	-0.594
R-squared			0.129		0.024
Number of observation	162	162	162	162	162

Legend: * $p < .1$; ** $p < .05$; *** $p < .01$

Coefficients of NBM are expressed in Incidence Rate Ratio (IRR) that corresponds to the exponential of obtained with initial NBM's coefficients.

3.4 Discussion and conclusion

This paper set out to explore the relative efficiency of third party or advisor advice and sanction to promote public good contributions in an artificially constructed environmental context.

We designed an experiment that included three treatments in which the adviser's payoff is correlated to the payoff of the members of his or her group assigned randomly. The BT is a classical PGG. The AT includes the advisor who based on observation of the average level of endowments and the previous contributions of her group's members, provides a recommendation about the desired level of individual contributions. In the ST, the advisor can impose a collective sanction by imposing an increase in the tax rate.

The four main results of our experiment are summarized below. First, in line with the experimental literature on public good provision, we observe that individuals contribute more than predicted by theoretic models based on a pure self-interest paradigm. This divergence from the theoretical predictions is observed in a population with heterogeneous social preferences. We observed this tendency for the three social preference profiles reported. The experiment's pool of subjects included a larger proportion of individualist and pro-social individuals and a decreasing level of contributions along the periods, with the minority competitive subjects contributing significantly less than the other two types.

Second, for the relative impact of advice and sanction for promoting cooperation within groups, we found that advice has a positive impact on increasing cooperation but this effect fades over time. In fact, after a certain period, the advice incentive provides no added value compared to a no incentive situation. These results are in line with the findings in My et al. (2017) which uses a PGG to study the impact of nudges on environmental behavior. It shows a positive effect of nudges on individual

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cooperation. This increased cooperation is dependent originally on the individual's environmental sensitivity but fades over time.

Chaudhuri et al. (2006) explain that if the majority of subjects display conditional cooperation, this produces a social norm within the group which leads to high levels of contributions without the threat of sanction. However, we observed that pro-socials that benefited from advice (in the AT) contributed significantly less than pro-socials in the BT. This result can be interpreted as a crowding-out effect of advice on pro-social individuals' motivation either as a "looking-glass self" effect (Bénabou and Tirole, 2003), or as a denial of autonomy in self-determination theory (Ryan and Deci, 2000).

There is a large literature which shows mixed effects of sanctions such as taxation on cooperation in a public good. Our experiment results suggest that sanctions are efficient. Moreover, they show that the threat of sanction is more efficient than advice (and more efficient than the situation without either advice or sanction) for promoting significantly higher levels of contributions in both the short and long run. This echoes the results of previous PGG experiments such as those where cooperation is increased without use of sanction as in Masclet et al. (2013) but where the threat alone (i.e., without its being applied) pushes individuals to increase the average level of their contributions significantly.

The literature suggests also that the presence of an institution (such as our third-party) that can express disapproval of non-cooperative behaviors induces the minority of free riders to adjust to the behavior of the majority by increasing their contribution (Gürer et al., 2006). Our data suggest that individuals punished in the ST increase their contributions. In line with results in Bowles et al. (2001), free-riders seem to be constrained by the shame of being sanctioned, and are influenced by the behavior of the majority of contributing partners.

Third, to estimate the impact of wealth heterogeneity on individual behavior,

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we analyzed absolute contributions as a function of participants' endowments. Our setting allows us to test the altruism hypothesis that wealthy individuals contribute more in absolute value than poorer ones (Becker, 1974). We observed that the population defined as *high wealth* contributed more in absolute value which confirms the altruism hypothesis but only in ST. However, in relative terms the contributions are not significantly different. It has been argued that wealthy individuals do not necessarily contribute more than less well-endowed ones because of an anticipated reciprocity effect (Cherry et al., 2005) where people expect reciprocation from their contributions. They are likely to contribute more if they believe that the other members of the group will also contribute more. Cherry et al. (2005) links this anticipation effect to the concept of conditional cooperation proposed in Fischbacher et al. (2001) who explain that an individual's contribution will be higher if she is optimistic about how much others will contribute. In our experiment, the *high wealth* subjects can infer information about the average endowments of group members, and thus, can appreciate that their partners cannot afford high levels of contribution, or at least not as high as they can contribute. Combined with the impact of incentives, these results show the importance of considering income heterogeneity when looking at the fairness of environmental policies and rules that impose the same contribution on all communities.

We analyzed the behavior of the third-party by looking at what determines the amount of advice offered, and the decision to impose a sanction. Table 3.6 shows that the amount of advice is a function of the level of the wealth (endowment) and the contributions of the subjects.

Fourth, in addition to interpreting the data from our experiment, we can highlight some policy implications of our behavioral findings. Our results could help to mitigate the detrimental impacts of State policy from the unanticipated individual reactions to incentives.

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Our experiment suggests some ways to limit the welfare losses associated to the management of waste sorting framed as a typical social dilemma. The modified PGG experiment we designed shows that the threat of sanction from the advisor – here substituting for the State, is more efficient for promoting cooperation than mere advice. It would seem also that in contrast to what some believe, wealthy people do not systematically cooperate more (in relative terms). Similar behavioral results can be found in the empirical literature on waste sorting management.

For instance, Van den Bergh (2008) highlights studies that show that people are not motivated solely by monetary compensation and notes that non-monetary instruments are also effective inducing desired behavior. Therefore, by focusing on social factors such as social norms, peer pressure and intrinsic or extrinsic motivation we can change individual behaviors. It is for this reason that behavioral non-monetary incentives such as provision of *advice* are used by public authorities to encourage individuals to adopt socially desirable behaviors. Our experimental results show that non-monetary types of incentive in the form of free advice are as successful for increasing group members' cooperation although the effect is not persistent over time.

On the other hand, the study by Fullerton and Kinnaman (1996) shows that following the introduction of an incentive pricing mechanism, the weight of waste collected reduced by 14% while the volume and weight of recycled material increased by respectively 37% and 16%. As in our experimental setting, a tax incentive can be efficient for enhancing cooperation, and thus promoting pro-social behaviors. However, Fullerton and Kinnaman (1996) show also that after controlling for estimated illegal waste diversion, the decrease in collected waste weight was only 10%. This can be likened to what we describe as free riding behavior in our experimental study. Although the effect of incentive pricing mechanisms remains positive, Fullerton and Kinnaman (1996) propose several arguments against this type of incentive. First,

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the administrative and implementation costs are too high; and second, 28% to 43% of total waste is diverted away from legal waste flows (illegal dumping, depositing waste in the workplace or in neighbors' bins, and burning of waste). The low proportion of sanctions applied in our experimental setting (only 19% of the total rounds in the ST) can be interpreted as exemplifying the first limitation (the high cost of implementing a tax). Other studies have examined the impact of various incentive pricing systems (based on waste weight, waste volume, bags and collection frequency) on the production of total, unsorted, compostable and recyclable waste (Nestor and Podolsky, 1998; Dijkgraaf and Gradus, 2004; Kinnaman and Fullerton, 2000; Ferrara and Missios, 2012). All these works shows the positive impact of various levels of monetary incentives in the form of taxes. Our experimental findings are in line with their results.

Policy makers could consider alternatives to monetary incentives such as advice which seems to have a degree of efficiency in driving behaviors in the desired direction - at least in the short term. However, much work is needed on the design of non-monetary incentive policy tools able to achieve long term sustainable behavioral change. From this perspective, our experimental results suggest use of sanctions in the form of the threat of an increase in the tax rate. They underline the complementarity of experimental studies to investigate individuals' behavioral responses to various types of waste sorting incentives.

CHAPTER 4

Willingness to pay attention for others: Do social preferences predict attentional contribution?

4.1 Introduction

An individual can choose to deposit waste in dustbin A (which means it cannot be recycled) or dustbin B (where it will be recycled). Disposing of the waste in the dustbin A increases the waste treatment cost whereas recycling the waste in dustbin B is of value to the community. How can we model and predict which dustbin will be chosen by the individual? The most intuitive framework to investigate these issues is the Public Good Game (henceforth PGG) (Samuelson, 1954). In the PGG, players choose a level of contribution that benefits all the players. Since the contribution is costly for the individual, the Nash equilibrium predicts that a rational self-interested player will not contribute based on an optimal cost-benefit trade-off. However, the total welfare is maximized if the whole community contributes (Pareto optimum). This tension between the Nash equilibrium and the Pareto optimum describes a social dilemma.

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Experimental results show that individuals do not behave as own payoff maximizers (Frey and Meier, 2004; Chaudhuri, 2011). To explain their larger contributions, economists have introduced the notion of “social preferences” (Rabin, 1993; Charness and Rabin, 2002; Fehr and Falk, 2002; Bénabou and Tirole, 2006; Fehr and Fischbacher, 2002; Villeval, 2012; Graf et al., 2013).

Social preferences are preferences that take others into account. These preferences can be represented by individual’s utility as a function of the distribution of players’ outcomes (“distributive” preferences) or a function of players’ beliefs about behaviors (“belief-dependent” preferences).¹ As a result, individuals with pro-social preferences are willing to reduce their own monetary reward to increase the payoff of strangers and the expression of such preferences shifts the contributions toward the Pareto optimum.

In the example above, the contribution to the PGG is the amount of attention paid to reach decision. Paying attention is associated to cognitive effort, or an opportunity cost. As a result, it increases the probability of making a distinction between the two dustbins, and thus decreasing the waste treatment costs.

We could expect from a rational individual that the level of attention paid is the result of an optimal cost-benefit trade-off. The optimal attentional contribution should maximize a utility function shaped by the interaction between individuals’ attentional process and her social preferences. Indeed, the attentional process represents the attentional contribution’s cost and its efficiency (the resulting probability to identify the proper dustbin). The benefits the individual receives from recycling or not is defined by her social preferences.

In most PGG experiments contributions are an “induced effort”. In such design,

¹For more details about the theoretical and experimental distinction of these two types of preferences see Attanasi and Nagel (2008). It has been shown that individual can express both types of social preferences and their expression can be confound. For methodological convenience, we did not experimentally disentangle between the two types of preferences and only elicit a standard measure of the expression of social preferences.

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the experimenter control the cost and the efficiency of the contribution that are common knowledge to subjects. Thus subjects explicitly choose a level of contribution that should reveal their social preferences. However, in situation where individuals invest real attention, the cost structure and the efficiency of the contribution is not necessary known neither by an observer nor by the individuals themselves².

The study of attention as an economic concept has gained importance since the late 1990s (Festré and Garrouste, 2015a). To express their preferences, individuals need to pay attention to investigate alternatives' possible outcomes. Paying attention reduces the uncertainty of the choice (Sims, 2003). However, since the available amount of attention is limited, an attention allocation problem appears: the individual may not consider all the available alternatives, and may not examine all the considered alternatives' characteristics (Caplin et al., 2011; Masatlioglu et al., 2012; Manzini and Mariotti, 2014; Sitzia et al., 2015; Li et al., 2016).

Choosing the optimal amount of attention suggests an infinite regress problem. Indeed choosing which amount of attention to allocate requires itself attentional resources to evaluate its associated outcomes (Lipman, 1991). Thus, the interaction with social preferences is not straightforward: if the individual chooses the dustbin *A*, how can we distinguish between an expression of her preferences against "recycling" (as if guided by destructive goals), and an unconscious insufficient level of attention? To what extent is the expression of social preferences affected by the particular cost and efficiency structure of the attentional contribution? This is an important issue when we consider that many pro-social behaviors require a contribution in the form of attention rather than a salient or a monetary effort with a known cost function.

A useful way to investigate the peculiar cost and efficiency structure of an at-

²Contribution are more often monetary. Several studies investigates PGG in the context of a real effort task. Lezzi et al. (2015) show the differences in behaviors between three real effort tasks and one induced effort. Brügger and Strobel (2007) and Dutcher et al. (2015) explain that these differences can be attributed to the unknowable effort cost function.

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tentional contribution is in an experiment where subjects invest real attention, in a setting similar to the dustbin example described above. In our experiment, subjects pay attention in order to reduce uncertainty in a two-alternatives forced-choice task, by choosing where to sort an item according to its composition. Our design allows us to measure both sides of an attention allocation process: the amount of *attentional resources* allocated in the decision measured by the Response Time (RT), and the amount of information properly processed (the uncertainty reduction) measured by the Error Rate (ER). We provide three treatments representing different incentive schemes. A baseline with no monetary incentives (T0), a treatment where the subject's accuracy increases her own payoff (T1), and a treatment where subject's accuracy increases others' payoffs (T2). A social preferences measure (social value orientation, SVO) is introduced prior to the task. According to economic theory, incentives should increase the attention allocation. In particular, in the pro-social treatment (T2), the pro-social individuals who revealed high social preferences should pay more attention than individualistic subjects.

Our experimental results show that monetary incentives increase the amount of the attention paid by the subjects without interaction with intrinsic motivation. These results prove that subjects' attention respond to incentives in our task. Furthermore, contrary to standard PGG results (Balliet et al., 2009), we show that social preferences, elicited through standard monetary elicitation method, do not explain the subjects' attention contribution.

The paper is organized as follows. The experimental design and the protocol are described in section 4.2; section 4.3 presents the results that are discussed in section 4.4.

4.2 Experimental design

4.2.1 Main idea of the experiment

The experiment described in subsection 4.2.2 builds on the introductory example (throwing waste into the correct or over the wrong dustbin). Subjects have an endowment of attentional resources represented by an amount of 45 minutes that they can devote to perform the task or an alternative free activity. Paying attention to the task decreases the inherent uncertainty in the choice but comes with an opportunity cost since the alternative activity may be more enjoyable. We do not control the subjects' attentional process by specifying any cost or benefit structure of attentional provision. However, we are able to measure the quantity of attention invested in the task with RT and the resulting outcome of the attentional process with ER. The attentional process can be considered a production process in which the individual invests *attentional resources* – as an input – to achieve an *effective* level of attention – as an output. The attentional resources quantify the cognitive resources invested by the individual, while the output quantifies the amount of information the individual is able to consider as a result of the process (Prinzmetal et al., 2005; Garrouste et al., 2017).

By varying among treatments the incentives (see subsection 4.2.3), we can investigate the effect on the allocation of attention. Then, by measuring social preferences, intrinsic motivation, and risk aversion (see subsection 4.2.4), we can estimate their interaction with incentives. The protocol is described in subsection 4.2.5.

4.2.2 The main task

Before beginning the task, subjects are matched randomly in anonymous groups of three.³ Players have a time endowment of 45 minutes to complete a hundred trials-task. They can allocate this time according to what they want, with no going back and knowing that once they complete the hundred trials, they are free to surf the internet until time is up.

In each trial, players have to place a *waste* (called “Item” in the instructions) in a white or a black *dustbin* (“Box” in the instruction). The items are composed of 49 balls. Subjects are told that each ball has a prior probability of a half to be black or white. Players know that the color of the majority of the item balls is indicative of the color of the correct box: thus, an item with a majority of white (black) balls should be put into the white (black) box. Trials follow on each other with no waiting time nor feedback. Once a subject has classified an item, the next one appears but remains masked on the screen until the subject clicks on it.⁴ When the item and the two boxes are revealed, the subject selects one box by clicking on it (see Figure 4.1).

Subjects invest attention to partially or fully reduce the uncertainty (e.g. based on their intuition, by counting x times all the balls, by counting a subset of the balls, etc.). The time spent on the task has an opportunity cost for participants: once they complete the hundred trials, (and after answering a motivation questionnaire, see subsection 4.2.4) they are free to surf the internet.⁵ Each correct answer (properly

³We decide to group subject by three to keep a PGG structure with the lowest number of players, since it is known that the individual contribution level decreases with the increase of group members in traditional PGG (Sandler, 1992).

⁴The masking between Items limits the dependence among the trials in two ways: 1) it prevents retinal persistence; 2) it forces subjects to relocate the mouse at the center of the screen which reduces subjects’ bias towards selecting the same box in consecutive trials. The average time taken to click on a new item (*Timeb*) controls for heterogeneity in subjects’ natural speed in the experiment. The absence of feedback also reduces the dependency between trials. As the objective prior probability ($\frac{1}{2}$) is given, we limit the effect of probability learning and the resulting distortions of decision from experience de Palma et al. (2014).

⁵This is not the first experiment to use time rather than money as a reward: Noussair and

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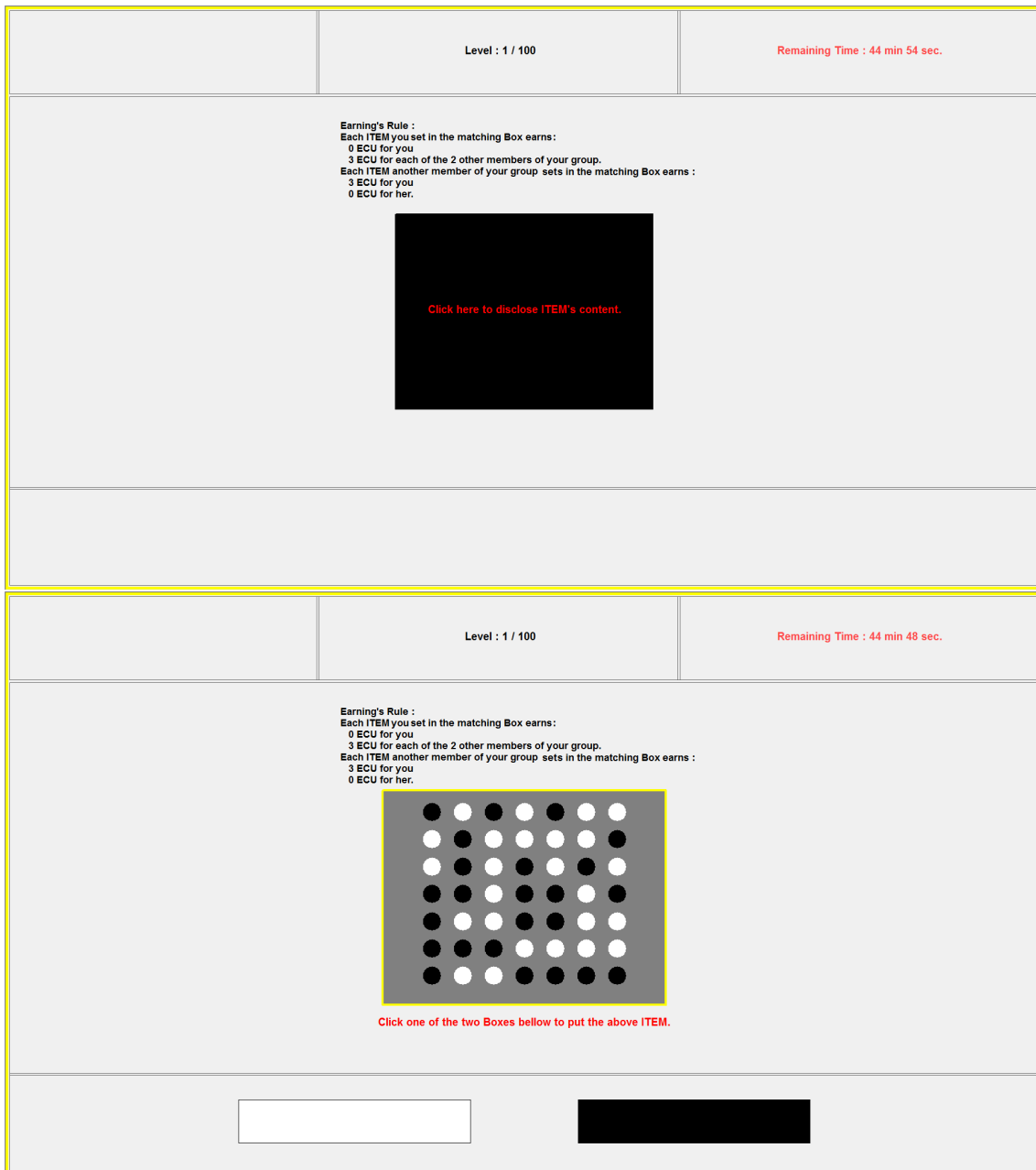


Figure 4.1: Screenshot of masked then unmasked Item

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recycled Item) earns the subject X *Experimental Currency Unit* (ECU) and earns each of the other two group members Y ECU. Different values of X and Y are implemented depending on the treatment, as described in the following section.

4.2.3 The treatments

Treatment	X for me	Y for each of other players
Baseline No incentives (T0)	0	0
Monetary Self-interested Incentives (T1)	6	0
Monetary Pro-social Incentives (T2)	0	3 (x2)

Table 4.1: Treatments

We propose three treatments with different monetary incentives for accuracy: absence of incentive - the baseline (T0); a self-interest incentive (T1), and a pro-social incentive (T2). Table 4.1 reports the characteristics of each one expressed in ECUs. Instructions are identical across treatments, only the values of X and Y differ.⁶

The baseline treatment

As a control with no monetary incentives (T0: $X = 0$ and $Y = 0$), this treatment allows us to know how subjects allocate their attention between our task and the free-time, with no involvement of a monetary aspect. Thus, it reveals the pure effect of the intrinsic motivation to complete the task. Subjects who prefer surfing the internet rather than participating in the task should complete the task as quickly as

Stoop (2015) propose a dictator, an ultimatum, and a trustgame experiment where subjects earn the right to leave the laboratory earlier. Also, Corgnet et al. (2015) propose an alternative free activity that the agent can perform instead of spending time on the task allocated by the principal. Kataria and Regner (2015) proposes an effort task translated to a donation to charity project.

⁶ Subjects know that the values of X and Y are the same for all the players in their group. This notion of group is only relevant for T2. However, we decide to frame all treatments with the same “group structure” in order to keep instructions as similar as possible.

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possible, and process the minimum amount of information. Thus, for these individuals the ER may be close to the pure hazard (50%).

Self-interest monetary incentive

With (T1: $X = 6$ and $Y = 0$), we obtain the direct impact of the monetary incentive on the allocation of attention: compared to $T0$, we obtain how much attention subjects are willing to pay to increase their expected payoff. Monetary incentives should increase both the amount of attention subjects pay to the task and the effective level of their attention.

The pro-social incentive

With (T2: $X = 0$ and $Y = 3$), this treatment has a PGG-like payment structure since a correct decision from a player benefits the other two members of the group (with $Y = 3$ for each), and differs only by the nature of the contribution (in the form of attention rather than money or some other effort). Therefore, social preferences should predict behavior in such environment. The incentives in this case ($T2$) are similar to $T0$ for pure-selfish players, and similar to $T1$ for players indifferent between their own and their group's outcome. More precisely, even if we do not control contribution cost, the Nash Equilibrium in $T2$ should be revealed by the behaviors in $T0$ while the behaviors in $T1$ described the Pareto Optimum in $T2$.

The way we measure social preference and other controls is described below.

4.2.4 Controls

Social preferences (SVO)

As discussed above, the difference in observed behaviors between T2 and other treatments should be explained by social preferences. The more pro-social the individual,

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the more similar will be her behaviors in T1 and T2. The more individualistic the individual, the more similar will be her behaviors in T0 and T2. We investigate the trade-off between self and collective interest using Social Values Orientation measure, based on Messick and McClintock (1968b) and McClintock (1972) using Murphy et al. (2011).

We used 15 successive choices among several distributions of outcome, for a player with another anonymous player chosen randomly by the computer. The test generates a *svo_angle* which represents the marginal rate of substitution between own and anonymous stranger's earnings. E.g. individuals with *svo_angle* < 0 are willing to reduce own earnings to reduce the earnings of others; individuals with *svo_angle* = 0 are not willing to reduce own earnings for others, and individuals with *svo_angle* = 45 are willing to reduce their own earnings by 1 in order to increase others' earnings by 1.

This measure provides four *svo_profiles* according to the closest extreme behavior: “*altruistic*” (maximizing others' outcome); “*prosocial*” (maximizing the shared outcome); “*individualistic*” (maximizing own outcome); and “*competitor*” (maximizing the difference between own and others' outcome).⁷

Intrinsic Motivation (IMI)

The attention subjects pay in T0 should reveal their level of intrinsic motivation to complete the task. Intrinsically motivated individuals engage in a task only for the pleasure and satisfaction of doing or competing it. However, intrinsic motivation and incentives may interact and generate crowding out effects on voluntary contributions (Bénabou and Tirole, 2006; Ariely et al., 2009; Gneezy et al., 2011; Frey and Oberholzer-Gee, 1997; Frey and Jegen, 2001b).⁸ To be able to distinguish be-

⁷ In our study we divided the population into two groups: Pro-social and individualists. Only one of our participants fitted the competitive profile and he was grouped with the individualists.

⁸See Festré and Garrouste (2015b) for a review of crowding out in economics and psychology

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tween direct and indirect (through motivation) effects of incentives on the attention allocation, we measure the subjects' intrinsic motivation with Intrinsic Motivation Inventory (IMI), (Deci and Ryan, 2003) . IMI is based on Self Determination Theory (Deci et al., 1982), a measure of intrinsic motivation and self-regulation that is popular in Cognitive Psychology and in Industrial and Organizational Psychology (Ryan et al., 1983). It is based on a self-reporting questionnaire about the feelings the player experienced during the task. The task includes 31 Lickert-like items split across 5 dimensions: enjoyment/interest, perceived competence, effort, pressure/tension, relatedness to the group. We administrated the complete IMI questionnaire to the participants, but we refer mainly to the interest/enjoyment subscale in the data analysis since this is the only subscale that assesses intrinsic motivation.

Risk aversion (HL)

In our task, as subjects allocate attention to reduce uncertainty, risk aversion may affect the willingness to pay attention. We employ the standard Holt and Laury (2002) (HL) risk-aversion elicitation method.

The subjects were confronted to 10 decisions between two lotteries A and B. Only one decision randomly selected for the payment (Figure 8 in Appendix). HL is the most popular way to measure risk-aversion in economics. In our elicitation method we let subject the possibility of switching twice and then use the number of times (HL) the risky option is chosen as a measure of the risk-aversion, as it is advised. Only one decision was randomly selected for the payment.

4.2.5 Protocol

The average duration of the experimental sessions was one hour. The sessions were conducted as follows:

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- 1) Subjects enter the room and the experimenter reads the general instructions out loud in French;
- 2) SVO preferences test;
- 3) Risk-aversion test;
- 4) subjects are informed about which treatment they are assigned to for the main task;
- 5) they play two practice rounds, with a trial example and comprehension questions related to the payoff structure, and provision of a help window to allow them to correct mistakes;
- 6) the 45 minutes countdown begins and subjects start the 100 trials;
- 7) after completing the 100 trials, subjects complete the IMI questionnaire with a submission time of a minimum of 3 minutes (to prevent random answers);
- 8) subjects spend the remaining time surfing the internet;
- 9) subjects are informed about the results of each step;
- 10) individuals are paid before completing a final questionnaire. ⁹

During the whole experiment, written instructions were available, and reminders were provided on computer screens. We measured social and risk preferences before the main task so that the experiment would finish with the “free-time” since we had no control over this last step. In order not to interfere with the task, the results of each step were given only at the end of the experiment.

We tried to avoid interference from the social and risk preferences measurement by giving players’ treatment information (X and Y value) only after these measures had been completed. Subjects were provided with headphones during the experiment to avoid communication among them, and to allow them to watch videos or listen

⁹ This final questionnaire was aimed at measuring subjects’ attitudes to anonymity, salience, experimenter demand effect, and knowledge about the experiment. The questionnaire is still subject to construction, and is the object of another project. We do not report its results here but they are available upon request.

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to music during the free time. The instructions concluded by providing a non-exhaustive list of websites (including social networks, news, games, blogs, music, videos). Subjects had access to calculators if they wanted to compute the expected payoff during HL test.

The experiment included a total of 114 subjects and 7 sessions (15 or 18 subjects per session) and was held in the “Laboratoire d’Économie Expérimentale de Nice” (LEEN) in “Université Cote d’Azur” in April and May 2016. The subjects were aged between 17 and 55 years¹⁰ ($M = 22.53, SD = 5.99$).¹¹ All were recruited using ORSEE (Greiner, 2015), and the experiment was implemented in zTree v3.5.1 (Fischbacher, 2007). Participants were mainly undergraduate students from multiple disciplines (economics, management, science, literature). All participants received a show-up fee of 5 euros. The experimental currency units were converted into cash at the rate 100 ECUs = 1 euro, and the average payment was 13.3 euros.

4.3 Results

Since subjects can neither observe the actions nor communicate with the other subjects until the end of the experiment, individuals decisions can be treated as independent between subjects. Table 4.2 presents descriptive statistics (aggregated variables). We observe an average RT of 9.8 seconds and an ER of 8%. 49% of the subjects are closer to pro-social than individualistic behavior.

We analyze and present the data at the subject level ($n_s = 113$, aggregating for each subject the 100 trials) with t.test and report Cohens’ d as a measure of effect size. To increase statistical power by controlling for trial complexity – mea-

¹⁰We have a student participating to the experiment aged of 17. This is explained by the fact that French students can start university courses of Bachelor before the age of majority. The latter differ across countries.

¹¹ We excluded one participant from the analysis. She did not understand the instructions, took twice as long as the other participants at the training levels, failed many times in comprehension questions, and showed a significantly higher ER than if she were playing randomly (82%).

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Variable	Description	M	SD	Min	Max	Obs
RT	Response Time : Time (in second) needed for a participants to reach a decision	9.83	8.62	.39	98.671	113
ER	Error Rate : the number of item misplaced	8.16	11.03	0	51	113
Prosocial	1 when subject expressed high social preferences in SVO test, 0 otherwise	.49	.50	0	1	113
Interest	Result of IMI scale on the interest to the task	28.50	10.45	7	49	113
risk aversion	Number of risky choice (out of 10) in the H&L test	6.44	1.94	0	10	113
svo_angle	SVO test result	19.62	15.97	-16.26	46.65	113
Male	1 for male, 0 otherwise	.372	.485	0	1	113
Age	Age of the subject in years	22.53	5.97	17	55	113
timeb	Time spent before disclosing a new item	0.802	0.266	0.420	1.746	113
difference	Difference between the number of black and white balls	5.55	4.22	1	23	700

Table 4.2: Descriptive statistics of the sample

sured by the absolute difference between the numbers of black and white balls – and evolution accross trials, we also regress RT (OLS) and ER (logit) at a trial level ($n_t = 11300$).¹² Table 4.3 presents regressions for all treatments to assess the effects of incentives, trials, complexity and individual characteristics on attention allocation, while Table 4.4 presents regressions to assess the effect of social preferences in T2. All regressions are clustered at the subject level. We accept a type I error rate of $\alpha = .1$

H1: Monetary incentives impact intrinsic motivation.

Figure 4.2 shows participants' self reported level of interest ($M = 28.50$, $SD = 10.45$) according to the treatment. In our task, we find no evidence of incentives affecting intrinsic motivation [$F(2, 110) = 0.25$, $p = .774$, $R^2 = 0.0046$]. This allows us to interpret the potential effect of incentives on attention as a direct effect, with no mediation of intrinsic motivation.

H2: Monetary incentives increase allocated attention.

Figure 4.3 shows subjects' RT (left) and ER (right) for each treatment. We find a significant effect of treatment on RT [$F(2, 110) = 7.81$, $p < .001$, $R^2 = 0.1243$].

¹² Matejka and McKay (2014) show how limited attention induces the choice probability to follow a logit formula

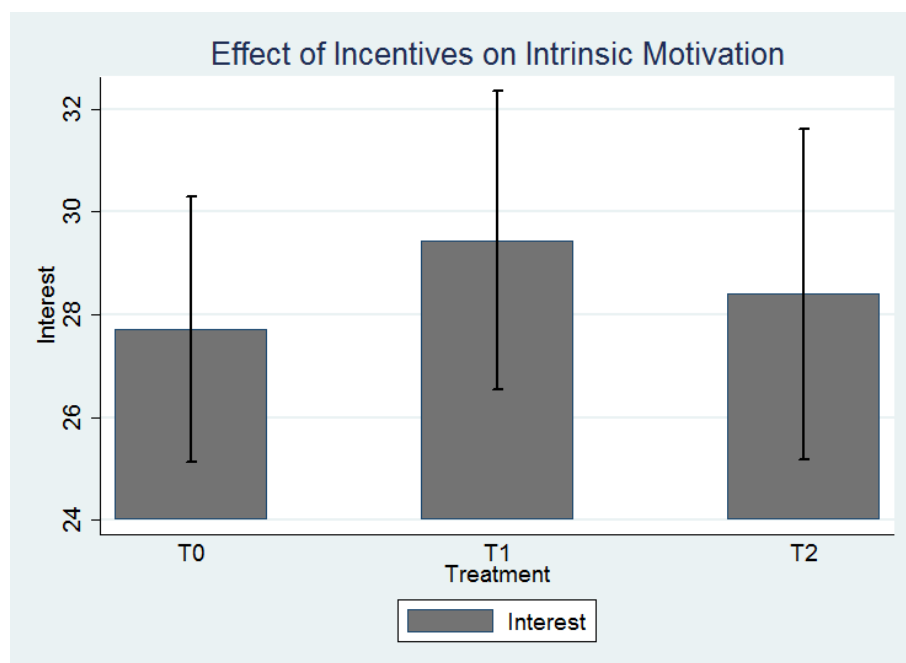


Figure 4.2: Incentives impact on Intrinsic Motivation

More precisely, RT are longer in T1 ($M = 11.98, SD = 4.005$) compared to T0 ($M = 7.94, SD = 4.480$) [$t(73) = -4.102, p < 0.001, d = 0.960$] and to T2 ($M = 9.72, SD = 4.734$) [$t(72) = 2.182, p = .032, d = 0.514$]. RT are longer in T2 compared to T0 [$t(75) = -1.721, p = .089, d = 0.397$]. These results are confirmed by the regression analysis at the trial level (see Table 4.3, Model (5): [$\beta = 4.137, t = 4.17, p < .001$] for T1, [$\beta = 2.430, t = 2.26, p = .026$] for T2). We conclude that monetary incentives increase the attention allocated in the task.

H3: Monetary incentives enhance attention efficiency.

ER are higher in the baseline T0 ($M = 12.25\%, SD = 0.149$) compared to T1 ($M = 4.64\%, SD = 0.0516$) [$t(73) = 2.945, p = .0049, d = 0.680$] and to T2 ($M = 9.72, SD = 0.0930$) [$t(75) = 1.747, p = .0848, d = 0.403$]. ER is slightly higher in T2 compared to T1 [$t(72) = -1.533, p = .1371, d = 0.354$].

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VARIABLES	(1) RT	(2) ER	(3) RT	(4) ER	(5) RT	(6) ER
T1	4.038*** (0.971)		4.019*** (0.971)		4.137*** (0.992)	
T2	1.807* (1.042)		1.776* (1.041)		2.430** (1.077)	
RT		-0.0815*** (0.00881)		-0.127*** (0.00951)		-0.127*** (0.0179)
RT×T1		-0.0137 (0.0102)		-0.00384 (0.0105)		-0.00173 (0.0236)
RT×T2		-0.0117 (0.0104)		-0.00813 (0.0108)		-0.0110 (0.0241)
trial			-0.1903*** (0.0223)	-0.00724 (0.00528)	-0.190*** (0.0223)	-0.00662 (0.00464)
(trial) ²			0.001354*** (0.000181)	5.09e-05 (4.98e-05)	0.00135*** (1.81e-04)	4.59e-05 (4.28e-05)
difference			-0.557*** (0.0342)	-0.253*** (0.0398)	-0.562*** (0.0341)	-0.253*** (0.0400)
prosocial					1.185 (0.783)	-0.219 (0.2135)
risk aversion					0.160 (0.208)	0.0432 (0.0578)
interest					-0.0665* (0.0386)	-0.00788 (0.0115)
age					-0.0570 (0.0791)	0.00330 (0.0191)
male					0.151 (0.816)	0.101 (0.233)
timeb					3.865** (1.929)	
Constant	7.939*** (0.711)	-1.448*** (0.236)	16.08*** (1.067)	-0.0748 (0.147)	14.28*** (2.416)	-0.160 (0.455)
Observations	11,300	11,300	11,300	11,300	11,300	11,300
R ²	0.036		0.166		0.185	

Robust standard errors clustered by subject in parentheses.

Pseudo R^2 are computed for logistic regressions of RT.

*** p<0.01, ** p<0.05, * p<0.1

Table 4.3: Attention allocation

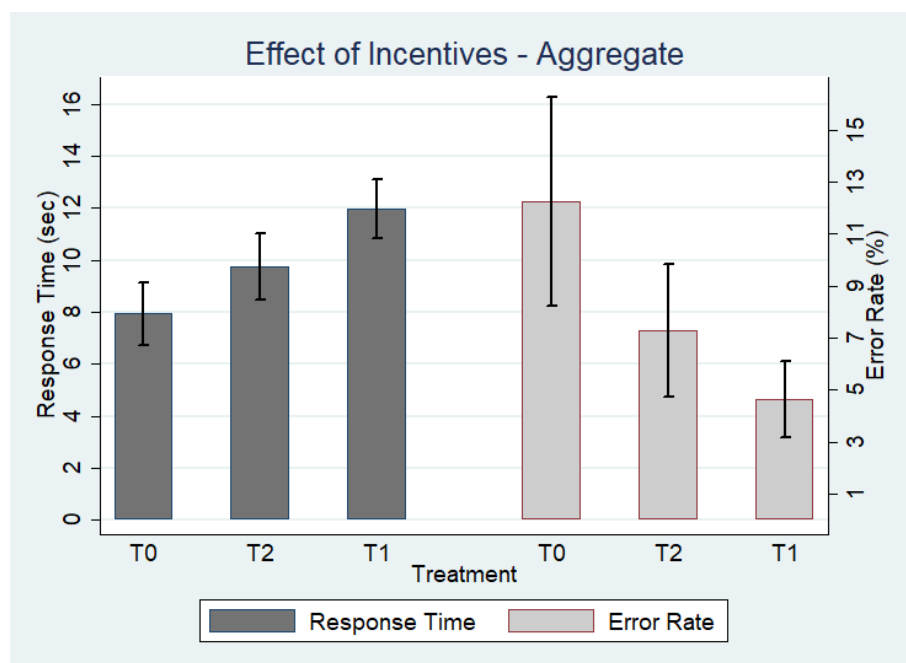


Figure 4.3: Incentives impact on Response Time (RT) and Error Rate (ER)

This reduction of ER due to incentives may be explained either by the higher amount of attention allocated to the task highlighted previously or by an increase in the efficiency of the attention allocation process. The regression analysis conducted at the trial level disentangles among the two explanations and shows that the marginal effect of RT on ER is not statistically different between treatments (Table 4.3, Model (6): [$\beta = -0.00173, t = -0.07, p = .942$] for T1 and [$\beta = -0.0110, t = -0.46, p = .649$] for T2).

We cannot conclude that monetary incentives increase the efficiency of the attention allocation process in our experiment.

H4: Attention allocation varies during the task.

Figure 4.4 shows the average RT in each of the hundred trials for each treatment. The attention spent on the task decreases until the last third of trials (

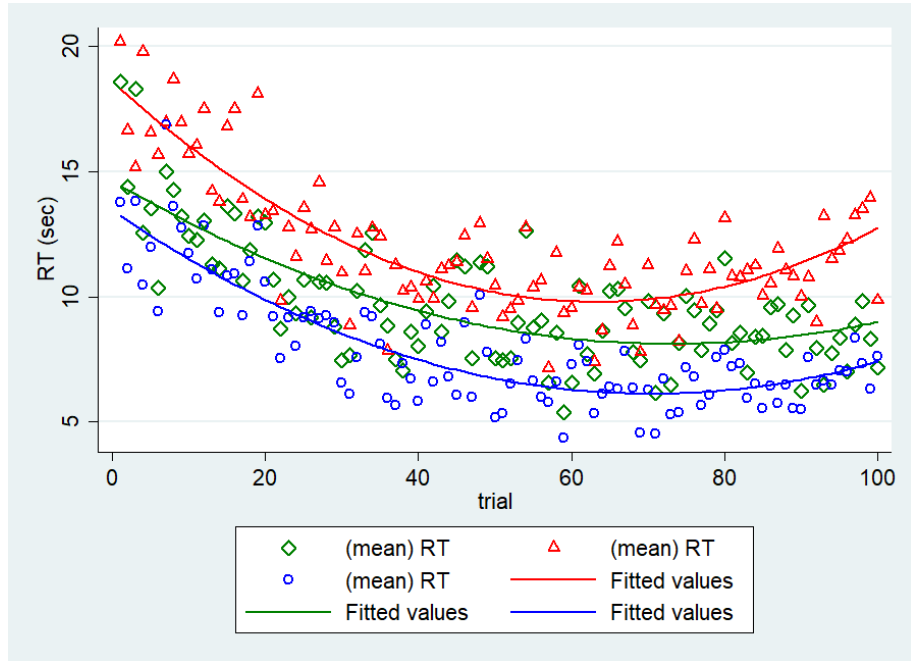


Figure 4.4: Average (RT) across trails and treatments

Table 4.3, [Model (5): $\beta = -0.190, t = -8.52, p < .001$] for the first order and [$\beta = 0.00135, t = 7.49, p < .001$] for the second order; marginal effect of the trial becomes positive for the 70st trial). We find no evidence of the influence of trial on the efficiency ([Model (6): $\beta = -0.00662, t = -1.43, p = .154$] for the first order, [$\beta = 4.59e^{05}, t = 1.07, p = .283$] for the second order).

H5: Complexity increases allocated attention.

We assume that the complexity of a trial is decreasing with the difference between white and black balls. We find that both RT and ER are decreasing with this difference (Table 4.3, [Model (5): $\beta = -0.562, t = -16.51, p < .001$] for RT and [Model (6): $\beta = -0.253, t = -6.32, p < 0.001$] for ER). We conclude that complexity increases allocated attention but decrease the effective level of attention.

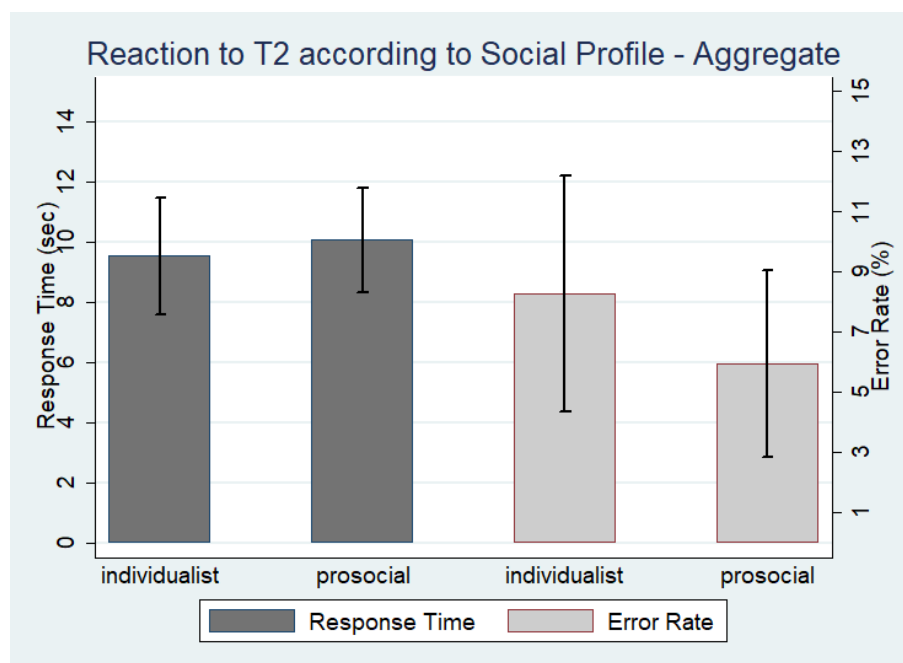


Figure 4.5: Impact of Social Preferences in T2

H6: Social preferences predict attentional contributions.

Figure 4.5 shows the RT and the ER in T2 for prosocial ($n=16$) and individualist ($n=22$) subjects. The behavior of the two groups is not significantly different [RT: $t(36) = -0.340, p = .736, d = 0.112$; ER: $t(36) = 0.759, p = .453, d = 0.249$]. These results are confirmed by a regression analysis at the trial level, restricted to the treatment T2 (Table 4.4: [Model (11): $\beta = 0.741, t = 0.56, p = .578$] for RT and [Model (12): $\beta = 0.0403, t = 1.27, p = .205$] for ER). SVO elicited social preferences do not explain the differences in attentional contribution in T2 compared to other treatments.

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VARIABLES	(7) RT	(8) ER	(9) RT	(10) ER	(11) RT	(12) ER
prosocial	0.535 (1.481)		0.619 (1.474)		0.741 (1.318)	
RT		-0.0809*** (0.0257)		-0.129*** (0.0210)		-0.132*** (0.0224)
RT×prosocial		0.0163 (0.0283)		0.0221 (0.0286)		0.0403 (0.0318)
trial			-0.147*** (0.0304)	-0.00990 (0.00822)	-0.148*** (0.0304)	-0.00860 (0.00833)
(trial) ²			9.47e-04*** (2.46e-04)	8.56e-05 (7.42e-05)	9.48e-04*** (2.46e-04)	7.79e-05 (7.59e-05)
difference			-0.572*** (0.0480)	-0.295*** (0.0716)	-0.569*** (0.0478)	-0.295*** (0.0724)
risk aversion					-0.226 (0.317)	0.115* (0.0658)
interest					-0.0584 (0.0636)	-0.340** (0.0159)
age					-0.112 (0.137)	0.00513 (0.0199)
male					1.311 (1.584)	-0.232 (0.417)
timeb					7.460* (4.394)	
Constant	9.521*** (1.123)	-1.957*** (0.324)	16.88*** (1.598)	-0.123 (0.240)	16.710*** (3.388)	-0.124 (0.743)
Observations	3,800	3,800	3,800	3,800	3,800	3,800
R^2	0.001	0.0309	0.127	0.132	0.158	0.159

Robust standard errors clustered by subject in parentheses.

Pseudo R^2 are computed for logistic regressions of RT.

*** p<0.01, ** p<0.05, * p<0.1

Table 4.4: Attention allocation in T2

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This null result may be due to an absence or a trivial effect and/or to small sample size. To disentangle between these two explanations, we compare our effect size with those usually found in comparable studies. In particular, the study of Balliet et al. (2009) reviewed 82 studies that measured both social preferences through SVO, and cooperation in social dilemma. In their meta-study, they found an average effect size of $d_0 = 0.629$ of being prosocial on contributions. This effect is higher than the one we find here ($\hat{d} = 0.112$) [$Z = -1.574, p = 0.0621$].

We conduct the following statistical test. μ_1 (\bar{X}_1) and μ_2 (\bar{X}_2) are the expected (average) RT for prosocial and individualists in T2. σ is the standard deviation. Under the Null ($d = \frac{\mu_1 - \mu_2}{\sigma} = d_0$), the statistic $Z = \frac{\hat{d} - d_0}{\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}} = \frac{\bar{X}_1 - \bar{X}_2}{\hat{\sigma} \times \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}} - \frac{d_0}{\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$ follows a Student's distribution with 36 degrees of freedom.

We thus conclude that monetary elicited social preferences are not a good predictor of attentional contribution.

4.4 Discussion

In everyday experience, numerous pro-social behaviors imply investment in attention rather than salient effort provision with known cost and benefits structures. In this paper, we examine how standard PGG experimental results obtained with induced effort, could be applied to attentional social dilemma. To the best of our knowledge, there are no other studies dedicated to understand whether paying attention is equivalent to monetary contribution in a PGG.

To address this question, we proposed a new experiment in which participants allocate a real attentional endowment of 45 minutes between reducing the uncertainty in a two-alternative forced-choices task, and enjoying an alternative activity (surfing the internet). Our design could be adapted to investigate a broader range of questions involving attention. It provides the following advantages. Our task reproduces the cost and the benefit structure of an attentional process, and enables measurement of the amount of attentional resources allocated (through RT) and the outcome of such investment (through ER) for each decision. These two measures reveal the input and the output of the individual attentional process (and permit to study the efficiency of such process) rather than impose a particular *ad hoc* structure. From a practical perspective, the design is easily understandable by subjects, and allows the researcher to gather numerous decisions for each participant, based on an average RT of less than 10 seconds, increasing statistical power.

In this framework, players were asked to complete one of three conditions which vary only by incentive manipulation: a baseline without incentives (T0), a self-interest incentives (T1), and pro-social incentives as in a PGG-like environment (T2). As predicted, monetary incentives increase both allocated and effective attention, and subjects react more to self-interest incentives than to pro-social incentives. Furthermore, the absence of interference with intrinsic motivation avoids any crowd-

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ing out effect and allows the researcher to interpret the responses to incentives as direct effects.

These results show the appropriateness of our design to investigate the expression of social preferences in an attentional public good game. According to the theory, T0 and T1 should respectively indicate the Nash-Equilibrium and the Pareto-Optimum in an environment (T2) where pro-social players should pay more attention than individualists. However, in our study subjects qualified as pro-socials based on the SVO test, although being the most willing to reduce their monetary earnings in order to increase others' payoffs, they are not more willing to pay attention in order to benefit others. This is an interesting result.

It provides evidence that revealed social preferences depend on the nature of their elicitation, with no monotonous relation between attention and monetary contribution. Individuals may reveal pro-social preferences in terms of monetary or effort provision but not in term of attention. This might be explained by the peculiar nature of attention compared to other resources: until individuals pay enough attention, they ignore how their decisions impact on others' welfare. Indeed, Grossman and van der Weele (2016a) and Dana et al. (2007) show that pro-social individuals who choose a fair option in a complete information game, may prefer willfully to remain ignorant in order to justify their selfish behavior. Thus, since remaining inattentive prevents the expression of social preferences, we cannot exclude that agents may strategically remain ignorant if they prefer that their acts are perceived - by others and/or self - as inattentive rather than selfish. This highlights the need for more carefulness from the researchers and policy makers when generalizing results obtained using induced effort game to environments where individuals' contributions mainly consume attention. Indeed, this calls for more research to investigate the role of attention in social dilemma, and requires a deeper understanding of both the role of and interaction between social preferences and attentional process.

CHAPTER 5

General Conclusion

5.1 Summary of contributions

In this thesis, we have proposed an approach allowing us to investigate the impact of incentives on pro-social behavior using laboratory experiments. More specifically, we proposed to study different situations of social interactions that can be related to PEB.

We started in Chapter 2 by presenting a literature review and a bibliometric analysis on PEB studies in experimental economics and psychology. After the literature review, we propose two experimental studies. The first experiment is presented in Chapter 3 and it is a PGG aiming to compare the effectiveness of a monetary incentive (sanction) and non-monetary incentive (nudge) in promoting pro-social behaviors. The second experiment is presented in Chapter 4 and relies on an original design proposed by the authors. The experiment aims to study the impact of incentives on pro-social behavior when individuals have to invest attention and not money. We outline the major findings of the thesis below.

Chapter 2 finds that the number of experimental studies on PEB is constantly increasing over time in both economics and psychology. We find a separation between the two disciplines reflected by a lack of interdisciplinary articles. Psychology

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research on PEB tends to focus on the relationship between the internal characteristics of the individual and her behavior such as emotions, values, preferences and attention. In economics, the focus is more on the external factors like incentives schemes, taxes, and nudges. However, we observe that inter-disciplinary research remains rare. The explanation proposed in this thesis relies on the methodological differences that limit the real collaboration between experimenters in economics and psychology.

Chapter 3 considers individual decisions through a public good game. Heterogeneous subjects, in terms of social preferences and endowments, were asked to contribute to a common good. Depending on the treatment and according to the will of a third party, subjects were incentivized with an advice (nudge) or punished for not contributing to the common good. The results of this chapter show that even in a situation of incomplete information, advising (nudging) individuals is effective in promoting their cooperation and reinforce the norms in the group. However, the impact of sanctioning shirkers shows a stronger effect in enhancing cooperation over time. Similarly to Masclet et al. (2013), we observe that the threat of sanction from the third party is more efficient in strengthening cooperation than advising. In terms of policy implications, policy makers can still count on the usefulness of sanction systems to promote public goods provision. Also nudging can be an alternative instrument although its impact is weaker and limited in time.

Chapter 4 compares the effect of two incentives on attention allocation. Precisely, we compare a self-interested incentives that makes the individual increase his pay-off by investing attention with a pro-social incentive that allows the individual to increase the pay-off of other individuals by investing her attention. We find that both incentives increase attention allocation, however the effect is stronger for self-interested incentives with respect to pro-social incentives. Surprisingly, pro-social individuals are less willing to pay attention in order to benefit others. We

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interpret this results as the evidence that revealed social preferences depend on the nature of their elicitation. A possible direction to interpretation of this result takes its inspiration in the theory of the Willingness Ignorance (Grossman and van der Weele, 2016b). Since remaining inattentive prevents the individual from expressing her social preferences, she may strategically remain ignorant if she prefers that her decision is perceived by others or herself as inattentive rather than selfish.

Overall, this thesis provides a new perspective on the study of pro-social and pro-environmental behaviors. As discussed in the literature, individuals' social preferences are commonly studies through PGG and social dilemma with a monetary effort. We identify the incentives that lead individuals to contribute to collective pro-environmental projects. However, evidence reported in this thesis suggests the importance of the contribution nature: an individual with certain preferences will behave differently when he has to spend and effort in terms of money or attention.

5.2 Limitations

Although this research contributes to a better understanding of the determinants of PEB, it has three main limitations.

The first limitation concerns the bibliometric analysis in Chapter 2. There is the possibility that some articles do not appear in the sample if the journals where they have been published are not indexed by Scopus. A solution would be to complement our data using other sources, such as Google Scholar or Web of Science (Thomson Reuters). Another limitation comes from the keywords of the articles collected. The keywords are chosen by the authors and the same concept in economics and psychology can be expressed in different ways. For instance, the keyword “motivation” rarely appears alone in psychology because psychologists tend to couple it with other specifying terms, such as “motivation and learning” or “motivation and emotion”.

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On the contrary, economists tend to use the keyword “motivation” alone to cover a broad set of subjects. The official classification in the two disciplines, JEL and PsycINFO, reflect the same bias towards specific subjects. For instance, the JEL code “motivation” does not exist, while in the PsycINFO classification several codes identify different type of motivations.

The second limitation, namely, the generalization of the results from laboratory to the field, concerns the analyses in Chapter 3 and 4. The external validity of the experimental data has been discussed in literature providing elements for the pros and cons (Denant-Boémont et al., 2008; Etchart-Vincent, 2007; Levitt and List, 2007). Experimental protocols can be qualified as artificial since the decision context is too simplified and far from real world. Both the instructions and the social preferences measures are presented in a non-contextualized frame. All these elements might constitute a criticism and a limitation to the external validity of our results. However, they present advantages concerning the internal validity. Any experimental economist faces this trade-off between internal and external validity.

The third limitation also concerns Chapter 3 and 4. In our experimental sessions, the participants are mainly students. As an experimenter, certain methodological choices give rise to a delicate arbitration. The choice of students might be an easy solution, but one which also knows limitations since the student population is not representative of the population of a country. The choice of students as experimental subjects is also criticized for the fact that these students are highly educated, and therefore able to understand or disclosure the intentions of the experimenter, therefore skew the collected data. In addition, during their studies, students may not have all had the opportunity to make decisions as real adults. As a result, the choices they are asked to make during the experiments might be abstract, which would lead them to give answers to their questions empty of real significance (Etchart-Vincent, 2007).

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Despite these limitations pointed out for Chapter 3 and 4 which may be relevant in the absolute, we believe that they are not enough to invalidate the results obtained with experiments made with students.

As explained by Etchart-Vincent (2007), laboratory experiments provide smaller samples than empirical studies, which have larger samples composed of several social and professional categories. In the case of laboratory experiments with lower samples, it is more appropriate to adopt a more homogeneous population to avoid any bias and to neutralize the possible effects of socio-occupational categories, thus ensure the “*all other things being equal*”. As in Guala (2005)’s book, we consider that experimental method in economics is the most powerful tool for estimating causal relations. By respecting its principles of no deception, non-contextualization and incentivizing choices, we insured the internal validity of our designs. We collected data that we analyzed with rigorous econometric methods, minimizing possible biases and controlling for subjects’ characteristics that might be correlated with the experimental treatment. We thus believe that our results enrich the economic literature about some regularities which occur outside the experimental laboratory.

5.3 Future work

As we have seen by highlighting the main contributions of this work, several promising areas of research might emerge from the studies carried out. We will now present the other research lines that, in our opinion, are worth investigating.

First, we reviewed the experimental findings on the determinants of PEB. We distinguish two trends in economics and psychology literature. One extension could be the analysis of the authors’ affiliations. According to this information, we could map the geographical evolution of the collaborations and identify leading research centres.

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Second, we discussed the importance of attention in understanding pro-social behavior. One possible extension should be to test the task and the impact of incentives on groups composed of two players. Following Battigalli and Dufwenberg (2007)'s work on social preference in social dilemma games, an experimental design composed by two individuals permits to grasp more precise insights about the expression of social preferences. Following this idea, we have already started working on a project built on the initial design of the experiment presented in Chapter 4 implementing some modifications. We start with modifications of the task to insure a better control and limit the maximal performance of the subjects. Then, we adopt a within subject design in order to increase statistical power and have a direct expression of social preferences elicited in terms of attention. Then, we include in the experiment a measure of participant's beliefs in order to distinguish distributional social preferences from belief dependent ones. Finally, built on the first behavioral insights gathered in the first experiment, we plan to elaborate a behavioral model on the impact on social preferences and attention allocation, discussing the different possible impacts of each of distributive and belief dependent social preferences.

Third, the results of Chapter 3 show the need for investigation on the frequency of nudge provision. The short run effect observed on individual's behavior could be longer and stronger if the nudge is introduced at the proper frequency. Besides the question of nudge provision frequency, we can investigate the question of which technological support is used to provide the nudge. The origin of the nudge may also affect its efficiency. As in the real life, individuals receive several information from different supports, one can ask the question about the trust an individual has according to the support and the origin of the provided information (nudge).

It is in this context that this PhD will be immediately followed by a post-doctoral research to be performed at the University of Côte d'Azur. This research involves the collaboration of the Monegasque Electricity and Gas Company (SMEG). The

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project concerns the Principality of Monaco where the authorities support a strong green policy. We will investigate the impact of different types of social norms and nudges on households' energy consumption. The methodology developed in this thesis will allow us to enrich the analysis of the link between social and environmental preferences and pro-environmental behaviors.

Conclusion Générale

5.4 Résumé des contributions

Dans cette thèse, nous avons proposé une approche permettant d'étudier l'effet de différents types d'incitations sur le comportement pro-social grâce à des expériences menées en laboratoire. Plus précisément, nous nous sommes intéressés aux études comportementales pour comprendre comment promouvoir les comportements pro-environnementaux.

Nous avons donc proposé d'étudier différentes situations d'interactions sociales pouvant être liées au PEB. Tout d'abord, nous nous sommes intéressés à la question des études comportementales sur le PEB en économie et en psychologie. Nous avons donc orienté notre recherche vers les méthodologies expérimentales traitant de cette question de recherche.

Nous avons commencé par le Chapitre 2 en présentant une revue de la littérature et une analyse bibliométrique sur les études des comportements pro-environnementaux en économie et en psychologie. Après la revue de la littérature, nous avons proposé deux études expérimentales. La première expérience est présentée dans le Chapitre 3. Il s'agit d'un jeu de bien public visant à comparer l'efficacité d'une incitation monétaire (sanction) et d'une incitation non monétaire (nudge) à la promotion de comportements pro-sociaux. La deuxième expérience est présentée dans le Chapitre 4. Elle repose sur un design original. L'expérience vise à étudier l'impact des in-

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citations sur le comportement pro-social lorsque les individus doivent investir de l'attention et non de l'argent. Nous présentons les principales conclusions de la thèse ci-dessous.

Le Chapitre 2 montre que le nombre d'études sur le PEB augmente constamment au fil du temps en économie et en psychologie. Nous montrons qu'il existe une tendance à la séparation entre les deux disciplines reflétée par un manque d'articles interdisciplinaires. La recherche en psychologie sur le PEB tend à se concentrer sur la relation entre les caractéristiques internes de l'individu et son comportement, telles que les émotions, les valeurs, les préférences et l'attention. En économie, l'accent est davantage mis sur les facteurs externes tels que les systèmes d'incitation, les taxes et les nudges. L'explication proposée dans cette thèse repose sur les différences méthodologiques qui limitent la collaboration réelle entre les expérimentateurs en économie et en psychologie.

Le Chapitre 3 considère les décisions individuelles à travers un jeu de bien public. Les sujets hétérogènes, en termes de préférences sociales et de dotations, sont invités à contribuer à un bien collectif. Selon le traitement et selon la volonté d'une tierce partie, les sujets sont incités par un conseil (nudge) ou punis pour ne pas contribuer au bien collectif. Les résultats de ce chapitre montrent que conseiller les individus est efficace pour promouvoir leur coopération et renforcer les normes sociales dans le groupe. Cependant, l'effet de la sanction des non-contributeurs montre un effet plus fort dans le renforcement de la coopération au fil du temps. De manière similaire à Maslet et al. (2013), nous observons que la menace de sanction du tiers est plus efficace pour renforcer la coopération que le simple conseil. En termes d'implications politiques, les décideurs peuvent toujours compter sur l'utilité des systèmes de sanctions (taxes) pour promouvoir le financement de biens publics. Le *nudge* représente un instrument alternatif bien que son effet soit plus faible et limité dans le temps.

Le Chapitre 4 compare l'effet de deux incitations sur l'allocation de l'attention.

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Plus précisément, nous comparons les incitations égoïstes, c'est-à-dire qui incitent l'individu à augmenter son profit en investissant son attention, avec une incitation pro-sociale, c'est-à-dire qui permet à l'individu d'augmenter le bénéfice des autres en investissant de l'attention pour la réalisation d'une tâche. Nous constatons que les deux incitations augmentent l'allocation de l'attention mais que l'effet est plus fort pour les incitations égoïstes en comparaison de celles pro-sociales. Chose étonnante, les individus pro-sociaux sont moins disposés à prêter attention afin que les autres en bénéficient. Nous interprétons ces résultats comme l'indication que les préférences sociales révélées dépendent de la nature de leur élicitation. Une direction possible à l'interprétation de ce résultat prend son inspiration dans la théorie de l'ignorance de la volonté.

En somme, cette thèse offre une nouvelle perspective sur l'étude des comportements pro-sociaux et pro-environnementaux. Comme discuté dans la littérature, les préférences sociales des individus sont généralement étudiées à travers des dilemmes sociaux et jeux de biens publics avec un effort monétaire. Nous identifions les incitations qui conduisent les individus à contribuer à des biens collectifs. Cependant, les résultats de cette thèse suggèrent l'importance de la nature de la contribution (attention) un individu avec certaines préférences se comportera différemment lorsqu'il devra investir un effort en termes d'argent ou bien en termes d'attention.

En ce sens, les résultats fournis dans cette thèse contribuent non seulement à une meilleure compréhension du rôle des incitations monétaires et non monétaires sur les comportements pro-sociaux mais proposent également un nouveau regard sur la manière d'étudier les comportements pro-sociaux en considérant les cas où un effort en termes d'attention est nécessaire.

5.5 Limites

Bien que cette recherche contribue à une meilleure compréhension des déterminants des comportements pro-sociaux et pro-environnementaux, nous devons néanmoins souligner trois limites principales.

La première limite concerne l'analyse bibliométrique du Chapitre 2.

Il est possible que certains articles n'apparaissent pas dans l'échantillon si les revues dans lesquelles ils ont été publiés ne sont pas indexées par Scopus. Une solution serait de compléter nos données en utilisant d'autres sources, telles que Google Scholar ou Web of Science (Thomson Reuters). Une autre limite vient des mots-clés des articles collectés. Les mots-clés sont choisis par les auteurs et le même concept en économie et en psychologie peut s'exprimer de différentes manières. Par exemple, le mot-clé "motivation" apparaît rarement seul en psychologie parce que les psychologues l'associent à d'autres termes spécifiques, tels que "motivation et apprentissage" ou "motivation et émotion". Au contraire, les économistes ont tendance à utiliser le mot-clé "motivation" seul pour couvrir un large éventail de sujets. La classification officielle dans les deux disciplines, respectivement, JEL et PsycINFO, reflète le même penchant pour des sujets spécifiques. Par exemple, le code JEL "motivation" n'existe pas, alors que dans la classification PsycINFO plusieurs codes identifient différents types de motivations.

La deuxième limite, à savoir, la question de la généralisation des résultats du laboratoire au terrain, concerne les Chapitres 3 et 4. La validité externe des données expérimentales a été discutée dans la littérature en fournissant des éléments avec ses avantages et ses inconvénients (Denant-Boémont et al., 2008; Etchart-Vincent, 2007; Levitt and List, 2007). Les protocoles expérimentaux peuvent être qualifiés d'artificiels puisque le contexte de décision est trop simplifié et éloigné du monde réel. Cependant, le chercheur doit faire un choix entre validité interne et externe. Les

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instructions et les mesures de préférences sociales sont présentées dans un cadre non contextualisé. Tous ces éléments peuvent constituer une critique et une limite à la validité externe de nos résultats. Cependant, ils présentent des avantages concernant la validité interne.

La troisième limite concerne également les chapitres 3 et 4. Dans nos sessions expérimentales, les participants sont principalement des étudiants. En tant qu'expérimentateur, certains choix méthodologiques donnent lieu à des arbitrages délicats. Le choix des étudiants est une solution, certes, facile, mais qui connaît aussi des limites puisque la population étudiante n'est pas représentative de la population d'un pays. Le choix des étudiants comme sujets expérimentaux est aussi critiqué du fait que ces derniers soient particulièrement éduqués et donc suspectés d'avoir la capacité de déjouer les intentions de l'expérimentateur, et par conséquent de biaiser les données recueillies. De plus, durant la période estudiantine, les étudiants n'ont pas forcément tous eu l'occasion de prendre des décisions d'adultes. De ce fait, les choix qu'on leur demande de faire durant les expériences peuvent leur paraître abstraits, ce qui les mènerait à donner des réponses dénuées de signification réelle (Etchart-Vincent, 2007).

Ces limites doivent être nuancées. Comme l'explique Etchart-Vincent (2007), les expériences en laboratoire présentent des échantillons moins importants que les études empiriques, qui elles, comportent de plus grands échantillons à plusieurs catégories socio-professionnelles. Dans le cas des expériences en laboratoire de taille plus réduite, il est plus judicieux d'adopter une population plus homogène pour éviter tout biais, neutraliser les possibles effets de catégories socio-professionnelles et d'assurer la *"toutes choses égales par ailleurs"*. Conformément à Guala (2005), nous considérons que la méthode expérimentale en économie est un outil puissant pour estimer les relations causales. En respectant ses principes de non-tromperie, de décontextualisation et de choix incités, nous avons assuré la validité interne de

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nos expériences. Nous avons collecté des données que nous avons analysées avec des méthodes économétriques rigoureuses, en minimisant les biais possibles et en contrôlant les caractéristiques des sujets qui pourraient être corrélées avec le traitement expérimental. Nous croyons donc que nos résultats enrichissent la littérature économique sur quelques régularités qui se produisent en dehors du laboratoire expérimental.

5.6 Travaux futurs

Comme nous l'avons vu en mettant en évidence les principales contributions de ce travail, plusieurs domaines de recherche prometteurs pourraient émerger des études réalisées. Nous allons maintenant présenter les perspectives de recherche susceptibles d'être développées pour prolonger notre travail.

Premièrement, nous avons examiné les résultats expérimentaux sur les déterminants du comportement pro-environnemental. Nous avons distingué des tendances dans la littérature expérimentale en économie et psychologie. Une extension consisterait à analyser les affiliations de chaque auteur. Grâce à cette information, nous pourrions cartographier l'évolution des collaborations et identifier les centres de recherche leaders à travers le monde, notamment en ce qui concerne les études inter-disciplinaires.

Deuxièmement, nous avons discuté de l'importance de l'attention dans la compréhension du comportement pro-social. Une extension réalisable à court terme consisterait à re-tester la tâche proposée dans le Chapitre 4 sur des groupes de deux individus. S'appuyant sur les travaux de Battigalli and Dufwenberg (2007) à propos des préférences sociales dans les jeux de dilemmes sociaux, un modèle expérimental composé de deux individus permettrait de mieux saisir le mécanisme d'expression des préférences sociales. Sur la base de cette idée, nous avons déjà commencé à travailler sur un projet construit sur la conception du design initial de

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l'expérience présentée dans le Chapitre 4 en mettant en œuvre certaines modifications. Nous commençons avec des modifications de la tâche dans le but d'assurer un meilleur contrôle et de limiter la performance maximale des sujets. Ensuite, nous adoptons une comparaison intra-sujet afin d'augmenter le pouvoir statistique de notre analyse et ainsi d'avoir une expression directe des préférences sociales suscitées en termes d'attention. Nous poursuivons en incluant dans l'expérience une mesure des croyances des participants afin de distinguer les préférences sociales distributives de celles dépendantes des croyances des individus. Enfin, sur la base des premières observations comportementales recueillies dans la première expérience, nous prévoyons d'élaborer un modèle comportemental sur l'impact des préférences sociales et l'allocation d'attention, en discutant des différents impacts possibles de chacune des préférences sociales distributives et dépendantes des croyances.

Troisièmement, les résultats du Chapitre 3 montrent la nécessité d'une enquête sur la fréquence d'application des *nudges*. L'effet à court terme observé sur le comportement de l'individu pourrait être plus long et plus fort si le *nudge* est introduit à la fréquence appropriée. En plus de la question de la fréquence de mise en place, nous pouvons étudier la question de savoir par quel support technologique le *nudge* est fourni. L'origine du coup de pouce peut également affecter son efficacité. Comme dans la vie réelle, les individus reçoivent plusieurs informations de différents supports, on peut se poser la question de la confiance qu'un individu a en fonction du support et de l'origine de l'information fournie.

C'est dans ce cadre que ce doctorat sera suivi immédiatement par une recherche post-doctorale que je réaliserai à l'Université Côte d'Azur. Cette recherche sera réalisée en collaboration avec la Société Monégasque d'Électricité et de Gaz (SMEG). Ce projet propose d'observer sur le terrain de la principauté de Monaco, où les autorités pratiquent une forte stratégie verte, certains déterminants des comportements pro-environnementaux analysés durant cette thèse. Précisément, il s'agira

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d'observer sur un groupe de ménages monégasques l'effet de normes sociales et les incitations non monétaires type *nudge* sur la consommation d'énergie. Cette méthodologie permettra d'approfondir les recherches sur le lien entre les préférences (sociales et environnementales) et les comportements pro-environnementaux.

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APPENDIX

.1 Appendix

.1.1 Additional Tables

Table 1: Economics Keywords frequency

keywords	Frequency
Choice experiment & Field experiments	156
Willingness to pay	59
Values	64
Preferences	43
Ecosystem services	21
Climate change	16
Environmental policy	15
Sustainability	11
Risk preference	10
Cost Benefit analysis & Benefits transfer	8

Table 2: Psychology Keywords frequency

keywords	Frequency
Stress	17
Environmental psychology and enrichment	20
Memory	9
Emotion	9
Attention	9
Learning	9
Anxiety	8
Reinforcement	6
Affect	4
Reward	3

Source: Scopus - Author's calculation.

APPENDIX

Table 3: Ranking of publications by average citations over fields

Article	Journal	Year	AV cit/year	Field
Estimation and inference in two-stage, semi-parametric models of production processes	Journal of Econometrics	2007	95	Economics
Phytoremediation of contaminated soils and groundwater: Lessons from the field	Environmental Science and Pollution Research	2009	42	
Environmental sustainability and behavioral science: Meta-analysis of pro-environmental behavior experiments	Environment and Behavior	2012	30	
A meta-analysis of hypothetical bias in stated preference valuation	Environmental and Resource Economics	2005	29	
Stated preference approaches for measuring passive use values: Choice experiments and contingent valuation	American Journal of Agricultural Economics	1998	28	Psychology
Normative social influence is underdetected	Personality and Social Psychology Bulletin	2008	54	
Trust in automation: Integrating empirical evidence on determinants that influence trust	Human Factors	2015	31	
The feedback-related negativity reflects the binary evaluation of good versus bad outcomes	Biological Psychology	2006	28	
General color and psychological functioning: The effect of red on performance attainment	Journal of Experimental Psychology	2007	24	
Exposure to restorative environments helps restore attentional capacity	Journal of Environmental Psychology	2005	22	

Note: AV cit/year means Average number of citation per year.

Source: Scopus - Author calculation.

.2 Appendix

.2.1 Additional Figures

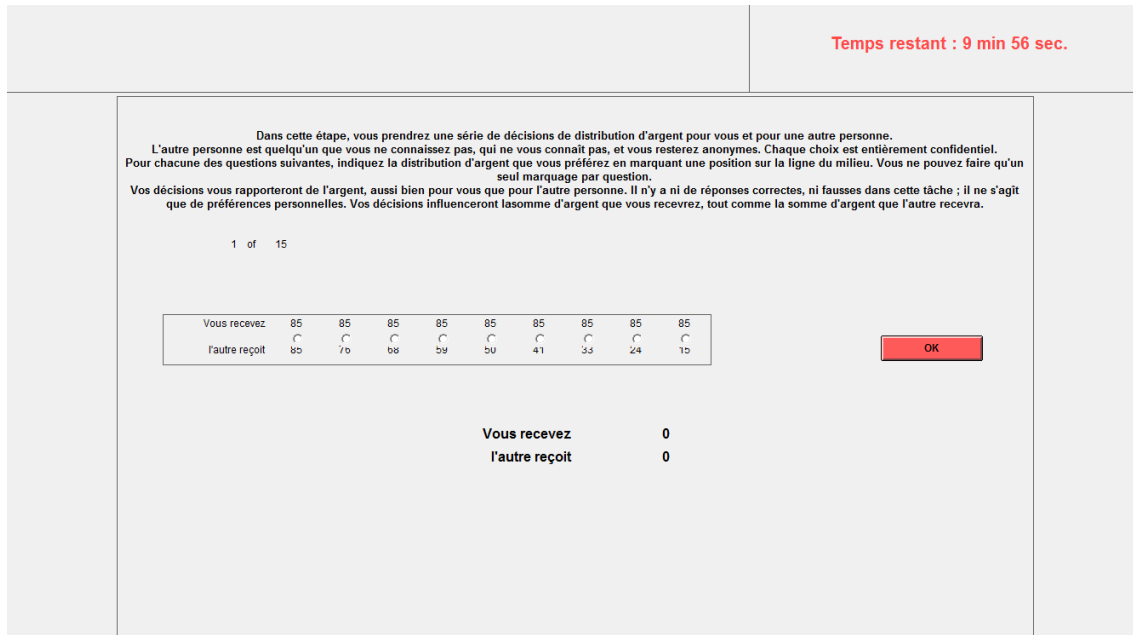


Figure 1: Social Value Orientation Test

English instruction: In this stage, you will take a couple of decisions about the distribution of ECUs to yourself and another person. For each of the following questions, please indicate the ECU distribution you prefer marking a position on the middle line. You are allowed to make only one decision. Your decision will earn ECU for you and for the other person. There are no right or wrong answers; it is a matter of personal preference.

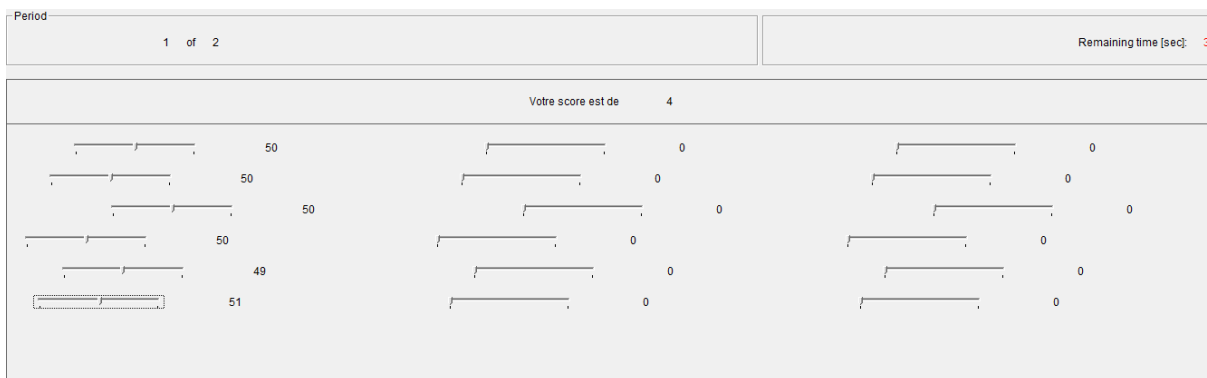


Figure 2: Slider effort task (Gill and Prowse, 2012)

.2.2 Text of the experimental instruction from French

Instructions *The following is the English translation of the instructions related to the baseline treatment (BT). The parts related to the advice and sanction treatments are in parentheses*

Welcome to the Nice Laboratory of Experimental Economics (LEEN - Nice Lab). You are going to participate in an experiment where your decisions will be anonymous, and in part will determine your final payment. Please read the following instructions carefully. In addition to the earnings accrued in the experiment, and depending on your decisions, you will be given a fixed sum of 50 ECU to cover your travel expenses. A variable amount will be added depending on the decisions made during the experiment. The total amount of your payoff will be paid to you at the end of the experiment and after you have completed a questionnaire. Payments are confidential in relation to the other participants and to ourselves. The currency used in this experiment is the experimental currency unit (ECU). However, at the end of the experiment you will be paid in euros according to the exchange rate: 10 ECU = 1 EURO. We ask you not to talk to one another for the duration of the experiment and to turn off your cellphones. Infringement of the rules means that the experiment will be interrupted and all payments canceled. If you encounter a technical problem, please raise your hand and wait for the experimenter to come to you. Everyone on the room has been given the same instructions and will participate in the same experiment.

The experiment consists of 3 steps.

Step 1: We propose an exercise in which you must decide anonymously about the distribution of payment for you and another person in the room but without knowing who this person is. You will be asked to indicate your preferred distribution of the money by marking a position on the middle line. There is no right or wrong answer; it is a matter of personal preference. In the example, one person chose to distribute the money so that he or she receives 85 units and the other person receives 33 units (see 1). You are allowed only one choice per question. You must answer 15 questions in total. Your decisions will earn you and the other person money. A period among the 15 will be drawn at random and this will define your payoff for that first part of the experiment. The conversion of points earned in this part of the experiment will

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be at a rate of 10 units = 1 ECU and added to the ECUs accumulated during the subsequent stages and converted into euros at the end of the experiment.

End of the first stage of the experiment

Step 2: You will be grouped randomly and anonymously with 3 other participants. The results and information gathered during the experiment will respect your anonymity. Each of you has an initial allocation of 5 ECU. During this stage of the game, you will be invited to participate in a game that will allow you to increase this initial endowment. The amount of your total endowment will be between a minimum of 5 ECU and a maximum of 10 ECU depending on your performance during the next game.

[In the Advice Treatment participants in the PGG are told: You will be grouped randomly into groups of 5 players. Each group will consist of 4 contributors and 1 observer. The results and information gathered during the experiment will respect your anonymity; the third-party (the observer) is told: Your role is to observe the behavior of the contributors in your group. You will be informed of the average endowment of the contributors in your group. You then will advise them about the amount of their contribution to a common good. Contributors can choose whether to follow your advice or ignore it.]

[In the Sanction Treatment, after the random groups have been formed, participants in the PGG are told: You need to wait for the contributors in your group to complete a slider game. This will provide you with information on the average endowment of the contributors in your group.]

How to increase your endowment The game requires you to use the computer mouse to place a maximum number of the sliders at the center of each slide (see figure 2) to point to the number 50, in a maximum of 60 seconds. At the end of the allotted time, the number of best positioned cursors will be converted into ECU, at the rate of: 4 well positioned cursors = 1 ECU. In this example, the participant has managed to position 4 sliders on the slides, earning him 1 extra ECU. You can see that the cursors placed on the digits 49 and 51 have not been validated. The task is to set the value at 50 exactly! In this example, the endowment of this participant

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for the rest of the experiment will be equal to: $5 \text{ ECU} + 1 \text{ ECU} = 6 \text{ ECU}$, i.e., the amount in ECU allocated at the start of the experiment + the additional amount in ECU earned through play slides equaling the total amount in ECU to be used during the rest of the experiment.

End of the second stage of the experiment

Step 3: Now that your endowment has been increased, you have the opportunity to transfer a portion of it to contribute to a common good (e.g. a device to better manage household waste). The proportion that you decide to allocate to the common good potentially will reduce the total cost of waste management for your group. The greater the collective contribution, the greater the cost reduction. The experiment will be repeated ten times in succession (10 periods) within the same group.

Computation of earnings: To help you make decisions, please refer to the table for the amounts of your endowment. The following tables present a simulation of your earnings based on the amount of your endowment, the amount of your contribution and the total amount contributed by your group members. (see example in Table ?? for a total endowment of 5 in the baseline treatment)

[In the advice treatment, the third-party (the observer) is given the following information about her payoff: Your payoff is equal to the average earnings of the contributors in your group.]

[In the sanction treatment, the third-party (the observer) is told: Your role is to observe the behavior of contributors in your group. You will be able to sanction them collectively if you consider that the average contribution of the group to the common good is not sufficient. This penalty is costly to you since your payoff is related to the average contributor payoffs in your group. At the end of each round, you will be informed of the average contributions within your group. You will then be able to maintain earnings as they are, or apply the penalty of a higher tax rate. The experience will be repeated ten times in ten successive rounds with the same groups and the same roles in each group. *The contributors* are given the following information: To help you make decisions, please see the table for the amount of your endowment. The following tables present a simulation of your payoff according to:

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The amount of your endowment; The amount of your contribution; The amount of the total contribution of the members of your group. In summary: your total payoff will depend on: 1) the decision of the observer to exert or not the sanction, 2) the share of private gain linked to private consumption, and 3) the part of the individual gain resulting from the collective behavior of your group. It might be that this latter share outweighs the share associated to private consumption.]

.2.3 Payoff tables

Table 4: Gain matrix for 5 ECUs of Endowment in Baseline treatment (T0)

		My Contribution					
		0	1	2	3	4	5
Sum of my group members contributions	0	2,4	2,79	3,04	3,08	2,85	2,23
	1	3,07	3,41	3,57	3,5	3,17	2,44
	2	3,74	3,99	4,05	3,89	3,47	2,64
	3	4,38	4,53	4,5	4,25	3,74	2,83
	4	4,97	5,03	4,91	4,59	4	3
	5	5,51	5,49	5,3	4,9	4,24	3,16
	6	6,02	5,92	5,66	5,2	4,47	3,32
	7	6,49	6,33	6	5,48	4,69	3,46
	8	6,93	6,71	6,33	5,74	4,9	3,61
	9	7,35	7,07	6,63	6	5,1	3,74
	10	7,75	7,42	6,93	6,24	5,29	3,87
	11	8,12	7,75	7,21	6,48	5,48	4
	12	8,49	8,06	7,48	6,71	5,66	4,12
	13	8,83	8,37	7,75	6,93	5,83	4,24
	14	9,17	8,66	8	7,14	6	4,36
	15	9,49	8,94	8,25	7,35	6,16	4,47
	16	9,8	9,22	8,49	7,55	6,32	4,58
	17	10,1	9,49	8,72	7,75	6,48	4,69
	18	10,39	9,75	8,94	7,94	6,63	4,8
	19	10,68	10	9,17	8,12	6,78	4,9
	20	10,95	10,25	9,38	8,31	6,93	5
	21	11,22	10,49	9,59	8,49	7,07	5,1
	22	11,49	10,72	9,8	8,66	7,21	5,2
	23	11,75	10,95	10	8,83	7,35	5,29
	24	12	11,18	10,2	9	7,48	5,39
	25	12,25	11,4	10,39	9,17	7,62	5,48
	26	12,49	11,62	10,58	9,33	7,75	5,57
	27	12,73	11,83	10,77	9,49	7,87	5,66
	28	12,96	12,04	10,95	9,64	8	5,74
	29	13,19	12,25	11,14	9,8	8,12	5,83
	30	13,42	12,45	11,31	9,95	8,25	5,92

Table 5: Gain matrix for 6 ECUs of Endowment in Baseline treatment (T0)

		My Contribution						
		0	1	2	3	4	5	6
Sum of my group members contributions	0	2,6	3,07	3,41	3,57	3,5	3,17	2,44
	1	3,32	3,74	3,99	4,05	3,89	3,47	2,64
	2	4,04	4,38	4,53	4,5	4,25	3,74	2,83
	3	4,73	4,97	5,03	4,91	4,59	4	3
	4	5,37	5,51	5,49	5,3	4,9	4,24	3,16
	5	5,96	6,02	5,92	5,66	5,2	4,47	3,32
	6	6,5	6,49	6,33	6	5,48	4,69	3,46
	7	7,01	6,93	6,71	6,33	5,74	4,9	3,61
	8	7,49	7,35	7,07	6,63	6	5,1	3,74
	9	7,94	7,75	7,42	6,93	6,24	5,29	3,87
	10	8,37	8,12	7,75	7,21	6,48	5,48	4
	11	8,78	8,49	8,06	7,48	6,71	5,66	4,12
	12	9,17	8,83	8,37	7,75	6,93	5,83	4,24
	13	9,54	9,17	8,66	8	7,14	6	4,36
	14	9,9	9,49	8,94	8,25	7,35	6,16	4,47
	15	10,25	9,8	9,22	8,49	7,55	6,32	4,58
	16	10,58	10,1	9,49	8,72	7,75	6,48	4,69
	17	10,91	10,39	9,75	8,94	7,94	6,63	4,8
	18	11,22	10,68	10	9,17	8,12	6,78	4,9
	19	11,53	10,95	10,25	9,38	8,31	6,93	5
	20	11,83	11,22	10,49	9,59	8,49	7,07	5,1
	21	12,12	11,49	10,72	9,8	8,66	7,21	5,2
	22	12,41	11,75	10,95	10	8,83	7,35	5,29
	23	12,69	12	11,18	10,2	9	7,48	5,39
	24	12,96	12,25	11,4	10,4	9,17	7,62	5,48
	25	13,23	12,49	11,62	10,6	9,33	7,75	5,57
	26	13,49	12,73	11,83	10,8	9,49	7,87	5,66
	27	13,75	12,96	12,04	11	9,64	8	5,74
	28	14	13,19	12,25	11,1	9,8	8,12	5,83
	29	14,25	13,42	12,45	11,3	9,95	8,25	5,92
	30	14,49	13,64	12,65	11,5	10,1	8,37	6

Table 6: Gain matrix for 7 ECUs of Endowment in Baseline treatment (T0)

		My Contribution							
		0	1	2	3	4	5	6	7
Sum of my group members contributions	0	2,78	3,32	3,74	3,99	4,05	3,89	3,47	2,64
	1	3,55	4,04	4,38	4,53	4,5	4,25	3,74	2,83
	2	4,33	4,73	4,97	5,03	4,91	4,59	4	3
	3	5,06	5,37	5,51	5,49	5,3	4,9	4,24	3,16
	4	5,74	5,96	6,02	5,92	5,66	5,2	4,47	3,32
	5	6,37	6,5	6,49	6,33	6	5,48	4,69	3,46
	6	6,95	7,01	6,93	6,71	6,33	5,74	4,9	3,61
	7	7,5	7,49	7,35	7,07	6,63	6	5,1	3,74
	8	8,01	7,94	7,75	7,42	6,93	6,24	5,29	3,87
	9	8,49	8,37	8,12	7,75	7,21	6,48	5,48	4
	10	8,95	8,78	8,49	8,06	7,48	6,71	5,66	4,12
	11	9,38	9,17	8,83	8,37	7,75	6,93	5,83	4,24
	12	9,8	9,54	9,17	8,66	8	7,14	6	4,36
	13	10,2	9,9	9,49	8,94	8,25	7,35	6,16	4,47
	14	10,58	10,25	9,8	9,22	8,49	7,55	6,32	4,58
	15	10,95	10,58	10,1	9,49	8,72	7,75	6,48	4,69
	16	11,31	10,91	10,39	9,75	8,94	7,94	6,63	4,8
	17	11,66	11,22	10,68	10	9,17	8,12	6,78	4,9
	18	12	11,53	10,95	10,25	9,38	8,31	6,93	5
	19	12,33	11,83	11,22	10,49	9,59	8,49	7,07	5,1
	20	12,65	12,12	11,49	10,72	9,8	8,66	7,21	5,2
	21	12,96	12,41	11,75	10,95	10	8,83	7,35	5,29
	22	13,27	12,69	12	11,18	10,2	9	7,48	5,39
	23	13,56	12,96	12,25	11,4	10,39	9,17	7,62	5,48
	24	13,86	13,23	12,49	11,62	10,58	9,33	7,75	5,57
	25	14,14	13,49	12,73	11,83	10,77	9,49	7,87	5,66
	26	14,42	13,75	12,96	12,04	10,95	9,64	8	5,74
	27	14,7	14	13,19	12,25	11,14	9,8	8,12	5,83
	28	14,97	14,25	13,42	12,45	11,31	9,95	8,25	5,92
	29	15,23	14,49	13,64	12,65	11,49	10,1	8,37	6
	30	15,49	14,73	13,86	12,85	11,66	10,25	8,49	6,08

Table 7: Gain matrix for 8 ECUs of Endowment in Baseline treatment (T0)

		My Contribution								
		0	1	2	3	4	5	6	7	8
Sum of my group members contributions	0	2,96	3,55	4,04	4,38	4,53	4,5	4,25	3,74	2,83
	1	3,77	4,33	4,73	4,97	5,03	4,91	4,59	4	3
	2	4,59	5,06	5,37	5,51	5,49	5,3	4,9	4,24	3,16
	3	5,37	5,74	5,96	6,02	5,92	5,66	5,2	4,47	3,32
	4	6,09	6,37	6,5	6,49	6,33	6	5,48	4,69	3,46
	5	6,76	6,95	7,01	6,93	6,71	6,33	5,74	4,9	3,61
	6	7,37	7,5	7,49	7,35	7,07	6,63	6	5,1	3,74
	7	7,95	8,01	7,94	7,75	7,42	6,93	6,24	5,29	3,87
	8	8,49	8,49	8,37	8,12	7,75	7,21	6,48	5,48	4
	9	9	8,95	8,78	8,49	8,06	7,48	6,71	5,66	4,12
	10	9,49	9,38	9,17	8,83	8,37	7,75	6,93	5,83	4,24
	11	9,95	9,8	9,54	9,17	8,66	8	7,14	6	4,36
	12	10,39	10,2	9,9	9,49	8,94	8,25	7,35	6,16	4,47
	13	10,82	10,58	10,25	9,8	9,22	8,49	7,55	6,32	4,58
	14	11,23	10,95	10,58	10,1	9,49	8,72	7,75	6,48	4,69
	15	11,62	11,31	10,91	10,39	9,75	8,94	7,94	6,63	4,8
	16	12	11,66	11,22	10,68	10	9,17	8,12	6,78	4,9
	17	12,37	12	11,53	10,95	10,25	9,38	8,31	6,93	5
	18	12,73	12,33	11,83	11,22	10,49	9,59	8,49	7,07	5,1
	19	13,08	12,65	12,12	11,49	10,72	9,8	8,66	7,21	5,2
	20	13,42	12,96	12,41	11,75	10,95	10	8,83	7,35	5,29
	21	13,75	13,27	12,69	12	11,18	10,2	9	7,48	5,39
	22	14,07	13,56	12,96	12,25	11,4	10,39	9,17	7,62	5,48
	23	14,39	13,86	13,23	12,49	11,62	10,58	9,33	7,75	5,57
	24	14,7	14,14	13,49	12,73	11,83	10,77	9,49	7,87	5,66
	25	15	14,42	13,75	12,96	12,04	10,95	9,64	8	5,74
	26	15,3	14,7	14	13,19	12,25	11,14	9,8	8,12	5,83
	27	15,59	14,97	14,25	13,42	12,45	11,31	9,95	8,25	5,92
	28	15,87	15,23	14,49	13,64	12,65	11,49	10,1	8,37	6
	29	16,16	15,49	14,73	13,86	12,85	11,66	10,25	8,49	6,08
	30	16,43	15,75	14,97	14,07	13,04	11,83	10,39	8,6	6,16

Table 8: Gain matrix for 9 ECUs of Endowment in Baseline treatment (T0)

My Contribution

	0	1	2	3	4	5	6	7	8	9
0	3,12	3,77	4,33	4,73	4,97	5,03	4,91	4,59	4	3
1	3,98	4,59	5,06	5,37	5,51	5,49	5,3	4,9	4,24	3,16
2	4,84	5,37	5,74	5,96	6,02	5,92	5,66	5,2	4,47	3,32
3	5,66	6,09	6,37	6,5	6,49	6,33	6	5,48	4,69	3,46
4	6,42	6,76	6,95	7,01	6,93	6,71	6,33	5,74	4,9	3,61
5	7,12	7,37	7,5	7,49	7,35	7,07	6,63	6	5,1	3,74
6	7,77	7,95	8,01	7,94	7,75	7,42	6,93	6,24	5,29	3,87
7	8,38	8,49	8,49	8,37	8,12	7,75	7,21	6,48	5,48	4
8	8,95	9	8,95	8,78	8,49	8,06	7,48	6,71	5,66	4,12
9	9,49	9,49	9,38	9,17	8,83	8,37	7,75	6,93	5,83	4,24
10	10	9,95	9,8	9,54	9,17	8,66	8	7,14	6	4,36
11	10,49	10,39	10,2	9,9	9,49	8,94	8,25	7,35	6,16	4,47
12	10,96	10,82	10,58	10,25	9,8	9,22	8,49	7,55	6,32	4,58
13	11,4	11,23	10,95	10,58	10,1	9,49	8,72	7,75	6,48	4,69
14	11,83	11,62	11,31	10,91	10,39	9,75	8,94	7,94	6,63	4,8
15	12,25	12	11,66	11,22	10,68	10	9,17	8,12	6,78	4,9
16	12,65	12,37	12	11,53	10,95	10,25	9,38	8,31	6,93	5
17	13,04	12,73	12,33	11,83	11,22	10,49	9,59	8,49	7,07	5,1
18	13,42	13,08	12,65	12,12	11,49	10,72	9,8	8,66	7,21	5,2
19	13,78	13,42	12,96	12,41	11,75	10,95	10	8,83	7,35	5,29
20	14,14	13,75	13,27	12,69	12	11,18	10,2	9	7,48	5,39
21	14,49	14,07	13,56	12,96	12,25	11,4	10,39	9,17	7,62	5,48
22	14,83	14,39	13,86	13,23	12,49	11,62	10,58	9,33	7,75	5,57
23	15,17	14,7	14,14	13,49	12,73	11,83	10,77	9,49	7,87	5,66
24	15,49	15	14,42	13,75	12,96	12,04	10,95	9,64	8	5,74
25	15,81	15,3	14,7	14	13,19	12,25	11,14	9,8	8,12	5,83
26	16,12	15,59	14,97	14,25	13,42	12,45	11,31	9,95	8,25	5,92
27	16,43	15,87	15,23	14,49	13,64	12,65	11,49	10,1	8,37	6
28	16,73	16,16	15,49	14,73	13,86	12,85	11,66	10,25	8,49	6,08
29	17,03	16,43	15,75	14,97	14,07	13,04	11,83	10,39	8,6	6,16
30	17,32	16,7	16	15,2	14,28	13,23	12	10,54	8,72	6,24

Sum of my group members contributions

Table 9: Gain matrix for 10 ECUs of Endowment in Baseline treatment (T0)

		My Contribution										
		0	1	2	3	4	5	6	7	8	9	10
Sum of my group members contributions	0	3,28	3,98	4,59	5,06	5,37	5,51	5,49	5,3	4,9	4,24	3,16
	1	4,17	4,84	5,37	5,74	5,96	6,02	5,92	5,66	5,2	4,47	3,32
	2	5,08	5,66	6,09	6,37	6,5	6,49	6,33	6	5,48	4,69	3,46
	3	5,94	6,42	6,76	6,95	7,01	6,93	6,71	6,33	5,74	4,9	3,61
	4	6,73	7,12	7,37	7,5	7,49	7,35	7,07	6,63	6	5,1	3,74
	5	7,47	7,77	7,95	8,01	7,94	7,75	7,42	6,93	6,24	5,29	3,87
	6	8,15	8,38	8,49	8,49	8,37	8,12	7,75	7,21	6,48	5,48	4
	7	8,79	8,95	9	8,95	8,78	8,49	8,06	7,48	6,71	5,66	4,12
	8	9,39	9,49	9,49	9,38	9,17	8,83	8,37	7,75	6,93	5,83	4,24
	9	9,95	10	9,95	9,8	9,54	9,17	8,66	8	7,14	6	4,36
	10	10,49	10,49	10,39	10,2	9,9	9,49	8,94	8,25	7,35	6,16	4,47
	11	11	10,96	10,82	10,58	10,25	9,8	9,22	8,49	7,55	6,32	4,58
	12	11,49	11,4	11,23	10,95	10,58	10,1	9,49	8,72	7,75	6,48	4,69
	13	11,96	11,83	11,62	11,31	10,91	10,39	9,75	8,94	7,94	6,63	4,8
	14	12,41	12,25	12	11,66	11,22	10,68	10	9,17	8,12	6,78	4,9
	15	12,85	12,65	12,37	12	11,53	10,95	10,25	9,38	8,31	6,93	5
	16	13,27	13,04	12,73	12,33	11,83	11,22	10,49	9,59	8,49	7,07	5,1
	17	13,67	13,42	13,08	12,65	12,12	11,49	10,72	9,8	8,66	7,21	5,2
	18	14,07	13,78	13,42	12,96	12,41	11,75	10,95	10	8,83	7,35	5,29
	19	14,46	14,14	13,75	13,27	12,69	12	11,18	10,2	9	7,48	5,39
	20	14,83	14,49	14,07	13,56	12,96	12,25	11,4	10,39	9,17	7,62	5,48
	21	15,2	14,83	14,39	13,86	13,23	12,49	11,62	10,58	9,33	7,75	5,57
	22	15,56	15,17	14,7	14,14	13,49	12,73	11,83	10,77	9,49	7,87	5,66
	23	15,91	15,49	15	14,42	13,75	12,96	12,04	10,95	9,64	8	5,74
	24	16,25	15,81	15,3	14,7	14	13,19	12,25	11,14	9,8	8,12	5,83
	25	16,58	16,12	15,59	14,97	14,25	13,42	12,45	11,31	9,95	8,25	5,92
	26	16,91	16,43	15,87	15,23	14,49	13,64	12,65	11,49	10,1	8,37	6
	27	17,23	16,73	16,16	15,49	14,73	13,86	12,85	11,66	10,25	8,49	6,08
	28	17,55	17,03	16,43	15,75	14,97	14,07	13,04	11,83	10,39	8,6	6,16
	29	17,86	17,32	16,7	16	15,2	14,28	13,23	12	10,54	8,72	6,24
	30	18,17	17,61	16,97	16,25	15,43	14,49	13,42	12,17	10,68	8,83	6,32

Table 10: Gain matrix for 5 ECUs of Endowment in Advice treatment (T1)

		My Contribution					
		0	1	2	3	4	5
Sum of my group members contributions	0	2,4	2,79	3,04	3,08	2,85	2,23
	1	3,07	3,41	3,57	3,5	3,17	2,44
	2	3,74	3,99	4,05	3,89	3,47	2,64
	3	4,38	4,53	4,5	4,25	3,74	2,83
	4	4,97	5,03	4,91	4,59	4	3
	5	5,51	5,49	5,3	4,9	4,24	3,16
	6	6,02	5,92	5,66	5,2	4,47	3,32
	7	6,49	6,33	6	5,48	4,69	3,46
	8	6,93	6,71	6,33	5,74	4,9	3,61
	9	7,35	7,07	6,63	6	5,1	3,74
	10	7,75	7,42	6,93	6,24	5,29	3,87
	11	8,12	7,75	7,21	6,48	5,48	4
	12	8,49	8,06	7,48	6,71	5,66	4,12
	13	8,83	8,37	7,75	6,93	5,83	4,24
	14	9,17	8,66	8	7,14	6	4,36
	15	9,49	8,94	8,25	7,35	6,16	4,47
	16	9,8	9,22	8,49	7,55	6,32	4,58
	17	10,1	9,49	8,72	7,75	6,48	4,69
	18	10,39	9,75	8,94	7,94	6,63	4,8
	19	10,68	10	9,17	8,12	6,78	4,9
	20	10,95	10,25	9,38	8,31	6,93	5
	21	11,22	10,49	9,59	8,49	7,07	5,1
	22	11,49	10,72	9,8	8,66	7,21	5,2
	23	11,75	10,95	10	8,83	7,35	5,29
	24	12	11,18	10,2	9	7,48	5,39
	25	12,25	11,4	10,39	9,17	7,62	5,48
	26	12,49	11,62	10,58	9,33	7,75	5,57
	27	12,73	11,83	10,77	9,49	7,87	5,66
	28	12,96	12,04	10,95	9,64	8	5,74
	29	13,19	12,25	11,14	9,8	8,12	5,83
	30	13,42	12,45	11,31	9,95	8,25	5,92

Table 11: Gain matrix for 6 ECUs of Endowment in Advice treatment (T1)

		My Contribution						
		0	1	2	3	4	5	6
Sum of my group members contributions	0	2,6	3,07	3,41	3,57	3,5	3,17	2,44
	1	3,32	3,74	3,99	4,05	3,89	3,47	2,64
	2	4,04	4,38	4,53	4,5	4,25	3,74	2,83
	3	4,73	4,97	5,03	4,91	4,59	4	3
	4	5,37	5,51	5,49	5,3	4,9	4,24	3,16
	5	5,96	6,02	5,92	5,66	5,2	4,47	3,32
	6	6,5	6,49	6,33	6	5,48	4,69	3,46
	7	7,01	6,93	6,71	6,33	5,74	4,9	3,61
	8	7,49	7,35	7,07	6,63	6	5,1	3,74
	9	7,94	7,75	7,42	6,93	6,24	5,29	3,87
	10	8,37	8,12	7,75	7,21	6,48	5,48	4
	11	8,78	8,49	8,06	7,48	6,71	5,66	4,12
	12	9,17	8,83	8,37	7,75	6,93	5,83	4,24
	13	9,54	9,17	8,66	8	7,14	6	4,36
	14	9,9	9,49	8,94	8,25	7,35	6,16	4,47
	15	10,25	9,8	9,22	8,49	7,55	6,32	4,58
	16	10,58	10,1	9,49	8,72	7,75	6,48	4,69
	17	10,91	10,39	9,75	8,94	7,94	6,63	4,8
	18	11,22	10,68	10	9,17	8,12	6,78	4,9
	19	11,53	10,95	10,25	9,38	8,31	6,93	5
	20	11,83	11,22	10,49	9,59	8,49	7,07	5,1
	21	12,12	11,49	10,72	9,8	8,66	7,21	5,2
	22	12,41	11,75	10,95	10	8,83	7,35	5,29
	23	12,69	12	11,18	10,2	9	7,48	5,39
	24	12,96	12,25	11,4	10,4	9,17	7,62	5,48
	25	13,23	12,49	11,62	10,6	9,33	7,75	5,57
	26	13,49	12,73	11,83	10,8	9,49	7,87	5,66
	27	13,75	12,96	12,04	11	9,64	8	5,74
	28	14	13,19	12,25	11,1	9,8	8,12	5,83
	29	14,25	13,42	12,45	11,3	9,95	8,25	5,92
	30	14,49	13,64	12,65	11,5	10,1	8,37	6

Table 12: Gain matrix for 7 ECUs of Endowment in Advice treatment (T1)

		My Contribution							
		0	1	2	3	4	5	6	7
Sum of my group members contributions	0	2,78	3,32	3,74	3,99	4,05	3,89	3,47	2,64
	1	3,55	4,04	4,38	4,53	4,5	4,25	3,74	2,83
	2	4,33	4,73	4,97	5,03	4,91	4,59	4	3
	3	5,06	5,37	5,51	5,49	5,3	4,9	4,24	3,16
	4	5,74	5,96	6,02	5,92	5,66	5,2	4,47	3,32
	5	6,37	6,5	6,49	6,33	6	5,48	4,69	3,46
	6	6,95	7,01	6,93	6,71	6,33	5,74	4,9	3,61
	7	7,5	7,49	7,35	7,07	6,63	6	5,1	3,74
	8	8,01	7,94	7,75	7,42	6,93	6,24	5,29	3,87
	9	8,49	8,37	8,12	7,75	7,21	6,48	5,48	4
	10	8,95	8,78	8,49	8,06	7,48	6,71	5,66	4,12
	11	9,38	9,17	8,83	8,37	7,75	6,93	5,83	4,24
	12	9,8	9,54	9,17	8,66	8	7,14	6	4,36
	13	10,2	9,9	9,49	8,94	8,25	7,35	6,16	4,47
	14	10,58	10,25	9,8	9,22	8,49	7,55	6,32	4,58
	15	10,95	10,58	10,1	9,49	8,72	7,75	6,48	4,69
	16	11,31	10,91	10,39	9,75	8,94	7,94	6,63	4,8
	17	11,66	11,22	10,68	10	9,17	8,12	6,78	4,9
	18	12	11,53	10,95	10,25	9,38	8,31	6,93	5
	19	12,33	11,83	11,22	10,49	9,59	8,49	7,07	5,1
	20	12,65	12,12	11,49	10,72	9,8	8,66	7,21	5,2
	21	12,96	12,41	11,75	10,95	10	8,83	7,35	5,29
	22	13,27	12,69	12	11,18	10,2	9	7,48	5,39
	23	13,56	12,96	12,25	11,4	10,39	9,17	7,62	5,48
	24	13,86	13,23	12,49	11,62	10,58	9,33	7,75	5,57
	25	14,14	13,49	12,73	11,83	10,77	9,49	7,87	5,66
	26	14,42	13,75	12,96	12,04	10,95	9,64	8	5,74
	27	14,7	14	13,19	12,25	11,14	9,8	8,12	5,83
	28	14,97	14,25	13,42	12,45	11,31	9,95	8,25	5,92
	29	15,23	14,49	13,64	12,65	11,49	10,1	8,37	6
	30	15,49	14,73	13,86	12,85	11,66	10,25	8,49	6,08

Table 13: Gain matrix for 8 ECUs of Endowment in Advice treatment (T1)

		My Contribution								
		0	1	2	3	4	5	6	7	8
Sum of my group members contributions	0	2,96	3,55	4,04	4,38	4,53	4,5	4,25	3,74	2,83
	1	3,77	4,33	4,73	4,97	5,03	4,91	4,59	4	3
	2	4,59	5,06	5,37	5,51	5,49	5,3	4,9	4,24	3,16
	3	5,37	5,74	5,96	6,02	5,92	5,66	5,2	4,47	3,32
	4	6,09	6,37	6,5	6,49	6,33	6	5,48	4,69	3,46
	5	6,76	6,95	7,01	6,93	6,71	6,33	5,74	4,9	3,61
	6	7,37	7,5	7,49	7,35	7,07	6,63	6	5,1	3,74
	7	7,95	8,01	7,94	7,75	7,42	6,93	6,24	5,29	3,87
	8	8,49	8,49	8,37	8,12	7,75	7,21	6,48	5,48	4
	9	9	8,95	8,78	8,49	8,06	7,48	6,71	5,66	4,12
	10	9,49	9,38	9,17	8,83	8,37	7,75	6,93	5,83	4,24
	11	9,95	9,8	9,54	9,17	8,66	8	7,14	6	4,36
	12	10,39	10,2	9,9	9,49	8,94	8,25	7,35	6,16	4,47
	13	10,82	10,58	10,25	9,8	9,22	8,49	7,55	6,32	4,58
	14	11,23	10,95	10,58	10,1	9,49	8,72	7,75	6,48	4,69
	15	11,62	11,31	10,91	10,39	9,75	8,94	7,94	6,63	4,8
	16	12	11,66	11,22	10,68	10	9,17	8,12	6,78	4,9
	17	12,37	12	11,53	10,95	10,25	9,38	8,31	6,93	5
	18	12,73	12,33	11,83	11,22	10,49	9,59	8,49	7,07	5,1
	19	13,08	12,65	12,12	11,49	10,72	9,8	8,66	7,21	5,2
	20	13,42	12,96	12,41	11,75	10,95	10	8,83	7,35	5,29
	21	13,75	13,27	12,69	12	11,18	10,2	9	7,48	5,39
	22	14,07	13,56	12,96	12,25	11,4	10,39	9,17	7,62	5,48
	23	14,39	13,86	13,23	12,49	11,62	10,58	9,33	7,75	5,57
	24	14,7	14,14	13,49	12,73	11,83	10,77	9,49	7,87	5,66
	25	15	14,42	13,75	12,96	12,04	10,95	9,64	8	5,74
	26	15,3	14,7	14	13,19	12,25	11,14	9,8	8,12	5,83
	27	15,59	14,97	14,25	13,42	12,45	11,31	9,95	8,25	5,92
	28	15,87	15,23	14,49	13,64	12,65	11,49	10,1	8,37	6
	29	16,16	15,49	14,73	13,86	12,85	11,66	10,25	8,49	6,08
	30	16,43	15,75	14,97	14,07	13,04	11,83	10,39	8,6	6,16

Table 14: Gain matrix for 9 ECUs of Endowment in Advice treatment (T1)

My Contribution

	0	1	2	3	4	5	6	7	8	9
0	3,12	3,77	4,33	4,73	4,97	5,03	4,91	4,59	4	3
1	3,98	4,59	5,06	5,37	5,51	5,49	5,3	4,9	4,24	3,16
2	4,84	5,37	5,74	5,96	6,02	5,92	5,66	5,2	4,47	3,32
3	5,66	6,09	6,37	6,5	6,49	6,33	6	5,48	4,69	3,46
4	6,42	6,76	6,95	7,01	6,93	6,71	6,33	5,74	4,9	3,61
5	7,12	7,37	7,5	7,49	7,35	7,07	6,63	6	5,1	3,74
6	7,77	7,95	8,01	7,94	7,75	7,42	6,93	6,24	5,29	3,87
7	8,38	8,49	8,49	8,37	8,12	7,75	7,21	6,48	5,48	4
8	8,95	9	8,95	8,78	8,49	8,06	7,48	6,71	5,66	4,12
9	9,49	9,49	9,38	9,17	8,83	8,37	7,75	6,93	5,83	4,24
10	10	9,95	9,8	9,54	9,17	8,66	8	7,14	6	4,36
11	10,49	10,39	10,2	9,9	9,49	8,94	8,25	7,35	6,16	4,47
12	10,96	10,82	10,58	10,25	9,8	9,22	8,49	7,55	6,32	4,58
13	11,4	11,23	10,95	10,58	10,1	9,49	8,72	7,75	6,48	4,69
14	11,83	11,62	11,31	10,91	10,39	9,75	8,94	7,94	6,63	4,8
15	12,25	12	11,66	11,22	10,68	10	9,17	8,12	6,78	4,9
16	12,65	12,37	12	11,53	10,95	10,25	9,38	8,31	6,93	5
17	13,04	12,73	12,33	11,83	11,22	10,49	9,59	8,49	7,07	5,1
18	13,42	13,08	12,65	12,12	11,49	10,72	9,8	8,66	7,21	5,2
19	13,78	13,42	12,96	12,41	11,75	10,95	10	8,83	7,35	5,29
20	14,14	13,75	13,27	12,69	12	11,18	10,2	9	7,48	5,39
21	14,49	14,07	13,56	12,96	12,25	11,4	10,39	9,17	7,62	5,48
22	14,83	14,39	13,86	13,23	12,49	11,62	10,58	9,33	7,75	5,57
23	15,17	14,7	14,14	13,49	12,73	11,83	10,77	9,49	7,87	5,66
24	15,49	15	14,42	13,75	12,96	12,04	10,95	9,64	8	5,74
25	15,81	15,3	14,7	14	13,19	12,25	11,14	9,8	8,12	5,83
26	16,12	15,59	14,97	14,25	13,42	12,45	11,31	9,95	8,25	5,92
27	16,43	15,87	15,23	14,49	13,64	12,65	11,49	10,1	8,37	6
28	16,73	16,16	15,49	14,73	13,86	12,85	11,66	10,25	8,49	6,08
29	17,03	16,43	15,75	14,97	14,07	13,04	11,83	10,39	8,6	6,16
30	17,32	16,7	16	15,2	14,28	13,23	12	10,54	8,72	6,24

Sum of my group members contributions

Table 15: Gain matrix for 10 ECUs of Endowment in Advice treatment (T1)

		My Contribution										
		0	1	2	3	4	5	6	7	8	9	10
Sum of my group members contributions	0	3,28	3,98	4,59	5,06	5,37	5,51	5,49	5,3	4,9	4,24	3,16
	1	4,17	4,84	5,37	5,74	5,96	6,02	5,92	5,66	5,2	4,47	3,32
	2	5,08	5,66	6,09	6,37	6,5	6,49	6,33	6	5,48	4,69	3,46
	3	5,94	6,42	6,76	6,95	7,01	6,93	6,71	6,33	5,74	4,9	3,61
	4	6,73	7,12	7,37	7,5	7,49	7,35	7,07	6,63	6	5,1	3,74
	5	7,47	7,77	7,95	8,01	7,94	7,75	7,42	6,93	6,24	5,29	3,87
	6	8,15	8,38	8,49	8,49	8,37	8,12	7,75	7,21	6,48	5,48	4
	7	8,79	8,95	9	8,95	8,78	8,49	8,06	7,48	6,71	5,66	4,12
	8	9,39	9,49	9,49	9,38	9,17	8,83	8,37	7,75	6,93	5,83	4,24
	9	9,95	10	9,95	9,8	9,54	9,17	8,66	8	7,14	6	4,36
	10	10,49	10,49	10,39	10,2	9,9	9,49	8,94	8,25	7,35	6,16	4,47
	11	11	10,96	10,82	10,58	10,25	9,8	9,22	8,49	7,55	6,32	4,58
	12	11,49	11,4	11,23	10,95	10,58	10,1	9,49	8,72	7,75	6,48	4,69
	13	11,96	11,83	11,62	11,31	10,91	10,39	9,75	8,94	7,94	6,63	4,8
	14	12,41	12,25	12	11,66	11,22	10,68	10	9,17	8,12	6,78	4,9
	15	12,85	12,65	12,37	12	11,53	10,95	10,25	9,38	8,31	6,93	5
	16	13,27	13,04	12,73	12,33	11,83	11,22	10,49	9,59	8,49	7,07	5,1
	17	13,67	13,42	13,08	12,65	12,12	11,49	10,72	9,8	8,66	7,21	5,2
	18	14,07	13,78	13,42	12,96	12,41	11,75	10,95	10	8,83	7,35	5,29
	19	14,46	14,14	13,75	13,27	12,69	12	11,18	10,2	9	7,48	5,39
	20	14,83	14,49	14,07	13,56	12,96	12,25	11,4	10,39	9,17	7,62	5,48
	21	15,2	14,83	14,39	13,86	13,23	12,49	11,62	10,58	9,33	7,75	5,57
	22	15,56	15,17	14,7	14,14	13,49	12,73	11,83	10,77	9,49	7,87	5,66
	23	15,91	15,49	15	14,42	13,75	12,96	12,04	10,95	9,64	8	5,74
	24	16,25	15,81	15,3	14,7	14	13,19	12,25	11,14	9,8	8,12	5,83
	25	16,58	16,12	15,59	14,97	14,25	13,42	12,45	11,31	9,95	8,25	5,92
	26	16,91	16,43	15,87	15,23	14,49	13,64	12,65	11,49	10,1	8,37	6
	27	17,23	16,73	16,16	15,49	14,73	13,86	12,85	11,66	10,25	8,49	6,08
	28	17,55	17,03	16,43	15,75	14,97	14,07	13,04	11,83	10,39	8,6	6,16
	29	17,86	17,32	16,7	16	15,2	14,28	13,23	12	10,54	8,72	6,24
	30	18,17	17,61	16,97	16,25	15,43	14,49	13,42	12,17	10,68	8,83	6,32

My Contribution

	0		1		2		3		4		5	
	NP	P	NP	P	NP	P	NP	P	NP	P	NP	P
0	2,4	2,4	2,79	3,08	3,04	3,35	3,08	3,31	2,85	2,95	2,23	2,13
1	3,07	3,38	3,41	3,76	3,57	3,86	3,5	3,7	3,17	3,24	2,44	2,3
2	3,74	4,14	3,99	4,35	4,05	4,32	3,89	4,05	3,47	3,5	2,64	2,47
3	4,38	4,78	4,53	4,86	4,5	4,73	4,25	4,38	3,74	3,74	2,83	2,62
4	4,97	5,35	5,03	5,32	4,91	5,11	4,59	4,68	4	3,97	3	2,77
5	5,51	5,86	5,49	5,75	5,3	5,47	4,9	4,97	4,24	4,19	3,16	2,9
6	6,02	6,33	5,92	6,15	5,66	5,8	5,2	5,24	4,47	4,4	3,32	3,04
7	6,49	6,76	6,33	6,52	6	6,11	5,48	5,5	4,69	4,6	3,46	3,17
8	6,93	7,17	6,71	6,88	6,33	6,42	5,74	5,75	4,9	4,79	3,61	3,29
9	7,35	7,56	7,07	7,22	6,63	6,7	6	5,98	5,1	4,97	3,74	3,41
10	7,75	7,93	7,42	7,54	6,93	6,98	6,24	6,21	5,29	5,15	3,87	3,53
11	8,12	8,29	7,75	7,85	7,21	7,24	6,48	6,43	5,48	5,32	4	3,64
12	8,49	8,63	8,06	8,15	7,48	7,5	6,71	6,65	5,66	5,49	4,12	3,75
13	8,83	8,96	8,37	8,43	7,75	7,75	6,93	6,85	5,83	5,65	4,24	3,86
14	9,17	9,27	8,66	8,71	8	7,99	7,14	7,05	6	5,81	4,36	3,97
15	9,49	9,58	8,94	8,98	8,25	8,22	7,35	7,25	6,16	5,96	4,47	4,07
16	9,8	9,88	9,22	9,24	8,49	8,45	7,55	7,44	6,32	6,11	4,58	4,17
17	10,1	10,16	9,49	9,5	8,72	8,67	7,75	7,63	6,48	6,26	4,69	4,27
18	10,39	10,44	9,75	9,75	8,94	8,89	7,94	7,81	6,63	6,41	4,8	4,37
19	10,68	10,72	10	9,99	9,17	9,1	8,12	7,99	6,78	6,55	4,9	4,46
20	10,95	10,98	10,25	10,23	9,38	9,31	8,31	8,16	6,93	6,69	5	4,56
21	11,22	11,24	10,49	10,46	9,59	9,51	8,49	8,34	7,07	6,82	5,1	4,65
22	11,49	11,5	10,72	10,69	9,8	9,71	8,66	8,5	7,21	6,96	5,2	4,74
23	11,75	12,72	10,95	10,91	10	9,9	8,83	8,67	7,35	7,09	5,29	4,83
24	12	12,99	11,18	11,13	10,2	10,1	9	8,83	7,48	7,22	5,39	4,92
25	12,25	13,25	11,4	11,34	10,39	10,28	9,17	8,99	7,62	7,34	5,48	5
26	12,49	13,5	11,62	11,56	10,58	10,47	9,33	9,15	7,75	7,47	5,57	5,09
27	12,73	13,75	11,83	11,76	10,77	10,65	9,49	9,3	7,87	7,59	5,66	5,18
28	12,96	13,99	12,04	11,97	10,95	10,83	9,64	9,45	8	7,71	5,74	5,26
29	13,19	14,24	12,25	12,17	11,14	11,01	9,8	9,6	8,12	7,83	5,83	5,34
30	13,42	14,47	12,45	12,36	11,31	11,18	9,95	9,75	8,25	7,95	5,92	5,42

Sum of my group members contributions

Table 16: Gain matrix for 5 ECUs of Endowment in Punishment treatment (T2)

My Contribution

	0		1		2		3		4		5		6	
	NP	P	NP	P	NP	P	NP	P	NP	P	NP	P	NP	P
0	2,6	2,6	3,07	3,38	3,41	3,76	3,57	3,86	3,5	3,7	3,17	3,24	2,44	2,3
1	3,32	3,67	3,74	4,14	3,99	4,35	4,05	4,32	3,89	4,05	3,47	3,5	2,64	2,47
2	4,04	4,49	4,38	4,78	4,53	4,86	4,5	4,73	4,25	4,38	3,74	3,74	2,83	2,62
3	4,73	5,18	4,97	5,35	5,03	5,32	4,91	5,11	4,59	4,68	4	3,97	3	2,77
4	5,37	5,79	5,51	5,86	5,49	5,75	5,3	5,47	4,9	4,97	4,24	4,19	3,16	2,9
5	5,96	6,34	6,02	6,33	5,92	6,15	5,66	5,8	5,2	5,24	4,47	4,4	3,32	3,04
6	6,5	6,85	6,49	6,76	6,33	6,52	6	6,11	5,48	5,5	4,69	4,6	3,46	3,17
7	7,01	7,33	6,93	7,17	6,71	6,88	6,33	6,42	5,74	5,75	4,9	4,79	3,61	3,29
8	7,49	7,77	7,35	7,56	7,07	7,22	6,63	6,7	6	5,98	5,1	4,97	3,74	3,41
9	7,94	8,19	7,75	7,93	7,42	7,54	6,93	6,98	6,24	6,21	5,29	5,15	3,87	3,53
10	8,37	8,59	8,12	8,29	7,75	7,85	7,21	7,24	6,48	6,43	5,48	5,32	4	3,64
11	8,78	8,98	8,49	8,63	8,06	8,15	7,48	7,5	6,71	6,65	5,66	5,49	4,12	3,75
12	9,17	9,35	8,83	8,96	8,37	8,43	7,75	7,75	6,93	6,85	5,83	5,65	4,24	3,86
13	9,54	9,7	9,17	9,27	8,66	8,71	8	7,99	7,14	7,05	6	5,81	4,36	3,97
14	9,9	10,04	9,49	9,58	8,94	8,98	8,25	8,22	7,35	7,25	6,16	5,96	4,47	4,07
15	10,25	10,37	9,8	9,88	9,22	9,24	8,49	8,45	7,55	7,44	6,32	6,11	4,58	4,17
16	10,58	10,69	10,1	10,16	9,49	9,5	8,72	8,67	7,75	7,63	6,48	6,26	4,69	4,27
17	10,91	11,01	10,39	10,44	9,75	9,75	8,94	8,89	7,94	7,81	6,63	6,41	4,8	4,37
18	11,22	11,31	10,68	10,72	10	9,99	9,17	9,1	8,12	7,99	6,78	6,55	4,9	4,46
19	11,53	11,61	10,95	10,98	10,25	10,23	9,38	9,31	8,31	8,16	6,93	6,69	5	4,56
20	11,83	11,89	11,22	11,24	10,49	10,46	9,59	9,51	8,49	8,34	7,07	6,82	5,1	4,65
21	12,12	12,18	11,49	11,5	10,72	10,69	9,8	9,71	8,66	8,5	7,21	6,96	5,2	4,74
22	12,41	12,45	11,75	11,75	10,95	10,91	10	9,9	8,83	8,67	7,35	7,09	5,29	4,83
23	12,69	12,72	12	11,99	11,18	11,13	10,2	10,1	9	8,83	7,48	7,22	5,39	4,92
24	12,96	12,99	12,25	12,23	11,4	11,34	10,4	10,28	9,17	8,99	7,62	7,34	5,48	5
25	13,23	13,25	12,49	12,47	11,62	11,56	10,6	10,47	9,33	9,15	7,75	7,47	5,57	5,09
26	13,49	13,5	12,73	12,7	11,83	11,76	10,8	10,65	9,49	9,3	7,87	7,59	5,66	5,18
27	13,75	13,75	12,96	12,93	12,04	11,97	11	10,83	9,64	9,45	8	7,71	5,74	5,26
28	14	13,99	13,19	13,15	12,25	12,17	11,1	11,01	9,8	9,6	8,12	7,83	5,83	5,34
29	14,25	14,24	13,42	13,37	12,45	12,36	11,3	11,18	9,95	9,75	8,25	7,95	5,92	5,42
30	14,49	14,47	13,64	13,59	12,65	12,56	11,5	11,35	10,1	9,9	8,37	8,07	6	5,5

Sum of my group members contributions

Table 17: Gain matrix for 6 ECUs of Endowment in Punishment treatment (T2)

Sum of my group members contributions

My Contribution	0		1		2		3		4		5		6		7	
	NP	P	NP	P	NP	P	NP	P	NP	P	NP	P	NP	P	NP	P
0	2,78	2,78	3,32	3,67	3,74	4,14	3,99	4,35	4,05	4,32	3,89	4,05	3,47	3,5	2,64	2,47
1	3,55	3,93	4,04	4,49	4,38	4,78	4,53	4,86	4,5	4,73	4,25	4,38	3,74	3,74	2,83	2,62
2	4,33	4,81	4,73	5,18	4,97	5,35	5,03	5,32	4,91	5,11	4,59	4,68	4	3,97	3	2,77
3	5,06	5,55	5,37	5,79	5,51	5,86	5,49	5,75	5,3	5,47	4,9	4,97	4,24	4,19	3,16	2,9
4	5,74	6,2	5,96	6,34	6,02	6,33	5,92	6,15	5,66	5,8	5,2	5,24	4,47	4,4	3,32	3,04
5	6,37	6,8	6,5	6,85	6,49	6,76	6,33	6,52	6	6,11	5,48	5,5	4,69	4,6	3,46	3,17
6	6,95	7,34	7,01	7,33	6,93	7,17	6,71	6,88	6,33	6,42	5,74	5,75	4,9	4,79	3,61	3,29
7	7,5	7,85	7,49	7,77	7,35	7,56	7,07	7,22	6,63	6,7	6	5,98	5,1	4,97	3,74	3,41
8	8,01	8,33	7,94	8,19	7,75	7,93	7,42	7,54	6,93	6,98	6,24	6,21	5,29	5,15	3,87	3,53
9	8,49	8,78	8,37	8,59	8,12	8,29	7,75	7,85	7,21	7,24	6,48	6,43	5,48	5,32	4	3,64
10	8,95	9,21	8,78	8,98	8,49	8,63	8,06	8,15	7,48	7,5	6,71	6,65	5,66	5,49	4,12	3,75
11	9,38	9,62	9,17	9,35	8,83	8,96	8,37	8,43	7,75	7,75	6,93	6,85	5,83	5,65	4,24	3,86
12	9,8	10,01	9,54	9,7	9,17	9,27	8,66	8,71	8	7,99	7,14	7,05	6	5,81	4,36	3,97
13	10,2	10,39	9,9	10,04	9,49	9,58	8,94	8,98	8,25	8,22	7,35	7,25	6,16	5,96	4,47	4,07
14	10,58	10,76	10,25	10,37	9,8	9,88	9,22	9,24	8,49	8,45	7,55	7,44	6,32	6,11	4,58	4,17
15	10,95	11,11	10,58	10,69	10,1	10,16	9,49	9,5	8,72	8,67	7,75	7,63	6,48	6,26	4,69	4,27
16	11,31	11,46	10,91	11,01	10,39	10,44	9,75	9,75	8,94	8,89	7,94	7,81	6,63	6,41	4,8	4,37
17	11,66	11,79	11,22	11,31	10,68	10,72	10	9,99	9,17	9,1	8,12	7,99	6,78	6,55	4,9	4,46
18	12	12,11	11,53	11,61	10,95	10,98	10,25	10,23	9,38	9,31	8,31	8,16	6,93	6,69	5	4,56
19	12,33	12,43	11,83	11,89	11,22	11,24	10,49	10,46	9,59	9,51	8,49	8,34	7,07	6,82	5,1	4,65
20	12,65	12,74	12,12	12,18	11,49	11,5	10,72	10,69	9,8	9,71	8,66	8,5	7,21	6,96	5,2	4,74
21	12,96	13,04	12,41	12,45	11,75	11,75	10,95	10,91	10	9,9	8,83	8,67	7,35	7,09	5,29	4,83
22	13,27	13,34	12,69	12,72	12	11,99	11,18	11,13	10,2	10,1	9	8,83	7,48	7,22	5,39	4,92
23	13,56	13,62	12,96	12,99	12,25	12,23	11,4	11,34	10,39	10,28	9,17	8,99	7,62	7,34	5,48	5
24	13,86	13,91	13,23	13,25	12,49	12,47	11,62	11,56	10,58	10,47	9,33	9,15	7,75	7,47	5,57	5,09
25	14,14	14,18	13,49	13,5	12,73	12,7	11,83	11,76	10,77	10,65	9,49	9,3	7,87	7,59	5,66	5,18
26	14,42	14,46	13,75	13,75	12,96	12,93	12,04	11,97	10,95	10,83	9,64	9,45	8	7,71	5,74	5,26
27	14,7	14,72	14	13,99	13,19	13,15	12,25	12,17	11,14	11,01	9,8	9,6	8,12	7,83	5,83	5,34
28	14,97	14,99	14,25	14,24	13,42	13,37	12,45	12,36	11,31	11,18	9,95	9,75	8,25	7,95	5,92	5,42
29	15,23	15,25	14,49	14,47	13,64	13,59	12,65	12,56	11,49	11,35	10,1	9,9	8,37	8,07	6	5,5
30	15,49	15,5	14,73	14,71	13,86	13,8	12,85	12,75	11,66	11,52	10,25	10,04	8,49	8,19	6,08	5,58

Table 18: Gain matrix for 7 ECUs of Endowment in Punishment treatment (T2)

My Contribution

	0		1		2		3		4		5		6		7		8	
	NP	P	NP	P	NP	P	NP	P	NP	P	NP	P	NP	P	NP	P	NP	P
0	2,96	2,96	3,55	3,93	4,04	4,49	4,38	4,78	4,53	4,86	4,50	4,73	4,25	4,38	3,74	3,74	2,83	2,62
1	3,77	4,17	4,33	4,81	4,73	5,18	4,97	5,35	5,03	5,32	4,91	5,11	4,59	4,68	4,00	3,97	3,00	2,77
2	4,59	5,11	5,06	5,55	5,37	5,79	5,51	5,86	5,49	5,75	5,30	5,47	4,90	4,97	4,24	4,19	3,16	2,90
3	5,37	5,90	5,74	6,20	5,96	6,34	6,02	6,33	5,92	6,15	5,66	5,80	5,20	5,24	4,47	4,40	3,32	3,04
4	6,09	6,59	6,37	6,80	6,50	6,85	6,49	6,76	6,33	6,52	6,00	6,11	5,48	5,50	4,69	4,60	3,46	3,17
5	6,76	7,22	6,95	7,34	7,01	7,33	6,93	7,17	6,71	6,88	6,33	6,42	5,74	5,75	4,90	4,79	3,61	3,29
6	7,37	7,80	7,50	7,85	7,49	7,77	7,35	7,56	7,07	7,22	6,63	6,70	6,00	5,98	5,10	4,97	3,74	3,41
7	7,95	8,34	8,01	8,33	7,94	8,19	7,75	7,93	7,42	7,54	6,93	6,98	6,24	6,21	5,29	5,15	3,87	3,53
8	8,49	8,85	8,49	8,78	8,37	8,59	8,12	8,29	7,75	7,85	7,21	7,24	6,48	6,43	5,48	5,32	4,00	3,64
9	9,00	9,33	8,95	9,21	8,78	8,98	8,49	8,63	8,06	8,15	7,48	7,50	6,71	6,65	5,66	5,49	4,12	3,75
10	9,49	9,78	9,38	9,62	9,17	9,35	8,83	8,96	8,37	8,43	7,75	7,75	6,93	6,85	5,83	5,65	4,24	3,86
11	9,95	10,22	9,80	10,01	9,54	9,70	9,17	9,27	8,66	8,71	8,00	7,99	7,14	7,05	6,00	5,81	4,36	3,97
12	10,39	10,64	10,20	10,39	9,90	10,04	9,49	9,58	8,94	8,98	8,25	8,22	7,35	7,25	6,16	5,96	4,47	4,07
13	10,82	11,04	10,58	10,76	10,25	10,37	9,80	9,88	9,22	9,24	8,49	8,45	7,55	7,44	6,32	6,11	4,58	4,17
14	11,23	11,43	10,95	11,11	10,58	10,69	10,10	10,16	9,49	9,50	8,72	8,67	7,75	7,63	6,48	6,26	4,69	4,27
15	11,62	11,80	11,31	11,46	10,91	11,01	10,39	10,44	9,75	9,75	8,94	8,89	7,94	7,81	6,63	6,41	4,80	4,37
16	12,00	12,17	11,66	11,79	11,22	11,31	10,68	10,72	10,00	9,99	9,17	9,10	8,12	7,99	6,78	6,55	4,90	4,46
17	12,37	12,52	12,00	12,11	11,53	11,61	10,95	10,98	10,25	10,23	9,38	9,31	8,31	8,16	6,93	6,69	5,00	4,56
18	12,73	12,87	12,33	12,43	11,83	11,89	11,22	11,24	10,49	10,46	9,59	9,51	8,49	8,34	7,07	6,82	5,10	4,65
19	13,08	13,20	12,65	12,74	12,12	12,18	11,49	11,50	10,72	10,69	9,80	9,71	8,66	8,50	7,21	6,96	5,20	4,74
20	13,42	13,53	12,96	13,04	12,41	12,45	11,75	11,75	10,95	10,91	10,00	9,90	8,83	8,67	7,35	7,09	5,29	4,83
21	13,75	13,85	13,27	13,34	12,69	12,72	12,00	11,99	11,18	11,13	10,20	10,10	9,00	8,83	7,48	7,22	5,39	4,92
22	14,07	14,17	13,56	13,62	12,96	12,99	12,25	12,23	11,40	11,34	10,39	10,28	9,17	8,99	7,62	7,34	5,48	5,00
23	14,39	14,47	13,86	13,91	13,23	13,25	12,49	12,47	11,62	11,56	10,58	10,47	9,33	9,15	7,75	7,47	5,57	5,09
24	14,70	14,77	14,14	14,18	13,49	13,50	12,73	12,70	11,83	11,76	10,77	10,65	9,49	9,30	7,87	7,59	5,66	5,18
25	15,00	15,07	14,42	14,46	13,75	13,75	12,96	12,93	12,04	11,97	10,95	10,83	9,64	9,45	8,00	7,71	5,74	5,26
26	15,30	15,36	14,70	14,72	14,00	13,99	13,19	13,15	12,25	12,17	11,14	11,01	9,80	9,60	8,12	7,83	5,83	5,34
27	15,59	15,64	14,97	14,99	14,25	14,24	13,42	13,37	12,45	12,36	11,31	11,18	9,95	9,75	8,25	7,95	5,92	5,42
28	15,87	15,92	15,23	15,25	14,49	14,47	13,64	13,59	12,65	12,56	11,49	11,35	10,10	9,90	8,37	8,07	6,00	5,50
29	16,16	16,19	15,49	15,50	14,73	14,71	13,86	13,80	12,85	12,75	11,66	11,52	10,25	10,04	8,49	8,19	6,08	5,58
30	16,43	16,46	15,75	15,75	14,97	14,94	14,07	14,01	13,04	12,94	11,83	11,68	10,39	10,18	8,60	8,30	6,16	5,66

Sum of my group members contributions

Table 19: Gain matrix for 8 ECUs of Endowment in Punishment treatment (T2)

My Contribution

	0		1		2		3		4		5		6		7		8		9	
	NP	P	NP	P	NP	P	NP	P	NP	P	NP	P	NP	P	NP	P	NP	P	NP	P
0	3,12	3,12	3,77	4,17	4,33	4,81	4,73	5,18	4,97	5,35	5,03	5,32	4,91	5,11	4,59	4,68	4	3,97	3	2,77
1	3,98	4,41	4,59	5,11	5,06	5,55	5,37	5,79	5,51	5,86	5,49	5,75	5,3	5,47	4,9	4,97	4,24	4,19	3,16	2,90
2	4,84	5,39	5,37	5,90	5,74	6,20	5,96	6,34	6,02	6,33	5,92	6,15	5,66	5,80	5,2	5,24	4,47	4,40	3,32	3,04
3	5,66	6,22	6,09	6,59	6,37	6,80	6,5	6,85	6,49	6,76	6,33	6,52	6	6,11	5,48	5,50	4,69	4,60	3,46	3,17
4	6,42	6,96	6,76	7,22	6,95	7,34	7,01	7,33	6,93	7,17	6,71	6,88	6,33	6,42	5,74	5,75	4,9	4,79	3,61	3,29
5	7,12	7,62	7,37	7,80	7,5	7,85	7,49	7,77	7,35	7,56	7,07	7,22	6,63	6,70	6	5,98	5,1	4,97	3,74	3,41
6	7,77	8,23	7,95	8,34	8,01	8,33	7,94	8,19	7,75	7,93	7,42	7,54	6,93	6,98	6,24	6,21	5,29	5,15	3,87	3,53
7	8,38	8,80	8,49	8,85	8,49	8,78	8,37	8,59	8,12	8,29	7,75	7,85	7,21	7,24	6,48	6,43	5,48	5,32	4	3,64
8	8,95	9,34	9	9,33	8,95	9,21	8,78	8,98	8,49	8,63	8,06	8,15	7,48	7,50	6,71	6,65	5,66	5,49	4,12	3,75
9	9,49	9,84	9,49	9,78	9,38	9,62	9,17	9,35	8,83	8,96	8,37	8,43	7,75	7,75	6,93	6,85	5,83	5,65	4,24	3,86
10	10	10,32	9,95	10,22	9,8	10,01	9,54	9,70	9,17	9,27	8,66	8,71	8	7,99	7,14	7,05	6	5,81	4,36	3,97
11	10,49	10,78	10,39	10,64	10,2	10,39	9,9	10,04	9,49	9,58	8,94	8,98	8,25	8,22	7,35	7,25	6,16	5,96	4,47	4,07
12	10,96	11,23	10,82	11,04	10,58	10,76	10,25	10,37	9,8	9,88	9,22	9,24	8,49	8,45	7,55	7,44	6,32	6,11	4,58	4,17
13	11,4	11,65	11,23	11,43	10,95	11,11	10,58	10,69	10,1	10,16	9,49	9,50	8,72	8,67	7,75	7,63	6,48	6,26	4,69	4,27
14	11,83	12,06	11,62	11,80	11,31	11,46	10,91	11,01	10,39	10,44	9,75	9,75	8,94	8,89	7,94	7,81	6,63	6,41	4,8	4,37
15	12,25	12,46	12	12,17	11,66	11,79	11,22	11,31	10,68	10,72	10	9,99	9,17	9,10	8,12	7,99	6,78	6,55	4,9	4,46
16	12,65	12,84	12,37	12,52	12	12,11	11,53	11,61	10,95	10,98	10,25	10,23	9,38	9,31	8,31	8,16	6,93	6,69	5	4,56
17	13,04	13,22	12,73	12,87	12,33	12,43	11,83	11,89	11,22	11,24	10,49	10,46	9,59	9,51	8,49	8,34	7,07	6,82	5,1	4,65
18	13,42	13,58	13,08	13,20	12,65	12,74	12,12	12,18	11,49	11,50	10,72	10,69	9,8	9,71	8,66	8,50	7,21	6,96	5,2	4,74
19	13,78	13,93	13,42	13,53	12,96	13,04	12,41	12,45	11,75	11,75	10,95	10,91	10	9,90	8,83	8,67	7,35	7,09	5,29	4,83
20	14,14	14,28	13,75	13,85	13,27	13,34	12,69	12,72	12	11,99	11,18	11,13	10,2	10,10	9	8,83	7,48	7,22	5,39	4,92
21	14,49	14,62	14,07	14,17	13,56	13,62	12,96	12,99	12,25	12,23	11,4	11,34	10,39	10,28	9,17	8,99	7,62	7,34	5,48	5,00
22	14,83	14,95	14,39	14,47	13,86	13,91	13,23	13,25	12,49	12,47	11,62	11,56	10,58	10,47	9,33	9,15	7,75	7,47	5,57	5,09
23	15,17	15,27	14,7	14,77	14,14	14,18	13,49	13,50	12,73	12,70	11,83	11,76	10,77	10,65	9,49	9,30	7,87	7,59	5,66	5,18
24	15,49	15,59	15	15,07	14,42	14,46	13,75	13,75	12,96	12,93	12,04	11,97	10,95	10,83	9,64	9,45	8	7,71	5,74	5,26
25	15,81	15,90	15,3	15,36	14,7	14,72	14	13,99	13,19	13,15	12,25	12,17	11,14	11,01	9,8	9,60	8,12	7,83	5,83	5,34
26	16,12	16,20	15,59	15,64	14,97	14,99	14,25	14,24	13,42	13,37	12,45	12,36	11,31	11,18	9,95	9,75	8,25	7,95	5,92	5,42
27	16,43	16,50	15,87	15,92	15,23	15,25	14,49	14,47	13,64	13,59	12,65	12,56	11,49	11,35	10,1	9,90	8,37	8,07	6	5,50
28	16,73	16,80	16,16	16,19	15,49	15,50	14,73	14,71	13,86	13,80	12,85	12,75	11,66	11,52	10,25	10,04	8,49	8,19	6,08	5,58
29	17,03	17,09	16,43	16,46	15,75	15,75	14,97	14,94	14,07	14,01	13,04	12,94	11,83	11,68	10,39	10,18	8,6	8,30	6,16	5,66
30	17,32	17,37	16,7	16,73	16	16,00	15,2	15,16	14,28	14,22	13,23	13,12	12	11,85	10,54	10,32	8,72	8,41	6,24	5,74

Sum of my group members contributions

Table 20: Gain matrix for 9 ECUs of Endowment in Punishment treatment (T2)

My Contribution

	0		1		2		3		4		5		6		7		8		9		10	
	NP	P	NP	P	NP	P	NP	P	NP	P	NP	P	NP	P	NP	P	NP	P	NP	P	NP	P
0	3,28	3,28	3,98	4,41	4,59	5,11	5,06	5,55	5,37	5,79	5,51	5,86	5,49	5,75	5,3	5,47	4,9	4,97	4,24	4,19	3,16	2,90
1	4,17	4,63	4,84	5,39	5,37	5,90	5,74	6,20	6,34	6,02	6,51	6,33	5,92	6,15	5,66	5,80	5,2	5,24	4,47	4,40	3,32	3,04
2	5,08	5,66	5,66	6,22	6,09	6,59	6,37	6,80	6,5	6,85	6,49	6,76	6,33	6,52	6	6,11	5,48	5,50	4,69	4,60	3,46	3,17
3	5,94	6,54	6,42	6,96	6,76	7,22	6,95	7,34	7,01	7,33	6,93	7,17	6,71	6,88	6,33	6,42	5,74	5,75	4,9	4,79	3,61	3,29
4	6,73	7,31	7,12	7,62	7,37	7,80	7,5	7,85	7,49	7,77	7,35	7,56	7,07	7,22	6,63	6,70	6	5,98	5,1	4,97	3,74	3,41
5	7,47	8,00	7,77	8,23	7,95	8,34	8,01	8,33	7,94	8,19	7,75	7,93	7,42	7,54	6,93	6,98	6,24	6,21	5,29	5,15	3,87	3,53
6	8,15	8,64	8,38	8,80	8,49	8,85	8,49	8,78	8,37	8,59	8,12	8,29	7,75	7,85	7,21	7,24	6,48	6,43	5,48	5,32	4	3,64
7	8,79	9,24	8,95	9,34	9	9,33	8,95	9,21	8,78	8,98	8,49	8,63	8,06	8,15	7,48	7,50	6,71	6,65	5,66	5,49	4,12	3,75
8	9,39	9,80	9,49	9,84	9,49	9,78	9,38	9,62	9,17	9,35	8,83	8,96	8,37	8,43	7,75	7,75	6,93	6,85	5,83	5,65	4,24	3,86
9	9,95	10,33	10	10,32	9,95	10,22	9,8	10,01	9,54	9,70	9,17	9,27	8,66	8,71	8	7,99	7,14	7,05	6	5,81	4,36	3,97
10	10,49	10,84	10,49	10,78	10,39	10,64	10,2	10,39	9,9	10,04	9,49	9,58	8,94	8,98	8,25	8,22	7,35	7,25	6,16	5,96	4,47	4,07
11	11	11,32	10,96	11,23	10,82	11,04	10,58	10,76	10,25	10,37	9,8	9,88	9,22	9,24	8,49	8,45	7,55	7,44	6,32	6,11	4,58	4,17
12	11,49	11,79	11,4	11,65	11,23	11,43	10,95	11,11	10,58	10,69	10,1	10,16	9,49	9,50	8,72	8,67	7,75	7,63	6,48	6,26	4,69	4,27
13	11,96	12,23	11,83	12,06	11,62	11,80	11,31	11,46	10,91	11,01	10,39	10,44	9,75	9,75	8,94	8,89	7,94	7,81	6,63	6,41	4,8	4,37
14	12,41	12,66	12,25	12,46	12	12,17	11,66	11,79	11,22	11,31	10,68	10,72	10	9,99	9,17	9,10	8,12	7,99	6,78	6,55	4,9	4,46
15	12,85	13,08	12,65	12,84	12,37	12,52	12	12,11	11,53	11,61	10,95	10,98	10,25	10,23	9,38	9,31	8,31	8,16	6,93	6,69	5	4,56
16	13,27	13,48	13,04	13,22	12,73	12,87	12,33	12,43	11,83	11,89	11,22	11,24	10,49	10,46	9,59	9,51	8,49	8,34	7,07	6,82	5,1	4,65
17	13,67	13,88	13,42	13,58	13,08	13,20	12,65	12,74	12,12	12,18	11,49	11,50	10,72	10,69	9,8	9,71	8,66	8,50	7,21	6,96	5,2	4,74
18	14,07	14,26	13,78	13,93	13,42	13,53	12,96	13,04	12,41	12,45	11,75	11,75	10,95	10,91	10	9,90	8,83	8,67	7,35	7,09	5,29	4,83
19	14,46	14,63	14,14	14,28	13,75	13,85	13,27	13,34	12,69	12,72	12	11,99	11,18	11,13	10,2	10,10	9	8,83	7,48	7,22	5,39	4,92
20	14,83	14,99	14,49	14,62	14,07	14,17	13,56	13,62	12,96	12,99	12,25	12,23	11,4	11,34	10,39	10,28	9,17	8,99	7,62	7,34	5,48	5,00
21	15,2	15,35	14,83	14,95	14,39	14,47	13,86	13,91	13,23	13,25	12,49	12,47	11,62	11,56	10,58	10,47	9,33	9,15	7,75	7,47	5,57	5,09
22	15,56	15,69	15,17	15,27	14,7	14,77	14,14	14,18	13,49	13,50	12,73	12,70	11,83	11,76	10,77	10,65	9,49	9,30	7,87	7,59	5,66	5,18
23	15,91	16,03	15,49	15,59	15	15,07	14,42	14,46	13,75	13,75	12,96	12,93	12,04	11,97	10,95	10,83	9,64	9,45	8	7,71	5,74	5,26
24	16,25	16,36	15,81	15,90	15,3	15,36	14,7	14,72	14	13,99	13,19	13,15	12,25	12,17	11,14	11,01	9,8	9,60	8,12	7,83	5,83	5,34
25	16,58	16,69	16,12	16,20	15,59	15,64	14,97	14,99	14,25	14,24	13,42	13,37	12,45	12,36	11,31	11,18	9,95	9,75	8,25	7,95	5,92	5,42
26	16,91	17,01	16,43	16,50	15,87	15,92	15,23	15,25	14,49	14,47	13,64	13,59	12,65	12,56	11,49	11,35	10,1	9,90	8,37	8,07	6	5,50
27	17,23	17,32	16,73	16,80	16,16	16,19	15,49	15,50	14,73	14,71	13,86	13,80	12,85	12,75	11,66	11,52	10,25	10,04	8,49	8,19	6,08	5,58
28	17,55	17,63	17,03	17,09	16,43	16,46	15,75	15,75	14,97	14,94	14,07	14,01	13,04	12,94	11,83	11,68	10,39	10,18	8,6	8,30	6,16	5,66
29	17,86	17,94	17,32	17,37	16,7	16,73	16	16,00	15,2	15,16	14,28	14,22	13,23	13,12	12	11,85	10,54	10,32	8,72	8,41	6,24	5,74
30	18,17	18,23	17,61	17,65	16,97	16,99	16,25	16,24	15,43	15,39	14,49	14,42	13,42	13,31	12,17	12,01	10,68	10,46	8,83	8,52	6,32	5,82

The sum of the contributions of the other members of my group

Figure 3: Table 21: Gain matrix for 10 ECUs of Endowment in Punishment treatment (T2)

.3 Appendix

The following text is an English translation of the instructions for the experiment

.3.1 Instructions

By agreeing to participate in this experiment, you are signaling your complete agreement with the Laboratory Regulations which are available on the website or on request. You will participate in an experiment where your decisions will be anonymous, and will determine your final payment in part. So please read the following instructions carefully. In addition to the earnings collected in the experiment, and irrespective of your decisions, you will receive a fixed amount of 5 euros to cover your travel expenses. A variable amount will be added to this, depending on the decisions you make during the experiment. The total amount of your earnings will be distributed to you individually and confidentially at the end of the experiment after you have completed a final questionnaire. The currency used in this experiment is the experimental currency unit (ECU). However, at the end of the experiment you will be paid in euros at the exchange rate of 100 ECU = 1 euro. A calculator will be available for the duration of the experiment. In order not to distort the results of the experiment, we ask you not to communicate or interfere with other participants. We would ask you also to turn off your mobile phones and refrain from using them for the duration of the experiment. In order to limit communication, we ask that you put on the headphones provided as soon as the instructions have been read out. Non-compliance with these rules will result in the experiment being interrupted and your earnings canceled. If you encounter a technical problem, we would ask you to raise your hand and wait for the experimenter to come to you. All participants in the room have access to the same instructions and will participate in the same experiment.

Experiment description: The experiment in which you are participating today consists of 3 successive stages. A summary of the instructions will appear on your computer screen at the beginning of each step.

Step1 The first stage consists of 15 consecutive rounds during which you will have to make anonymous decisions to allocate ECUs to yourself and another participant

whose identity will be unknown to you. All participants in the experiment will be given the same problems. There are no good or bad answers; the choices you make will be based on personal preferences. In each round, you will be able to make only one choice from the 9 proposed. You will be asked to indicate the distribution of money (ECU) that you prefer by clicking on the point corresponding to the column of your choice.

Gain in step 1: At the end of the step, the computer will make a random selection of one from the 15 rounds, for each participant. The distribution chosen by the participant in the selected round will be awarded to him or her and another participant. Each participant will receive an amount that her or she has chosen plus an amount chosen by another participant. Thus, your earnings at this stage will depend on your decisions and those of another participant. To avoid influencing successive decisions, the information on the round selected and the earnings collected in this stage will be communicated to you only at the end of the experiment.

Step2 The second stage of the experiment involves choices (numbered 1 to 10) between two lotteries A and B. Each lottery is associated with two possible earnings which are fixed during each of the choices, namely:

Lottery A will always allow you to earn either 200 ECU or 160 ECU;

Lot B will always allow you to win either 385 ECU or 10 ECU.

However, the chances of receiving the higher amounts will be different for each of the 10 choices. The 10 choices will be presented in rows on the same screen, with each row corresponding to one of the choices. For each choice, you will have to click on the description of the lottery in which you would like to participate.

For example, in choice number 1 corresponding to the first row of the table, you can choose between two lotteries:

If you choose Lottery A, the computer will generate a random integer between 1 and 100.

If the number randomly drawn is between 1 and 100 (100% chances), then you will earn 200 ECU.

On the other hand, if the number is between 101 and 100 (0% chance), then you will earn 160 ECU.

If you choose Lottery B, the computer will generate a random integer between 1 and 100.

If the number drawn at random is between 1 and 100 (100% chance), then you will earn 385 ECU.

On the other hand, if the number is between 101 and 100 (0% chance), then you will earn 10 ECU.

Gain in step 2: At the end of the second step, a single row from the table will be drawn randomly by the computer to determine your winnings. The lottery chosen from this row will be activated. Therefore, your winnings at this stage will depend on your decisions and luck. In order not to influence your decisions in the next step, the number of the chosen choice and the amount gained during this step will be communicated to you only at the end of the experiment.

Step3

Step 3 will begin and end at the same times for all participants. It will last for exactly 45 minutes. The time can be split among three periods, and each participant is free to decide on the allocation of time between the three periods:

Period 1: where you have a task to perform;

Period 2 : where you will be asked to complete a task evaluation questionnaire;

Period 3 : where you will be free to surf the internet.

Once a participant completes one of the periods, she or he will move automatically to the next period; there is no requirement to wait for the other participants.

Period1: task description Before starting the period, the computer will assign you randomly to a group with two other participants, whose identity you do not know. You will remain in the same group throughout the stage. The first period is 100 trials. In each trial, an ITEM will appear in the center of the screen. This ITEM will be hidden and requires you to click on it to reveal its contents. Clicking on the ITEM will reveal a content composed of 49 balls which may be white balls or black balls. Each ball is as likely to be black as to be white. Once the content of the ITEM is displayed, you must place it in one of the two boxes - the White box or the Black box - which will appear on your screen. The payment in this step will depend on the earnings rule and the number of items placed by you and the other members

of your group in the corresponding box (see next page (Period 1 - Earnings during the period)).

Each ITEM corresponds to the box whose color is the same as that of the majority of the balls:

That is, ITEMS composed of a larger number of white balls than black balls correspond to the white box;

ITEMS composed of a larger number of black balls than white balls correspond to the black box.

To place the ITEM in one of the two boxes requires you to click on the box of your choice. In the example above, the ITEM contains 20 white balls and 29 black balls. Therefore, the box corresponding to this ITEM is the Black Box.

As soon as an ITEM has been placed in one of the boxes, you will pass automatically and immediately to the next turn; there is no possibility of going back.

The task will end when you have completed 100 trials, i.e. when you have placed all the ITEMS in one of the two boxes.

Period 1: Earnings during task The payment in this step will depend on the earnings rule and the number of ITEMS placed in the corresponding boxes by you and the other members of your group. At the beginning of the stage, the computer will randomly assign an earnings rule that will be applied to your group. This rule will inform you of two numbers which we will refer to here as X and Y, and will tell you how many ECUs are associated with the ITEMS placed in the corresponding boxes. ITEMS placed in the wrong box will not earn any ECUs for any of the group members.

The values of X and Y will be communicated to you at the beginning of the step. They may be positive or equal to 0. These values may differ according to the group but will be the same for the members of the same group and will not change throughout the step.

In this step, the gain will depend on the number of ITEMS placed in the corresponding box by the members of the group, and the values of X and Y:

Whenever a participant places an ITEM in the correspondingly colored box it will earn him or her X ECU.

Each time a participant places an ITEM in the correspondingly colored box it will earn Y ECU for the other members of his or her group (not to him).

ITEMs placed in the incorrect (not corresponding) boxes will not earn any ECUs for any of the group members.

The values of X and Y will be repeated on the screen during each trial, and above the ITEM. Please pay attention to the instructions on the screen.

Before the task begins, you will have two example rounds on screen.

Two training trials: Before you start the stage, you will be given two examples trials on the screen, so that you can familiarize yourself with the task described above and make sure that you understand the earning rule. The time spent during the two training trials will not be deducted from the 45 minutes and the answers will not be taken into account in the calculation of your earnings. On the right half of the screen the example will be shown, and on the left half a series of questions to ensure you understand the task and rules. The training trials will not be validated when you choose one of the two boxes, but when you correctly answer all the questions asked. In the case of incorrect answers, an information bubble will appear with an explanation, in order to help you to correct your answers.

The stage will begin and the 45 minutes count will begin as soon as all participants have completed the two training trials.

Period 2: Questionnaire

Once you have placed each of the 100 ITEMs in one of the two boxes, you will be given a questionnaire about the task you performed in the previous period.

The questionnaire consists of 30 statements. For each you must indicate how much you agree or disagree by changing the position of the cursor. All questionnaire items will be displayed on the same screen. To ensure that you take the questionnaire seriously and think about your answers, you will be unable to submit your responses until 3 minutes have elapsed (when the button will appear).

These are the questions in the IMI questionnaire proposed to the participants:

1. Bloc : Interest and enjoyment

- I have much appreciated doing this task

- This task was fun to do
- I found the activity boring
- This task has not caught my attention
- I would describe this task as very interesting
- I found the activity quite pleasant
- I thought how much I appreciated the task while doing it

2. **Bloc : Perceived competence**

- I think I'm good enough in this task
- After practicing this task for a while, I felt competent
- I'm pretty proud of my performance at this task
- I was pretty skilled at this task
- It was an activity that I did not manage to do very well
- I think I have done well in this task

3. **Bloc : Effort and importance**

- I did a lot of efforts for this task
- I have not done much to do this task well
- It was very important for me to do the job well
- I did not put a lot of energy into this task
- I really tried to do well this task

4. **Bloc : Pressure and tension**

- I did not feel nervous about doing this task
- I felt tense when doing the task
- I was very relaxed doing the task
- I was anxious the task
- I felt under pressure while completing the task

5. Bloc : Relatedness

- I felt distant from other members of my group
- I doubt that I can be friend with members of my group
- I felt that the members of my group were trustworthy
- I would like to have the opportunity to interact with members of my group more often
- I would prefer not to have to interact with members of my group in the future
- I did not feel that I could trust members of my group
- I feel close to the members of my group

Temps restant : 30 min 54 sec.

Merci d'indiquer, à l'aide du curseur, votre degré d'accord ou de désaccord avec chacune des propositions suivantes.

Plus vous placerez le curseur vers la gauche, plus vous marquerez votre désaccord avec la proposition.
Plus vous placerez le curseur vers la droite, plus vous marquerez votre accord avec la proposition.

Si vous n'êtes ni en accord ni en désaccord, ou si vous ne savez pas répondre à la question, vous pouvez placer le curseur au milieu.

Indiquez à quel point vous êtes en accord ou en désaccord avec chacune des propositions suivantes.										Indiquez à quel point vous êtes en accord ou en désaccord avec chacune des propositions suivantes.									
	Pas du tout d'accord	←	→	Tout à fait d'accord							Pas du tout d'accord	←	→	Tout à fait d'accord					
J'étais anxieux(se) en faisant la tâche.										Je me suis senti(e) distant(e) des autres membres de mon groupe.									
J'aimerais avoir l'occasion d'interagir avec les membres de mon groupe.										J'étais très défendu(e) en faisant la tâche.									
J'ai beaucoup apprécié faire cette tâche.										Je pense être assez bon dans cette tâche.									
J'ai été assez habile à cette tâche.										J'ai trouvé l'activité ennuyeuse.									
J'ai vraiment essayé de bien faire cette tâche.										Je n'ai pas mis beaucoup d'énergie dans cette tâche.									
Je me suis senti tendu(e) en faisant la tâche.										Je n'ai pas eu le sentiment que je pouvais faire confiance aux membres de mon groupe.									
Je sentais que les membres de mon groupe étaient dignes de confiance.										Ce fut une activité que je ne suis pas arrivé(e) à très bien faire.									
Cette tâche était amusante à faire.										J'ai trouvé l'activité assez agréable.									
Je suis assez fier(e) de ma performance à cette tâche.										Il était très important pour moi de bien faire la tâche.									
Cette tâche n'a pas du tout retenu mon attention.										Je me sens proche des membres de mon groupe.									
J'ai fait beaucoup d'efforts pour cette tâche.										Après avoir pratiqué cette tâche pendant un certain temps, je me suis senti(e) compétent(e).									
Je préférerais ne pas avoir à interagir avec les membres de mon groupe dans le futur.										Je décrirais cette tâche comme très intéressante.									
Je pense avoir assez bien réussi à faire cette tâche.										Je me sentais sous pression pendant l'accomplissement de la tâche.									
Je ne me suis pas du tout senti nerveux(se) en faisant cette tâche.										Je n'ai pas vraiment essayé de bien faire cette tâche.									
Je pensais à combien j'appréciais la tâche tout en la faisant.										Je doute du fait de pouvoir être ami(e) avec les autres membres de mon groupe.									

Vous pouvez à présent cliquer sur OK pour valider vos réponses au questionnaire.

OK

Figure 4: IMI items presentation in the experiment

Period 3: Internet browsing

Once the task is completed and the responses to the questionnaire have been submitted, an internet page will open and you will be able to use an time remaining from the 45 minutes allocated for the previous period to browse the internet. During this time, you can watch videos, listen to music, read articles, check your emails, play mini-games, consult social networks. You can also browse merchants' websites but we would discourage you from purchasing during the experiment, and we will not be responsible in the event of a problem. A directory of websites that potentially might interest you is provided in the appendix to these instructions. This directory is information only. You can visit other websites (in compliance with the charter of use of the Internet of the University of Nice). In order to guarantee anonymity and confidentiality of your navigation, the web page will open in "private navigation" mode thus, no navigation data can be recorded by the experimenter.

End of Step3

As soon as the 45 minutes allocated to step 3 have passed, the web page will close automatically and you will be redirected to the experiment screen where your results will be displayed. We will tell you how many ITEMS you and the members of your group placed in the corresponding boxes, and the earnings resulting. We will also

display the choices made and the earnings accrued in the first two steps. The total earnings will be displayed along with the euro value based on the rate 100 ECU = 1 euro and rounded to 50 euro cents.

At that stage, the experiment has been completed. We ask you not to stand up and refer to the last page of the instructions describing the payment procedure.

All the instructions have now been provided and the experiment will start in a few moments. We ask you to focus on the computer screen and to put on your headphones. In case of a problem, do not hesitate to raise your hand and wait for the experimenter to come to you.

We remind you that communication with other participants in the room, and use of mobile phones are prohibited during the entire experiment. The following page of the instructions describes the end of experiment and the payment procedure. They will be read out to you when the experimenter informs you orally that the experiment has ended.

We thank you for your attention and hope you enjoy the experiment

.3.2 list of website

www.google.com	www.leconomiste.eu
www.pagesjaunes.fr	www.lesechos.fr
www.yahoo.com	www.facebook.com
www.Lemonde.fr	www.twitter.com
www.lefigaro.fr	www.linkedin.com
www.lequipe.fr	www.tumblr.com
www.allocine.fr	www.youtube.com
www.msn.com	www.jeuxvideo.com
www.wikipedia.org	www.minijeux.com
www.commentcamarche.net	www.dailymotion.com/fr
www.nouvelobs.com	www.leboncoin.fr
www.meteofrance.com	www.amazon.fr
www.journaldunet.com	www.ebay.fr
www.worldpress.com	www.cddiscount.com

