Social information and collective action

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Social Information and collective action

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Abstract

Little is known about the effect of social information on the ability of groups to overcome a collective action problem. By social information, we mean information about the actions of other group members and their effects. This thesis aims to shed new light on this subject. In the first chapter, we analyze the effect of different levels of information regarding subjects' actions, and different ways to deliver it, on the extraction of a common pool resource. In the second and third chapters, we analyze the effect of presenting the actions of other group members as generating positive or negative externalities on the group's ability to produce a public good. In these chapters, we replicate the frame of the voluntary contribution mechanism created by Andreoni (1995); and add peer pressure (Masclet et al., 2003) or peer punishment (Fehr & Gachter, 2000). Besides, throughout this thesis, we pay particular attention to how social information influences subjects' cooperation and still the way they react to the social information delivered. As a result, the taste for conformity is an important driver of group dynamics. Furthermore, the perception subjects have of others' actions can hinder their ability to converge on a high rate of contribution. We also observe different reactions to the information delivered depending on the subjects' social orientation (Murphy et al., 2011). The more individualistic tend to imitate the worst behaviors when they are displayed and seem more sensitive to the framing effect. These results invite us to take better account of social preferences in order to understand the effects of the dissemination of social information and, in particular, the impact of different feedback on the management of natural resources.

Keywords: cooperation, social information, common pool resource, public good, framing, peer pressure, peer punishment

Résumé

Nous avons à ce jour peu de connaissances quant à l'effet de l'information sociale sur la capacité des groupes à surmonter un problème d'action collective. Par information sociale, nous entendons toute information qui concerne les actions des autres membres d'un groupe et leurs effets. Cette thèse vise à amener de nouveaux éléments sur ce sujet. Dans le premier chapitre, nous analysons l'effet de l'accès à différents niveaux d'information sociale et des différentes façons de la fournir sur l'extraction d'une ressource commune. Dans les chapitres deux et trois, nous analysons la capacité du groupe à produire un bien public selon que les actions des autres membres du groupes soient présentées comme générant des externalités positives ou négatives. Dans ces chapitres, nous reproduisons le framing du mécanisme de contribution volontaire créé par Andreoni (1995) ; et ajoutons des mécanismes de pression par les pairs (Masclet et al., 2003) ou la punition (Fehr & Gachter, 2000). Dans l'ensemble de cette thèse, nous portons une attention particulière à la manière dont l'information sociale influence la coopération des sujets et plus encore la manière dont ils réagissent à l'information sociale délivrée. Il en résulte que le goût du conformisme est un moteur important de la dynamique de groupe. De plus, la perception que les sujets ont des actions des autres est un élément qui peut entraver leur capacité à converger vers un taux de contribution élevé. On observe également des réactions différentes à l'information délivrée selon les orientations sociales des sujets (Murphy et al., 2011). Les plus individualistes ont tendance à imiter les pires comportements lorsqu'ils sont affichés et semblent plus sensibles à l'effet du framing. Ces résultats nous invitent à mieux prendre en compte les préférences sociales afin de comprendre les effets de la diffusion d'informations sociales et, en particulier, l'impact des différents types de feedback sur la gestion des ressources naturelles.

Mots clés : coopération, information sociale, ressource commune, bien public, framing, pression par les pairs, punition par les pairs

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General introduction

Most natural resources are overexploited and require collective action to be governed. However, how to promote and maintain collective action is one of the most debated issues. Whether for the provision of a public good or for the management of a common resource, when individual interests conflict with the collective interest, cooperation is difficult to achieve. The individual has an incentive not to bear the cost of the contribution, or to extract as much as possible, whereas the interest of the group is to regulate behavior in order to provide and maintain the resource. As a consequence, it theoretically leads to under-provision of public goods (Olson, 2009), and over-exploitation of common pool resources also known as the tragedy of the commons (Hardin, 1968).

Contradicting these conclusions, in her seminal work, Ostrom (1990) demonstrated that local groups are able to sustainably manage the common pool without a strict definition of ownership or state control. Based on this work, she identifies eight governance principles that enable to avoid the tragedy of the commons : (i) a clear definition of group boundaries, (ii) a proportional distribution of costs and benefits, (iii) arrangements established on a collective basis, (iv) the establishment of a monitoring and control system, (v) the establishment of graduated sanctions, (vi) the existence of a low price dispute resolution mechanism, (vii) the recognition of the right to organize, (viii) the application of these rules on multiple scales (nested enterprises). Going further in investigations about how behavioral aspects might explain why groups succeed or fail to cooperate, Ostrom remains a pioneer to use experimental economics to study these aspects. As a result of this work, she demonstrates that mechanisms, which should not impact group dynamics, such as communication (cheap talk), enable groups to generate and maintain cooperation (Ostrom et al., 1994). In line with this work, advances in behavioral and experimental economics reveal that other mechanisms were also effective to generate and maintain cooperation, such as : monetary sanctions (Fehr and Gächter, 2000), symbolic sanctions (Masclet et al., 2003) and rewards (Sefton et al., 2007). Those mechanisms are based on the expression of approval or disapproval of others' actions and should not impact behavior if we have a narrow interpretation of human economic interest. Nevertheless, they are present in most groups.

Continuing Ostrom's work, Dietz et al. (2003) considers that to achieve efficient governance, it is necessary that, among other things, i) information about resources and users' actions are available at a low price ; and ii) communities maintain frequent communication and dense social network (social capital). The question of the effect of these dimensions on the effective capacity of communities to maintain a resource is very topical and of primary importance. Institutions involved in resource management are gradually putting in place systems that provide information on users' actions and the state of resources in order to facilitate their governance.

For example, in terms of water management, the "Compagnie d'Aménagement des Coteaux de Gascogne (CACG)", which is an organization that delivers water to farmers, has set up a connected system that was initially designed to identify better the actual consumption of their users (and their schedule) and thus optimize their management. Indeed, within the framework of the "*Loi sur l'eau*" of 2006 and the decree of August 2007, the CACG must ensure that the commitments to achieve a good state of the environment are respected. As such, it must ensure that a minimum flow ("*Débit Objectif d'Etiage*"= Low Flow Objective and a fortiori a "*Débit de Crise*" =Crisis Flow) is maintained in the environments impacted by withdrawals dedicated to irrigation. The installation of tele-connected meters makes it possible to obtain more precise (daily) information concerning the needs (real withdrawals) of farmers and their temporalities. This information enables the company to optimize the timing of releases from the water reservoirs under its management. Indeed, when releases do not correspond to needs, the water supplied is not used by farmers and therefore not invoiced. Moreover, this unused water risks generating a shortage at the end of the crop year. Here the system's initial function is to facilitate coordination between the actions of the manager and the farmers. The implementation and acceptance of this system were strongly influenced by the different levels of pressure on the resource. It is an instrument contributing to the creation of a new relationship between water and society (Burger-Leenhardt et al., 2018 ; Collard et al., 2019). As such, it has also been used to disseminate social information, displaying the average rate of water consumption (Chabe-Ferret et al., 2019).

Another example is the setting up of an information platform called "Système d'Information sur l'Eau du Marais Poitevin" (SIEMP) by the "Etablissement public de l'eau et de la biodiversité sur le Marais Poitevin" (EPMP). The EPMP is a public institution whose mission is to coordinate the management of the geographical area called Marais Poitevin. It was created after the condemnation France's condemnation due to the degradation of the environment in 1999 (non-respect of the birds directive). This degradation was generated by the consequent development of irrigation in this zone, which is now identified as having a high tension on the water resource (Zones de Répartition des Eaux (ZRE)). This zone is characterized by a substantial diversity in the actors involved in the management of the environment (nature protection associations, fishermen, marshland syndicate associations, State services, local authorities, etc.). The SIEMP information system provides information on the state of the resource but also on current collective extraction by farmers to all stakeholders concerned ; it is divided into two parts. The first part is dedicated to the general public and provides information about the state of the resources. It aims to provide a better understanding of the functioning of "Marais Poitevin" and thus to build trust and facilitate dialogue between the wide range of stakeholder involved. The second part is devoted to the actors involved in establishing the management rules. This second system allows them to monitor the actual extractions levels of the group of farmers.

Many issues emerge from the implementation of this kind of information systems. Will the fact to deliver information about other users' actions facilitate the management of a resource ? Numerous questions arise about the form, level of detail and manner in which this information has to be provided and its effects. How will the individual use this information ? Can this information change their behaviors ? In other words, can this information favor the emergence of a cooperation norm, or on the contrary make it more difficult ? Moreover, what can be the influence of subjects' perception of the effect of others' actions on the group's ability to cooperate ? This questioning stems from Andreoni (1995b)'s results, emphasizing that subjects are more willing to cooperate when they perceive others' actions as having positive effects than when they perceive them as having negative ones. Finally, to what extent can this perception, created by the information provided in the Andreoni (1995b) frame, interact with the group's ability to cooperate ?

This thesis aims to bring new insights concerning the effects of providing information about users' actions on the management of natural resources, illustrating them by common pool and public good contexts. We more particularly concentrate our study on the effect of the information about peers' actions and their potential effects on group dynamics. We first analyze the effect of displaying social information under different modalities on group dynamics in a common pool context. This experiment composes the first chapter of this thesis. In the second part, we examine the effect of the perception that subjects have of the actions of others on group dynamics by presenting their peers' actions as having potential positive or negative externalities. In this part, we analyze how the framing effect interacts with mechanisms aimed at fostering cooperation such as peer pressure and peer punishment. The effect of the frame interaction with those two mechanisms composes respectively our chapter 2 and 3. Moreover, through all the thesis, we try to analyze how social preferences impact subjects' sensitivity to social information. The questions raised by these three aspects will be presented with more detail in the following paragraphs.

Social information

We consider that non-excludability and rivalry are at the source of most of the problems related to the management of natural resources. As a consequence, we choose, in our first chapter, a game that represents a Common Pool Resource. We adopt, for our analysis, the protocol established by Herr et al. (1997) that represents groundwater management. This chapter is devoted to the analysis of the effect of social information on the group's cooperation. More specifically, the effect of displaying individuals' actions on the group dynamic is observed.

In her behavioral framework, Ostrom (1998) states that delivering information about other group members actions' is necessary to establish trust and build a reputation, which she considers being determinants for group cooperation success. However, there are many field works, finding that delivering information about other users' actions, far from generating an increase of cooperation, induces a convergence of behaviors toward the average behavior displayed (Schultz, 1999 ; Schultz et al., 2007 ; Croson & Shang, 2008 ; Ferraro & Price, 2013). Experimental works also demonstrate that displaying individuals actions, or individual payoffs (complete information), can worsen collective action, as subjects are more tempted to imitate the most competitive behavior displayed (Carpenter, 2004 ; Offerman et al., 2002 ; Villena & Zecchetto, 2011 ; Bigoni & Suetens, 2012).

In order to shed light on the question of the effect of social information on CPR management, and more precisely about the effect of displaying individuals' actions, we compare treatments in which only the group aggregated extraction is displayed with a treatment in which individual extractions are displayed. Besides, we also analyze the effect of different modalities in the way of providing social information. Kreitmair (2015) argues that the voluntary dimension of the information disclosure can play an important role in the willingness to cooperate. In her experiment on public good's contribution, she proposes a mechanism that enables subjects to signal their willingness to make their own action public before they make their choices. We are testing the effect of the same mechanism in a CPR context. Moreover, as Chaudhuri and Paichayontvijit

(2006) experiment shows, subjects contribute more when they get informed that a majority of subjects in their group are willing to do so. We, therefore decided to add a majority dimension in this information disclosure mechanism. Through these treatments, we are testing if the voluntary dimension enables subjects to signal their willingness to cooperate. These treatments allow us to provide results about how the willingness to display subjects' extraction is linked to a willingness to cooperate in reducing their extractions. In other words, these results allow us to understand better whether the voluntary dimension is used as a signal of willingness to cooperate. Also, this work allows us to understand better the effect of having a majority of subjects declaring their willingness to make their actions public on the group's ability to cooperate.

Finally, we analyze the impact of providing social information by disclosing the actions of individuals on group dynamics. More precisely, we examine if the fact to provide aggregated or individual information impacts the extraction strategies. To do so, we use the learning analysis as defined in Huck et al. (1999), that determines which strategies better explain contributions change from period to period. To establish the different strategies of extraction, we adapt those defined in Villena and Zecchetto (2011), which is the first article that considers the effect of learning in a common pool resource context. Chapter 1 provides insights to understand the drivers of group dynamics and how the level of aggregation concerning social information discloses can impact it. In other words, we are providing new results to understand how subjects might modify their extractions strategies depending on the kind of information available concerning others' actions.

In the remainder of the thesis, we analyze another dimension of the effects of social information provision. We examine how the information provided to describe collective action issues and the effects of peer actions have an impact on group cooperation and the effectiveness of the mechanisms that are identified as promoting cooperation.

Presenting others'actions as having positive vs negative externalities and disapproval ratings

Numerous experiments demonstrate that the way to present a collective action issue strongly influences group cooperation (Andreoni, 1995b ; Cox, 2015 ; Cubitt et al., 2011a ; Cubitt et al., 2011b ; Dufwenberg et al., 2011 ; Fosgaard et al., 2014 ; Fujimoto and Park, 2010 ; Messer et al. ,2007 ; Messer et al., 2013 ; Gächter et al., 2017). In most cases, subjects are more willing to contribute when the social interaction is described as having potential positive externalities rather than negative ones. In his experiment, Andreoni (1995b) demonstrates that subjects are more willing to cooperate when they perceive that they are doing good than doing bad onto others. He concludes that the warm glow effect is more efficient in promoting cooperation than the cold prickle effect. We analyze if this perception might interact with mechanisms that are present in most of the groups and that have proved their efficiency in fostering cooperation : peer pressure and peer punishment.

By peer disapproval, we mean a mechanism that allows subjects to express dissatisfaction/disagreement with the actions of other individuals in their groups (their peers). Peer punishment (Fehr and Gächter, 2000 ; Ostrom et al., 1994) and peer pressure (Masclet et al., 2003) demonstrated their efficiency to promote and maintain cooperation. Considering that individuals are strictly selfish, they should not bear the cost of sending monetary sanctions and should neither change their behavior when receiving other's symbolic disapproval. However, experimental evidence demonstrates that when these mechanisms are introduced, the majority act in a cooperative manner, whereas this is not the case when they are absent. Fehr and Fischbacher (2004) argue that sanctions enable the activation of a social norm of cooperation. Nevertheless, Messer et al. (2013)'s experiment shows that mechanisms such as communication and other cheap talk mechanisms were less efficient under a frame that highlights the negative externalities of social interactions. In chapters 2 and 3, we examine whether the effectiveness of disapproval ratings and the common norm of cooperation they activate could be affected by the frame.

To do so, we strictly replicate the frames of the voluntary contribution experiment created by Andreoni (1995b). We thus distinguish between a positive frame that highlights the potential positive externality of social interaction and a negative frame that highlights the potential negative externality of the latter. For these two frames, we add the possibility to send symbolic sanctions in chapter 2 and monetary ones in chapter 3 (in between conditions). We also control the order effect of these disapproval ratings by introducing them in the first sequence or the second sequence depending on the treatment.

Those two chapters provide new results concerning Andreoni(1995)'s framing effect on groups' contribution. Moreover, we provide new insights into the robustness of disapproval ratings to contextual changes. Our work provides a better understanding of how highlighting the potential positive vs negative externalities of social interaction impacts the willingness to disapprove, the reaction to disapproval and as a consequence the capacity of the group to define a contribution norm. We also provide new results that are consistent with what is identified as the main effects of framing, namely the perception, or misperception and the willingness to reciprocate.

Finally, through all this thesis, we analyze how subjects' social preference might affect their response to social information.

Social preferences

While strategical understanding and confusion are essential explanations for group cooperation, Andreoni (1995a) also invites us to consider social preferences as important drivers for group dynamics. In this thesis, we firstly analyze how social preferences influence cooperation in both common pool resources and public goods. To do so, in all the experiments presented, we measure the subjects' social value orientation using Murphy et al. (2011) method. Thanks to this test, we obtain an individual social value orientation score that reflects the subjects' preference for equal sharing. Besides, we analyze how this score influence cooperative behavior.

Moreover, in both public good and CPR contexts, we shed light on how social preferences interact with social information. More specifically, we analyze how social preferences may interact with the reaction to the disclosure of information about the actions of others. Next, we analyze how social preferences interact with the way the issue of collective action is presented (positively or negatively). In other words, does the social orientation of the subjects influence the way they react to the presentation of collective action ? In this replica of Andreoni(1995b)'s frame, the economic incentives remain strictly identical.

In the first chapter, we develop a theoretical framework to identify how social preferences such as altruism (Levine, 1997), reciprocity (Sugden, 1984), aversion to inequality (Fehr & Schmidt, 1999) or a taste for conformity (Luzzati, 1999) can influence how individuals react to the disclosure of others' actions. At the same time, we conduct a learning analysis to identify how individuals actually modify their strategies based on the available information. Moreover, like Bigoni and Suetens (2012), we go further in this analysis of learning by distinguishing between different types of subjects. The main difference is that we use the categories defined by Murphy's test to establish types. This analysis allows us to provide new evidence on how social preferences influence how subjects respond to information about the actions of others.

In chapter 2 and 3, we analyze how social preferences influence the willingness to reciprocate depending on the frame. Indeed, Park (2000) finds that social value orientations strongly influence the way subjects react to the frame. The global analysis of chapters 2 and 3 provides results regarding how social orientation impacts subjects' sensitivity to a frame that highlight the potential positive vs negative externalities of social interactions. Moreover, we provide new results that increase our understanding of how those social preferences influence their stated willingness to reciprocate depending on the frame.

Lastly, Fehr and Schmidt (1999) demonstrate that, when material sanctions are applied, the full contribution to the public good can be an equilibrium. We provide results that show it can be affected by the frame. In other words, chapter 3 provides results to understand better how the frame could affect group capacity to converge towards full contribution when material sanctions are applied. To better understand these results, we analyze how subjects react to sanctions introduction, changing their extractions strategies, distinguishing subjects depending on their social orientation value.

To sum up, this thesis contributes to the literature on the impact of social information on group dynamics in the face of social dilemmas. In the first part, we analyze the effects of social information diffusion on extraction in the context of a common pool resource. In the second part, we analyze the effects of a framing highlighting respectively, the positive or negative effects of peer actions on the contribution to a public good. For each of these two parts, we pay particular attention to how social preferences influence on the one hand the willingness to cooperate and on the other hand the reaction to information about peer actions and their effects.

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1

The effect of social information and voluntary display of individual extractions in a common pool resource context

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Abstract

The management of a natural resource, more particularly a water resource, often refers to a problem of managing a common pool resource. In this context, Ostrom (1998) and Dietz et al. (2003) highlight the importance of disseminating information on the actions of co-users in order to facilitate its governance. However, several experiments show that, far from facilitating cooperation, the disclosure of social information can induce convergence towards average behavior which can accelerate resource predation. In this experiment, we seek to determine the effect of social information disclosure on the extraction of a common resource. We reproduce the experiment of Walker et al. (2000), and we test the effects of different levels of social information, i.e. information about co-users' actions, (aggregated, individual) and different mechanisms for sharing it (compulsory, voluntary, or based on a majority vote) (Kreitmair, 2015). To determine if and how social preferences can induce different effects of social information disclosure on extraction dynamics, we produce on the one hand a theoretical framework, and on the other hand, we analyze what the actual extraction changes are by mobilizing learning analyses as described by Huck et al. (1999) and Bigoni and Suetens (2012). When we consider group extraction, it appears that the different treatments do not improve the management of the resource. All groups result in a level of extractions close to Nash's equilibrium. The theoretical framework provides an element of explanation ; when subjects have preferences for reciprocity or compliance, social information may induce an increase of extractions. Learning models confirm this result ; the taste for conformity as well as an individualistic best response are important drivers of the extraction dynamics. Moreover, subjects with an individualistic or a competitive social orientation tend to imitate the most extractive behaviors when displayed. These findings tend to support the assumption that the dissemination of social information can aggravate the tragedy of the commons.

Keywords : common pool resource, social information, feedback, voluntary sharing

1.1 Introduction

Natural resource management, and more particularly water resource management, often refer to a common pool dilemma. Users cannot be excluded but compete in the resource appropriation. As a consequence, there is a social dilemma, the individual interest being in contradiction with the collective one. Hardin (1968) advocates that without a clear definition of good's boundaries and control by the State, this dilemma will lead to an overexploitation of the resource, which the author called the tragedy of the commons. Criticizing this conclusion, Ostrom (1990) identified in her seminal work eight governance principles that would enable to avoid it. Continuing this work, Dietz et al. (2003) argue that delivering liable information about : (i) the State of the resource, (ii) the users' actions, and (iii) the uncertainties, is determinant for governance efficiency. In this work, we do concentrate on the effects of disclosing information about users' actions on extraction. In other words, we analyze the effects of disclosing information about the user's actions on the extraction behaviors.

There is no clear statement about the potential effect of disclosing social information, which refers to information about other users' actions in a collective action issue. In her behavorial framework, Ostrom (1998) defends the idea that delivering information about other users' actions is determinant to build reputation and trust, which both strongly influence the group capacity to cooperate. This argument may let us think that making all users' actions public could have strong and positive effects on group cooperation. Empirical evidence suggests that providing social information strongly influences behaviors in a wide range of situations, such as water consumption (Ferraro & Price, 2013), curbside recycling (Schultz, 1999), energy consumption (Schultz et al., 2007) and even donations to a radio (Croson & Shang, 2008). In most of these cases, there is a convergence towards the average observed actions. This fact seems to imply that the most predator behaviors tend to decrease their consumptions, but also that the most virtuous ones tend to increase it. As a consequence, public information about private decisions can worsen the outcome of social interactions, compared to a situation where individuals' decisions remain private. This effect is called the "Boomerang effect" (Schultz et al., 2007). Delivering information about subjects' realized actions seems, therefore, to strongly affect behaviors. In some cases, convergence to the average may be desirable as it provides an improvement of the group welfare. However, in other contexts, it may have the opposite effect, i.e. degradation of the group welfare.

In light of these findings, the experiment of Kreitmair (2015) seems to bring interesting lines of thought. In her public good experiment, Kreitmair shows that a mechanism based on subjects' willingness to display their actions can increase group cooperation. Indeed, she finds that contributions are significantly higher when subjects choose voluntarily to disclose them in contrast to situations where the display of their actions is compulsory. In the voluntary display treatment, subjects declare if they want to disclose their actions, and they get informed about the total number of subjects who are willing to do so in their group before each group member decides about their contribution. This voluntary dimension calls for more attention since the cost of getting information about real actions can be high. However, thanks to the development of new technologies, we can imagine that the voluntary disclosure can be an affordable solution. Indeed, the user will be able to easily disclose his extraction level, for instance through the use of smartphones, which will induce a much lower cost than the control procedure to obtain it.

The aim of this work, based on experimental economics, is to increase our knowledge about how social information can impact cooperation in a CPR context, more specifically in groundwater management. Our research question is : "Does the fact of disclosing social information affect

CPR extraction ?". We have then two subquestions : i) Can social information, more precisely the fact of disclosing all subjects' actions, worsen the tragedy of the commons ? ii) Is the voluntary disclosure of extraction a mechanism that can promote and maintain cooperation in CPR management ?

To answer these questions, we built an experimental protocol based on four information treatments, 1) No disclosure, in which individuals receive only the aggregate information of group extraction, 2) Compulsory disclosure, in which individuals receive information on every group member's extraction, 3) Individual disclosure, in which only the extraction of subjects who are willing to do so is disclosed ; 4) Majority disclosure, in which the disclosure of all subjects' extractions in a group depends on the will of the majority. To sum up, the treatments differ depending on the level of extraction disclosed (individual or aggregate) and the mechanism used for disclosure : compulsory or based on voluntary mechanisms (individual, majority vote).

The effect of providing aggregated or individual information about the subject's actions on the collective dynamics of the group is unclear. In a public context, Weimann (1994) 's experiment shows that there is no effect, whereas Carpenter (2004) 's experiment demonstrates a quicker decrease of the public good provision due to an imitation of the worst behaviors displayed. Carpenter (2004) explains his result by a taste of conformity which worsens the group dynamic when individual information is displayed. These results are consistent with those obtained in CPR experiments in which the subjects' actions are made public (Janssen, 2013 ; Janssen et al., 2014), or in which complete information is provided (Villena & Zecchetto, 2011) that observe a quicker depletion of the resource. In these experiments, subjects tend to adopt the most predatory behavior when they observe others' behavior. Based on this evidence, we assume that the Compulsory disclosure will worsen the tragedy of the commons, making it quicker compared to a situation in which subjects have information about the aggregate extraction. Considering the voluntary dimension, we assume that, like communication (Falk et al., 2002), it will allow subjects to express their willingness to cooperate and therefore, to declare their types. It is the reason why we consider that in the treatment with a voluntary display mechanism, subjects who express a desire to display their actions will have significantly lower extractions than others. Also, following the results of Chaudhuri et al. (2006) showing that cooperation increases when subjects are informed that a majority of subjects are willing to cooperate if others do so, we make the following hypothesis : if the group is informed that a majority of subjects are willing to display their extraction, and that is a credible signal of the willingness to cooperate, extractions should be lower.

In this experiment, we are paying attention to social preferences ; more precisely how they may affect the willingness to display extraction and reaction to the social information displayed. To do so, we firstly analyze how this information, theoretically affects the best response through different patterns of social preferences such as altruism (Levine, 1997), reciprocity (Sugden, 1984), inequality aversion (Fehr & Schmidt, 1999) or conformity (Luzzati, 1999). In the second part, we analyze how the information provided is actually used by the subjects to modify their extractions. To do this, we use a learning analysis model that is based on different assumptions about how subjects use the information provided to modify their extractions. To formulate our learning hypotheses, we adapt those of Villena and Zecchetto (2011) and for the analysis we adopt the one provided by Huck et al (1999) and reproduced by Bigoni and Suetens (2012). Finally, we distinguish our learning analysis by subject type to determine whether social preferences have an impact on the use of social information displayed.

Our results show that disclosing information about individual extractions does not affect the extraction dynamics. The trend of extraction increase is similar in each treatments. The voluntary mechanism does not foster collective action in the CPR context. Indeed, even if the willingness to display extraction is correlated with lower extraction levels, especially in the first period after the introduction of the mechanism, over the game, extractions keep on increasing. It leads us to say that the voluntary disclosure mechanism is used as a signal of the willingness to cooperate, but it is not sufficient to generate and maintain cooperation. Since most groups obtain a majority in favor of displaying extractions, its ineffectiveness cannot be explained by a weak willingness to display extractions. The theoretical framework shows that individuals with an altruistic preference should have lower extraction. In contrast, when individuals have preferences for reciprocity and conformity, providing information about the extraction of other subjects may increase collective extraction. These theoretical predictions are consistent with our learning analysis. Group's extraction dynamics are mostly driven by convergence towards the observed "average contribution" and also the "self-interested best reply". Moreover, when individuals' information is displayed (i.e. in the Compulsory treatment), subjects with an individualistic or competitive social orientation tend to imitate the average displayed extraction less and to imitate the highest extraction. This result lends credence to the conjecture that disclosing individual information can worsen collective dynamics. These results call on us to take into account social preferences, such as reciprocity and conformity, to better understand the dynamics of collective action.

The rest of the chapter proceeds as follows ; section 2 presents the common pool game, section 3, the experimental design. Section 4 exposes the behavioral hypothesis. Results are presented in section 5, and we discuss them in section 6.

1.2 The CPR model

We rely on the CPR game presented in Walker et al. (2000) and Herr et al. (1997). This protocol reproduces a groundwater's functioning. In this game, a group of players exploit a CPR by implementing individual extraction choices. Subjects are assigned since the beginning to partner groups of $n = 5$ players, during ten periods times two sequences. The number of periods in each sequence is announced since the beginning of the game and is common knowledge. As the game was repeated a finite number of times, we can restrict the theoretical description to the constituent game.

Each period, player i has to choose the amount ($x_i \in \{0; 30\}$) he/she extracts from the CPR. This amount generates a benefit ($B_i(x_i)$), representing an agricultural production function, which is described as follows :

$$B_i(x_i) = ax_i - bx_i^2 \tag{1.1}$$

It implies that the benefit received by an appropriator is independent of the extraction of other appropriators. The parameters a and b are positive constants. Appropriators are homogeneous, so the benefit function applies to each appropriator i.

The rivalry aspect, characterizing common pool extraction (Apesteguia & Maier-Rigaud, 2006), is reflected in the extraction costs. Player i' s extraction cost depends on his action but also on the total group action ($X = \Sigma_{j=1}^{n} x_j$). $C_i(x_i, X)$ is the product of the amount withdrawn by i, x_i, and the average extraction cost AVC which depends on group extraction (X). It reflects the fact that the deeper the group extract, the deeper the groundwater level, and therefore the higher the marginal cost of extraction is. Indeed, there is a base cost of extraction c and a positive incremental cost of c for each additional unit extracted by the group. Strategic interaction arises, therefore, through the extraction cost.

$$AVC = \frac{c + cX}{2} \tag{1.2}$$

$$C_i(x_i, X) = x_i \times c(X + 1)/2 \tag{1.3}$$

Once taking into account these two components, at the end of each period, player i's earning is equal to :

$$\pi_i(x_i, X) = ax_i - bx_i^2 - x_i \times c(X + 1)/2 \tag{1.4}$$

It is worth noticing that in this game, subjects are entirely dependent on resource extraction. Indeed, if they choose not to extract the resource, they will get no gains. They do not have the opportunity to get a payoff from an alternative action or activity like in the contest game.

The unique Nash equilibrium of the extraction game is given by :

$$x_i^* = \frac{2a - c}{4b + c(n + 1)} \tag{1.5}$$

This corresponds to the best response $\dfrac{\partial \pi_i(x_i, X_{-i})}{\partial x_i} = 2a - c(1 + X_{-i}) - x_i(4b + 2c) = 0$ to the best response, since all subjects are homogenous.

The social optimum, Pareto Optimum, is determined by $\dfrac{\partial \sum U_j}{\partial X} = 0$ and is equal to :

$$x_i^P = \frac{2a - c}{4b + 2cn} \tag{1.6}$$

The ratio of, the payoff generated by the extraction corresponding to the unique Nash equilibrium and the payoff generated by the social optimum, equal to 0.60. We choose the parameters in order to have an important difference between the payoff subjects get when they play the unique Nash equilibrium ($U(24.59) = 17, 29$) and the payoff they get when all group members have an extraction corresponding to the Pareto solution ($U(15.03) = 29.04$). Moreover, even if all the gains are positive, we wanted it to be close to zero when all the members of the group choose the maximum extraction($x^{max} = 30$). The parameters chosen correspond to $a = 3.89$, $b = 0.0036$ and $c = 0.05$.

Another important aspect of this experiment is the level of details about costs and payoffs given to the subjects. Even if Apesteguia (2006) defends the idea that providing detailed payoff tables does not affect subjects' behavior in an experimental CPR game, because they reach Nash equilibrium in any case, we wanted to avoid as much as possible the "spite effect". Indeed, Saijo and Nakamura (1995) demonstrate that subjects are more likely to be spiteful when they have low details about the payoff's structure. So in order to avoid the spite effect generated by a poor understanding of the game's incentives, we provide them detailed tables about the costs and payoffs they will get depending on their extraction level (x_i) and on the extraction of others group members (X_{-i}).

1.3 Experimental design

We realize four treatments. They allow us to study two dimensions of the effect of social information on extraction in a CPR :(i) the level of information details and (ii) the voluntary dimension in the disclosing. We are using Between conditions. Each treatment is composed of two successive sequences of ten periods. During the first sequence, all subjects performed the same treatment (Baseline conditions). In sequence 2 we implemented the test treatment (details about treatments are provided in table 1.1).

Table 1.1 – Number of subjects per treatment in the social information experiment

Treatment	Part 1 (periods 1 – 10)	Part 2(periods 11-20)	Subjects number [number of groups]
T1	Baseline	Baseline	55 [11]
T2	Baseline	Compulsory	55 [11]
T3	Baseline	Individual	60 [12]
T4	Baseline	Majority	75 [15]

In the **Baseline treatment**, at the end of each period, subjects get a feedback containing the group extraction ($X = \Sigma_{j=1}^{n} x_j$) and also the global extraction of the other group members (X_{-i}). In the other treatments, as in Kreitmair's experiment, they get additional information about others' contributions.

In the **Compulsory treatment**, extractions ($x_j, \forall j$) were automatically disclosed and made available to all members of a group at the end of each period.

The voluntary dimension is analyzed through two treatments.

In the **Individual disclosure** treatment, we are reproducing Kreitmair's mechanism. At the beginning of each period, subjects individually must decide if they want to display their extraction. Before making their extraction choices, they are informed about the number of group members who agreed to do so in this period. At the end of each period, only the extractions level of subjects who vote in favor are displayed.

In the **Majority disclosure** treatment, subjects must also decide if they want to disclose their extractions, and they get informed about the number of group members who are willing to do so, before making their extractions choices. The major difference from the Individual disclose lies in the fact that if the majority ($n \geq 3$) of the group members is in favor of disclosure, all groups members extraction will be displayed at the end of the period. Reciprocally, if the group does not get a majority in favor of disclosing extraction, none of the group member's extractions will be displayed in this period.

In all treatments, subjects get an historic which displays the group's global extractions of all the precedent periods of the sequence. Moreover, in treatment with individual extractions, they also get an historic of individual extractions displayed. To enable the creation of reputation, subjects are identified by a letter : A B C D or E, which remains unchanged during all the experiment. The information displayed by treatment is presented in table 1.2.

Table 1.2 – Information disclosed by treatment

Treatment		**Information displayed**
Baseline		$X(X_{-i})$
Compulsory		$(+)x_j, \forall j$
Voluntary dimension	Individual	$(+)x_j, i \neq j$ if j vote in favor
	Majority	$(+)x_j, \forall j$ if ≥ 3 vote in favor

This experiment is compounded of 3 parts : the two first parts rely on the two sequences of the CPR game, and in the last one we replicate the Social Value Orientation test created by Murphy et al. (2011). In this test, subjects make 15 allocations decisions between themselves and an anonymous receiver. Their choices enable us to get an individual score reflecting the subject's preference for equal sharing.

The experiment was conducted in the Laboratory of Experimental Economics of Montpellier (LEEM) between July 2017 and January 2019. In total, 245 subjects participated (with 46 percent of women). Upon arrivals at the laboratory, each participant chose a cubicle where he was seated in front of a computer terminal. Subjects were informed that the experiment consisted of 3 parts. They received the corresponding instructions at the beginning of each part. Subjects were invited to read the instructions privately before the person in charge of the experiment read them one more time loudly. Subjects were informed that only one period of the CPR game, randomly selected, would be paid. Additionally, they were paid for one of the SVO decisions, also randomly selected at the end of the experiment. Before starting the experiment, each participant answered a comprehension questionnaire. At the end of the experiment, subjects were asked if they were able to identify the extraction that would maximize their group payoffs (the social optimum). These answers were used by the experimenter to compute an understanding score and a dummy variable reflecting the identification of the socially optimal extraction level.

An experimental session lasted approximately two hours. The average earning was 16 euros per subject in addition to a show-up fee of 2 or 6 euros depending on the distance of the subject's location from the LEEM. The experiments were conducted using Ztree (Fischbacher, 2007) for the CPR game, the SVO test was coded in Python.

In the following section, we detail our hypotheses about the effects of the different treatments based on a behavioral framework. We also explain how we analyze the way individuals use the information to modify their extraction.

1.4 Behavioral hypotheses

To develop hypotheses about how the different information systems will affect subjects' extraction behavior, we first briefly explain the behavioral models that can be relevant to our research question. Secondly, we expose how this theoretical framework can be reflected in different learning models.

1.4.1 How behavioral aspects can explain the social information effect

In this section, we present what are the possible effects on the extraction level of the two dimensions that we test in this experiment, namely the provision of social information and the voluntary feature of this provision.

Providing social information

If we consider that subjects are not sensitive to any social comparison, providing social information should not affect extraction behaviors. It will be reflected in self-interest behavior.

Self-interest individual

We consider the strategy of a purely self-interested individual. We can define the individual payoff as

$$\pi_i(x_i, X_{-i}) = ax_i - bx_i^2 - x_i \times c \times \frac{(x_i + X_{-i} + 1)}{2}$$

This self-interested subject will try to maximize his payoff determining the optimal extraction level

$$\frac{\partial \pi_i(x_i, X_{-i})}{\partial x_i} = 2a - c(1 + X_{-i}) - x_i(4b + 2c) = 0$$

Without taking into account the game constraints, the self-interested best reply is defined as follow :

$$\hat{x}_i^S(X_{-i}) = \frac{2a - c(1 + X_{-i})}{4b + 2c} \tag{1.7}$$

Incorporating the maximum extraction constraint gives us the individual's best-response function :

$$x_i^S(X_{-i}) = min[\hat{x}_i^S(X_{-i}), x_i^{max}] \tag{1.8}$$

In contrast, if we consider that individuals are sensitive to social comparison due to others social regarding preferences such as altruism (Levine, 1997), reciprocity (Sugden, 1984), inequality aversion (Fehr & Schmidt, 1999) or conformity (Luzzati, 1999), getting information about other's actions should impact their behaviors. All these social preferences are taken into account in the framework created by Velez et al. (2009). We adapted it to our CPR game to identify the effects of these different social preferences on the extraction's behavior.

Other regarding preference : altruism, reciprocity and inequity aversion

Considering that individual utility is not only affected by somedody's own payoff but also by others regarding preferences as altruism, reciprocity, and inequity aversion ; we define it as follow :

$$U_i(\pi_i, \pi_j) = \pi_i + \beta_i \sum_{j \neq i} \pi_j \tag{1.9}$$

This parameter β_i captures both altruism and reciprocity preferences in the following way :

$$\beta_i = \beta_i(x_i - \bar{X}_{-i}) = \{ \begin{array}{ll} \alpha_i + \varphi_i^+ & ,if \quad x_i \geq \bar{X}_{-i} \\ \alpha_i - \varphi_i^- & ,if \quad x_i < \bar{X}_{-i} \end{array} \tag{1.10}$$

The parameter captures α_i the altruism aspect. It is the marginal value that i places on the utility of other players and is independent of their choices. In contrast, the reciprocity preference

φ_i^+, φ_i^- implies that the weight that the individual places on the payoffs of others is conditioned on the average level compared to his own. The parameters α_i, φ_i^+ and φ_i^- are positive constants. The utility function can be express as follow :

$$U_i = ax_i - bx_i^2 - x_i \times c \times \frac{(x_i + X_{-i} + 1)}{2} + \beta_i[aX_{-i} - b\sum_{j\neq i} x_j^2 - X_{-i} \times c\frac{(x_i + X_{-i} + 1)}{2}] \quad (1.11)$$

Maximizing U_i, requires $\frac{\partial U_i(x_i, X_{-i})}{\partial x_i} = 2a - c(1 + X_{-i}) - \beta_i cX_{-i} - x_i(4b + 2c) = 0$ Without taking into account the extraction constraint, the best response to X_{-i} equals :

$$\hat{x}_i^\beta(X_{-i}) = \frac{2a - c(1 + X_{-i}) - \beta_i cX_{-i}}{4b + 2c} \quad (1.12)$$

$$= \hat{x}_i^S(X_{-i}) + \frac{-\beta_i cX_{-i}}{4b + 2c} \quad (1.13)$$

We do obtain :

$$\hat{x}_i^\beta(X_{-i}) = \{ \begin{array}{lcll} \hat{x}_i^{\beta+}(X_{-i}) & = & \hat{x}_i^S(X_{-i}) - (\alpha_i + \varphi_i^+)\frac{cX_{-i}}{4b+2c} & , for \quad x_i \geq \bar{X}_{-i} \\ \hat{x}_i^{\beta-}(X_{-i}) & = & \hat{x}_i^S(X_{-i}) - (\alpha_i - \varphi_i^-)\frac{cX_{-i}}{4b+2c} & , for \quad x_i < \bar{X}_{-i} \end{array} \quad (1.14)$$

Incorporating the game constraint, the best response of an individual which is motivated by a combination of altruism, reciprocity and pure self-interest is defined by :

$$x_i^\beta(X_{-i}) = min[\hat{x}_i^\beta(X_{-i}), x_i^{max}] \quad (1.15)$$

Altruism

Now we consider that the individual has no preferences for reciprocity $\varphi_i^+ = \varphi_i^- = 0$, but has an altruism preference α_i.

The best response for an altruistic subject will be defined as follow :

$$\hat{x}_i^\alpha(X_{-i}) = \hat{x}_i^S(X_{-i}) - \alpha_i\frac{cX_{-i}}{4b + 2c} \quad (1.16)$$

This best response function has the same intercept than the self interest one $\hat{x}_i^\alpha(0) = \hat{x}_i^S(0)$. However, it has a lower slope, meaning that the extraction choice reaction to others' extraction will be lower. Indeed $\frac{\partial \hat{x}_i^S(X_{-i})}{\partial X_{-i}} = \frac{-c}{4b + 2c} > \frac{\partial \hat{x}_i^\alpha(X_{-i})}{\partial X_{-i}} = \frac{-c(1 + \alpha_i)}{4b + 2c}$

This fact conducts us to our first hypothesis.

H1 : If the subject has altruistic preferences, the provision of social information should induce less extraction (as illustrated in figure 1.1).

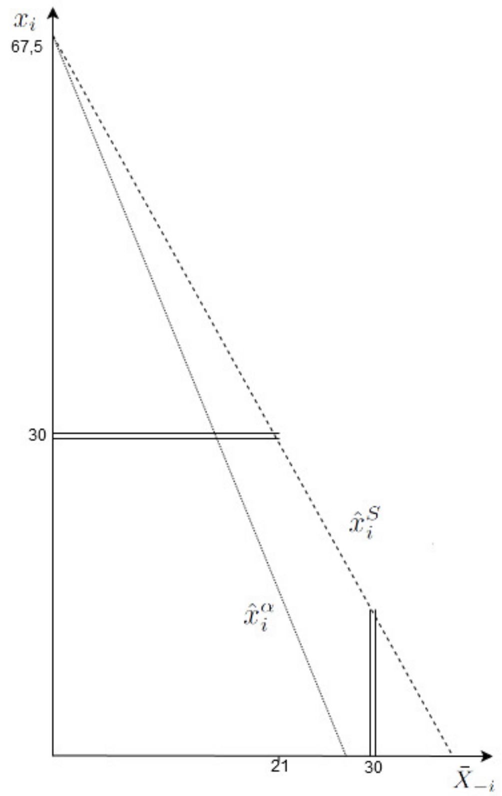

FIGURE 1.1 – Schema best response altruism.

Reciprocity

Here we consider that the individual has no altruist preference $\alpha_i = 0$ but a preference for reciprocity. His best response will be equal to :

$$\hat{x}_i^\varphi(X_{-i}) = \begin{cases} \hat{x}_i^{\varphi+}(X_{-i}) = \hat{x}_i^S(X_{-i}) - \varphi_i^+ \times \dfrac{cX_{-i}}{4b+2c} & ,for \quad x_i \geq \bar{X}_{-i} \\ \hat{x}_i^{\varphi-}(X_{-i}) = \hat{x}_i^S(X_{-i}) + \varphi_i^- \times \dfrac{cX_{-i}}{4b+2c} & ,for \quad x_i < \bar{X}_{-i} \end{cases} \tag{1.17}$$

Once again, the initial intercepts of those best response functions are the same as the self-interested one. However, reciprocity induces a higher extraction in reaction to the average extraction if the subject has a lower extraction level than the average, compared to the self-interested reaction. In comparison, it also induces a lower extraction reaction to the average extraction when the subject has a higher extraction than the average. Indeed :

$$\frac{\partial \hat{x}_i^{\varphi+}(X_{-i})}{\partial X_{-i}} = \frac{\partial \hat{x}_i^S(X_{-i})}{\partial X_{-i}} - \frac{c\varphi_i^+}{4b+2c}$$

$$\frac{\partial \hat{x}_i^{\varphi-}(X_{-i})}{\partial X_{-i}} = \frac{\partial \hat{x}_i^S(X_{-i})}{\partial X_{-i}} + \frac{c\varphi_i^-}{4b+2c}$$

$$\frac{\partial \hat{x}_i^{\varphi+}(X_{-i})}{\partial X_{-i}} < \frac{\partial \hat{x}_i^S(X_{-i})}{\partial X_{-i}} < \frac{\partial \hat{x}_i^{\varphi-}(X_{-i})}{\partial X_{-i}}$$

As long as the individual has an extraction level which is higher than the average, his reaction follows the best reply function $\hat{x}_i^{\varphi+}(X_{-i})$. When $x_i = \bar{X}_{-i}$, his reaction follows the monotonic increasing straight line $x_i = \bar{X}_{-i}$. When his extraction is lower than the average extraction of others group members his reaction is described by the best reply function $\hat{x}_i^{\varphi-}(X_{-i})$. This is illustrated in figure 1.2.

Inequity aversion

Velez et al. (2009) chose to express the utility function of subject which are inequity averse this way $U_i = \pi_i - \beta_i(\pi_i - \bar{\pi}_{-i})$ With :

$$\beta_i = \{ \begin{array}{ccc} \varphi_i^+ & if & \pi_i \geq \bar{\pi}_{-i} \\ -\varphi_i^- & if & \pi_i < \bar{\pi}_{-i} \end{array}$$

Falk et al. (2000), demonstrated that self-interest combined with inequality aversion generates a best response function that has the same basic shape that the one generated by self-interest combined with reciprocity.

H2 : A preference for reciprocity can lead to a higher or a lower extraction dynamic, depending on the fact that the subject has a lower or higher extraction than the average of the other group members.

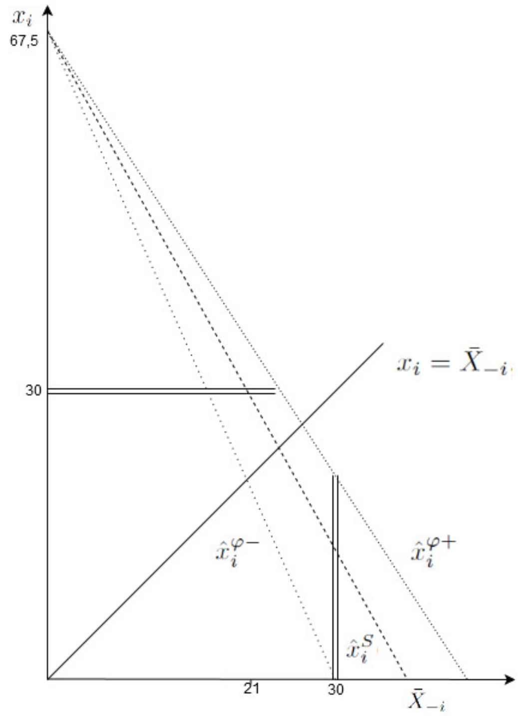

FIGURE 1.2 – Schema best response reciprocity.

Now, we will consider another type of preferences which is the taste of conformity.

Conformity

Here individuals are motivated by a desire of conformity to the extraction behavior observed in their group.

The individual i's utility function is given by :

$$U_i = \pi_i - \frac{\gamma_i (x_i - \bar{X}_{-i})^2}{2} \tag{1.18}$$

The parameter γ_i is a positive constant, reflecting the taste for conformity. Maximizing this utility without taking into account the extraction constraints will correspond to

$$\frac{\partial U_i}{\partial x_i} = 2a - c - X_{-i}(c + \gamma_i) - x_i(4b + 2c + 2\gamma_i) = 0$$

The best reply function without taking into account the game constrainst is equal to :

$$\hat{x}_i^{\gamma}(X_{-i}) = \hat{x}_i^{S}(X_{-i}) \times \frac{4b + 2c}{4b + 2c + 2\gamma_i} + \frac{X_{-i} \times 2\gamma_i/(n-1)}{4b + 2c + 2\gamma_i} \tag{1.19}$$

This generates a lower intercept $\hat{x}_i^{S}(0) > \hat{x}_i^{S}(0) \times \dfrac{4b + 2c}{4b + 2c + 2\gamma_i}$, but the slope is higher. Indeed :

$$\frac{\partial \hat{x}_i^{\gamma}(X_{-i})}{\partial X_{-i}} = \frac{\partial \hat{x}_i^{S}(X_{-i})}{\partial X_{-i}} \times \frac{4b + 2c}{4b + 2c + 2\gamma_i} + \frac{2\gamma_i/(n-1)}{4b + 2c + 2\gamma_i} > \frac{\partial \hat{x}_i^{S}(X_{-i})}{\partial X_{-i}}$$

H3 : The taste of conformity can generate a higher extraction dynamic than the best response generated by self-interest. As a consequence, delivering social information about other members' extractions can increase extraction compared to a situation where there is none.

Providing social information can make subjects reciprocate positively or negatively depending on the level of extractions disclosed. Moreover, the taste of conformity can also lead to increase extractions. Let us now discuss the potential impacts of the voluntary dimension of extractions display.

Voluntary dimension

The effect of sending a signal about subject types and the expected behavior is stated as one of the elements explaining the success of communication in a social action dilemma (Falk et al., 2002). In their work, Falk et al. (2002) defend the idea that if individuals, who have social preferences, signal their types through a non-coercive mechanism like communication (cheap talk), it can be sufficient to promote cooperation. We hypothesize that the voluntary disclosure mechanism will act as a signal of willingness to cooperate. As a result, we consider that cooperators are more likely to express their willingness to disclose extraction. By cooperator, we mean subjects with a relatively lower level of extraction than others. We also assume that subjects with social preferences will be more willing to cooperate and signal their willingness to do so through this mechanism.

H4 : Low extractors should be in favor of displaying information to signal their willingness to cooperate.

Moreover, considering that the majority of the subjects can be qualified as conditional cooperators (Fischbacher et al., 2001), which implies that subjects' willingness to cooperate depends on other members' contributions ; we make the hypothesis that receiving a signal that the majority of subjects is willing to disclose their extractions level can facilitate cooperation. Chaudhuri et al. (2006) also demonstrate that when subjects get informed that a majority of their group's members are willing to contribute if others do so, contributions are significantly higher. In order words, we make the hypothesis that if the majority of the group signal its willingness to disclose extraction level, and that this signal is a vector of the willingness to collaborate, group extraction should decrease. We also make the hypothesis that the Majority treatment will facilitate the creation of a consensus on information disclosure.

H5 : Cooperation within a group is fostered when the majority sends a signal that they are in favour of information display.

1.4.2 Learning models

Beyond this theoretical analysis, we develop an analysis to understand how the information provided influences the dynamics of subjects' exctractions within a sequence. It has been shown that the behaviors observed in a repeated experiment cannot only be reduced to learning because of the "restart effect" (Andreoni, 1988). Learning fails to explain why subjects increase their contributions at the beginning of a new sequence, whereas those contributions were low in the past period of the precedent sequence. However, we do argue that within a sequence, learning analysis keeps its relevance because the subjects are not subject to the restart effect. In this case, they can learn and adapt their strategies from one period to the next.

Indeed, numerous Cournot markets experiments show that the type of information displayed (feedback) strongly influence the group dynamic. Huck et al. (1999) and Offerman et al. (2002) found that when subjects get a complete information, i.e. the individuals' payoff, subjects tend to imitate the most successful behavior (which is the highest quantity bought) leading to an increasingly competitive market. Those results confirm Vega-Redondo (1997) argument that if subjects imitate the most successful behavior, it leads to a Walrasian output.

Nevertheless, little is known about how different feedbacks can affect behavior in collective action issues. In public good Bigoni and Suetens (2012) and Carpenter (2004) found that delivering respectively, a complete information, i.e. displaying individuals' payoffs, or only the individual actions, worsen the collective dynamic. In a CPR context, Villena and Zecchetto (2011) found that delivering complete information also generates the imitation of the most successful behavior, which accelerates the common tragedy.

As a result, through learning strategy analysis, we aim to provide a new insight concerning our understanding of how feedback affects group dynamics in collective action issues. To do so, we adapt the learning models presented in Villena and Zecchetto (2011), taking into account the specificities of our experiment in which subjects only get the individuals' extraction (and not individuals' payoffs). This analysis is complementary to the theoretical approach. For each of the learning models tested, we link with the effects of the different preferences mentioned above. However, it is important to stress that they do not flow directly from it. In facts, a lot of parameters exposed in the theoretical part cannot be measured. We must therefore make hypotheses about how these different aspects impact the choices of extraction modifications.

The **self-interested best response**, the subject i adopts an extraction level in period t (x_i^t) that would have maximized his payoffs in the precedent period ($t-1$) considering the extraction of the other group members (X_{-i}^{t-1}). In the model, the subject is myope and naive, as he is considering that the other member's extraction level will remain unchanged. However, considering these elements, he has the most strategical use of the information disclosed.

$$BR_i^t = \{z \in \Gamma : \pi_i(z, X_{-i}^{t-1}) \geq \pi_i(z', X_{-i}^{t-1}), \forall z' \in \Gamma\}$$

The best reply is given by the reaction function $x_i^{BR}(X_{-i}^{t-1}) = x_i^S(X_{-i}^{t-1}) = min[(\hat{x}_i^S(X_{-i}^{t-1}), x_i^{max}]$.

Imitate the average, subject adopts an extraction level in period t, which is equal to the average extraction of his group in the precedent period. It should be noted that in this model, the subject takes into account both his own extraction level and the extraction of other members of his group to calculate the average. This model reflects a taste for conformity to the social norm that emerges from the group dynamic. We calculate it using $IA_i^t = X^{t-1}/n$.

Follow the exemplary, the individual adopts the extraction level observed in his group in the precedent period that, if all group members adopted, it maximized the group payoffs. In other words, the example is the extraction level that gives the highest sum of payoffs if all subjects follow it. In this model, subjects express their willingness to reciprocate to the most cooperative action observed positively.

$$FE_i^t = \{\exists j \in I : \Sigma\pi_i(x_j^{t-1}) \geq \Sigma\pi_i(x_k^{t-1}), \forall k \in I\}$$

Maximum extraction displays, the subject adopts the maximum extraction that was observed in his group in the precedent period MAX_i^t. This model can be viewed as the negative reciprocation to the most extreme extraction observed.

The two first models can be applied in all treatments. Such as in Baseline treatment where subjects are only informed about the global extraction of their group (X) and their own extraction level (x_i). The two last models can only be applied when subjects get informed about others' individual extractions ($x_j, \forall j \neq i$). It corresponds to the Compulsory treatment. For the Individual and Majority treatments, we took into account the extractions that were actually displayed in each group at each period.

To evaluate the performance of the different learnings at the individual level, we adapted the estimation introduced in Huck et al. (1999), which was also reproduced in Bigoni and Suetens (2012) :

$$x_i^t - x_i^{t-1} = \beta_0 + \beta_1(BR_i^t - x_i^{t-1}) + \beta_2(IA_i^t - x_i^{t-1}) + \beta_3(FE_i^t - x_i^{t-1}) + \beta_4(MAX_i^t - x_i^{t-1}) \quad (1.20)$$

This analysis enables us to estimate how the theoretical prediction matches the real change of contribution between two successive periods of the same sequence. To establish these models, we determined theoretical extraction depending on different learning strategies for each subject and at every period of the game, excluding the first ones of each sequence.

1.5 Experimental results

Result 1 *: There is no treatment effect. Neither providing social information nor the voluntary disclosure mechanism are strong enough to promote and maintain cooperation.*

This result is illustrated in figure 1.3, where extractions trends are the same in all treatments. Indeed, in all treatments, the average extraction level overpasses the Pareto Optimum (15,03 tokens). Through periods it keeps on increasing reaching 24 tokens in the last period, which corresponds to the Nash equilibrium. The absence of treatment effects is also confirmed the panel tobit estimation presented in table 1.3 and by Mann Withney test (cf to appendix 1.D.3). In panel tobit estimation, treatments are presented by dummy variables, and we also control for the period, the sequence and socio-demographic variables. As a consequence, the introduction of an information sharing option does not affect the extraction levels compared to the baseline condition. This result leads us to say that neither providing social information nor the voluntary displaying of extractions are, per se, mechanisms that can avoid the overexploitation of the resource.

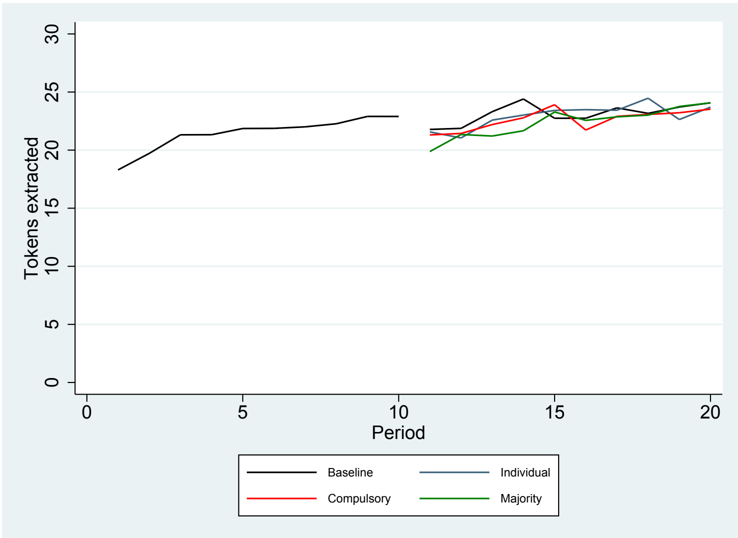

FIGURE 1.3 – Evolution of the average extraction by treatment in the social information experiment.

Table 1.3 – Panel tobit estimation of individuals extractions in the social information experiment (two sided, random effects).

	(1) All data	(2) All data
PrelevementID		
Individual	0.239	0.179
	(0.522)	(0.521)
Compulsory	0.186	-0.346
	(0.527)	(0.572)
Majority	0.520	0.514
	(0.490)	(0.489)
Sequence	-2.851***	-2.827***
	(0.493)	(0.499)
Period	0.404***	0.403***
	(0.0316)	(0.0327)
SVO_score		-10.50***
		(1.897)
Age		0.00595
		(0.0543)
Gender		-1.154
		(0.712)
Optimal_Identification		-0.738
		(0.743)
Understanding_score		0.0199
		(0.224)
_cons	20.25***	25.68***
	(0.408)	(2.436)
sigma_u		
_cons	5.420***	5.143***
	(0.280)	(0.276)
sigma_e		
_cons	6.093***	6.088***
	(0.0745)	(0.0768)
N	4900	4600

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

Result 2 *: Subjects with higher social orientation value, which can be described as cooperative type, have significantly lower extraction level.*

This result is confirmed by the strong significant negative effect of the variable SVO score (expressed in radian), on the extraction level (see table 1.3). In other words, the more an individual is concerned about equal sharing, which is an expression of the preference for altruism, the less resource he will extract. This result seems to confirm our first hypothesis H1.

Looking at other individual determinants, it is worth noticing that age and gender do not affect the extraction level. Moreover, the variable "Optimal Identification", which is a dummy variable reflecting the fact that the subject can identify the Pareto optimal extraction value, has no significant effect. This means that knowing the level of extraction that allows the resource to be preserved is not sufficient to maintain extraction at that level. In other words, even subjects who identify the optimal extraction have a high extraction due to their group dynamics. Finally, the understanding score that was calculated based on the comprehension questionnaire is not correlated with the extraction. Therefore, the level of comprehension of the game incentives did not interfere with the extraction strategy.

To better understand why the mechanisms tested in these treatments are inefficient, we analyze more deeply those group dynamics. We firstly analyze if the voluntary mechanisms were used as a signal of cooperation. Indeed, if the voluntary mechanisms are used as a signal, then individuals with lower extraction levels should be more likely to share their information and doing so, signal their types. We analyze how the voluntary display mechanism evolves through the game and how it impacts extractions. Secondly, we try to understand what drives the group dynamics. In other words :"how do subjects modify their extraction strategy considering different learning models ?"

1.5.1 Analysis of the voluntary displaying treatments

Result 3 *: The vote in favour of display is correlated with lower levels of extraction. In the first period after the introduction of the voluntary disclosure, it is used as a signal for low extractors.*

This result is supported by the panel tobit estimation presented in table 1.4, which is restricted to the voluntary treatments : Individual and Majority. The dummy variable Vote, which is equal to one when the subject was in favor of the display of his extraction level, has a significant negative impact on extraction. When individuals are in favor of information display, they have a lower extraction level. As a consequence, we argue that through the voluntary sharing mechanism, subjects do signal their types and willingness to cooperate, confirming H4.

This result is even more pronounced in the first period of these treatments, as illustrated in figures 1.4. These figures represent the spread of extraction depending on the willingness to display it in the first period of introduction of voluntary sharing mechanisms. In the Majority disclose treatment, when subjects are in favor of information display, their median extraction is 16 tokens ; whereas it is around 25 tokens when subjects are against it. This difference is also observed in the Individual disclose treatment, in which medians are respectively equal to 17.5 and 27 tokens. Those differences of extraction level due to subject willingness to display information are highly significant using Mann Whitney test ; with the p-value respectively equal 0.000 and 0.001 in Individual and Majority treatment.

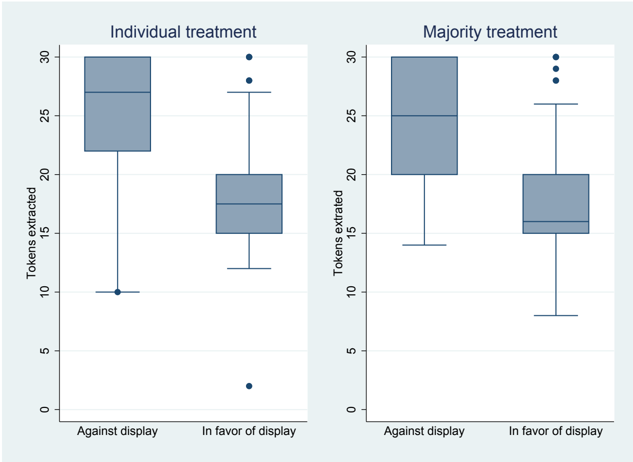

FIGURE 1.4 – Extraction level in the first period depending on the willingness to display extractions.

Nevertheless, through the game, the extraction level of subjects that express their willingness to display keeps on increasing. To such a point that at the end of the game, they are no more significantly different from subjects which are against it (as illustrated in figure 1.5).

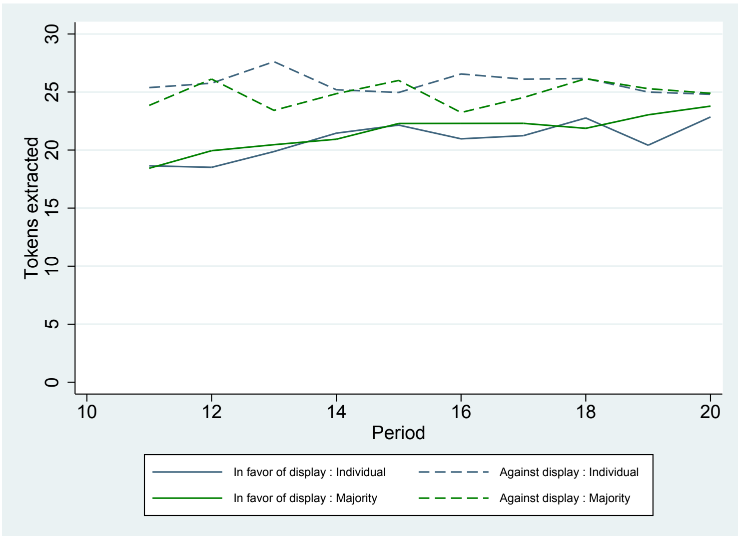

FIGURE 1.5 – Evolution of the average extraction level depending on the willingness to display extractions.

To better understand why, even though cooperators do signal their willingness to display information, these mechanisms are inefficient in generating cooperation, we have to analyze more deeply this display dynamic. Overtime does a majority of subjects declare to be in favor of display ? Then, we analyze if the fact that subjects get informed that a majority of their group members are willing to cooperate impacts their extraction level. To finish, does the display of the extractions of all group members have an impact on the individual extractions ?

Result 4 *: Getting a majority of individuals wishing to display their extractions does not induce cooperation.*

This result, which is refuting H5, is based on three intermediary results, which are presented below.

***Result 4. 1** : Overtime, a majority of groups, vote in favor of sharing information. Consequently, extractions of a majority of subjects were displayed in all periods of the game.*

This result is confirmed by the percentage of the groups having a majority of subjects (≥ 3 subjects) who were in favor of displaying extraction in each period. As illustrated in figure 1.6, on both Individual and Majority treatments, at least 50 percent of the groups get a majority of subjects who vote in favor of information display in every period.

Those percentages are sharply higher when obtaining a majority induces display all group members' extractions, i.e., in the Majority treatment. In this treatment, a majority of subjects (65.3 percent) vote between 8 and 10 times upon the 10 in favor of information display (as illustrated in figure 1.7). This distribution's difference between the two treatments is significant (Epps Singleton test, p-value 0.011). We conclude that the Majority treatment generates a broad consensus for information display, whereas Individual treatment induces a stronger heterogeneity.

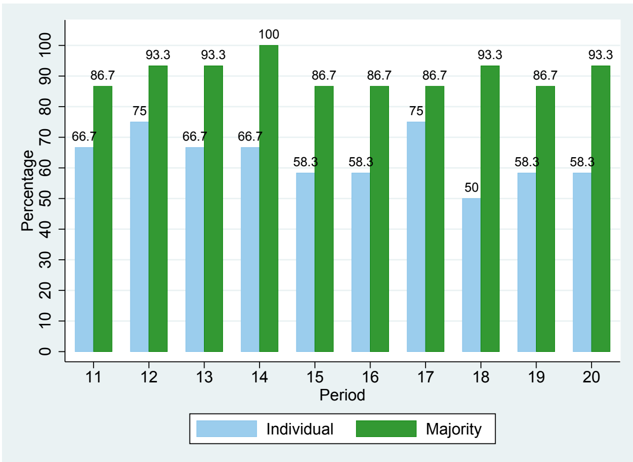

FIGURE 1.6 – Percentage of groups having a majority in favor of displaying their extractions.

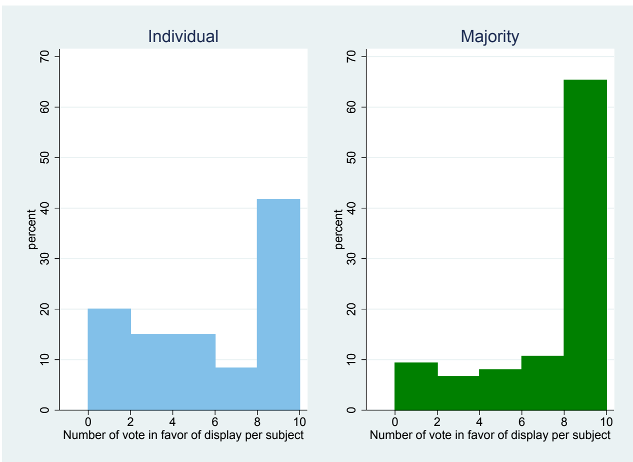

FIGURE 1.7 – Distribution of the number of vote in favor of display by subjects according to the treatment.

Result 4. 2 *: Getting the majority of subjects to vote in favor of displaying extractions has no impact on extraction levels.*

In both voluntary information treatment, subjects get the exact number of subjects who vote in favor of extractions display, before they made their extractions choices. However, the "Majority treatment" induces displaying all group member's extractions, i.e., even of those who were against it. That is the reason why the effect of receiving a signal that a majority of group members is willing to display their extractions can only be measured in the Individual treatment. The dummy variable "Majority in favor" presented in table 1.4, is equal to one if a majority of subjects in the group vote (≥ 3) in favor of information display, and send this signal before they make their extractions choices. It has no significant effect. We argue that the fact of receiving a signal that a majority of subjects is willing to share information does not, per se, induce more cooperative behaviors.

Result 4. 3 *: Displaying the extraction level of the group members does not impact the extraction level.*

This result is provided by the dummy variable "Display" presented in table 1.4 which has no significant effect on extractions. In other words, the fact of knowing that all group members' extractions will be made public do not, per se, enable the group to reduce them. We can argue that the fact of displaying extraction, when a subject was against it, can generate an even higher extraction level. However, the dummy variable "Conflict", reflecting this fact (the individual vote against information display but his group obtain a majority) does not affect the extraction level.

To conclude, in Voluntary treatments, the subjects who have a relatively lower extraction do signal their willingness to share information. However, those mechanisms are inefficient in promoting and maintaining cooperation. This inefficiency cannot be explained by the fact that a majority of subjects vote against displaying extractions. On the contrary, in all game's periods, a majority of the groups vote in favor of displaying extractions. It is especially true in the Majority treatment were information display was adopted by the quasi totality of the group in all periods of the game. That leads us to say that in this treatment, voting in favor of extractions display became a consensus. However, as we have seen, neither receiving a signal that the majority wish to display information, nor that all the choices of the group members will be made public, has an impact on the extraction behavior. It is the reason why it appears determinant to understand better what drives the group dynamic. More precisely, how do subjects modify their extractions strategy from a period to another ? To do so, we consider the different simulations we get from the learning strategies and compare them with the observations.

TABLE 1.4 – Panel tobit estimation of individuals extractions in voluntary sharing treatments (two sided, random effects).

	(1) Information treatments	(2) Individual	(3) Individual	(4) Majority	(5) Majority	(6) Majority
Vote	-3.139***	-4.210***	-4.362***	-2.121***	-2.126***	-3.994**
	(0.489)	(0.721)	(0.762)	(0.662)	(0.678)	(1.656)
Period	0.363***	0.244***	0.250***	0.448***	0.448***	0.448***
	(0.0575)	(0.0879)	(0.0883)	(0.0760)	(0.0760)	(0.0758)
SVO_score	-5.329***	-8.893**	-8.886**	-2.845	-2.844	-2.748
	(1.998)	(3.606)	(3.589)	(2.213)	(2.214)	(2.223)
Age	-0.0104	0.0623	0.0609	-0.0948	-0.0949	-0.0937
	(0.0548)	(0.0872)	(0.0868)	(0.0676)	(0.0676)	(0.0679)
Gender	-1.791**	-3.226**	-3.248**	-1.325	-1.324	-1.238
	(0.788)	(1.421)	(1.415)	(0.872)	(0.872)	(0.878)
Optimal_Identification	-1.133	-2.087	-2.148	-0.280	-0.278	-0.262
	(0.817)	(1.613)	(1.608)	(0.869)	(0.871)	(0.874)
Understanding_score	-0.134	0.146	0.166	-0.335	-0.336	-0.320
	(0.236)	(0.429)	(0.428)	(0.260)	(0.261)	(0.262)
Majority in favor			0.464			
			(0.746)			
Display					0.0324	1.273
					(0.898)	(1.344)
Conflit						-2.149
						(1.737)
_cons	25.21***	26.29***	25.87***	24.82***	24.80***	25.23***
	(2.737)	(4.416)	(4.448)	(3.331)	(3.381)	(3.410)
sigma_u						
_cons	3.973***	4.718***	4.692***	3.105***	3.105***	3.123***
	(0.330)	(0.567)	(0.567)	(0.374)	(0.375)	(0.375)
sigma_e						
_cons	5.805***	5.778***	5.776***	5.804***	5.804***	5.794***
	(0.140)	(0.216)	(0.215)	(0.183)	(0.184)	(0.183)
N	1350	600	600	750	750	750

Standard errors in parentheses

* $p<0.10$; ** $p<0.05$; *** $p<0.01$

1.5.2 Analysis of group dynamics

Result 5 *: The group extraction is driven by the adoption of the average extraction in the past period and the self-interested best reply. It leads the group extraction to increase and to converge to an extraction level which is close to Nash's equilibrium.*

This result is corroborated by the learning analysis based on the panel tobit estimation presented in table 1.5. In both sequences and for all treatments, the extraction change predicted by the "imitating the average" model and the "self-interested best response" model is significantly correlated with the observed changes. This result leads us to affirm that the "taste for conformity" and the strategic response to the actions of others are the drivers of group dynamics. These results allow us to understand the continuous increase in extraction, leading to the overexploitation of the resource. Furthermore, they confirm our H3 hypothesis and are consistent with those of the field experiment of Velez et al. (2009).

It is also interesting to note that when the actions of individuals are automatically displayed (i.e. Compulsory treatment), the imitation of the "the exemplary" is significantly correlated to the extraction dynamic. Moreover, in this treatment, average imitation seems to have less influence. Thus, it can be assumed that this treatment induces positive reciprocity. Nevertheless, given the final extraction, it is not enough to create and maintain cooperation. In order to better understand what happens in this compulsory treatment, we analyze learning strategies by distinguishing subjects according to their type. This distinction is made based on the social orientation value obtained in Murphy et al. (2011) test. We find three types : Prosocial, individualistic and competitive subjects.

TABLE 1.5 – Replication of Huck model, panel tobit estimation two sided, random effects

	(1) Baseline seq1	(2) Baseline seq1	(3) Baseline seq2	(4) Baselibe seq2	(5) Compulsory	(6) Individual	(7) Majority
Imitate the average	0.445∗∗∗	0.391∗∗∗	0.564∗∗∗	0.585∗∗∗	0.248∗	0.643∗∗∗	0.765∗∗∗
	(0.0320)	(0.0638)	(0.0625)	(0.171)	(0.135)	(0.0850)	(0.115)
Self interested best response	0.385∗∗∗	0.367∗∗∗	0.365∗∗∗	0.410∗∗∗	0.290∗∗∗	0.325∗∗∗	0.353∗∗∗
	(0.0221)	(0.0298)	(0.0416)	(0.0660)	(0.0590)	(0.0402)	(0.0421)
Maximum extraction displayed		0.0670		-0.165	0.137	-0.00655	0.00263
		(0.0546)		(0.162)	(0.124)	(0.0352)	(0.0355)
Follow the exemplary		0.000375		0.117	0.139∗∗	-0.0734	0.000914
		(0.0429)		(0.0777)	(0.0655)	(0.0493)	(0.0882)
[1em] _cons	-1.950∗∗∗	-2.307∗∗∗	-0.946∗	0.663	-1.090	-0.763∗	-1.254∗∗
	(0.258)	(0.474)	(0.501)	(1.015)	(0.851)	(0.432)	(0.552)
sigma_u							
_cons	2.912∗∗∗	2.901∗∗∗	3.305∗∗∗	3.363∗∗∗	2.788∗∗∗	2.645∗∗∗	2.694∗∗∗
	(0.227)	(0.227)	(0.442)	(0.444)	(0.414)	(0.430)	(0.346)
sigma_e							
_cons	5.198∗∗∗	5.198∗∗∗	4.064∗∗∗	4.038∗∗∗	4.220∗∗∗	4.753∗∗∗	4.949∗∗∗
	(0.0860)	(0.0860)	(0.141)	(0.140)	(0.147)	(0.160)	(0.147)
N	2205	2205	495	495	495	540	675

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

The extractions of pro-socially oriented subjects continue to be mainly correlated to the "imitation of the average" and "self-interested best reply". However, to a lesser extent, their extractions are also correlated to the model "follow the exemplary". Whereas, in comparison, the extraction dynamic of subjects with an individualistic or competitive social orientation, are mainly correlated to the "self-interested best reply", and the "imitation of the highest extraction displayed" (as illustrated in table 1.6). These results seem all the more interesting since, when subjects only obtain aggregate information, all types can only adopt the same strategy, which is a mixture of imitating the average and the best self-interested response (as illustrated in table 1.7). These results lend credence to the argument that delivering information about individuals' actions and payoffs can worsen the tragedy of the commons. In fact, as Villena and Zecchetto (2011) argue, some subjects will mimic the worst behavior, leading to faster overexploitation of the resource.

Nevertheless, further research needs to be carried out to distinguish the possible effects of information dissemination : 1) individuals' actions and 2) a complete information. Indeed, Offerman et al. (2002) in their experiment in the Cournot market show that subjects behave differently depending on whether they obtain only the individuals' actions (the quantities purchased) or individuals payoff. In the first case, they seem more inclined to imitate the smaller quantity purchased ("follow the example"). In the second case, they imitate the strategies that lead to the highest payoffs. Bigoni et al. (2012), in a public good experiment, have also shown that group contribution collapses more rapidly when subjects obtain individual earnings compared to a situation where they only receive individual contributions. They explain that some subjects, the least willing to cooperate, tend to imitate the lowest contribution in the first situation. Moreover, Croson (1995) 's experiment with the public good shows that providing individual contributions increases behavioral heterogeneity (with more free-riders and more cooperators). Nevertheless, it is interesting to note that these results appear only after the second sequence in which individuals are subjected to these conditions. In the case of our experiment, subjects are subjected to different conditions only during a sequence, which may attenuate the appearance of these differences.

To sum up, in our experiment, it results that imitating the average and the best-interested response are two reliable drivers of group dynamics. This combination can reasonably explain the tendency to exceed the Pareto optimal extraction and reach the Nash equilibrium. In doing so, the resource is overexploited. This result seems to apply to the larger part of the CPR where there is no mechanism that effectively induces cooperation. Moreover, it appears that when subjects obtain information about the actions of others, the more individualistic ones mimic the worst behavior (maximum extraction displayed). Those findings are consistent with the thesis that the dissemination of information about the actions of individuals can make the group production collapse more rapidly. It calls for further investigations to better understand how social preferences can influence how subjects respond to social information.

TABLE 1.6 – Replication of Huck model for the Complusory treatment distinguishing by subjects types, panel tobit estimation two sided, random effects.

	(1) Pro social	(2) Pro social	(3) Individualist	(4) Individualist	(5) Competitive	(6) Competitive
Imitate the average	0.576***	0.500***	0.192*	-0.404**	0.643***	-0.0802
	(0.0805)	(0.182)	(0.116)	(0.189)	(0.171)	(0.343)
Self interested best response	0.313***	0.289***	0.466***	0.310***	0.321*	0.233*
	(0.0559)	(0.0765)	(0.0774)	(0.0820)	(0.180)	(0.140)
Maximum extraction displayed		-0.0964		0.528***		0.885***
		(0.157)		(0.168)		(0.314)
Follow the exemplary		0.181*		0.0835		-0.0538
		(0.0969)		(0.103)		(0.173)
_cons	-2.062***	-0.399	-1.081*	-3.227***	1.243	-3.213
	(0.682)	(1.137)	(0.569)	(1.248)	(1.219)	(2.179)
sigma_u						
_cons	3.229***	3.126***	1.376*	8.92e-17	1.684	0.701
	(0.564)	(0.560)	(0.715)	(1.300)	(1.144)	(1.359)
sigma_e						
_cons	4.138***	4.119***	4.343***	4.377***	4.291***	4.167***
	(0.187)	(0.187)	(0.278)	(0.250)	(0.458)	(0.442)
N	288	288	153	153	54	54

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

Table 1.7 – Replication of Huck model for the Baseline conditions during sequence distinguishing by subjects types, panel tobit estimation two sided, random effects.

	(1) Pro social	(2) Pro social	(3) Individualist	(4) Individualist	(5) Competitive	(6) Competitive
Imitate the average	0.451***	0.408***	0.431***	0.324***	0.534***	0.596**
	(0.0423)	(0.0880)	(0.0506)	(0.0990)	(0.136)	(0.244)
Self interested best response	0.392***	0.379***	0.353***	0.308***	0.532***	0.566***
	(0.0295)	(0.0406)	(0.0351)	(0.0484)	(0.0852)	(0.114)
Maximum extraction displayed		0.0435		0.156		-0.128
		(0.0707)		(0.0956)		(0.224)
Follow the exemplary		0.00665		-0.0000583		0.0213
		(0.0609)		(0.0658)		(0.145)
_cons	-2.774***	-2.957***	-0.881**	-1.724**	-1.325	-0.559
	(0.330)	(0.636)	(0.396)	(0.767)	(1.542)	(2.069)
sigma_u						
_cons	2.331***	2.308***	2.826***	2.888***	5.841***	5.723***
	(0.284)	(0.287)	(0.361)	(0.363)	(1.281)	(1.283)
sigma_e						
_cons	5.378***	5.381***	4.989***	4.970***	4.648***	4.653***
	(0.119)	(0.119)	(0.135)	(0.134)	(0.289)	(0.290)
N	1224	1224	828	828	153	153

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

1.6 Discussion

This study aims to analyze how social information can impact subjects' extraction behavior in a CPR context. To do so, we focus on two dimensions : i) the effect of providing information about the actions of other group members (i.e. social information), and ii) the effect of the voluntary disclosure of this information.

The voluntary dimension in the information disclosure did not foster collective action in a CPR context. In fact, contrary to the results found by Kreitmair (2015) in a public good experiment, we did not find that enabling subjects to vote if they want their actions to be displayed, and informing them about the vote result before they make their decisions, increases cooperation. This difference in efficiency may be due to the rivalry inherent in the common pool context. However, it is worth noticing that voluntary mechanisms are used as a signal of the willingness to cooperate. The willingness to display extraction is correlated with lower extraction levels. It is particularly true during the first period after the introduction of those mechanisms, where the extraction levels of subjects who vote in favor of disclosure are significantly lower than those observed for subjects who vote against it. Nevertheless, this signal is inefficient to induce cooperation. Indeed, through periods, the extraction level of subjects willing to disclose information keeps on increasing, following the group dynamic. This inefficiency cannot be explained by the fact that only a small percentage of subjects vote in favor of information disclosed, and only a small part of the groups gets a majority who was in favor of information display. In fact, at every period at least 50 percent of the groups had a majority of subjects that was in favor of displaying their extractions. In the Majority treatment, the percentage is even higher than 80 percent on average for all the groups. It leads us to argue that, in this treatment, delivering information became a consensus. As a consequence, receiving the signal that a majority is willing to display information does not enable to generate cooperation of all group members, even when it is a credible signal of the willingness to reduce extraction.

The provision of information on the actions of other members does not in itself generate cooperation in CPR context. For all treatments, i.e. with only aggregated information or with individual information, group extraction continues to increase, exceeding the Pareto optimum and leading to the Nash equilibrium. The analytical framework we have developed provides some explanation for these results. Indeed, for subjects with prosocial preferences (willing to reciprocate or with inequality aversion) or with a taste for conformity, the provision of social information could lead to an increase in their extractions.

The analysis of how information is used to modify the extraction strategies seems to point out the same explanation. The learning analysis enables us to identify that "imitating the average" as well as the "self-interested best reply" are the models who best explain the extractions observed. This result shows that the taste of conformity may play a substantial role in the observed behaviors. Our results partially confirmed Velez et al. (2009) ones, who found that the best reply integrating a preference for conformity in the utility function is the one that best explains their observations. This result also confirms the convergence of behaviors to the average of the actions displayed observed in other experiments (Schultz, 1999 ; Schultz et al., 2007 ; Croson & Shang, 2008). When we distinguish the analysis by type of subjects, we find that when the actions of individuals are displayed, subjects with an individualistic orientation of social values tend to imitate the worst (most extractive) behaviors. In comparison, prosocial subjects seem to keep the same behavior, which is a mixture of imitating the average and the self-interested best reply. The attitude of subjects with an individualistic and competitive social orientation thus seems to induce an increase in average extraction. Because of the dynamics of conformity and reciprocity, the latter is amplified. This result gives credence to the argument that delivering information about individuals' actions and payoffs can worsen the collective action dynamic (Villena & Zecchetto, 2011 ; Bigoni et al., 2012), or lead to more competitive behaviors in different contexts (Huck et al., 1999 ; Offerman et al., 2002 and Huck et al., 2017). Nevertheless, the difference in the potential effect of displaying individuals' actions and displaying individuals' earnings in the CPR is not yet clear.

Those results call for more investigation about how social information, and more precisely how different kinds of feedback (i.e. information on the actions carried out by the co-users) impact natural resource management. Indeed, in most real-life situations, users do not have the information about the total group extraction (X) nor the average members' extraction ($\bar{x_j}$). There are substantial reasons to think that delivering this information can impact the subjects' behaviors. Paying particular attention to how information is used according to the types of subjects may be an interesting research path. Moreover, in real situations, we can consider that some subjects might be sensitive to their image. It implies that their utilities are affected by the moral cost of their actions, and this latter is even higher when their wrong actions are made public (Levitt & List, 2007). In this case, information disclosure can have an impact, and more specifically, it can reinforce the disapproval mechanisms (both symbolic and costly ones). Finally, little is known about the effects of the informational mechanism (such as the addition of an injunctive norm) in a context where users are strictly dependent on the resource and rivals in its use, such as those characterizing many CPR.

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Appendices of chapter 1

1.A Instructions of the social information experiment

1.A.1 Common pool resource

Here are presented the translate of the experiment instructions we used. There originally were given in french.

Welcome

The experiment you are going to participate in is for the study of decision making. We ask you to read the instructions carefully. They must enable you to understand the experiment. When all the participants have read them, an experimenter will read them aloud.

All your decisions will be treated anonymously. You will indicate your choices to the computer in front of which you are sitting.

During the experiment, you will accumulate gains expressed in ECU. At the end of the experiment, your ECU will be converted into euros according to a conversion rate which is specified at the end of these instructions.

This experiment has three parts. From now on, we ask you to stop talking. If you have a question, raise your hand and an experimenter will come to answer you in private. The attached instructions are from Part 1. The instructions in Part 2 and 3 will be distributed at the end of each game.

Part 1

1. General framework

At the beginning of the experiment, the central computer will randomly train **groups of 5**. The **composition of these groups will remain unchanged** throughout the game. In each group each will be assigned an identifier, A, B, C, D or E, which he will keep for the whole game.

The game has **10 periods**. In each period, **you** and the **four other people** in your group will have to decide each one of the number of chips to be charged in a common account.

Each token charged earns **BENEFIT**, explained below, and generates a COST, which depends on total extraction made by the group (your extraction + the extraction of others). The calculation COST of levy is detailed in the following instructions.

At each period, your **PAYOFF** will be equal to the difference between your income and your cost. **PAYOFF= BENEFIT – COST**

2. Benefit

Each token collected earns benefit as described in Table 1. Each cell in the table indicates the benefit according to the quantity taken. Each member of the group can collect at **maximum 30 tokens.** *Example 1 : You decide to take 15 tokens. Your benefit will be 57.54 ECU.*

Tokens extracted	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Benefit	**3,9**	**7,8**	**11,6**	**15,5**	**19,4**	**23,2**	**27,1**	**30,9**	**34,7**	**38,5**	**42,4**	**46,2**	**50,0**	**53,8**	**57,5**

Tokens extracted	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Benefit	**61,3**	**65,1**	**68,9**	**72,6**	**76,4**	**80,1**	**83,8**	**87,6**	**91,3**	**95,0**	**98,7**	**102,4**	**106,1**	**109,8**	**113,5**

3. Extraction cost

Unity cost of extraction :

Each token collected generates a cost that depends not only on the amount of tokens you collect, but also the amount taken by the other members of your group. The more the number of tokens collected by your group is high, the higher the unit cost of extraction will be. The rule is the following : the cost of the first token is equal to 0.05 ECU and each additional token costs 0,05 ECU in addition to the previous one.

Example 2 : Your group collects 30 tokens. The first token costs 0.05 ECU, the second token costs 0.10 ECU, the third costs 0.15 ECU and so on until the 30th, which will cost 1.50 ECU.

Average cost of extraction :

The AVERAGE Token Cost in a round will be the same for each participant. The "average token cost" in a given decision round can easily be computed as :

[(BASE COST)+(COST OF THE LAST TOKEN ORDERED IN THE ROUND)]/2

Example 2 (follow) : The first token costs 0.05 ECU and the last (the thirtieth) 1.50 ECU. The average cost per token for a 30 token is therefore equal to (0.05 + 1.50) / 2 = 0.775 ECU per token.

Individual extraction cost :

The **individual cost** of each member depends on the amount collected. Precisely, the individual cost is equal to the **individual quantity extracted** multiplied by the **average cost**.

Example 2 (follow) : If the average cost is 0.775 ECU and you take 6 tokens out of 30 tokens extracted by your group (which corresponds to an extraction of 24 tokens made by the other four members), your individual cost is equal to 6 0.775 = 4.65 ECU.

It is the **individual cost** of extraction that will be deducted from your benefit to determine your payoff during the period.

Table 2 shows the cost of extraction. Each cell indicates your **individual cost of extraction** based on your **own extraction and the extraction of 4 other members of your group**. This table is identical for all members of your group.

Cost of your order		Tokens you order																													
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Tokens order by the 4 others players in your group	0	-	0,1	0,2	0,3	0,5	0,8	1,1	1,4	1,8	2,3	2,8	3,3	3,9	4,6	5,3	6,0	6,8	7,7	8,6	9,5	10,5	11,6	12,7	13,8	15,0	16,3	17,6	18,9	20,3	21,8	23,3
	4	-	0,2	0,4	0,6	0,9	1,3	1,7	2,1	2,6	3,2	3,8	4,4	5,1	5,9	6,7	7,5	8,4	9,4	10,4	11,4	12,5	13,7	14,9	16,1	17,4	18,8	20,2	21,6	23,1	24,7	26,3
	8	-	0,3	0,6	0,9	1,3	1,8	2,3	2,8	3,4	4,1	4,8	5,5	6,3	7,2	8,1	9,0	10,0	11,1	12,2	13,3	14,5	15,8	17,1	18,4	19,8	21,3	22,8	24,3	25,9	27,6	29,3
	12	-	0,4	0,8	1,2	1,7	2,3	2,9	3,5	4,2	5,0	5,8	6,6	7,5	8,5	9,5	10,5	11,6	12,8	14,0	15,2	16,5	17,9	19,3	20,7	22,2	23,8	25,4	27,0	28,7	30,5	32,3
	16	-	0,5	1,0	1,5	2,1	2,8	3,5	4,2	5,0	5,9	6,8	7,7	8,7	9,8	10,9	12,0	13,2	14,5	15,8	17,1	18,5	20,0	21,5	23,0	24,6	26,3	28,0	29,7	31,5	33,4	35,3
	20	-	0,6	1,2	1,8	2,5	3,3	4,1	4,9	5,8	6,8	7,8	8,8	9,9	11,1	12,3	13,5	14,8	16,2	17,6	19,0	20,5	22,1	23,7	25,3	27,0	28,8	30,6	32,4	34,3	36,3	38,3
	24	-	0,7	1,4	2,1	2,9	3,8	4,7	5,6	6,6	7,7	8,8	9,9	11,1	12,4	13,7	15,0	16,4	17,9	19,4	20,9	22,5	24,2	25,9	27,6	29,4	31,3	33,2	35,1	37,1	39,2	41,3
	28	-	0,8	1,6	2,4	3,3	4,3	5,3	6,3	7,4	8,6	9,8	11,0	12,3	13,7	15,1	16,5	18,0	19,6	21,2	22,8	24,5	26,3	28,1	29,9	31,8	33,8	35,8	37,8	39,9	42,1	44,3
	32	-	0,9	1,8	2,7	3,7	4,8	5,9	7,0	8,2	9,5	10,8	12,1	13,5	15,0	16,5	18,0	19,6	21,3	23,0	24,7	26,5	28,4	30,3	32,2	34,2	36,3	38,4	40,5	42,7	45,0	47,3
	36	-	1,0	2,0	3,0	4,1	5,3	6,5	7,7	9,0	10,4	11,8	13,2	14,7	16,3	17,9	19,5	21,2	23,0	24,8	26,6	28,5	30,5	32,5	34,5	36,6	38,8	41,0	43,2	45,5	47,9	50,3
	40	-	1,1	2,2	3,3	4,5	5,8	7,1	8,4	9,8	11,3	12,8	14,3	15,9	17,6	19,3	21,0	22,8	24,7	26,6	28,5	30,5	32,6	34,7	36,8	39,0	41,3	43,6	45,9	48,3	50,8	53,3
	44	-	1,2	2,4	3,6	4,9	6,3	7,7	9,1	10,6	12,2	13,8	15,4	17,1	18,9	20,7	22,5	24,4	26,4	28,4	30,4	32,5	34,7	36,9	39,1	41,4	43,8	46,2	48,6	51,1	53,7	56,3
	48	-	1,3	2,6	3,9	5,3	6,8	8,3	9,8	11,4	13,1	14,8	16,5	18,3	20,2	22,1	24,0	26,0	28,1	30,2	32,3	34,5	36,8	39,1	41,4	43,8	46,3	48,8	51,3	53,9	56,6	59,3
	52	-	1,4	2,8	4,2	5,7	7,3	8,9	10,5	12,2	14,0	15,8	17,6	19,5	21,5	23,5	25,5	27,6	29,8	32,0	34,2	36,5	38,9	41,3	43,7	46,2	48,8	51,4	54,0	56,7	59,5	62,3
	56	-	1,5	3,0	4,5	6,1	7,8	9,5	11,2	13,0	14,9	16,8	18,7	20,7	22,8	24,9	27,0	29,2	31,5	33,8	36,1	38,5	41,0	43,5	46,0	48,6	51,3	54,0	56,7	59,5	62,4	65,3
	60	-	1,6	3,2	4,8	6,5	8,3	10,1	11,9	13,8	15,8	17,8	19,8	21,9	24,1	26,3	28,5	30,8	33,2	35,6	38,0	40,5	43,1	45,7	48,3	51,0	53,8	56,6	59,4	62,3	65,3	68,3
	64	-	1,7	3,4	5,1	6,9	8,8	10,7	12,6	14,6	16,7	18,8	20,9	23,1	25,4	27,7	30,0	32,4	34,9	37,4	39,9	42,5	45,2	47,9	50,6	53,4	56,3	59,2	62,1	65,1	68,2	71,3
	68	-	1,8	3,6	5,4	7,3	9,3	11,3	13,3	15,4	17,6	19,8	22,0	24,3	26,7	29,1	31,5	34,0	36,6	39,2	41,8	44,5	47,3	50,1	52,9	55,8	58,8	61,8	64,8	67,9	71,1	74,3
	72	-	1,9	3,8	5,7	7,7	9,8	11,9	14,0	16,2	18,5	20,8	23,1	25,5	28,0	30,5	33,0	35,6	38,3	41,0	43,7	46,5	49,4	52,3	55,2	58,2	61,3	64,4	67,5	70,7	74,0	77,3
	76	-	2,0	4,0	6,0	8,1	10,3	12,5	14,7	17,0	19,4	21,8	24,2	26,7	29,3	31,9	34,5	37,2	40,0	42,8	45,6	48,5	51,5	54,5	57,5	60,6	63,8	67,0	70,2	73,5	76,9	80,3
	80	-	2,1	4,2	6,3	8,5	10,8	13,1	15,4	17,8	20,3	22,8	25,3	27,9	30,6	33,3	36,0	38,8	41,7	44,6	47,5	50,5	53,6	56,7	59,8	63,0	66,3	69,6	72,9	76,3	79,8	83,3
	84	-	2,2	4,4	6,6	8,9	11,3	13,7	16,1	18,6	21,2	23,8	26,4	29,1	31,9	34,7	37,5	40,4	43,4	46,4	49,4	52,5	55,7	58,9	62,1	65,4	68,8	72,2	75,6	79,1	82,7	86,3
	88	-	2,3	4,6	6,9	9,3	11,8	14,3	16,8	19,4	22,1	24,8	27,5	30,3	33,2	36,1	39,0	42,0	45,1	48,2	51,3	54,5	57,8	61,1	64,4	67,8	71,3	74,8	78,3	81,9	85,6	89,3
	92	-	2,4	4,8	7,2	9,7	12,3	14,9	17,5	20,2	23,0	25,8	28,6	31,5	34,5	37,5	40,5	43,6	46,8	50,0	53,2	56,5	59,9	63,3	66,7	70,2	73,8	77,4	81,0	84,7	88,5	92,3
	96	-	2,5	5,0	7,5	10,1	12,8	15,5	18,2	21,0	23,9	26,8	29,7	32,7	35,8	38,9	42,0	45,2	48,5	51,8	55,1	58,5	62,0	65,5	69,0	72,6	76,3	80,0	83,7	87,5	91,4	95,3
	100	-	2,6	5,2	7,8	10,5	13,3	16,1	18,9	21,8	24,8	27,8	30,8	33,9	37,1	40,3	43,5	46,8	50,2	53,6	57,0	60,5	64,1	67,7	71,3	75,0	78,8	82,6	86,4	90,3	94,3	98,3
	104	-	2,7	5,4	8,1	10,9	13,8	16,7	19,6	22,6	25,7	28,8	31,9	35,1	38,4	41,7	45,0	48,4	51,9	55,4	58,9	62,5	66,2	69,9	73,6	77,4	81,3	85,2	89,1	93,1	97,2	101,3
	108	-	2,8	5,6	8,4	11,3	14,3	17,3	20,3	23,4	26,6	29,8	33,0	36,3	39,7	43,1	46,5	50,0	53,6	57,2	60,8	64,5	68,3	72,1	75,9	79,8	83,8	87,8	91,8	95,9	100,1	104,3
	112	-	2,9	5,8	8,7	11,7	14,8	17,9	21,0	24,2	27,5	30,8	34,1	37,5	41,0	44,5	48,0	51,6	55,3	59,0	62,7	66,5	70,4	74,3	78,2	82,2	86,3	90,4	94,5	98,7	103,0	107,3
	116	-	3,0	6,0	9,0	12,1	15,3	18,5	21,7	25,0	28,4	31,8	35,2	38,7	42,3	45,9	49,5	53,2	57,0	60,8	64,6	68,5	72,5	76,5	80,5	84,6	88,8	93,0	97,2	101,5	105,9	110,3
	120	-	3,1	6,2	9,3	12,5	15,8	19,1	22,4	25,8	29,3	32,8	36,3	39,9	43,6	47,3	51,0	54,8	58,7	62,6	66,5	70,5	74,6	78,7	82,8	87,0	91,3	95,6	99,9	104,3	108,8	113,3

4. Payoff for the period

Your payoff in each period is equal to the difference between your Benefit and your individual cost of extraction. To make it easier for you to identify your potential winnings in each period, Table 3 shows your payoff based on your extraction and the extraction of the other 4 members of your group. Table 3 was constructed by differentiating between the benefits table (Table 1) and the cost table (Table 2).

Example 3 : You decide to collect 20 tokens, the other four members of the group take 20 tokens each (a total extraction of 80). You get a gain of 25.9 ECU.

Example 4 : You decide to collect 20 tokens, the other four members of the group take 10 tokens each (a total extraction of 40). You get a gain of 45.9 ECU.

5. Explanation of the method of remuneration and the conversion of ECU into euros

You will be paid according to the earnings you have earned during a period. This period will be randomly drawn from among the 20 periods comprising all of the two parts, that is to say, this part and the one that will follow (whose instructions will be distributed to you later). The draw will be done at the end of the game.

The conversion rate of ECU into euros is 0.75. For example, if you earn 20 ECU you will get 15 euros.

Your payoff		Tokens you order																														
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Tokens order by the 4 others players of your group	0	0	3,8	7,6	11,3	15,0	18,6	22,2	25,7	29,1	32,5	35,8	39,1	42,3	45,4	48,5	51,5	54,5	57,4	60,3	63,1	65,9	68,6	71,2	73,8	76,3	78,8	81,2	83,5	85,8	88,0	90,2
	4	0	3,7	7,4	11,0	14,6	18,1	21,6	25,0	28,3	31,6	34,8	38,0	41,1	44,1	47,1	50,0	52,9	55,7	58,5	61,2	63,9	66,5	69,0	71,5	73,9	76,3	78,6	80,8	83,0	85,1	87,2
	8	0	3,6	7,2	10,7	14,2	17,6	21,0	24,3	27,5	30,7	33,8	36,9	39,9	42,8	45,7	48,5	51,3	54,0	56,7	59,3	61,9	64,4	66,8	69,2	71,5	73,8	76,0	78,1	80,2	82,2	84,2
	12	0	3,5	7,0	10,4	13,8	17,1	20,4	23,6	26,7	29,8	32,8	35,8	38,7	41,5	44,3	47,0	49,7	52,3	54,9	57,4	59,9	62,3	64,6	66,9	69,1	71,3	73,4	75,4	77,4	79,3	81,2
	16	0	3,4	6,8	10,1	13,4	16,6	19,8	22,9	25,9	28,9	31,8	34,7	37,5	40,2	42,9	45,5	48,1	50,6	53,1	55,5	57,9	60,2	62,4	64,6	66,7	68,8	70,8	72,7	74,6	76,4	78,2
	20	0	3,3	6,6	9,8	13,0	16,1	19,2	22,2	25,1	28,0	30,8	33,6	36,3	38,9	41,5	44,0	46,5	48,9	51,3	53,6	55,9	58,1	60,2	62,3	64,3	66,3	68,2	70,0	71,8	73,5	75,2
	24	0	3,2	6,4	9,5	12,6	15,6	18,6	21,5	24,3	27,1	29,8	32,5	35,1	37,6	40,1	42,5	44,9	47,2	49,5	51,7	53,9	56,0	58,0	60,0	61,9	63,8	65,6	67,3	69,0	70,6	72,2
	28	0	3,1	6,2	9,2	12,2	15,1	18,0	20,8	23,5	26,2	28,8	31,4	33,9	36,3	38,7	41,0	43,3	45,5	47,7	49,8	51,9	53,9	55,8	57,7	59,5	61,3	63,0	64,6	66,2	67,7	69,2
	32	0	3,0	6,0	8,9	11,8	14,6	17,4	20,1	22,7	25,3	27,8	30,3	32,7	35,0	37,3	39,5	41,7	43,8	45,9	47,9	49,9	51,8	53,6	55,4	57,1	58,8	60,4	61,9	63,4	64,8	66,2
	36	0	2,9	5,8	8,6	11,4	14,1	16,8	19,4	21,9	24,4	26,8	29,2	31,5	33,7	35,9	38,0	40,1	42,1	44,1	46,0	47,9	49,7	51,4	53,1	54,7	56,3	57,8	59,2	60,6	61,9	63,2
	40	0	2,8	5,6	8,3	11,0	13,6	16,2	18,7	21,1	23,5	25,8	28,1	30,3	32,4	34,5	36,5	38,5	40,4	42,3	44,1	45,9	47,6	49,2	50,8	52,3	53,8	55,2	56,5	57,8	59,0	60,2
	44	0	2,7	5,4	8,0	10,6	13,1	15,6	18,0	20,3	22,6	24,8	27,0	29,1	31,1	33,1	35,0	36,9	38,7	40,5	42,2	43,9	45,5	47,0	48,5	49,9	51,3	52,6	53,8	55,0	56,1	57,2
	48	0	2,6	5,2	7,7	10,2	12,6	15,0	17,3	19,5	21,7	23,8	25,9	27,9	29,8	31,7	33,5	35,3	37,0	38,7	40,3	41,9	43,4	44,8	46,2	47,5	48,8	50,0	51,1	52,2	53,2	54,2
	52	0	2,5	5,0	7,4	9,8	12,1	14,4	16,6	18,7	20,8	22,8	24,8	26,7	28,5	30,3	32,0	33,7	35,3	36,9	38,4	39,9	41,3	42,6	43,9	45,1	46,3	47,4	48,4	49,4	50,3	51,2
	56	0	2,4	4,8	7,1	9,4	11,6	13,8	15,9	17,9	19,9	21,8	23,7	25,5	27,2	28,9	30,5	32,1	33,6	35,1	36,5	37,9	39,2	40,4	41,6	42,7	43,8	44,8	45,7	46,6	47,4	48,2
	60	0	2,3	4,6	6,8	9,0	11,1	13,2	15,2	17,1	19,0	20,8	22,6	24,3	25,9	27,5	29,0	30,5	31,9	33,3	34,6	35,9	37,1	38,2	39,3	40,3	41,3	42,2	43,0	43,8	44,5	45,2
	64	0	2,2	4,4	6,5	8,6	10,6	12,6	14,5	16,3	18,1	19,8	21,5	23,1	24,6	26,1	27,5	28,9	30,2	31,5	32,7	33,9	35,0	36,0	37,0	37,9	38,8	39,6	40,3	41,0	41,6	42,2
	68	0	2,1	4,2	6,2	8,2	10,1	12,0	13,8	15,5	17,2	18,8	20,4	21,9	23,3	24,7	26,0	27,3	28,5	29,7	30,8	31,9	32,9	33,8	34,7	35,5	36,3	37,0	37,6	38,2	38,7	39,2
	72	0	2,0	4,0	5,9	7,8	9,6	11,4	13,1	14,7	16,3	17,8	19,3	20,7	22,0	23,3	24,5	25,7	26,8	27,9	28,9	29,9	30,8	31,6	32,4	33,1	33,8	34,4	34,9	35,4	35,8	36,2
	76	0	1,9	3,8	5,6	7,4	9,1	10,8	12,4	13,9	15,4	16,8	18,2	19,5	20,7	21,9	23,0	24,1	25,1	26,1	27,0	27,9	28,7	29,4	30,1	30,7	31,3	31,8	32,2	32,6	32,9	33,2
	80	0	1,8	3,6	5,3	7,0	8,6	10,2	11,7	13,1	14,5	15,8	17,1	18,3	19,4	20,5	21,5	22,5	23,4	24,3	25,1	25,9	26,6	27,2	27,8	28,3	28,8	29,2	29,5	29,8	30,0	30,2
	84	0	1,7	3,4	5,0	6,6	8,1	9,6	11,0	12,3	13,6	14,8	16,0	17,1	18,1	19,1	20,0	20,9	21,7	22,5	23,2	23,9	24,5	25,0	25,5	25,9	26,3	26,6	26,8	27,0	27,1	27,2
	88	0	1,6	3,2	4,7	6,2	7,6	9,0	10,3	11,5	12,7	13,8	14,9	15,9	16,8	17,7	18,5	19,3	20,0	20,7	21,3	21,9	22,4	22,8	23,2	23,5	23,8	24,0	24,1	24,2	24,2	24,2
	92	0	1,5	3,0	4,4	5,8	7,1	8,4	9,6	10,7	11,8	12,8	13,8	14,7	15,5	16,3	17,0	17,7	18,3	18,9	19,4	19,9	20,3	20,6	20,9	21,1	21,3	21,4	21,4	21,4	21,3	21,2
	96	0	1,4	2,8	4,1	5,4	6,6	7,8	8,9	9,9	10,9	11,8	12,7	13,5	14,2	14,9	15,5	16,1	16,6	17,1	17,5	17,9	18,2	18,4	18,6	18,7	18,8	18,8	18,7	18,6	18,4	18,2
	100	0	1,3	2,6	3,8	5,0	6,1	7,2	8,2	9,1	10,0	10,8	11,6	12,3	12,9	13,5	14,0	14,5	14,9	15,3	15,6	15,9	16,1	16,2	16,3	16,3	16,3	16,2	16,0	15,8	15,5	15,2
	104	0	1,2	2,4	3,5	4,6	5,6	6,6	7,5	8,3	9,1	9,8	10,5	11,1	11,6	12,1	12,5	12,9	13,2	13,5	13,7	13,9	14,0	14,0	14,0	13,9	13,8	13,6	13,3	13,0	12,6	12,2
	108	0	1,1	2,2	3,2	4,2	5,1	6,0	6,8	7,5	8,2	8,8	9,4	9,9	10,3	10,7	11,0	11,3	11,5	11,7	11,8	11,9	11,9	11,8	11,7	11,5	11,3	11,0	10,6	10,2	9,7	9,2
	112	0	1,0	2,0	2,9	3,8	4,6	5,4	6,1	6,7	7,3	7,8	8,3	8,7	9,0	9,3	9,5	9,7	9,8	9,9	9,9	9,9	9,8	9,6	9,4	9,1	8,8	8,4	7,9	7,4	6,8	6,2
	116	0	0,9	1,8	2,6	3,4	4,1	4,8	5,4	5,9	6,4	6,8	7,2	7,5	7,7	7,9	8,0	8,1	8,1	8,1	8,0	7,9	7,7	7,4	7,1	6,7	6,3	5,8	5,2	4,6	3,9	3,2
	120	0	0,8	1,6	2,3	3,0	3,6	4,2	4,7	5,1	5,5	5,8	6,1	6,3	6,4	6,5	6,5	6,5	6,4	6,3	6,1	5,9	5,6	5,2	4,8	4,3	3,8	3,2	2,5	1,8	1,0	0,2

Summary of this part This part has 10 periods. At the beginning of the period you are asked to indicate the amount of tokens you extract.

At the end of each period, you will be informed about : 1) The total number of tokens collected by your group 2) The average cost of extraction 3) Of your benefit, the cost of your extraction and your payoff for this period

Part 2

[Baseline]

This is exactly the same game as in the previous part.

As with Part 1, in each period, you and the other four people in your group will have to decide how many tokens to extract from a common account. The calculation of earnings and the conversion rate are identical to those in Part 1.

Similarly, the composition of the groups is identical to that of part 1. So you are in the same group as before. You also keep your ID of the previous part and this during the 10 periods of this game.

Summary of this part

This part has 10 periods. At the beginning of the period you are asked to indicate the amount of tokens you extract.

At the end of each period, you will be informed about : 1) The total number of tokens collected by your group 2) The average cost of extraction 3) Of your benefit, the cost of your extraction and your payoff for this period

[Compulsory]

However, in this section 2, the withdrawals of all members of your group (you and the other four members of the group) will be displayed at the end of each period. Example : You are member A and the other members are B, C, D and E. At the end of each period you will know the number of tokens extracted by B, C, D and E.

At the end of each period, you will be informed about : + 4) Individual quantities extracted by all members of your group.

[Individual]

Nevertheless, in this part 2, at each period before making your extraction decision the computer will ask you whether you want to display your extraction of the period or not. Before making your extraction decision, you will know how many members of your group have decided to display their decision. At the end of the period the extractions of members who have agreed to display them will be known to all members of your group.

Example : You are member A and the other members are B, C, D and E. In period 5 you decide to display your extraction. Similarly, members C and E decide to display their extractions. At the beginning of period 5 you will be informed that 3 members of your group (including you) have decided to display their extractions. At the end of Period 5, withdrawals of A (you), C and E members will be displayed. On the other hand, the extraction of the members B and D will not be displayed, it will be written "NA".

At the end of each period, you will be informed about : + 4) Individual extractions of members of your group who have agreed to display them.

[Majority]

Nevertheless, in this part 2, at each period before making your extraction decision the computer will ask you whether you want to display your extraction of the period or not. If the majority of people in your group, i.e. at least 3 people, accept then all the individual extractions will be known to all members of your group at the end of the period. Before making your decision to collect, you will know the result of the vote.

At the end of each period, you will be informed about : + 4) Individual extraction of all members of your group if the majority of people wished to display their extractions.

1.A.2 Social Value Orientation estimation

In this experiment, you have to decide how to share an amont between you and "another person". This other person is in this room, and will be randomly selected and the end of of the experiment. You can not identify her and she can not identify you. All your choies are completely confidential.

Concretely, you have to select one the between 9 distributions proposed. There are no right or wrong answers. You have to choose the distribution you prefered. You have to make this choice 15 times through 15 screens that present differents distribution proposal.

Once all the people present in this room, have answer the question, the computer will randomly select on of the 15 propositions. This will be paied depending of your choice. The part dedicated to the "other person" will be sent to a subject selected randomly.

You will also receive the "Other Person" share resulting from the choices of another individual present in this room who will also be selected randomly at the end of the game.

The results of this experiment will be communicated to you at the end of the session, and you will receive at that time the amount corresponding to your winnings.

In this experiment we used an experimental currency : ECU. The ECU you accumulate during the experiment will be converted into euros with a conversion rate of 0.01 . One hundred ECU will therefore correspond to 1 euro.

1.A.3 Understanding questions in the social information experiment

1) Including you, your group is composed of :
— i. 3 people
— ii. 4 people
— iii. 5 people
Answer posted : The correct answer was : 5 people. In your group, there are 4 other players plus.

2) Do you change group each period ?
— i. True
— ii. False
Answer posted : The correct answer was : False. You keep the same group during the ten periods of this game.

3) Your compensation will depend on the earnings you got during
— i. of all the periods of a game randomly drawn
— ii. of a single period randomly drawn on the two parts
— iii. of all periods of the two parts
Answer posted : The correct answer was : only one period drawn on the two parts.

4) Your BENEFIT during a period depends
— i. Only on your extraction
— ii. On the extraction of other members of your group
— iii. On your extraction and the extraction of other members of your group
Answer posted : The correct answer was : your BENEFIT depends solely on your extraction/

5) Your Individual Extraction Cost during a period depends
— i. Only on your extraction
— ii. On the extraction of other members of your group
— iii. On your extraction and the extraction of other members of your group
Answer posted : The correct answer was : your extraction and the extraction of the 4 other members of your group. Indeed, your individual cost = your extraction level * average cost of extraction. But the average cost depends on the total extraction of the entire group : your extraction + that of the other 4 people.

6) Your PAYOFF during a period depends :
— i. Only on your extraction
— ii. Only on the extraction of other members of your group
— iii. On your extraction and the extraction of other members of your group
Answer posted : The correct answer was : your extraction and the extraction of the 4 other members of your group. Your PAYOFF = BENEFIT - Individual Extraction Cost.

7) You take 14 tokens, the other people in your group also draw 14 tokens each : a) Your BENEFIT for these extractions decisions is from ?
— i. 53,8 ECU
— ii. 14,4 ECU
Answer posted : The correct answer was : 53.8 ecu. Your benefit is explained in Table 1

8) You take 14 tokens, the other people in your group also draw 14 tokens each : b) What is

the total group extraction ?

— i. 56 Tokens

— ii. 70 Tokens

Answer posted : The correct answer was : 70 tokens. That's 14 * 5 people.

9) You take 14 tokens, the other people in your group also draw 14 tokens each : c) What is the total extraction from the 4 other person of your group ?

— i. 42 Tokens

— ii. 56 Tokens

Answer posted : The correct answer was : 56 tokens. 14 * 4 other members of the group.

10) You take 14 tokens, the other people in your group also draw 14 tokens each : d) What is the average cost of extraction ? Use the formula : $(Costofthefirsttoken + Costofthelasttoken)/2$

— i. 1,775=(0,05 + 70*0,05)/2

— ii. 1,425=(0,05 + 56*0,05)/2

Answer posted : The correct answer was : 1,775 ecu. This is the average cost for a group extraction of 70 tokens.

11) You take 14 tokens, the other people in your group also draw 14 tokens each : e) What is your individual cost of extraction ? Use the cost table :

— i. 24,9 ECU

— ii. 30 ECU

Answer posted : The correct answer was : 24.9 ecu. Indeed, in the table of costs, you have to look at the line 56 tokens (= taking of the 4 others) and the column 14 tokens (for your extraction).

11) You take 14 tokens, the other people in your group also draw 14 tokens each : f) What is your PAYOFF ? Use the Payoff table :

— i. 28,9 ECU

— ii. 23.3 ECU

Answer posted : The correct answer was : 28.9 ecu. Indeed, in the table of the gains, you have to look at the line 56 tokens (= withdrawal of the 4 others) and the column 14 tokens (for your extraction).

1.B Characteristics of Experimental Sessions in the social information experiment

TABLE 1.B.1 – Characteristics of expeimental sessions in the social information experiment

Session Number	Number of Subjects	Number of groups	Treatment	Periods 1-10	Periods 11-20
4	20	4	Baseline	Baseline	Baseline
6	15	3	Baseline	Baseline	Baseline
12	20	4	Baseline	Baseline	Baseline
2	15	3	Individual	Baseline	Individual
8	20	4	Individual	Baseline	Individual
9	10	2	Individual	Baseline	Individual
14	15	3	Individual	Baseline	Individual
1	20	4	Compulsory	Baseline	Compulsory
7	15	3	Compulsory	Baseline	Compulsory
13	20	4	Compulsory	Baseline	Compulsory
3	15	3	Majority	Baseline	Majority
5	20	4	Majority	Baseline	Majority
10	20	4	Majority	Baseline	Majority
11	20	4	Majority	Baseline	Majority

1.C Description of demographics variables in the social information experiment

Looking at demographics variables gender, age and social value orientation there are no differences between treatments (doing kruskall wallis and chi2 analysis). There are neither differences between treatments concerning the understanding score (kruskall wallis). However it seem that a difference appear in the capacity to identify the extraction level socially optimal.

Presentation of gender by framing.

TABLE 1.C.1 – Gender summary statistics in the social information experiment

Treatment	Number of women
Baseline	28(55)
Individual	28(60)
Compulsory	19[40]*
Majority	31(75)

The chi2 p-value if the statistical description presented in table 1.C.1 is 0.744. In some of the compulsory treatment the demographics survez were not run correctly. As a consequence we do not have the results for these data.

TABLE 1.C.2 – Age summary statistics in the social information experiment

Treatment	Obs	Mean	Std. Dev.
Baseline	55	24.91	6.48
Individual	60	25.23	7.85
Compulsory	40*	24.02	4.42
Majority	75	23.80	6.41

The kruskall wallis p-value of the statistical description presented in table 1.C.2 is 0.542.

Table 1.C.3 – SVO_score summary statistics in the social information experiment

Treatment	Obs	Mean	Std. Dev.
Baseline	55	0.46	0.16
Individual	60	0.44	0.20
Compulsory	55	0.47	0.20
Majority	75	0.48	0.19

The kruskall wallis p-value of the statistical description presented in table 1.C.3 is 0.5392.

Table 1.C.4 – SVO type summary statistics in the social information experiment

Treatment	Prosocial	Individualist	Competitive
Baseline	30	24	1
Individual	29	26	5
Compulsory	32	17	6
Majority	45	25	5

The chi2 p-value if the statistical description presented in table 1.C.4 is 0.370.

The 12 question of the comprehension score were used to compute the understanding score (the maximum score is 12).

Table 1.C.5 – Understanding summary statistics in the social information experiment

Treatment	Obs	Mean	Std. Dev.
Baseline	55	8.71	1.58
Individual	60	8.65	1.70
Compulsory	55	8.71	1.51
Majority	75	8.45	1.66

The kruskall wallis p-value of the statistical description presented in table 1.C.5 is 0.729.

Moreover at the end of the experiment, we ask the subjects what would be the extraction level that if ot had been respected by all the group menbers would have maximize the group payoffs. The real value is 15.3 due to the way the payoffs are presented we consider the answer as correct if there were included between $[14; 16]$.

Table 1.C.6 – Capacity to identify the Pareto Optimum summary statistics

Treatment	Number of subjects who were able to identify it
Baseline	28(55)
Individual	18(60)
Compulsory	19(55)
Majority	36(75)

The chi2 p-value if the statistical description presented in table 1.C.6 is 0.053*.

1.D Non parametric tests in the social information experiment

The Mann Whitney analysis describing the fact that we have significant differences between treatments since the first period are presented in tables 1.D.1 and 1.D.2. The initial problem remains.

Table 1.D.1 – Mann Whitney test during the first sequence (Baseline) in the social information experiment

Treatment compared	p-value
Baseline Individual	0.518
Baseline Compulsory	0.264
Baseline Majority	0.024**
Individual Compulsory	0.622
Individual Majority	0.088*
Compulsory Majority	0.169

Table 1.D.2 – Mann Whitney test during the five last periods of the first sequence (Baseline) in the social information experiment

Treatment compared	p-value
Baseline Individual	0.975
Baseline Compulsory	0.279
Baseline Majority	0.139
Individual Compulsory	0.356
Individual Majority	0.092*
Compulsory Majority	0.586

Table 1.D.3 – Mann Whitney test in the second sequence in the social information experiment

Treatment compared	p-value
Baseline Individual	0.878
Baseline Compulsory	0.646
Baseline Majority	0.126
Individual Compulsory	0.498
Individual Majority	0.118
Compulsory Majority	0.568

1.E Details in the voluntary treatments

Here are presented the details of figures 1.6 and 1.7 in tables 1.E.1 and 1.E.2.

TABLE 1.E.1 – Percentage of groups displaying their extractions by treatment [number of groups]

Period	1	2	3	4	5	6	7	8	9	10
Majority treatment	86.7 [13]	93.3 [14]	93.3 [14]	100 [15]	86.7 [13]	86.7 [13]	86.7 [13]	93.3 [14]	86.7 [13]	93.3 [14]
Individual treatment	66.7 [8]	75 [9]	66.7 [8]	66.7 [8]	58.3 [7]	58.3 [7]	75 [9]	50 [6]	58.3 [7]	58.3 [7]

TABLE 1.E.2 – Percentage of number of vote in favor of display by treatment

Treatment compared	0-1	2-3	4-5	6-7	8-9	10
Individual	20	15	15	8.33	13.33	28.33
Majority	9.33	6.67	8	10.67	28	37.33

1.F Diff and Diff analysis in the social information experiment

Voluntary2, Compulsory2 and Majority2 are dummy variables which are equal to 1 whenever treatment Voluntary Compulsory or Majority were applied in sequence 2.

The variables seq_Voluntary2, seq_Compulsory2 and seq_Majority2 are dummy variables which represent the real introduction of the differents treatments.

We observe that the data of the Voluntary treatment are significantly different from the Baseline ones and since the beginning of the treatment (Baseline conditions in sequence 1).

TABLE 1.F.1 – Diff and Diff analysis between Baseline and Voluntary treatment (panel tobit estimation, two sided random effects).

	(1) PrelevementID	(2) PrelevementID
Voluntary2	-0.274	-0.959
	(1.260)	(1.189)
Sequence	1.069∗∗∗	1.069∗∗∗
	(0.389)	(0.389)
seq_Voluntary2	0.278	0.279
	(0.540)	(0.540)
SVO_score		-14.62∗∗∗
		(3.236)
Age		0.0618
		(0.0801)
Gender		-1.572
		(1.150)
Optimal_Identification		-1.464
		(1.267)
Understanding_score		0.422
		(0.371)
_cons	23.58∗∗∗	26.61∗∗∗
	(0.911)	(3.749)
sigma_u		
_cons	6.410∗∗∗	5.822∗∗∗
	(0.486)	(0.445)
sigma_e		
_cons	6.101∗∗∗	6.101∗∗∗
	(0.111)	(0.111)
N	2300	2300

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

TABLE 1.F.2 – Diff and Diff analysis between Baseline and Compulsory treatment (panel tobit estimation, two sided random effects).

	(1) PrelevementID	(2) PrelevementID
Compulsory2	-1.285	-1.141
	(1.077)	(1.080)
Sequence	1.064***	1.064***
	(0.378)	(0.374)
seq_Compulsory2	0.325	-0.215
	(0.529)	(0.570)
SVO_score		-15.39***
		(2.926)
Age		-0.0155
		(0.0908)
Gender		0.153
		(1.034)
Optimal_Identification		-0.694
		(1.086)
Understanding_score		0.120
		(0.339)
_cons	23.48***	30.12***
	(0.764)	(3.784)
sigma_u		
_cons	5.283***	4.740***
	(0.411)	(0.406)
sigma_e		
_cons	5.945***	5.883***
	(0.108)	(0.115)
N	2200	1900

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

Table 1.F.3 – Diff and Diff analysis between Baseline and Majority treatment (panel tobit estimation, two sided random effects).

	(1) PrelevementID	(2) PrelevementID
Majoritaire2	-2.256**	-2.187**
	(0.983)	(0.944)
Sequence	1.060***	1.060***
	(0.403)	(0.403)
seq_Majority2	0.791	0.792
	(0.525)	(0.524)
SVO_score		-9.018***
		(2.483)
Age		-0.0232
		(0.0694)
Gender		-1.063
		(0.894)
Optimal_Identification		0.0411
		(0.923)
Understanding_score		-0.191
		(0.284)
_cons	23.55***	30.43***
	(0.749)	(3.223)
sigma_u		
_cons	5.113***	4.802***
	(0.364)	(0.346)
sigma_e		
_cons	6.332***	6.332***
	(0.106)	(0.106)
N	2600	2600

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

2

Introduction of chapters 2 and 3

This part is based on a joint work with and Katherine Farrow, David Masclet and Marc Willinger

2.1 Introduction of chapters 2 and 3

Several public policies aim to encourage individuals or groups to provide public goods (e.g. public open areas, air and water quality) or preserve existing resources (e.g. biodiversity, fisheries, forests or groundwater supply). Individuals are asked to create resources in the former, whereas they are asked to maintain an existing level of resource in the latter. While the actions themselves differ in these two situations (contributing vs extracting), each decision can be described as a cooperation decision. Individuals must decide to what extent they contribute or the level of their extraction. In the next two chapters, we will analyze how the way in which a public game is framed, i.e. presented while the economic incentives remain unchanged, affects its provision. Our experiments are based on a voluntary contribution mechanism where subjects make an investment decision between two accounts. The marginal return of the group account, which represents the public good, is lower than that of the private account, creating a social dilemma. The individual interest is not to cooperate, by not investing in the group's account ; whereas the collective interest is to obtain a high level of cooperation.

Experimental evidence has shown that subjects contribute on average between 40 and 60 percent of their endowment in early rounds of a repeated game. This observation contradicts standard game theory predictions based on selfish rational players. However, contributions decay with the repetition of the game, almost reaching zero, thus tending to confirm the Nash prediction (Chaudhuri, 2011). Various mechanisms have been identified to overcome the under-supply of public goods, and prevent the tendency to free-ride : communication, peer punishment (Ostrom et al., 1994 ; Fehr & Gächter, 2000) peer pressure (Masclet et al., 2003) and reward (Sefton et al., 2007). These mechanisms allow subjects to express their disapproval or approval of the actions of others and thus express their social expectations. Subjects have shown that they are sensitive to these latter, as they change their behavior by becoming more cooperative. However, little is known about the robustness of theses mechanisms to contextual changes. In particular, the way the contribution option is framed, i.e. described ceteris paribus, might affect cooperation among group members. These two chapters aim to investigate whether the way the voluntary contribution mechanism (VCM) is framed, affects the effectiveness of symbolic punishment (chapter 2) or monetary punishment (chapter 3) to promote cooperation among group members. These two mechanisms allow subjects to express their disagreement towards the actions of their peers. However, they must be distinguished. Symbolic sanctions are free of charge both for the sender and for the recipient so that they can be described as "cheap talk". They enable peer pressure. In contrast, monetary sanctions modify the incentives for gambling, as they are costly for both the sender and the receiver. Material sanctions enable peer punishment. To sum up, does the way the collective issue is framed influence the capacity of the group to generate and maintain a high level of contribution to the public good when symbolic or monetary sanctions can be inflicted ?

Previous studies have shown that cooperation for providing a public good tends to be higher than cooperation for maintaining it (Andreoni, 1995 ; Park, 2000 ; Lopez & Nelson, 2005 ; Messer et al., 2007 ; Gächter et al., 2017). A number of studies attempted to isolate possible framing effects to explain these findings (Andreoni, 1995 ; Cox, 2015 ; Cubitt et al., 2011a ; Dufwenberg et al., 2011 ; Fosgaard et al., 2014 ; Fujimoto & Park, 2010 ; Khadjavi & Lange, 2015 ; Park, 2000). One possible reason for the framing effect is that it affects subjects' perception of the social dilemma that underlies the VCM and therefore, their willingness to cooperate (ceteris paribus). Indeed, individuals may perceive that creating resources would generate more positive externalities than maintaining existing resources. In other words, (failing to) contribute to a public good may be judged more acceptable (blameworthy) than preserving (exploiting) an existing public good (see Gächter et al., 2017 ; Cubitt et al., 2011b). According to Andreoni (1995), the difference is related to the fact that most individuals prefer doing good ("warm glow") to others than doing bad ("cold prickle"). The strength of the "warm glow" effect is higher than the "cold-prickle" to induce cooperation.

In these two chapters, we aim to contribute to the debate regarding the impact of framing on the effectiveness of peer pressure in chapter 2 and of peer punishment in chapter 3. We add a new perspective to the existing literature by testing the role of framing as defined by Andreoni (1995), on the effectiveness of peer pressure and peer punishment. We follow Cartwright (2016), by considering that the frame created by Andreoni (1995) and the "give and take" frame must be distinguished by three dimensions : i) the initial allocation of the endowment, ii) the choice presented to subject and iii) the way the externalities of a subject's action are characterized.

In the give (take) frame, the endowment is initially allocated in the private account (in the public account), and subjects are asked to decide how much they would like to put in (take frame) the public account. As a result, their action serves to either increase or decrease the amount they and others obtain from the group account.

In the positive and negative frames defined by Andreoni (1995), subjects' initial endowments are not allocated to one of the two accounts at the beginning of the game. Both in the positive and the negative framing, individuals are asked to decide the amounts that they want to invest in each account, under the constraint that the sum of these two amounts must be equal to their endowment. Andreoni (1995)'s frames differ only with respect to whether the positive or the negative externality of an individual's choice is made salient. In the positive frame, the positive consequences of investing in the group account are highlighted, whereas, in the negative frame, the negative consequence of investing in the private account is made salient. Unlike in the give vs take framing, not only the economic consequences of the set of actions are identical, but so are the possible actions themselves. Experiments based on this framing (Andreoni, 1995 ; Park, 2000 ; Fujimoto & Park, 2010), found that contribution levels are higher in the positive frame than in the negative one.

Our results on framing effects are fragile since we do not observe the effect described by Andreoni (1995) in Chapter 2 while we observe it in Chapter 3. It seems essential to present the global analysis, which takes into account the entire database of framing experiments (combined symbolic and monetary sanctions). It is the main objective of this introduction. To do so, we will briefly describe the experimental design and then present our behavioral predictions. Then, in the third part, we will present the main results of the introduction of symbolic or monetary sanctions in different framing. In this part, we will try to identify an explanation for the fragility of the effect of the frame.

2.2 The experimental design

The experiment is based on a repeated VCM, with and without the possibility of disapproving the actions of other members of the group, by sending them symbolic or material sanctions. We rely on a 2x3 factorial design that varies both the framing (positive versus negative) and the opportunity to send sanctions (symbolic, material or none) to other players. Each of the six treatments is repeated over 10 periods. Each group played two sequences, one with sanctions and one without sanctions (except for the Baseline). Half of the groups played first a sequence without sanctions followed by a sequence with sanctions. The other half of the groups were exposed to the reverse ordering. We identify the treatment order as follow :

— **Removal condition** refers to treatments where symbolic or material sanctions were introduced from period 1 to 10 sequence 1 and removed in sequence 2.
— **Introduction condition** refers to treatments in which there were no symbolic or material sanction in sequence 1, but there were introduced in sequence 2.
— **Baseline** refers to treatments where no symbolic or material sanctions were introduced.

The number of subjects [groups] for each of the six treatments is summarized in table 2.1.

TABLE 2.1 – Numbers of subjects [groups] per treatment

	Framing [groups]	
	Positive	Negative
Symbolic	Removal 32[8] Introduction 36[9]	Removal 28[7] Introduction 40[10]
Material	Removal 28[7] Introduction 32[8]	Removal 32[8] Introduction 36[9]
Baseline	28[7]	32[8]

The specifics of Andreoni (1995)'s frames will be presented in more detail in the two next chapters.

The experiment was conducted in the Montpellier Experimental Economics Laboratory (LEEM) between May 2018 and November 2019. In total 324 subjects participated in the experiment.

Upon arrival at the laboratory, each participant chose a booth in which he was seated in front of a computer terminal. Subjects were informed that the experiment consisted of 3 parts and that each of the three parts would be paid at the end of the session. They were given specific instructions at the start of each part. They were invited to read first the instructions in private, after what they were read again aloud by the person administering the experiment.

The experiment began by eliciting each participant's social value orientation (SVO), using Murphy et al. (2011) 's method. In this task, subjects were asked to make 15 allocation decisions between themselves and an anonymous receiver. For each decision, 9 options were proposed. One of the fifteen allocation decisions was randomly selected to be paid at the end of each session. In order not to influence subjects decisions in the public good game, they were informed of the results of the SVO task only at the end of the experiment.

Before starting the experiment, each participant had to answer eight control questions. After each question, the correct answer and a detailed explanation were displayed. This part aimed to help participants understand the game and how contributions translated into earnings and vice versa. The answers to the comprehension questionnaire were used by the experimenter to compute an understanding score.

An experimental session lasted approximately one hour and a half. The average payment was 16.01 euros per person in addition to a show-up fee of 2 to 6 euros depending on the distance travelled by the participant. The experiments were conducted using zTree (Fischbacher, 2007). The SVO procedure was adapted from Crosetto et al. (2012).

2.3 Behavioral predictions

We now state our hypotheses concerning the effect of framing on contributions, and, more importantly, on the disapproval ratings tested. The null hypothesis is that framing does not affect contribution levels in the experimental treatments without disapproval ratings. We hypothesize that the frame, i.e. how the collective problem is presented and perceived, can influence subjects' willingness to cooperate. Allowing subjects to perceive that their choices generate gains or losses could induce different behaviors (Tversky & Kahneman, 1981). The way a situation is presented can also affect moral judgment about what is acceptable or objectionable behavior (Kahneman, 1992). We consider that the perception created by the frame affects how the subjects qualify the actions of others. Cubitt et al. (2011b) 's experiment showed that in a public good using the give and take frames, acting as a free rider is more strongly condemned in the give frame than in the take frame. We hypothesize that subjects who perceive others actions as hurting them will be less cooperative than subjects who perceive others' actions as doing them good, leading to prediction 1.

Prediction 1 *: Contributions to the public good are lower under negative framing than under positive framing.*

If we consider agents as strictly selfishly oriented, they should not pay attention to being disapproved. Receiving symbolic sanctions should not affect their behavior. Moreover, when sanctions are costly to send, as in case of monetary sanctions, they should have no incentive to do so. For this narrow conception of individual utility, the disapproval ratings we are tested should not have any effects on the willingness to cooperate. Nevertheless, it has been shown that the opportunity to send disapproval through symbolic (Masclet et al., 2003 ; Dugar, 2010 ; Dugar, 2013) and material sanctions (Fehr & Gächter, 2000) foster cooperation. According to Fehr and Fischbacher (2004), the availability of sanctions enables the activation of a social norm of cooperation. Moreover, Fehr and Schmidt (1999) demonstrate that as soon as there is a sufficient proportion of subjects who are inequality averse, the introduction of punishment makes cooperation possible. It leads us to the second prediction.

Prediction 2 *: The availability of sanctions, both symbolic and material, increases contributions to the public good.*

Regarding the sanctions' efficiency, the null hypothesis is that the symbolic or material does not depend on framing, ceteris paribus. However, in light of previous evidence, framing could have an impact on their effectiveness. If the negative externalities induced by others' behavior is salient, free riding may be the contribution norm, reducing both the willingness to punish and to contribute. Messer et al. (2013) provide evidence that the efficiency of mechanisms that are supposed to foster cooperation are lower when the effect of other actions was negatively framed. With regards to these results, we state the third prediction.

Prediction 3 *: The sanctions are less effective under negative framing than under positive framing.*

2.4 Results

Result 1 : ***In the baseline conditions, average groups contributions are slightly higher under positive framing than under negative framing. However, this effect is fragile.***

Result 1 is corroborated by the tobit panel estimates presented in tables 2.2 and 2.3. The dummy variable Framing has a significant positive effect on contributions. However, the framing effect is not robust when we add control variables : the variable Framing is no longer significant. Furthermore, it is not significant in the Introduction conditions (see table 2.3). It is mainly due to the fact that under these conditions, we observe an inverse effect of the frame between symbolic and monetary sanctions. The contributions are higher in the positive frame when monetary sanctions are introduced, whereas they are higher in the negative frame for symbolic sanctions. The higher cooperation in the negative frame is only observed under the latter conditions (Introduction conditions with symbolic sanctions). For all other conditions, we observe a higher contribution in the positive frame than in the negative frame (as shown in figures 2.1 and 2.2).

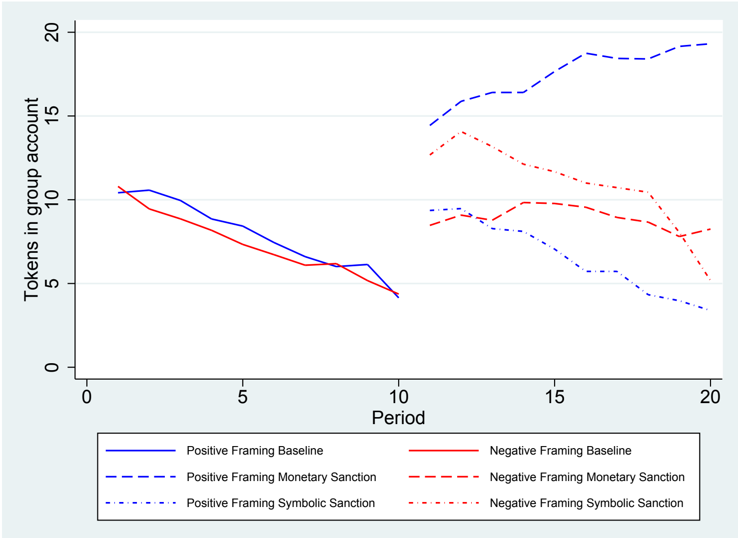

FIGURE 2.1 – Evolution of the average group contribution in Introduction condition for all framing data.

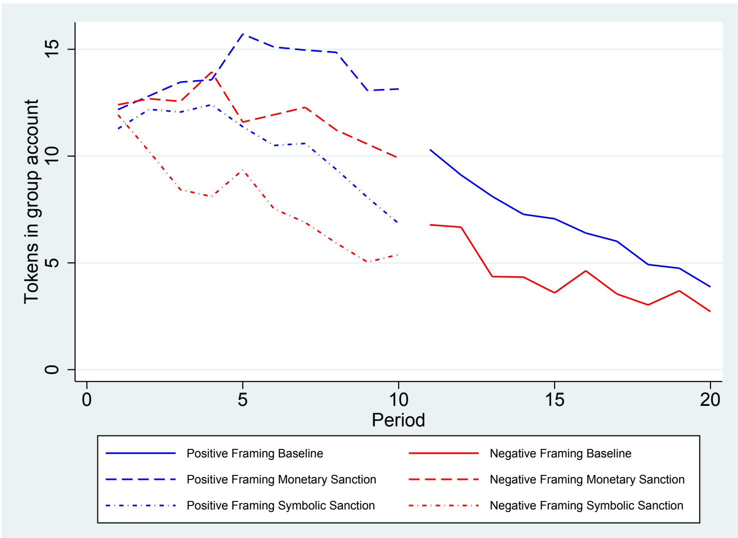

FIGURE 2.2 – Evolution of the average group contribution in Removal condition for all framing data.

TABLE 2.2 – Individual contributions to the group account for all framing data (panel tobit estimation two sided, random effects).

	(1) All data	(2) All data	(3) All data	(4) Without sanction
Framing	2.610***	2.062**	1.528	2.480**
	(1.011)	(1.026)	(1.040)	(1.157)
Symbolic sanctions	4.994***	5.855***	5.860***	
	(0.428)	(0.599)	(0.597)	
Material sanctions	11.58***	9.434***	9.479***	
	(0.444)	(0.590)	(0.589)	
Period	-0.409***	-0.408***	-0.408***	-0.728***
	(0.0247)	(0.0246)	(0.0246)	(0.0414)
Symbolic × Framing		-1.766**	-1.734**	
		(0.846)	(0.844)	
Material × Framing		4.686***	4.707***	
		(0.875)	(0.873)	
SVO_score			12.62***	14.43***
			(2.530)	(2.908)
Gender			2.074**	2.113*
			(0.951)	(1.092)
Age			-0.151	-0.0552
			(0.129)	(0.149)
Understanding			0.725**	0.0318
			(0.335)	(0.384)
_cons	6.705***	6.985***	-0.481	3.094
	(0.752)	(0.749)	(3.815)	(4.412)
sigma_u				
_cons	8.717***	8.553***	8.084***	9.112***
	(0.393)	(0.388)	(0.370)	(0.459)
sigma_e				
_cons	10.06***	10.03***	10.03***	9.337***
	(0.145)	(0.145)	(0.145)	(0.178)
N	6480	6480	6480	3840

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

TABLE 2.3 – Individual contributions to the group account discriminating for Removal and Introduction conditions for all framing data (panel tobit estimation two sided, random effects).

	(1) Removal + Bsl	(2) Removal + Bsl	(3) Removal + Bsl	(4) Introduction + Bsl	(5) Introduction + Bsl	(6) Introduction + Bsl
Framing	3.824***	4.143***	4.249***	1.674	0.611	-0.440
	(1.423)	(1.459)	(1.469)	(1.162)	(1.125)	(1.141)
Symbolic sanction	1.579**	1.506	1.568	8.362***	9.764***	9.829***
	(0.769)	(1.016)	(1.015)	(0.689)	(0.850)	(0.845)
Material sanction	6.511***	7.409***	7.513***	16.30***	11.59***	11.72***
	(0.760)	(0.957)	(0.955)	(0.730)	(0.873)	(0.869)
Period	-0.608***	-0.609***	-0.604***	-0.654***	-0.646***	-0.652***
	(0.0450)	(0.0450)	(0.0450)	(0.0437)	(0.0431)	(0.0431)
Symbolic × Framing		0.130	0.175		-3.152***	-3.113***
		(1.272)	(1.269)		(1.071)	(1.066)
Material × Framing		-1.939	-1.870		10.43***	10.40***
		(1.247)	(1.245)		(1.163)	(1.157)
SVO_score			14.61***			14.35***
			(3.598)			(2.783)
Gender			0.957			2.944***
			(1.381)			(1.022)
Age			-0.0622			-0.227
			(0.179)			(0.152)
Understanding			0.368			0.713*
			(0.459)			(0.386)
_cons	8.755***	8.599***	0.299	8.988***	9.495***	2.518
	(1.171)	(1.183)	(5.320)	(0.862)	(0.825)	(4.508)
sigma_u						
_cons	9.182***	9.191***	8.712***	7.902***	7.379***	6.726***
	(0.559)	(0.560)	(0.535)	(0.449)	(0.428)	(0.397)
sigma_e						
_cons	9.703***	9.701***	9.703***	9.843***	9.734***	9.733***
	(0.191)	(0.191)	(0.191)	(0.174)	(0.172)	(0.172)
N	3600	3600	3600	4080	4080	4080

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

Overall, our results partly replicate Andreoni (1995) 's result. However, the framing effect lacks robustness and is not always observed. This fragility of the framing effect is nevertheless also observed in experiments that replicate the give and take frame. Indeed, if most of the studies find a higher contribution in the give frame, there are some exceptions such as Fosgaard et al. (2014), which has a pool of 2 042 subjects and finds a higher contribution in the Take frame. Sell and Son (1997) and Sell et al. (2002) also find a higher contribution in the take frame, even if the difference is not significant in Sell and Son (1997). Cox et al. (2013) find similar contribution level in the give and take frames. Moreover, even in experiments where contributions are higher under the give frame, it is not always statistically significant. Cox (2015) find that the framing effect is stronger for men than for women. Dufwenberg (2011) who is adding a label dimension to the give and take frame, adding a community name to the experiment or not, only finds a significant difference between the treatment Give frame without label and Take frame with the Community label. Cubitt (2010a), who introduces monetary sanctions in a "Give and Take" framing, observes stronger contributions in the give than in the take frame. However, the difference is only significant between "Give" with punishment and "Take" without punishment. Cartwright and Ramaligam (2019) tried to disentangle the effect of give and take frame for the frame created by Andreoni (1995) and found no significant difference in the aggregated contributions and though for both kind of frames.

In our experiment, the lack of robustness is partly due to three groups in the treatment symbolic sanctions with negative framing, which have a significantly higher contribution than others. This effect is illustrated by the diff and diff analysis presented in table 2.4. The variable called "Groups where symbolic sanctions are introduced" refers to a dummy which is equal to

1 whenever symbolic sanction are introduced in sequence 2. The positive and significant sign of this variable shows that, in this treatment, groups make significantly higher contributions than others groups in the same conditions since the beginning of the repeated game (i.e. in the baseline conditions where there is no mechanism to foster cooperation). Moreover, if we remove these 3 groups from the database, the variable "*Groups where symbolic sanctions are introduced*" is no more significant (cf appendix 2.C.3). This element implies that without these 3 groups, the groups constituting the symbolic sanctions treatment under Introduction condition for the negative framing are not different from the groups constituting the negative framing sample.

In addition, another explanation of the fragility of the framing is that it depends on inherent group capacities to cooperate. In order to take into account the specific initial capacity of the group to cooperate, we integrate the initial contribution of the group into the regression. We assume that a subject's initial contribution reflects his or her willingness to cooperate. In this first period, subjects respond to their beliefs, or to what they think should be done, without changing their behavior in response to the actions of others. There is no reciprocity effect in this first stage. As a consequence, we assume that the sum of contributions at the first period of the game reflects the group's inherent capacity to cooperate [1]. This variable, called "Initial group contribution" is positively and significantly correlated with individual contribution dynamic. Although the effect is relatively weak, it reinforce the framing effect (cf appendix 2.C.1 and 2.C.2). We conclude that the effect of framing is dependent on groups' initial willingness to cooperate.

1. A similar hypothesis was formulated by Dugar (2010). They analyzed the effect of the first-period minimum on the group's contribution and the effect of the disapproval and approval ratings.

TABLE 2.4 – Diff and Diff analysis in the negative framing Introduction condition for symbolic sanctions (panel tobit estimation two sided, random effects).

	(1) pbl	(2) pbl
Groups where symbolic sanctions are introduced	5.759***	5.767***
	(2.211)	(2.095)
Sequence	-4.024***	-4.030***
	(1.010)	(1.009)
Symbolic sanctions	6.978***	6.986***
	(1.337)	(1.336)
SVO_score		13.68**
		(5.412)
Gender		3.167
		(1.991)
Age		-0.132
		(0.295)
Understanding		1.106
		(0.834)
_cons	3.428**	-8.021
	(1.654)	(8.850)
sigma_u		
_cons	8.420***	7.801***
	(0.830)	(0.780)
sigma_e		
_cons	11.24***	11.23***
	(0.353)	(0.353)
N	1440	1440

t statistics in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

Finally, experiments that replicated Andreoni (1995) 's frame also found that subjects characteristics influence the effect. Park (2000) found a significant difference between the two framing conditions in overall contribution rates. However, he did not find a significant effect on some of the subjects with a cooperative social orientation. Our results confirm that the social value orientation is a strong determinant of the willingness to cooperate in collective actions issues. Indeed, the social orientation score has a high positive and significant effect on the contribution to the public good, as it is illustrated in tables 2.2 and 2.3. The stronger their preference for equal sharing, the larger their contribution to the public good. The different effect of framing according to the type of subject will be discussed more in detail in the conclusion of these two chapters. Additionally, Fujimoto and Park (2010) found that men mostly generate the lower contribution in the negative frame. Our results partly confirm this fact. Women seem to contribute more to the public good. This observation is supported by the variable Gender, which has a positive and significant in the global analysis (see table 2.2 column 3). It should be noted that this effect is mainly observed under the Introduction condition.

It is worth noticing that the three groups that have a significantly higher contribution than others are not characterized by a higher proportion of men or of prosocial subjects, which could have been an alternative reason for these differences (cf appendix 2.B.1).

Result 2 : ***The availability of symbolic or monetary sanctions significantly increases contributions.***

Result 2 is supported by the significant and positive sign of the variables symbolic and material sanctions presented in table 2.3.

Nevertheless, it should be noted that for both symbolic and monetary sanctions, their effect is stronger in the Introduction condition. It implies that once subjects have gone through a sequence in which they have not been able to express their disapproval. For symbolic sanctions, their effects are even absent if only the Removal Condition is considered.

Result 3 : ***The lower effectiveness of disapproval ratings in the negative frame is only observed for monetary sanctions in the Introduction condition.***

Result 3 is supported by the significant and positive sign of the interaction variable *Material* $\times$*Framing*. It reflects the fact that monetary sanctions are most effective in the context of positive framing. In this context, they lead the majority of groups to contribute fully until the last period of the experiment. Conversely, the increase in contributions is relatively smaller in the negative framing where, on average, groups increase their contributions up to half of their endowment (see figure 2.1).

However, it should be noted that in this Introduction condition, the interaction variable *Symbolic* $\times$ *framing* has a reverse effect as predicted. At odds with Messer et al. (2013) 's findings, the symbolic sanctions are more efficient under the negative frame. We hypothesize that the groups composing the negative framing under Introduction conditions have a greater willingness to cooperate ; that is why they are more sensitive to the introduction of symbolic sanctions. Those results will be discussed in more detail in Chapter 2.

This contradictory effect between symbolic and monetary sanctions annihilates the effect of framing under the Introduction condition.

The two chapters that follow will present the specific effect of the frame on i) symbolic (chapter 2) and ii) monetary sanctions (chapter 3). As these results seem contradictory, we will explain the effects of each dataset with more details. Lastly, we will discuss the global effect of the frame on the disapproval ratings studied, and we will try to go further in the explanation of its main drivers.

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Appendices of the Introduction of chapters 2 and 3

2.A Robustness check

As a robustness, we also made panel analysis of the contribution including clusters by groups.

TABLE 2.A.1 – Individual contributions to the group account for all framing data (panel regression random effects with cluster by group).

	(1) All data	(2) All data	(3) All data	(4) Without sanction
Framing	1.638*	1.359	1.056	1.404*
	(0.842)	(0.842)	(0.823)	(0.839)
Symbolic sanctions	2.566***	3.100***	3.097***	
	(0.488)	(0.720)	(0.719)	
Material sanctions	6.299***	5.104***	5.129***	
	(0.798)	(1.020)	(1.023)	
Period	-0.218***	-0.219***	-0.219***	-0.375***
	(0.0338)	(0.0333)	(0.0333)	(0.0421)
Symbolic × Framing		-1.066	-1.042	
		(0.971)	(0.973)	
Material × Framing		2.552	2.552*	
		(1.555)	(1.548)	
SVO_score			5.926***	6.023***
			(1.402)	(1.561)
Gender			0.975**	0.724
			(0.438)	(0.488)
Age			-0.0758	-0.0376
			(0.0602)	(0.0589)
Understanding			0.386**	0.0696
			(0.182)	(0.173)
_cons	8.079***	8.224***	4.599**	7.012***
	(0.626)	(0.633)	(2.065)	(2.138)
N	6480	6480	6480	3840
R^2	0.135	0.151	0.180	0.100

t statistics in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

TABLE 2.A.2 – Individual contributions to the group account discriminating for Removal and Introduction conditions for all framing data (panel regression random effects with cluster by group).

	(1) Removal + Bsl	(2) Removal + Bsl	(3) Removal + Bsl	(4) Introduction + Bsl	(5) Introduction + Bsl	(6) Introduction + Bsl
Framing	2.264**	2.364**	2.345**	1.201	0.657	0.0601
	(1.109)	(1.161)	(1.114)	(0.965)	(0.916)	(0.885)
Symbolic sanctions	0.624	0.609	0.632	4.562***	5.465***	5.485***
	(0.595)	(0.550)	(0.546)	(0.890)	(1.180)	(1.178)
Material sanctions	3.817***	4.110***	4.155***	8.849***	6.289***	6.377***
	(1.011)	(1.256)	(1.256)	(1.226)	(1.638)	(1.655)
Period	-0.329***	-0.330***	-0.327***	-0.353***	-0.352***	-0.355***
	(0.0453)	(0.0453)	(0.0454)	(0.0501)	(0.0503)	(0.0503)
Symbolic × Framing		0.0264	0.0536		-1.919	-1.871
		(0.898)	(0.890)		(1.466)	(1.480)
Material × Framing		-0.631	-0.599		5.411***	5.369***
		(1.921)	(1.915)		(1.951)	(1.960)
SVO_score			6.331***			7.318***
			(1.962)			(1.611)
Gender			0.343			1.444***
			(0.554)			(0.559)
Age			-0.0231			-0.123*
			(0.0792)			(0.0680)
Understanding			0.212			0.411*
			(0.208)			(0.212)
_cons	9.272***	9.223***	5.306*	9.207***	9.461***	5.849**
	(0.780)	(0.788)	(2.763)	(0.797)	(0.789)	(2.482)
N	3600	3600	3600	4080	4080	4080
R^2	0.167	0.167	0.194	0.122	0.173	0.214

t statistics in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

2.B Analysis including groups' initial contribution

In order to take into account the groups' initial capacity to cooperate, we integrate the initial contribution of the group into the regression. This variable is called "Initial contribution", is significantly correlated with the individual contribution. While the effect of this variable is relatively small, its introduction reinforces the treatment effect.

TABLE 2.B.1 – Individual contributions taking into account the initial contribution of the group for all framing data (panel tobit estimation two sided random effects, first period excluded)).

	(1)	(2)	(3)	(4)
	All data	All data	All data	Without sanction
Framing	3.175***	2.500**	2.168**	3.133***
	(0.964)	(0.986)	(1.010)	(1.086)
Symbolic sanctions	5.096***	5.790***	5.794***	
	(0.436)	(0.609)	(0.608)	
Material sanctions	11.98***	9.748***	9.795***	
	(0.455)	(0.602)	(0.601)	
Period	-0.391***	-0.390***	-0.390***	-0.706***
	(0.0266)	(0.0265)	(0.0265)	(0.0442)
Initial group contribution	0.198***	0.189***	0.173***	0.207***
	(0.0292)	(0.0289)	(0.0280)	(0.0313)
Symbolic × Framing		-1.442*	-1.415	
		(0.864)	(0.862)	
Material × Framing		4.909***	4.919***	
		(0.895)	(0.893)	
SVO_score			11.15***	12.57***
			(2.453)	(2.735)
Gender			1.893**	1.870*
			(0.918)	(1.022)
Age			-0.182	-0.104
			(0.125)	(0.139)
Understanding			0.481	-0.296
			(0.325)	(0.362)
_cons	-2.695*	-1.940	-5.920	-2.702
	(1.509)	(1.494)	(3.780)	(4.226)
sigma_u				
_cons	8.247***	8.128***	7.751***	8.420***
	(0.379)	(0.375)	(0.360)	(0.433)
sigma_e				
_cons	9.997***	9.964***	9.965***	9.296***
	(0.149)	(0.148)	(0.148)	(0.183)
N	6156	6156	6156	3636

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

TABLE 2.B.2 – Individual contributions taking into account the initial contribution of the group, discriminating for Removal and Introduction conditions, all framing data (panel tobit estimation two sided random effects, first period excluded).

	(1) Removal + Bsl	(2) Removal + Bsl	(3) Removal + Bsl	(4) Introduction + Bsl	(5) Introduction + Bsl	(6) Introduction + Bsl
Framing	3.617∗∗∗	3.622∗∗	3.816∗∗∗	2.104∗∗	0.991	0.411
	(1.391)	(1.426)	(1.444)	(1.069)	(1.058)	(1.095)
Symbolic sanctions	1.635∗∗	1.086	1.139	8.142∗∗∗	9.516∗∗∗	9.585∗∗∗
	(0.785)	(1.036)	(1.035)	(0.698)	(0.861)	(0.856)
Material sanctions	7.107∗∗∗	7.606∗∗∗	7.699∗∗∗	16.09∗∗∗	11.52∗∗∗	11.65∗∗∗
	(0.778)	(0.976)	(0.974)	(0.739)	(0.886)	(0.882)
Period	-0.597∗∗∗	-0.597∗∗∗	-0.592∗∗∗	-0.607∗∗∗	-0.599∗∗∗	-0.605∗∗∗
	(0.0483)	(0.0483)	(0.0483)	(0.0466)	(0.0460)	(0.0460)
Initial group contribution	0.236∗∗∗	0.236∗∗∗	0.217∗∗∗	0.183∗∗∗	0.157∗∗∗	0.136∗∗∗
	(0.0520)	(0.0521)	(0.0502)	(0.0303)	(0.0290)	(0.0283)
Symbolic × Framing		1.051	1.088		-3.113∗∗∗	-3.081∗∗∗
		(1.302)	(1.300)		(1.091)	(1.086)
Material × Framing		-1.095	-1.031		10.08∗∗∗	10.07∗∗∗
		(1.280)	(1.279)		(1.180)	(1.175)
SVO_score			13.47∗∗∗			11.55∗∗∗
			(3.538)			(2.686)
Gender			0.772			2.386∗∗
			(1.355)			(0.972)
Age			-0.0200			-0.309∗∗
			(0.176)			(0.144)
Understanding			0.280			0.323
			(0.451)			(0.373)
_cons	-2.383	-2.395	-9.691∗	0.486	2.148	1.580
	(2.649)	(2.651)	(5.669)	(1.541)	(1.479)	(4.276)
sigma_u						
_cons	8.910∗∗∗	8.915∗∗∗	8.509∗∗∗	7.181∗∗∗	6.796∗∗∗	6.297∗∗∗
	(0.547)	(0.548)	(0.527)	(0.420)	(0.403)	(0.379)
sigma_e						
_cons	9.619∗∗∗	9.618∗∗∗	9.620∗∗∗	9.806∗∗∗	9.698∗∗∗	9.698∗∗∗
	(0.196)	(0.196)	(0.196)	(0.179)	(0.177)	(0.177)
N	3420	3420	3420	3876	3876	3876

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

TABLE 2.B.3 – Individual contributions to the group account, all framing data (panel regression random effects with cluster by group, first period excluded).

	(1) All data	(2) All data	(3) All data	(4) Without sanction
Framing	1.920***	1.598**	1.419*	1.793**
	(2.59)	(2.17)	(1.92)	(2.41)
Symbolic sanctions	2.604***	3.051***	3.047***	
	(5.20)	(4.07)	(4.07)	
Material sanctions	6.482***	5.293***	5.318***	
	(8.15)	(5.07)	(5.07)	
Period	-0.204***	-0.205***	-0.205***	-0.359***
	(-5.72)	(-5.84)	(-5.84)	(-8.36)
Initial group contribution	0.114***	0.108***	0.101***	0.115***
	(5.29)	(4.99)	(4.78)	(5.54)
Symbolic × Framing		-0.893	-0.872	
		(-0.88)	(-0.86)	
Material × Framing		2.541	2.539	
		(1.64)	(1.64)	
SVO_score			5.003***	4.979***
			(3.78)	(3.34)
Gender			0.866**	0.618
			(2.06)	(1.37)
Age			-0.0928	-0.0592
			(-1.53)	(-1.05)
Understanding			0.241	-0.0928
			(1.41)	(-0.56)
_cons	2.657**	3.060**	1.390	3.433 *
	(2.58)	(2.88)	(0.67)	(1.77)
N	6156	6156	6156	3636
R^2	0.196	0.207	0.228	0.143

t statistics in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

TABLE 2.B.4 – Individual contributions to the group account discriminating for Removal and Introduction conditions, all framing data (panel regression random effects with cluster by group, first period excluded).

	(1) Removal + Bsl	(2) Removal + Bsl	(3) Removal + Bsl	(4) Introduction + Bsl	(5) Introduction + Bsl	(6) Introduction + Bsl
Framing	2.122**	2.100*	2.129**	1.457*	0.891	0.597
	(1.018)	(1.080)	(1.042)	(0.773)	(0.718)	(0.731)
Symbolic sanctions	0.652	0.403	0.420	4.440***	5.299***	5.322***
	(0.591)	(0.546)	(0.544)	(0.890)	(1.202)	(1.195)
Material sanctions	4.117***	4.272***	4.311***	8.734***	6.308***	6.379***
	(1.015)	(1.327)	(1.330)	(1.217)	(1.652)	(1.668)
Period	-0.318***	-0.318***	-0.316***	-0.325***	-0.325***	-0.327***
	(0.0471)	(0.0471)	(0.0472)	(0.0522)	(0.0523)	(0.0523)
Initial group contribution	0.120***	0.121***	0.113***	0.113***	0.0985***	0.0891***
	(0.0345)	(0.0342)	(0.0340)	(0.0250)	(0.0244)	(0.0232)
Symbolic × Framing		0.468	0.491		-1.825	-1.795
		(0.934)	(0.925)		(1.530)	(1.531)
Material × Framing		-0.331	-0.304		5.140**	5.125**
		(1.922)	(1.921)		(1.997)	(2.007)
SVO_score			5.682***			5.507***
			(1.862)			(1.574)
Gender			0.221			1.108**
			(0.558)			(0.520)
Age			-0.000303			-0.175**
			(0.0764)			(0.0679)
Understanding			0.159			0.167
			(0.204)			(0.207)
_cons	3.515**	3.513**	0.0873	3.952***	4.845***	5.127**
	(1.744)	(1.760)	(2.920)	(1.020)	(1.035)	(2.350)
N	3420	3420	3420	3876	3876	3876
R^2	0.207	0.207	0.228	0.193	0.228	0.255

t statistics in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

2.C Details of the cooperative groups

Here are the details of the contributions of the groups for which symbolic sanctions are introduced in the Introduction conditions.

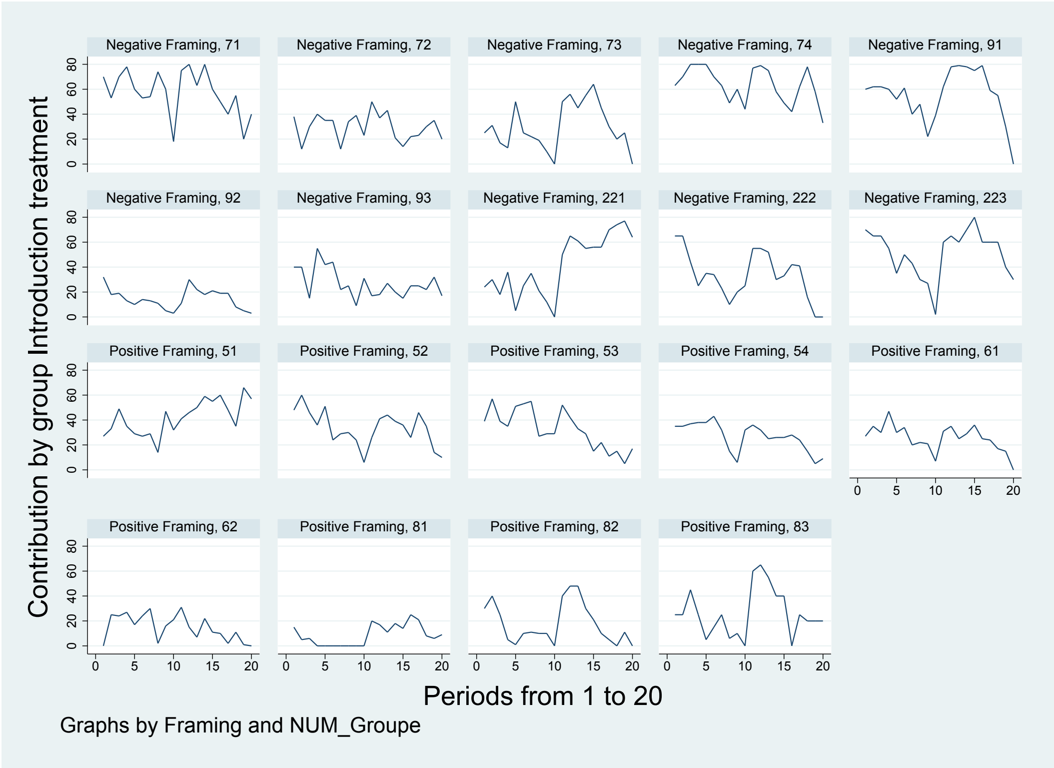


FIGURE 2.C.1 – Average contribution over time by group for symbolic sanctions experiment (Introduction condition).

Groups identified as high contributing groups (71, 74, 91) without peer pressure were excluded, in order to identify the treatment effect without these groups.

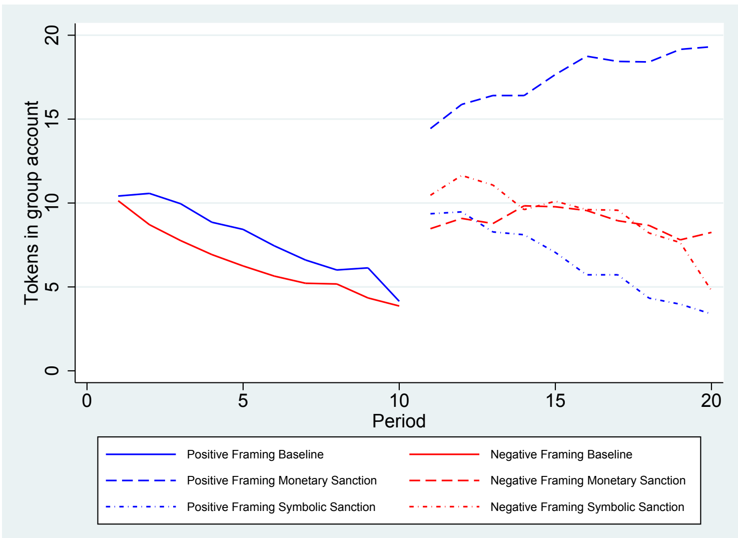


FIGURE 2.C.2 – Evolution of public good contribution in Introduction condition (excluding cooperative groups).

Details about groups with a significantly higher contribution to the public good without any mechanism.

TABLE 2.C.1 – Details of subject type by group for the three groups

Group number	Type	
	Prosocial	Individualist
71	1	3
74	1	3
91	3	1

TABLE 2.C.2 – Details of subject gender by group for the three groups

Group number	Type	
	Men	Women
71	0	4
74	1	3
91	2	2

TABLE 2.C.3 – Diff and Diff analysis in the negative framing Introduction condition for symbolic sanctions without cooperative groups (panel tobit estimation two sided random effects).

	(1) pbl	(2) pbl
Groups where symbolic sanctions are introduced	1.685	2.133
	(2.149)	(1.990)
Sequence	-3.845***	-3.852***
	(0.918)	(0.918)
Symbolic sanctions	7.557***	7.566***
	(1.314)	(1.314)
SVO_score		17.02***
		(5.067)
Gender		2.672
		(1.851)
Age		-0.0946
		(0.261)
Understanding		0.389
		(0.803)
_cons	3.759**	-6.121
	(1.478)	(8.178)
sigma_u		
_cons	7.490***	6.655***
	(0.820)	(0.744)
sigma_e		
_cons	10.25***	10.24***
	(0.340)	(0.340)
N	1200	1200

t statistics in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

Groups where sanctions are introduced is a dummy variable which is equal to 1 whenever monetary sanction are introduced in sequence 2.

2.D Analysis without the cooperative groups

TABLE 2.D.1 – Individual contributions to the group account, for all framing data excluding the three cooperative groups excluded (panel tobit estimation two sided random effects).

	(1) All data	(2) All data	(3) All data	(4) Without sanction
Framing	3.621***	3.048***	2.642***	3.598***
	(0.983)	(1.002)	(1.020)	(1.134)
Symbolic sanctions	4.830***	5.773***	5.771***	
	(0.436)	(0.639)	(0.638)	
Material sanctions	11.52***	9.457***	9.506***	
	(0.435)	(0.578)	(0.577)	
Period	-0.389***	-0.385***	-0.386***	-0.700***
	(0.0245)	(0.0245)	(0.0245)	(0.0414)
Symbolic × Framing		-1.765**	-1.730**	
		(0.867)	(0.865)	
Material × Framing		4.510***	4.522***	
		(0.856)	(0.854)	
SVO_score			13.34***	15.65***
			(2.455)	(2.826)
Gender			1.704*	1.771*
			(0.927)	(1.065)
Age			-0.131	-0.0312
			(0.124)	(0.143)
Understanding			0.503	-0.184
			(0.326)	(0.374)
_cons	5.561***	5.840***	-1.009	2.085
	(0.746)	(0.748)	(3.672)	(4.251)
sigma_u				
_cons	8.299***	8.177***	7.697***	8.659***
	(0.385)	(0.380)	(0.361)	(0.450)
sigma_e				
_cons	9.860***	9.827***	9.828***	9.297***
	(0.144)	(0.143)	(0.143)	(0.179)
N	6240	6240	6240	3720

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

TABLE 2.D.2 – Individual contributions to the group account discriminating for Removal and Introduction conditions, for all framing data excluding the three cooperative groups excluded (panel tobit estimation two sided random effects).

	(1) Removal + Bsl	(2) Removal + Bsl	(3) Removal + Bsl	(4) Introduction + Bsl	(5) Introduction + Bsl	(6) Introduction + Bsl
Framing	3.824***	4.143***	4.249***	3.148***	2.047*	1.197
	(1.423)	(1.459)	(1.469)	(1.107)	(1.079)	(1.101)
Symbolic sanctions	1.579**	1.506	1.568	7.701***	9.607***	9.667***
	(0.769)	(1.016)	(1.015)	(0.702)	(0.929)	(0.923)
Material sanctions	6.511***	7.409***	7.513***	15.69***	11.14***	11.29***
	(0.760)	(0.957)	(0.955)	(0.708)	(0.845)	(0.840)
Period	-0.608***	-0.609***	-0.604***	-0.596***	-0.588***	-0.593***
	(0.0450)	(0.0450)	(0.0450)	(0.0428)	(0.0422)	(0.0421)
Symbolic × Framing		0.130	0.175		-3.610***	-3.585***
		(1.272)	(1.269)		(1.120)	(1.113)
Material × Framing		-1.939	-1.870		10.05***	10.02***
		(1.247)	(1.245)		(1.122)	(1.115)
SVO_score			14.61***			15.19***
			(3.598)			(2.635)
Gender			0.957			2.494**
			(1.381)			(0.974)
Age			-0.0622			-0.197
			(0.179)			(0.141)
Understanding			0.368			0.401
			(0.459)			(0.369)
_cons	8.755***	8.599***	0.299	7.183***	7.747***	1.713
	(1.171)	(1.183)	(5.320)	(0.848)	(0.817)	(4.221)
sigma_u						
_cons	9.182***	9.191***	8.712***	7.277***	6.841***	6.133***
	(0.559)	(0.560)	(0.535)	(0.432)	(0.413)	(0.378)
sigma_e						
_cons	9.703***	9.701***	9.703***	9.542***	9.421***	9.421***
	(0.191)	(0.191)	(0.191)	(0.172)	(0.170)	(0.170)
N	3600	3600	3600	3840	3840	3840

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

TABLE 2.D.3 – Individual contributions taking into account the initial contribution of the group, for all framing data excluding the three cooperative groups excluded (panel tobit estimation two sided random effects)).

	(1)	(2)	(3)	(4)
	All data	All data	All data	Without sanction
Framing	3.895***	3.223***	2.981***	3.898***
	(0.953)	(0.977)	(1.001)	(1.074)
Symbolic sanctions	4.941***	5.745***	5.742***	
	(0.444)	(0.649)	(0.648)	
Material sanctions	11.90***	9.736***	9.787***	
	(0.445)	(0.589)	(0.588)	
Period	-0.367***	-0.364***	-0.364***	-0.675***
	(0.0264)	(0.0263)	(0.0263)	(0.0441)
Initial group contribution	0.167***	0.159***	0.145***	0.177***
	(0.0292)	(0.0289)	(0.0278)	(0.0311)
Symbolic × Framing		-1.517*	-1.485*	
		(0.883)	(0.881)	
Material × Framing		4.754***	4.757***	
		(0.874)	(0.872)	
SVO_score			12.05***	14.01***
			(2.416)	(2.690)
Gender			1.656*	1.689*
			(0.907)	(1.008)
Age			-0.162	-0.0801
			(0.122)	(0.135)
Understanding			0.340	-0.418
			(0.320)	(0.356)
_cons	-2.237	-1.579	-5.644	-2.878
	(1.474)	(1.464)	(3.695)	(4.121)
sigma_u				
_cons	8.001***	7.907***	7.498***	8.106***
	(0.376)	(0.372)	(0.356)	(0.428)
sigma_e				
_cons	9.772***	9.736***	9.737***	9.235***
	(0.147)	(0.146)	(0.146)	(0.183)
N	5928	5928	5928	3528

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

TABLE 2.D.4 – Individual contributions taking into account the initial contribution of the group discriminating for Removal and Introduction conditions, for all framing data excluding the three cooperative groups excluded (panel tobit estimation two sided random effects).

	(1) Removal + Bsl	(2) Removal + Bsl	(3) Removal + Bsl	(4) Introduction + Bsl	(5) Introduction + Bsl	(6) Introduction + Bsl
Framing	3.617***	3.622**	3.816***	3.161***	2.112**	1.636
	(1.391)	(1.426)	(1.444)	(1.048)	(1.039)	(1.073)
Symbolic sanctions	1.635**	1.086	1.139	7.452***	9.449***	9.501***
	(0.785)	(1.036)	(1.035)	(0.710)	(0.938)	(0.932)
Material sanctions	7.107***	7.606***	7.699***	15.42***	10.99***	11.13***
	(0.778)	(0.976)	(0.974)	(0.715)	(0.855)	(0.850)
Period	-0.597***	-0.597***	-0.592***	-0.539***	-0.531***	-0.537***
	(0.0483)	(0.0483)	(0.0483)	(0.0455)	(0.0449)	(0.0448)
Initial group contribution	0.236***	0.236***	0.217***	0.139***	0.116***	0.0959***
	(0.0520)	(0.0521)	(0.0502)	(0.0305)	(0.0292)	(0.0278)
Symbolic × Framing		1.051	1.088		-3.806***	-3.776***
		(1.302)	(1.300)		(1.136)	(1.129)
Material × Framing		-1.095	-1.031		9.744***	9.728***
		(1.280)	(1.279)		(1.136)	(1.129)
SVO_score			13.47***			13.07***
			(3.538)			(2.601)
Gender			0.772			2.180**
			(1.355)			(0.944)
Age			-0.0200			-0.260*
			(0.176)			(0.137)
Understanding			0.280			0.164
			(0.451)			(0.360)
_cons	-2.383	-2.395	-9.691*	0.844	2.322	0.919
	(2.649)	(2.651)	(5.669)	(1.481)	(1.423)	(4.091)
sigma_u						
_cons	8.910***	8.915***	8.509***	6.829***	6.478***	5.884***
	(0.547)	(0.548)	(0.527)	(0.413)	(0.396)	(0.367)
sigma_e						
_cons	9.619***	9.618***	9.620***	9.466***	9.345***	9.346***
	(0.196)	(0.196)	(0.196)	(0.175)	(0.173)	(0.173)
N	3420	3420	3420	3648	3648	3648

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

3

Effectiveness of peer's pressure under negative framing

This chapter is based on joint work with and Katherine Farrow, David Masclet and Marc Willinger

Abstract

Andreoni (1995) showed that framing effects might influence contribution in Voluntary Contribution Mechanisms (VCM) by comparing a standard public goods game, called the positive frame condition, with a negative frame condition. In the former, a subject's decision to invest in the public good makes the other subjects better off, whereas, in the latter, a subjects' decision to invest in his/her private good makes the other subjects worse off. This paper examines whether framing influences the effectiveness of a mechanism that has been shown to foster cooperation, particularly peer pressure (Masclet et al., 2003). There is little evidence on this topic. Nevertheless, Messer et al. 2013 demonstrate that the efficiency of cheap talk mechanisms, such as communication and voting, is lower when the VCM is negatively framed. Our experimental design varies both the frame of the game, "à la Andreoni", and the opportunity for sending symbolic sanctions that are free of charge for the sender and the receiver. We did not replicate Andreoni (1995)'s findings in this set of data ; this is partly explained by three groups whose contributions are abnormally high. Our results also suggest that Andreoni (1995)'s framing is fragile and strongly depends on groups inherent willingness to cooperate. Nevertheless, we found that framing has an impact on subjects' perceptions of the effects of others' actions and on their reported conditional contributions. Both are lower in the negative frame. Moreover, since both are important drivers of group dynamics, we suggest that framing may impact group dynamics.

Keywords : cooperation, public good, framing, peer pressure.

3.1 Introduction

Social norms have been shown to affect substantially groups' ability to cooperate (Barron & Gjerde, 1997 ; Holländer, 1990 ; Lindbeck et al., 2003 ; Kandel & Lazear, 1992). The ability to communicate, and therefore to signal approval or disapproval of other group members' actions is one of the mechanisms that can promote collective action (Ostrom et al., 1994 ; Ostrom, 1992 ; Ostrom, 2000). It can be described as "cheap talk" because it allows subjects to express their expectations and disapproval concerning behaviors, without affecting material incentives. One of the mechanisms that have proven to be effective in promoting cooperation is symbolic sanctions, which are free of charge for both senders and recipients (Masclet et al., 2003). The main reasons put forward are that they allow subjects to express their expectations and disagreement in terms of behavior, and thus activate reciprocity and guilt aversion (Masclet et al., 2003 ; Dugar, 2010 ; Dugar, 2013).

However, little is known regarding the robustness of this mechanism to contextual change. In other words, can agents' perceptions of the collective action problem they face, or of the actions of others, influence the effectiveness of this mechanism ? Indeed, most of the real-world collective action issues such as the management of a natural resource or the provision of a public good (i.e. public infrastructures) are complex. The perception (or misperception) that individuals have of the functioning of the collective good, the actions of others and their real effects, influence their willingness to cooperate and their preferences for contribution rules (Ostrom, 1990 ; Kuziemko et al., 2015 ; Alesina et al., 2018). In this paper, we aim to contribute to the debate regarding the impact of framing on peer pressure's effectiveness. We add a new perspective to the existing literature by testing the role of framing as defined by Andreoni (1995) on the effectiveness of symbolic sanctions.

Advances in experimental economics showed that the way the voluntary contribution mechanism (VCM) is presented significantly influences outcomes even though economic incentives are unchanged (Andreoni, 1995 ; Gächter et al., 2017 ; Messer et al., 2007 ; Park, 2000 ; Willinger & Ziegelmeyer, 1999). Various studies attempted to explain these findings by isolating the possible framing effects (Andreoni, 1995 ; Cox, 2015 ; Cubitt et al., 2011a ; Dufwenberg et al., 2011 ; Fosgaard et al., 2014 ; Fujimoto & Park, 2010 ; Khadjavi & Lange, 2015 ; Park, 2000). They found that cooperation tends to be stronger when subjects have to create a resource (i.e. giving to the public good) than when there is a maintenance issue (i.e. taking from the public good). One possible explanation is that subjects are more willing to cooperate when they perceive the potential externalities resulting from social interaction as positive rather negative. Andreoni (1995) advocates that subjects prefer doing good to others ("warm glow") than doing bad ("cold prickle"). Cubitt et al. (2011b), demonstrated that the give and the take frame generate different expectations. Not contributing under the context of giving is much more blameworthy than in the context of taking. It seems that the context generated by the frame affects agents' moral judgments of others' actions and thus their reciprocity.

In this paper, we try to disentangle this effect, relying on the distinction introduced by Cartwright (2016) between the "give and take frame" and the frame as defined by Andreoni (1995). In the framing proposed by Andreoni (1995), the subjects' endowments are not initially distributed in any account. They must choose how much they invest in the group (public) account and how much they invest in the private account. In comparison, in the give frame (take), the endowments are initially allocated to the private (public) account, and they must choose how much they invest in the public (private) account. In Andreoni (1995) 's frame, the actions proposed to the subjects are strictly identical. The positive and negative frame created by Andreoni (1995) differs in the way the consequences of the actions are presented to the subjects. In the positive frame, investing in the group account is presented as having a positive effect on the earnings of other players ; whereas in the negative frame, investing in the private account is presented as having a negative effect on the earnings of other players. This way of framing the contribution game focuses on the potential consequences of subjects' actions and is therefore relevant for investigating the robustness of a peer pressure mechanism.

We conjecture that if failing to contribute to the public good is judged more morally blameworthy than exploiting an existing public good, one should observe more cooperation in the positive framing. Moreover, the reciprocity dynamic should also be easier to encourage in a positive frame. There is no evidence about how the frame affects the effectiveness of symbolic sanctions. However, Messer et al. (2013) [1] showed that the frame affects the effectiveness of other cheap talk mechanisms such as communication and voting. More specifically, Messer et al. (2013) have shown that when the subjects' actions can only generate negative externalities (i.e. their endowment is initially in the public account), the introduction of communication and voting is less effective than when their actions can only generate positive externalities (i.e. their endowment is initially in the private account). We assume that the effectiveness of the peer pressure mechanism may also be affected by the frame.

We reproduce Andreoni (1995) 's frame, and we give subjects the opportunity to send symbolic sanctions. We varied the order of the treatment by either playing first the no symbolic sanctions treatment followed by the symbolic sanctions treatment (Introduction condition) or the opposite (Removal condition). Our main result is the absence of framing effect in this set of data. It is partly due to three groups whose contributions are significantly higher than the other groups. However, it must also be concluded that the framing effect is fragile and depends strongly on the dynamics of the groups, which is determined by the willingness of the subjects to cooperate without any mechanism. The introduction of symbolic sanctions generally has a positive effect on contributions to the public good and, therefore, on the earnings of individuals (Masclet et al., 2003 ; Dugar, 2010 ; Dugar 2013). However, this effect is strongly dependent on the dynamics inherent to each group. Besides, the effect of symbolic sanctions is mainly observed when they are introduced after the subjects have experienced for the first time a sequence in which they have been unable to express their disapproval. In this experiment, we did not observe a different effect of symbolic sanctions according to the frame. Once again, the fact that the groups composing the negative frame have a strong willingness to cooperate (without any mechanism) and react strongly to the introduction of symbolic sanctions may be an explanation. It should be noted that the number of symbolic sanctions imposed is slightly higher in the negative frame, even if the drivers of disapproval are identical in the two frames. Finally, framing seems to affect the perception of others' actions and the stated reciprocity, i.e. the declared contribution with regards to others' actions, are both higher in the positive frame.

The remainder of this chapter is organized as follow. Section 2 describes the experimental design. In section 3, we discuss our theoretical predictions. Section 4 presents the results. Section 5 discusses the main findings.

1. Messer et al. (2013) are using an alternative to the give and take frame, labelling respectively the public and the private account, account A and B.

3.2 Experimental design

The experiment consists of a repeated linear public good game with and without the opportunity to send symbolic sanctions to other group members. Subjects are assigned to groups of four players. Treatments rely on two dimensions, 2 $\times$ 2 factorial design : 2 framings (positive vs negative) and 2 conditions (with and without the availability of peer pressure through the sending of symbolic disapprovals). Each of the four treatments is repeated over 10 periods.

We adopt a partner matching with a within subject design. Each group was exposed to two conditions : with and without peer pressure. We control for possible order effects by varying the sequence in which symbolic sanctions are available. Each subject only experienced one frame (positive or negative). However, for the treatments where symbolic sanctions are introduced, no disapproval ratings is available in the first sequence and it is introduced in the second sequence, or the opposite. Treatments for which symbolic sanctions are available in the first sequence and removed in the second one, are called Removal condition. They correspond to treatments T3 and T6 (cf table 3.1). Treatments with the reverse order, are called Introduction condition (T2 and T5). The baseline treatment refers to treatments in which subjects played two sequences without peer pressure (T1 and T4).

Table 3.1 – Number of subjects per treatment in Symbolic sanction experiment [number of groups]

Treatment	Framing	Part 1 period$(1-10)$	Part 2 period$(11-20)$	Number of subjects [groups]
T1		Baseline	Baseline	28[7]
T2	Positive	Baseline	Symbolic sanctions (Introduction)	36[9]
T3		Symbolic sanctions	Baseline (Removal)	32[8]
T4		Baseline	Baseline	32[8]
T5	Negative	Baseline	Symbolic sanctions (Introduction)	40[10]
T6		Symbolic sanctions	Baseline (Removal)	28[7]

Andreoni (1995) 's design has the feature that subjects have to do exactly the same task in both frames (positive and negative one). Players' strategy sets and payoff functions are strictly identical in both frames. In the first stage, they have to allocate their endowment between the *Individual Exchange* (x_i) and the *Group Exchange* (y_i). The sum must be equal to 20 tokens, which corresponds to the endowment of each subject per period.

In the Positive frame, investment in the group contribution is presented as having a positive effect on others' payoffs. The exact statement of the instructions was : "*Every token you invest in the Individual Exchange will yield a return of one. [...] Every token invested in the Group Exchange will yield a return of* $\beta = 0.4$ *for each member of the group, not just the person who invested it.*" This frame makes explicit that each group's member can have a positive influence onto others through his investment in the group account. Player i's earning under the positive framing can therefore be written :

$$\Pi_i(y_i, y_{-i}) = x_i + \beta(y_i + y_{-i}) \tag{3.1}$$

In contrast, under the Negative frame, the instructions stated : "*Every token you invest in the Individual Exchange will yield a return of one. However, each token invested in the Individual Exchange will reduce the earnings of other players by* $\beta = 0.4$*. It will also be true that when the other members of your group invest in the Individual Exchange, then your earnings will be reduced* *by* 0.4 *times their investment in the Individual Exchange.[...] Every token invested in the Group Exchange will yields a return of* $\beta = 0.4$." In this framing, each token invested in the private account has a negative impact onto other's payoffs. It is intended to make subjects perceive the social interaction has having potential negative effects. The formal expression of player i's payoff under negative framing is given by equation 3.2. The negative externality of others' investments on a subject's payoff is described by $(-\beta x_{-i})$. For payoffs to be strictly identical, for the same action in both frames, in the negative frame players receive an automatic earning each period, equal to $\beta(n-1)e$ (24 ECU with our parameters $0.4 \times 3 \times 20$). From equation 3.2 it is easy to see that payoffs are identical under both frames, since $y_{-i} = (n-1)e - x_{-i}$:

$$\Pi_i(x_i, x_{-i}) = x_i - \beta x_{-i} + \beta y_i + \beta(n-1)e \tag{3.2}$$

In treatments where subjects can express their disapproval, by sending symbolic sanctions, there is a second stage in each period. In this second stage, once the contribution to the group account of each group member is displayed, subjects must decide individually the number of symbolic sanctions that they send to each other member. In every period, subjects can send from 0 to 5 symbolic sanctions to each member of their group. In order to avoid, reputation effects, subjects'contributions are presented in a random order in each new period. Symbolic sanctions do not affect payoffs. Nevertheless, at the end of each period, subjects get informed about the number of symbolic sanctions they individually received.

The experiment was conducted in the Experimental Economics Laboratory of Montpellier(LEEM) between May 2018 and November 2019. In total 196 subjects participated in the experiment. Upon arrival at the laboratory, each participant chose a cubicle to seat in front of a computer terminal. Subjects were invited to first read instructions privately, after which they were read again out loud by the person in charge of the experiment. The experiment consisted of 3 parts. In part 1, each participant's social value orientation (SVO) was elicitated following Murphy et al. (2011). In this task, subjects were asked to make 15 allocation decisions between themselves and an anonymous receiver. For each decision, 9 options were proposed. One of the fifteen allocation decisions was randomly selected to be paid at the end of each session. In order not to influence the willingness to cooperate of subjects in the public good game, they were informed of the results of the SVO at the end of the experiment only. Before starting the experiment, each participant had to answer eight control questions. After each question, the correct answer and a detailed explanation were displayed. This part aimed to help participants understand the game and how contributions translated into earnings and vice versa. The answers to the comprehension questionnaire were used by the experimenter to compute an understanding score. An experimental session lasted approximately one hour and a half. The average payment was 16.01 euros in addition to a show-up fee of 2 to 6 euros depending on how far the participant travelled to participate in the experiment. The experiments were conducted using zTree (Fischbacher, 2007). The SVO procedure was adapted from Crosetto et al. (2012).

3.3 Behavioural predictions for symbolic sanctions

As the economic incentives remain unchanged, the frame should not influence the contribution to the group account and the reaction to peer pressure. However, from past experimental evidence, we may assume that the way the collective action issue is presented to subjects may impact their behavior (Andreoni, 1995 ; Gächter et al., 2017 ; Messer et al., 2007 ; Park, 2000 ; Willinger & Ziegelmeyer, 1999). It has been shown that making salient the potential gains or losses of the same action induces different behaviors (Tversky & Kahneman, 1981). Moreover, the way a situation is described influences the acceptable behavior and moral judgment on them (Kahneman, 1992). In VCM experiment, Cubitt et al. (2011b) show that not contributing in the give frame is judged more severely than not contributing in the take frame (by withdrawing all). With regards to these results, we state the first prediction.

Prediction 1 : Contributions are lower in the negative frame than in the positive frame.

Symbolic sanctions do not affect payoffs, as they are free to send, and they do not reduce the payoff of the subject receiving them. As a consequence, the implementation of such a mechanism should not have any influence on the propensity to cooperate. Nevertheless, Masclet et al. (2003), Dugar (2010) and Dugar (2013) provide evidence that symbolic sanctions can foster collective action by increasing contributions to a public good significantly. Individuals seem to punish for altruistic reasons, and the same reasons may explain their sensitivity to peer pressure (Fehr & Gächter, 2002 ; Carpenter, 2007). It leads to our second prediction.

Prediction 2 : The availability of symbolic sanctions increases contributions.

From a theoretical point of view, the frame should not affect the reaction to peer pressure. However, experimental evidence shows that the information provided to subjects affects their reactions to the expression of social disapproval (Nikiforakis, 2010 ; Ramalingam et al., 2018). Those experiments rely on monetary sanctions, but even when subjects are using disapprovals that leave monetary incentives unchanged, the frame impacts the efficiency of those mechanisms. Indeed, Messer et al. (2013) showed that communication and voting were less effective in a frame where negative externalities were highlighted than in a frame where positive externalities were highlighted. If it is less blameworthy not to contribute under the negative frame, it may impact the reaction to symbolic disapproval.

Prediction 3 : Peer pressure should be less efficient under negative framing than under the positive frame.

3.4 Experimental Results

In this section, we will first analyze how framing affects contributions. In order to understand its interaction with symbolic sanctioning, we will analyze its influence on disapproving behavior and the way subjects react to it. We will also analyze the effects of framing on the perception of the actions of others and stated conditional contribution. Finally, we will analyze the effect of framing on the effectiveness of symbolic disapprovals.

3.4.1 Voluntary contributions under different framing with and without peer pressure

Result 1 : *There is no significant framing effect in our data.*

Result 1 is supported by the panel tobit estimation presented in tables 3.2 and 3.3. The dummy variable Framing is not significant. This result is also illustrated by figures 3.1, 3.2 and

3.3. This lack of effect is partly explained by three groups in the Introduction condition with a negative frame which have a significantly higher contribution since the first period of the game (i.e. without any mechanism that fosters cooperation). This fact is supported by the double-difference analysis (Diff and Diff) where the dummy variable, distinguishing the groups where symbolic sanctions were implemented, has a significant and positive impact on contributions (cf appendix 3.F.4). It implies that those groups have a significantly higher contribution than the other groups which are in the same conditions : in the negative frame and the first sequence of the experiment without sanctions. The presence of these groups is one of the reasons that attenuate the framing effect, which appears if one considers only the Removal Condition (as illustrated in table 3.3).

However, it also seems that the framing effect is fragile, and depends on the inherent capacities of groups the cooperate. In this experiment, many groups under negative framing in the Introduction condition, have a relatively high level of contribution to the public good during the first sequence of the game (i.e. without symbolic sanctions). If we consider that this high contribution reflects the inherent capacity of the group to cooperate, this may explain why there is a high level of contribution when the mechanism that foster cooperation is introduced.

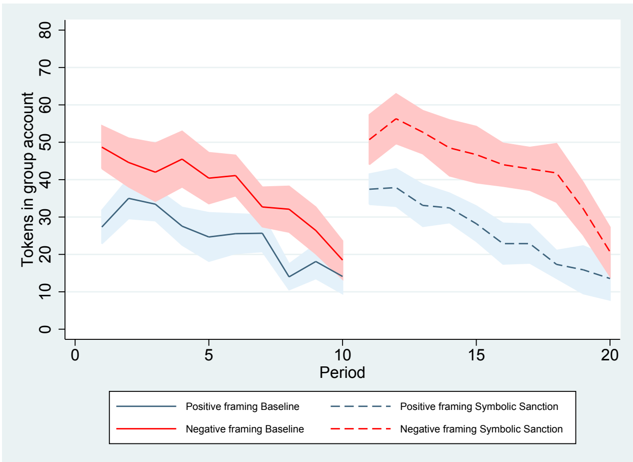


FIGURE 3.1 – Evolution of the average group contribution in the Introduction condition in Symbolic sanctions experiment.

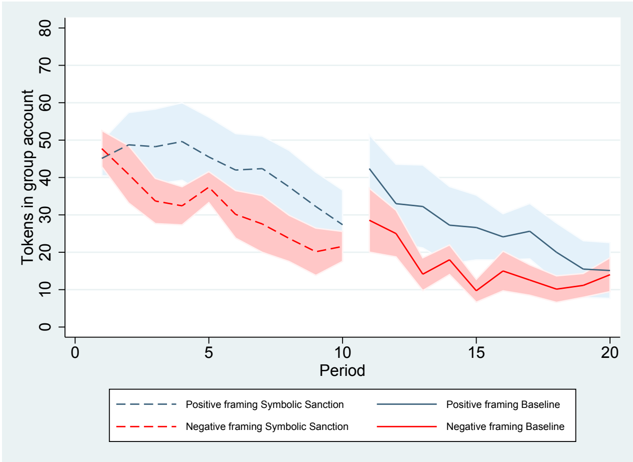


FIGURE 3.2 – Evolution of the average group contribution in the Removal condition in Symbolic sanctions experiment.

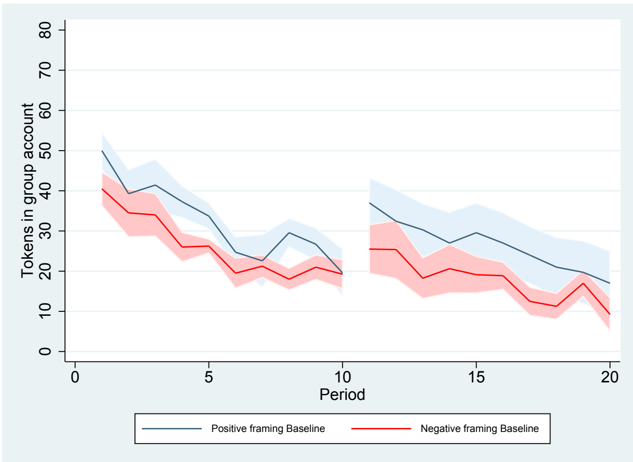


FIGURE 3.3 – Evolution of the average group contribution in the Baseline.

TABLE 3.2 – Individual contributions to the group account in Symbolic sanctions experiment (panel tobit estimation two sided, random effects).

	(1) All data	(2) All data	(3) All data	(4) Without sanction	(5) Sanctions
Framing	-0.687	-0.134	-0.169	0.116	-3.820*
	(1.375)	(1.407)	(1.401)	(1.443)	(2.075)
Symbolic santions	5.250***	6.010***	6.047***		
	(0.437)	(0.612)	(0.611)		
Period	-0.530***	-0.532***	-0.532***	-0.626***	-1.079***
	(0.0322)	(0.0323)	(0.0323)	(0.0453)	(0.103)
Symbolic × Framing		-1.535*	-1.496*		
		(0.861)	(0.860)		
SVO_score			14.97***	15.70***	10.08*
			(3.443)	(3.644)	(5.227)
Gender			3.476***	3.508**	4.511**
			(1.291)	(1.366)	(1.969)
Age			-0.220	-0.160	-0.292
			(0.181)	(0.192)	(0.260)
Understanding			0.553	0.279	1.323*
			(0.471)	(0.497)	(0.711)
_cons	9.291***	9.042***	1.848	2.596	14.50*
	(1.020)	(1.028)	(5.373)	(5.697)	(7.733)
sigma_u					
_cons	9.258***	9.234***	8.579***	8.896***	10.68***
	(0.540)	(0.539)	(0.506)	(0.570)	(0.827)
sigma_e					
_cons	10.05***	10.04***	10.04***	9.190***	10.32***
	(0.188)	(0.188)	(0.188)	(0.212)	(0.339)
N	3920	3920	3920	2560	1360

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

Table 3.3 – Individual contributions to the group account discriminating for Removal and Introduction conditions in Symbolic sanctions experiment (panel tobit estimation, random effects).

	(1) Removal + Bsl	(2) Removal + Bsl	(3) Removal + Bsl	(4) Introduction + Bsl	(5) Introduction + Bsl	(6) Introduction + Bsl
Framing	3.543**	3.488*	3.528**	-2.666*	-1.910	-2.157
	(1.802)	(1.833)	(1.799)	(1.442)	(1.456)	(1.423)
Symbolic sanctions	1.612**	1.504	1.595	8.813***	10.07***	10.16***
	(0.782)	(1.022)	(1.019)	(0.720)	(0.888)	(0.884)
Period	-0.609***	-0.609***	-0.604***	-0.703***	-0.703***	-0.707***
	(0.0487)	(0.0487)	(0.0487)	(0.0486)	(0.0486)	(0.0485)
Symbolic × Framing		0.205	0.327		-2.673**	-2.662**
		(1.261)	(1.257)		(1.090)	(1.086)
SVO_score			19.96***			14.77***
			(4.437)			(3.553)
Gender			2.344			3.817***
			(1.659)			(1.315)
Age			-0.0373			-0.338*
			(0.230)			(0.200)
Understanding			0.413			0.398
			(0.581)			(0.507)
_cons	8.331***	8.358***	-4.258	11.61***	11.26***	7.349
	(1.417)	(1.427)	(6.777)	(1.064)	(1.062)	(5.968)
sigma_u						
_cons	9.521***	9.520***	8.624***	8.008***	7.901***	7.099***
	(0.716)	(0.716)	(0.658)	(0.562)	(0.557)	(0.509)
sigma_e						
_cons	9.532***	9.532***	9.534***	9.824***	9.817***	9.817***
	(0.230)	(0.230)	(0.230)	(0.215)	(0.215)	(0.215)
N	2400	2400	2400	2720	2720	2720

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

Result 2 : *The ability to express disapproval, by sending symbolic sanctions increases significantly contributions to the public good.*

Result 2 is supported by the panel tobit estimation presented in tables 3.2. The dummy variable Symbolic Sanction has a significant and positive effect (cf columns (1), (2), (3)). It has to be noted that this mechanism seems to be more efficient in the Introduction condition, i.e. after subjects experienced a sequence in which there were not able to express their disapproval. This result is supported by the variable "Symbolic sanction" presented in table 3.3 which has a positive and significant sign in the Introduction condition, columns (4), (5) and (6).

Result 3 : *Peer pressure is no less effective under negative framing.*

Result 3 is supported by the interaction variable Symbolic × Framing which has a negative sign but with a low significance effect on contribution to the public good, as illustrated in table 3.2. It implies that if there is an efficiency difference of symbolic sanctions depending on the frame, but in the direction opposite to the predicted one. This effect is mainly due to the higher effect of symbolic sanction in the Introduction condition as it can be seen from table 3.3. Once again, this effect can be partially explained by the higher capacity of those three groups to cooperate without disapproval ratings.

Given these results, it is important to analyze whether framing affects the dynamics of peer pressure and the reactions to it.

3.4.2 Disapproval behavior

Does framing influence the likelihood of disapproving others' actions and the severity of this disapproval ? To answers these questions, we consider two aspects of peer pressure. First, we analyze whether the propensity to disapprove others' actions depends on the frame : does the likelihood of sending symbolic sanctions differ according to the frame ? To answer this question, we analyze subjects' symbolic disapproval vectors, i.e. the three symbolic disapproval decisions taken by subject i towards subjects $j \neq i$. Second, we study whether the intensity of peer pressure is frame dependent. To do so, we analyze whether the sum of the symbolic sanctions received by subjects i ($\sum p_{ji}$) differs between frames.

Is the propensity to send symbolic sanctions frame-dependent ?

Result 4 : *The propensity to disapprove is lower in the positive frame.*

Result 4 is illustrated by figure 3.4, which shows that the number of symbolic sanctions sent is slightly higher in the negative frame. Moreover, it is supported by the results of the regressions presented in table 3.4. The dummy variable Framing has a negative and significant impact on the likelihood to send symbolic sanctions.

One of the main disapproval factors of subject j is his lower contribution compared to subjects i that sent him symbolic sanctions ($y_j - y_i < 0$). In reverse, if subject j's contribution is higher than subject i's, subject j is less likely to receive symbolic sanctions. The social comparison with the other group members also seems to have an impact. If subject j's contribution is larger than the average of the two others members of the group ($y_j - \bar{y}_{-i-j} > 0$), he is less likely to be disapproved by subject i.

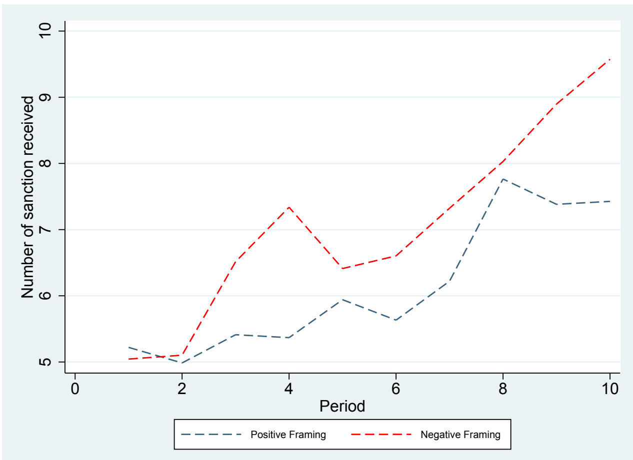


FIGURE 3.4 – Evolution of the number of symbolic sanctions received.

TABLE 3.4 – Subject i's propensity to send symbolic sanction to subject j (probit analysis with cluster by subject).

	(1) All data	(2) All data	(3) Removal	(4) Removal	(5) Introduction	(6) Introduction
Framing	-0.395***	-0.389***	-0.329**	-0.350**	-0.485***	-0.436***
	(0.111)	(0.110)	(0.165)	(0.167)	(0.160)	(0.165)
(absolute) Negative Deviation $y_j - y_i < 0$	0.151***	0.140***	0.147***	0.137***	0.159***	0.145***
	(0.0167)	(0.0169)	(0.0219)	(0.0223)	(0.0273)	(0.0276)
Positive Deviation $y_j - y_i > 0$	-0.0661***	-0.0509***	-0.0588***	-0.0472**	-0.0742***	-0.0554***
	(0.0114)	(0.0135)	(0.0183)	(0.0222)	(0.0132)	(0.0156)
Own contribution	-0.0891***	-0.0793***	-0.0863***	-0.0784***	-0.0951***	-0.0820***
	(0.00840)	(0.00953)	(0.0122)	(0.0141)	(0.0125)	(0.0146)
Period	-0.00815	-0.000632	-0.0118	-0.00684	-0.00668	0.00482
	(0.0126)	(0.0137)	(0.0169)	(0.0179)	(0.0191)	(0.0215)
Sequence	0.323*	0.255				
	(0.166)	(0.171)				
Positive deviation from others two $y_j - \bar{y}_{-i-j} > 0$		-0.0234**		-0.0171		-0.0279**
		(0.0103)		(0.0159)		(0.0139)
(absolute) Negative deviation from others two $y_j - \bar{y}_{-i-j} < 0$		0.0121		0.0115		0.0132
		(0.0115)		(0.0152)		(0.0176)
_cons	0.900***	0.790***	0.845***	0.770***	1.310***	1.025**
	(0.177)	(0.198)	(0.229)	(0.252)	(0.381)	(0.449)
N	3720	3720	1800	1800	1920	1920

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

Is the number of symbolic sanctions sent frame dependent ?

The number of symbolic sanctions sent is higher in the negative frame, as illustrated in figure 3.4. However, the likelihood of receiving symbolic sanctions, once taking into account the deviation from peer's average contribution ($|y_i - \bar{y}_{-i}|$), is similar in both frames, as illustrated in figure 3.5.

The number of symbolic sanctions received is slightly higher in the negative frame. This result seems to be confirmed by the panel tobit estimation presented in table 3.5. The dummy variable Framing is negatively correlated with the number of symbolic sanctions received, even if this result is not robust. The severity of peers' disapproval is linked to a negative deviation from the contribution of other group members (as illustrated in figure 3.5). The less a subject contributes compared to his peers, the higher the number of disapproval he receives (see figure 3.6).

To sum up, being disapproved is mainly due to a lower contribution than peers. As such, it is determined by social comparisons. The number of symbolic sanctions sent and received is slightly higher in the negative frame, but the drivers of disapproval seem to be the same. We conclude that the higher level of symbolic sanctions send is linked to a higher dispersion of contributions. It is corroborated by the higher number of observations deviating from peers' average contribution in the negative frame.

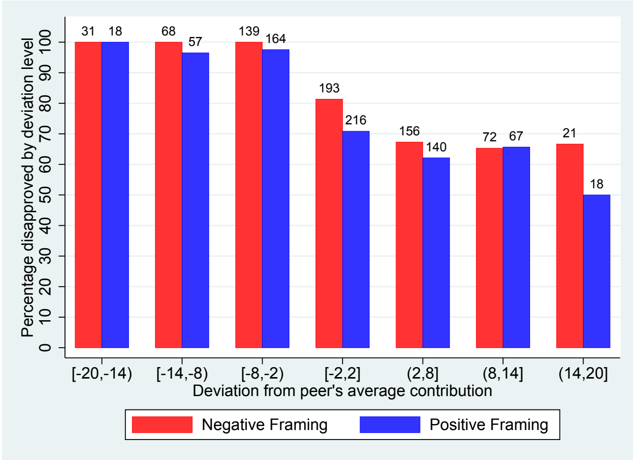


FIGURE 3.5 – Likelihood to receive symbolic sanctions by deviation level (with number of observations).

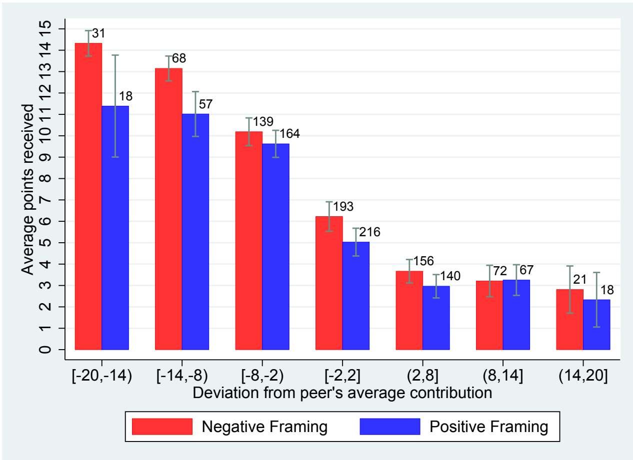


FIGURE 3.6 – Average number of symbolic sanctions received by deviation level (with number of observations).

TABLE 3.5 – Number of symbolic sanctions received (panel tobit estimation two sided, random effects).

	(1) All data	(2) All data	(3) Removal	(4) Removal	(5) Introduction	(6) Introduction
Framing	-1.944***	-1.159	-1.388	0.289	-2.180***	-2.581
	(0.471)	(0.853)	(0.863)	(1.134)	(0.533)	(1.724)
Positive Deviation $y_i - \bar{y}_{-i} > 0$	-0.491***	-0.506***	-0.446***	-0.365***	-0.530***	-0.605***
	(0.0314)	(0.0429)	(0.0475)	(0.0639)	(0.0414)	(0.0575)
(absolute) Negative Deviation $y_i - \bar{y}_{-i} \leq 0$	0.925***	0.977***	0.941***	1.110***	0.925***	0.912***
	(0.0341)	(0.0460)	(0.0522)	(0.0773)	(0.0450)	(0.0567)
Peers'average contribution	-0.542***	-0.543***	-0.603***	-0.608***	-0.519***	-0.523***
	(0.0313)	(0.0313)	(0.0488)	(0.0481)	(0.0418)	(0.0419)
Period	0.0966**	0.118**	0.0273	0.0587	0.142**	0.155**
	(0.0430)	(0.0508)	(0.0623)	(0.0834)	(0.0593)	(0.0782)
Sequence	0.226	0.271				
	(0.635)	(0.634)				
Period × Framing		-0.0506		-0.0720		-0.00786
		(0.0586)		(0.108)		(0.101)
Positive Deviation × Framing		0.0304		-0.143		0.155*
		(0.0612)		(0.0927)		(0.0815)
(absolute) Negative Deviation × Framing		-0.114*		-0.297***		0.0326
		(0.0646)		(0.0968)		(0.0880)
_cons	9.809***	9.458***	10.27***	9.389***	9.357***	9.445***
	(0.648)	(0.719)	(0.897)	(0.970)	(1.268)	(1.487)
sigma_u						
_cons	2.420***	2.407***	3.061***	3.016***	1.788***	1.798***
	(0.191)	(0.191)	(0.338)	(0.333)	(0.222)	(0.222)
sigma_e						
_cons	3.655***	3.645***	3.571***	3.524***	3.698***	3.683***
	(0.0954)	(0.0952)	(0.144)	(0.143)	(0.127)	(0.126)
N	1360	1360	600	600	760	760

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

3.4.3 Responsiveness to symbolic sanctions

To analyze how framing influences responsiveness to disapproval, we consider first how the number of symbolic sanctions received affects the change in contribution. Second, we analyze how the sending of symbolic sanctions affects the formation of a common contribution level.

How do symbolic sanctions affect changes in contributions ?

We observe that the larger the number of symbolic sanctions received by a subject, the more likely he will increase his contribution to the public good. It is supported by the positive and significant effect of the variable "Symbolic sanctions received in $t-1$" on the contribution change between period $t-1$ and t presented in table 3.6.

However, it is worth noticing that on average subjects must receive a relatively high number of symbolic sanctions to increase their contribution to the public good, over 7 points as illustrated in figure 3.7. On average, below this number, subjects do not react by an increase but by a decrease in their contributions. This observation suggests that the strength of the disapproval signal induced by symbolic sanctions is relatively low.

There is no difference in reactions to the received sanction according to the frame. This result is supported by the panel regressions presented in table 3.6. The variable Framing and the interaction variable Symbolic sanctions received in $t-1 \times$ Framing, which reflects the potentially different reaction to the symbolic sanctions received between the two framings, are not significant. As a result, there is no difference in reactions to the symbolic sanctions received according to the frame. The main drivers of the evolution of contributions are linked to social comparison. If the individual had a higher contribution than the members of his group in the previous, he generally decreases his contribution in the following period. Conversely, if an individual had a lower contribution than the average contribution of the other members of his group, he increases his contribution. Those results are supported by the variables Positive deviation in $t-1$ and Negative deviation in $t-1$, which have respectively negative and positive significant effects on contributions' changes (see figure 3.8).

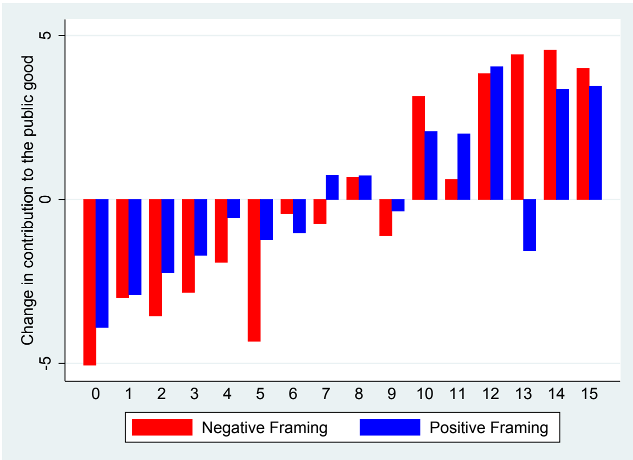


FIGURE 3.7 – Contribution change depending of the numbers of symbolic sanction received

TABLE 3.6 – Contribution change (t) in Symbolic sanctions experiment (panel regression random effects with clusters by group).

	(1) All data	(2) Removal	(3) Introduction
Framing	0.457	1.343	-0.00153
	(0.669)	(0.967)	(0.870)
Symbolic sanctions received in $t-1$	0.158**	0.257**	0.0735
	(0.0756)	(0.119)	(0.0924)
Peers'average in $t-1$	-0.113***	-0.127***	-0.140**
	(0.0350)	(0.0401)	(0.0556)
Positive Deviation in $t-1$	-0.764***	-0.700***	-0.838***
	(0.0834)	(0.131)	(0.0908)
Negative Deviation in $t-1$	0.309***	0.280***	0.357***
	(0.0752)	(0.101)	(0.107)
Period	-0.246***	-0.218**	-0.276***
	(0.0648)	(0.104)	(0.0846)
Sequence	2.202***		
	(0.626)		
Symbolic sanctions in period $t-1$ × Framing	-0.0700	-0.0952	-0.0750
	(0.100)	(0.173)	(0.112)
_cons	2.252***	1.143	6.082***
	(0.845)	(0.910)	(1.804)
N	1224	540	684
R^2	0.339	0.321	0.361

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

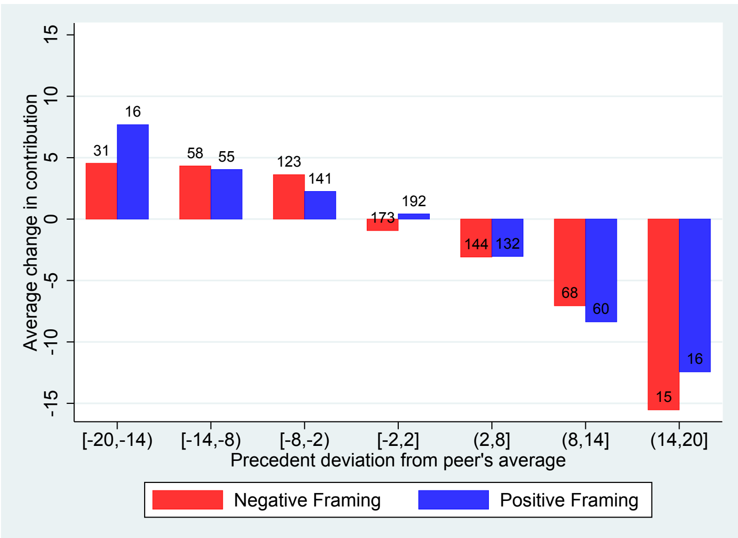


FIGURE 3.8 – Average contribution change with respect to deviation from peer average over previous period in Symbolic sanctions experiment.

Emergence of a common contribution standard ?

We analyze whether the implementation of a disapproval rating promotes the emergence of a contribution standard in groups. We therefore examine whether a specific level of contribution has been chosen more frequently over time. To do this, we consider the distribution of the different levels of contribution in each period for the different treatments.

In the Baseline conditions, the percentage of subjects who fully contribute to the group account is low. As illustrated in figure 3.9, the first period excluded, it is around 10 percent in both frames. The most common behavior is free-riding (zero contribution to the public good). Over periods, the number of subjects who adopt this behavior keeps on increasing, reaching respectively 61 and 75 percent in the positive and in the negative frame, in the last period of the game.

In the Removal condition, when the disapproval rating is available initially, we observe a relative increase in the percentage of full contributors in the positive frame, as illustrated in figure 3.10. It even becomes the most frequently level of contribution adopted in period 4 of the game, with 47 percent of subjects contributing fully. There is no such increase in the negative frame where the percentage of full contributors remains below 14 percent (the first period excluded). We assume that, under these conditions, the positive frame leads to a stronger identification of full contribution as a socially desirable behavior.

In the Introduction condition, when sanctions are introduced, we observe that full contributing becomes the most frequent behavior, in the negative frame (over 30 percent of the subjects). In contrast, the number of full contributors in the positive frame remains relatively low (reaching 0 percent in period 6 after the introduction of symbolic sanctions). Those results are illustrated in figure 3.11. A possible reason is the large number of full contributors in the negative frame in sequence 1 (without symbolic sanctions), reaching 35 percent in period 4. We state that this relatively high percentage of full contributors demonstrates that these groups have a strong desire to cooperate, without any mechanism to promote it. Conversely, under these conditions, in the positive frame, the percentage of full contributors is relatively low (even compared to the baseline conditions). This relatively low percentage is observed since the first period of the first sequence, where it represents about 8 percent of the subjects adopting this behavior. This may reflect the relatively low willingness of these groups to cooperate.

To sum up, without symbolic disapproval, the observed dynamics are similar in both frames. With repetition, free-riding becomes the most frequently adopted behavior. However, we argue that the introduction of symbolic disapproval may reveal a different willingness to cooperate, depending on the frame. In other words, the effectiveness of the disapproval rating in preventing the tendency to free-riding is strongly influenced by the inherent willingness of the group to cooperate.

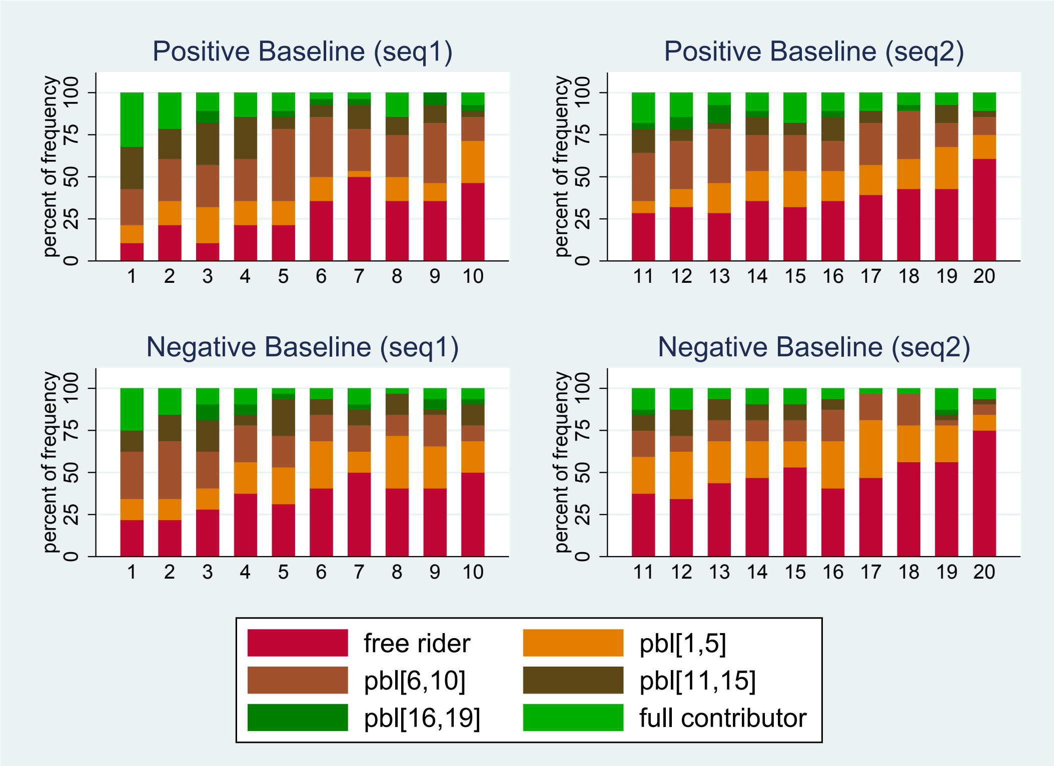


FIGURE 3.9 – Evolution of contribution categories in Symbolic sanctions experiment (Baseline).

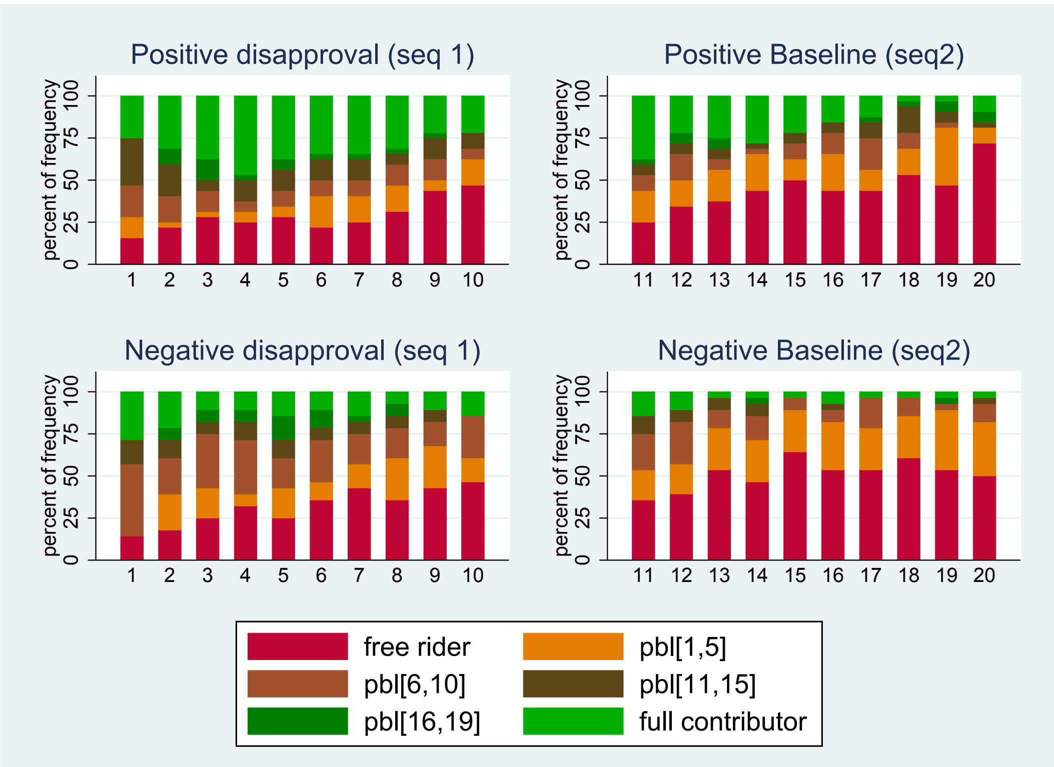


FIGURE 3.10 – Evolution of contribution categories in Symbolic sanctions experiment (Removal condition).

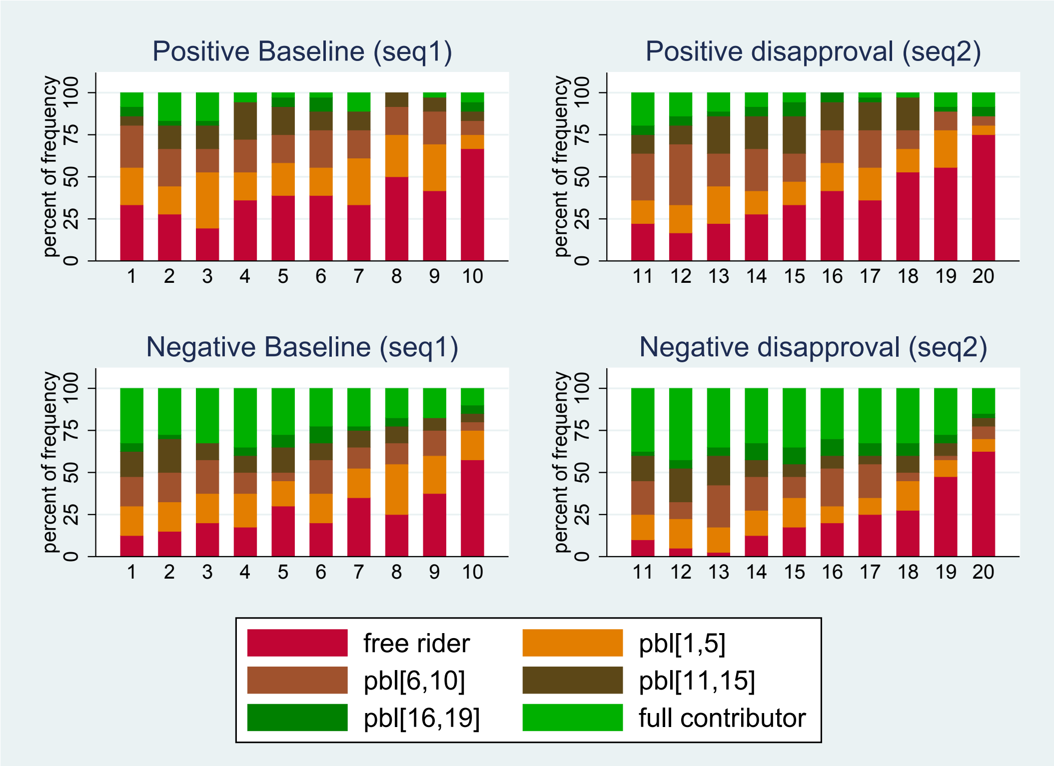


FIGURE 3.11 – Evolution of contribution categories in Symbolic sanctions experiment (Introduction condition).

To better understand the effect of framing, we analyze how it affects the perception of the actions of others, and the stated conditional contribution.

3.4.4 What are the potential effects of the frame on perception and the stated conditional contributions ?

How does framing affects the perception of others' actions ?

We analyze how the frame impacts the perception of others' actions ; at the end of the experiment, we asked subjects to qualify their effects. They could be qualified as generating : i) important losses, ii) losses, iii) no gains or losses, iv) gains and v) important gains. Answers were transformed in order to generate a perception score. Results are presented in figure 3.12. In order to analyze the framing effect on perception, we used an ordered logit model.

Result 4 : *The perception of others' actions is more favorable under the positive frame.*

This result is supported by the higher percentage of subjects that qualify others' actions as having positive effects, generating : "gains" or "important gains". It is worth noticing that the qualification "important gains" is only observed in the positive frame. Result 4 is also supported by the ordered logit estimation reported in table 3.7. The dummy variable Framing has a positive and significant effect on perception, as presented in table 3.7. To ensure that the effect of framing on perception is not due to different levels of actual contribution, we control this effect. To do so, we introduce the average contributions of one subject their peers for the whole experiment. The introduction of this variable does not decrease the framing effect. To sum up, the perception of others' actions is better in the positive frame. [2].

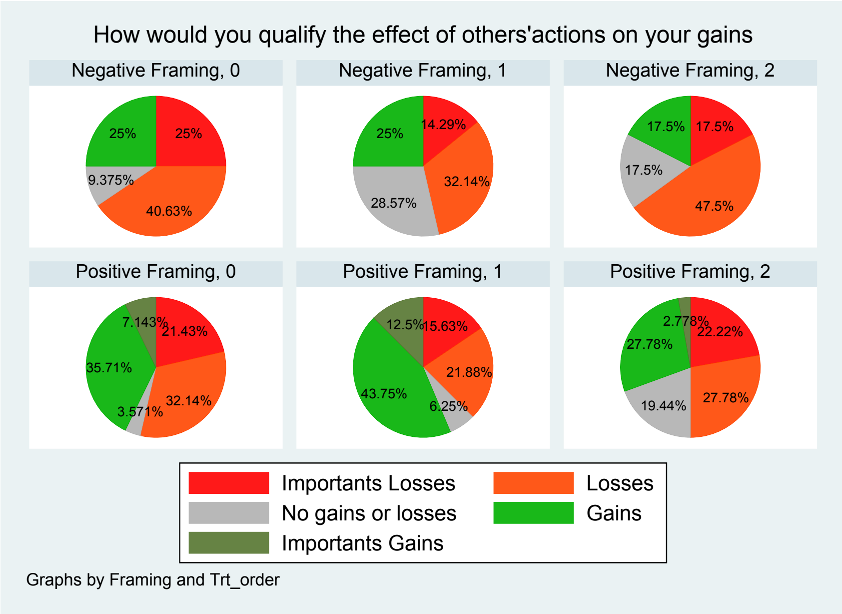


FIGURE 3.12 – Perception of others' actions effect by treatment in Symbolic sanctions experiment

2. The numbers describe treatments conditions : 0 refers to Baseline Conditions, 1 to Removal condition and 2 to Introduction condition.

TABLE 3.7 – Perception of others' actions in Symbolic sanctions experiment (ordered logit analysis).

	(1) QF_Perception_Effets	(2) QF_Perception_Effets	(3) QF_Perception_Effets
Framing	0.563**	0.662**	0.721**
	(0.262)	(0.280)	(0.282)
Symbolic sanctions applied	1.245**	1.093*	1.092*
	(0.572)	(0.588)	(0.595)
Treatment order	-0.645**	-0.581*	-0.742**
	(0.313)	(0.317)	(0.325)
SVO_score		0.499	0.274
		(0.707)	(0.716)
Gender		-0.217	-0.282
		(0.262)	(0.264)
Age		0.0116	0.0143
		(0.0362)	(0.0368)
Understanding		-0.101	-0.159
		(0.0953)	(0.0977)
Average Peer Contributions (sum)			0.0451***
			(0.0119)
cut1			
_cons	-1.055***	-1.231	-0.845
	(0.285)	(1.085)	(1.104)
cut2			
_cons	0.553**	0.398	0.840
	(0.276)	(1.084)	(1.105)
cut3			
_cons	1.185***	1.036	1.514
	(0.286)	(1.088)	(1.110)
cut4			
_cons	3.810***	3.666***	4.296***
	(0.465)	(1.144)	(1.179)
N	196	196	196

Standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.01

What are the potential effects of the frame on stated conditional contribution ?

To analyze the impact of the frame on the stated reciprocity, at the end of the experiment, we reproduce the questions introduced by Fosgaard et al. (2014) in order to elicit the level of stated conditional contribution. Subjects were asked how much they would invest in the group account to maximize group income in two situations.

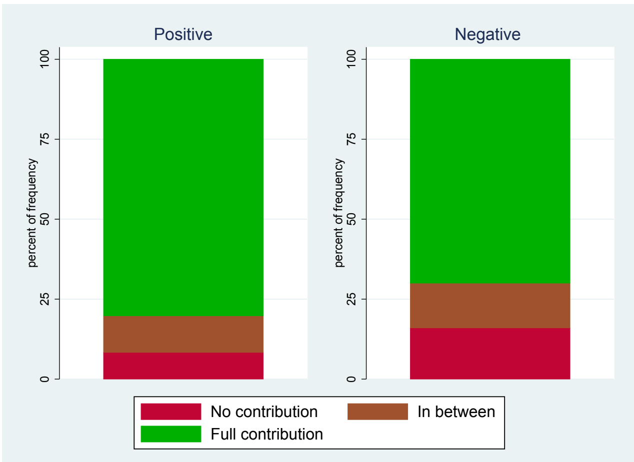
In the first situation, they were told that none of the other group members contributes. In this situation, all the subjects and in both frames declare that they would invest nothing either.

In the second situation, they were told that all other group members contribute their endowment to the group account. In this case, a large majority of subjects, with respectively 80% in the positive frame and 70% in the negative frame, declared that they would also fully contribute to the group account (see figure 3.13).

This observation suggests that subjects do not address the game strategically. The dynamics of cooperation is strongly driven by conditional reciprocity. It gives credit to Fischbacher et al. (2001) 's behavioral observation, which states that the majority of subjects willingness to cooperate depends strongly on others' contributions. However, it is worth noticing that the percentage of subjects who state that they will contribute fully is slightly higher in the positive frame. Moreover, when we distinguish the results depending on the treatment conditions, we observe that this difference in stated contribution depending on the frame is mainly due to the Removal condition (see figure 3.14). Conversely, in the Introduction condition, the frequency of full contributors are similar in both frames (figure 3.15).

If we consider that stated contributions reflect reciprocity or a preference for cooperation (Gächter et al., (forthcoming [3]) we can conclude that framing seems to impact reciprocity. As the percentage of stated full contributors are slightly lower in the negative frame, we can state that the frame reduces the willingness to reciprocate. Nevertheless, under the Introduction condition, it is worth noticing that the groups who compose the negative framing treatment had a relatively high percentage of stated full contributors. As a consequence, we assume that these groups have a high willingness to reciprocate. This observation provides an explanation of the relatively higher efficiency of the disapproval rating in this treatment.

FIGURE 3.13 – Stated contributions if others fully contribute in Symbolic sanctions experiment (all data presented in this chapter)



3. This article was presented at the ESA (Europe) conference in Dijon in September 2019. The authors reproduced Fosgaard et al. (2014) 's questions, and found that subjects are less likely to fully contribute under the negative frame.

FIGURE 3.14 – Stated contributions if others fully contribute in Symbolic sanctions experiment (Removal condition)

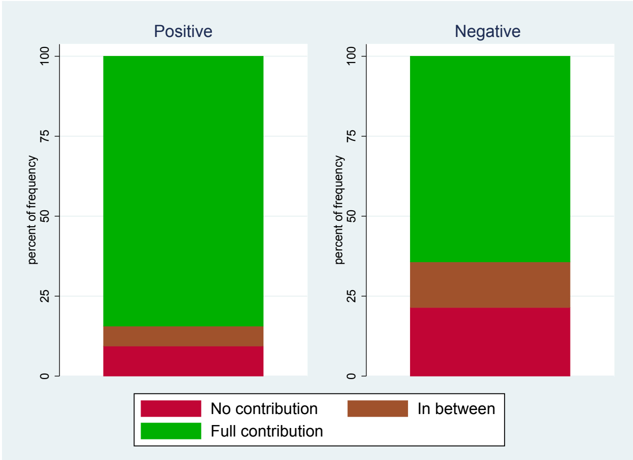
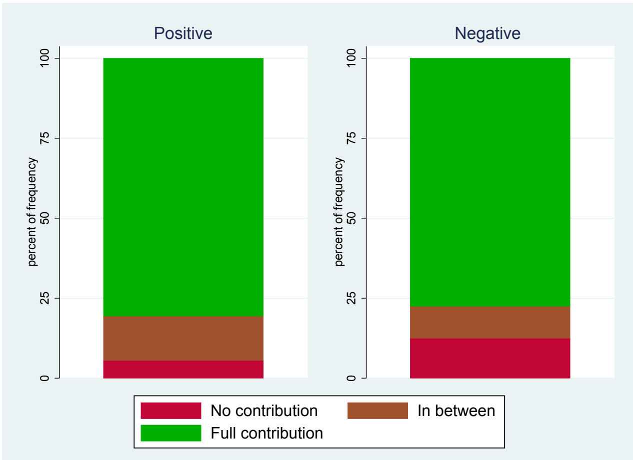


FIGURE 3.15 – Stated contributions if others fully contribute in Symbolic sanctions experiment (Introduction condition)



3.4.5 Does peer pressure affect payoffs ?

Result 5 : *The availability of peer pressure increases individual payoffs.*

Result 5 is supported by the panel regression results reported in table 3.8. The dummy variable "Symbolic sanctions" has a significant and positive effect on payoffs. This result is mainly explained by their effects in the Introduction condition (see table 3.9).

Moreover, in this experiment, the framing does not affect payoffs. This result is supported by the variable Framing presented in table 3.8. When we differentiate the treatment depending on the sequence where symbolic sanctions were introduced, we observe that it could have an effect on the Removal condition, but it has a low significance (cf table 3.9). The absence of effect in the Introduction condition is due to a higher contribution under the negative frame. Explanations which have been mentioned throughout this chapter may be one of the reasons explaining the lack of effect when considering all the groups making up this experiment.

To conclude, the availability of disapproving the actions of others by sending symbolic sanctions, at no cost to the sender and recipient, makes it possible to increase the contributions and, consequently, the earnings of the members of the group. The lack of effect of the Framing' effects on contributions is due to a contradictory effect between the Removal condition and the Introduction condition. For the former, there is a higher level of contributions in the positive framing, while for the latter, there is a higher level of contributions in the negative framing. It has the effect of cancelling the framing effect.

TABLE 3.8 – Individual payoffs in Symbolic sanctions experiment (panel regression, random effects).

	(1) All data	(2) All data	(3) All data	(4) Without sanctions	(5) Sanctions
Framing	-0.0755	0.126	-0.144	-0.263	-0.998
	(0.526)	(0.541)	(0.574)	(0.585)	(0.763)
Symbolic sanctions	1.584∗∗∗	1.875∗∗∗	1.878∗∗∗		
	(0.192)	(0.272)	(0.272)		
Period	-0.161∗∗∗	-0.162∗∗∗	-0.162∗∗∗	-0.199∗∗∗	-0.293∗∗∗
	(0.0141)	(0.0141)	(0.0141)	(0.0203)	(0.0408)
Symbolic × Framing		-0.579	-0.588		
		(0.384)	(0.384)		
SVO_score			-1.732	-0.771	-1.932
			(1.403)	(1.468)	(1.913)
Gender			-0.339	-0.309	-0.108
			(0.527)	(0.551)	(0.723)
Age			0.0607	0.107	-0.0531
			(0.0740)	(0.0777)	(0.0952)
Understanding			0.210	0.352∗	0.000904
			(0.192)	(0.201)	(0.261)
_cons	25.63∗∗∗	25.54∗∗∗	24.11∗∗∗	22.19∗∗∗	31.34∗∗∗
	(0.400)	(0.404)	(2.199)	(2.311)	(2.848)
N	3920	3920	3920	2560	1360
R^2	0.035	0.036	0.044	0.046	0.017

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

Table 3.9 – Individual payoffs discriminating for Removal and Introduction conditions in Symbolic sanctions experiment (panel regression, random effects).

	(1) Removal + Bsl	(2) Removal + Bsl	(3) Removal + Bsl	(4) Introduction + Bsl	(5) Introduction + Bsl	(6) Introduction + Bsl
Framing	1.364*	1.357*	1.288*	-0.764	-0.487	-0.861
	(0.681)	(0.697)	(0.748)	(0.624)	(0.626)	(0.661)
Symbolic sanctions	0.408	0.392	0.377	2.821***	3.288***	3.289***
	(0.342)	(0.450)	(0.450)	(0.332)	(0.411)	(0.411)
Period	-0.197***	-0.197***	-0.198***	-0.222***	-0.222***	-0.221***
	(0.0214)	(0.0214)	(0.0215)	(0.0220)	(0.0220)	(0.0220)
Symbolic × Framing		0.0286	0.00514		-0.990*	-1.006*
		(0.549)	(0.549)		(0.514)	(0.514)
SVO_score			-1.520			-2.650
			(1.840)			(1.645)
Gender			-0.671			-0.353
			(0.691)			(0.610)
Age			0.134			0.0588
			(0.0958)			(0.0932)
Understanding			0.0385			0.357
			(0.241)			(0.235)
_cons	25.38***	25.39***	23.26***	26.37***	26.24***	24.51***
	(0.557)	(0.563)	(2.826)	(0.467)	(0.463)	(2.774)
N	2400	2400	2400	2720	2720	2720
R^2	0.053	0.053	0.066	0.038	0.043	0.060

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

3.5 Discussion

In our experiment, we reproduce Andreoni (1995) 's frame, which states that subjects are more willing to contribute when they perceive social interactions as generating positive externalities than when they perceive them as generating negative externalities. We investigate whether the frame can affect the effectiveness of mechanisms known to promote cooperation, such as symbolic sanctions. Our data does not replicate the framing effect established by Andreoni (1995). In other words, in this set of data, we did not find the warm glow effect. It is partly explained by three groups in the negative frame in the Introduction condition that have a contribution level in the first sequence (i.e. without sanctions) which is significantly higher than the other groups of the negative frame in the Baseline conditions. Moreover, we have to conclude that the framing effect is fragile. It is strongly dependent on groups propensity to cooperate. Once again, numerous groups in the negative frame under the Introduction condition have a relatively high level of contribution to the public good in the first period of the game. We state that it reflects their inherent high willingness to cooperate, which implies that they are less sensitive to the negative framing.

The ability to send symbolic sanctions generally has a positive effect on the contribution to the public good. It should be noted that this effect is stronger when the capacity to disapprove the actions of others is introduced after subjects first experienced a sequence in which signalling disapproval was not available. It seems important to remind that the strong effect of symbolic sanctions on contributions observed by Masclet et al. (2003) was obtained in identical conditions, i.e. symbolic sanctions were introduced after a sequence where they unable to disapprove others members. Moreover, the efficiency of this disapproval rating on cooperation's increase is strongly dependent on groups specific willingness to cooperate.

Contrary to Messer et al. (2013), we did not find that "cheap talk", or more precisely, the symbolic disapproval, was less effective in the negative frame. On the contrary, symbolic sanctions tend to have a higher effect on the negative frame under the Introduction condition. One more time, we state that it is linked to the inherent higher propensity of the groups that compose this treatment to cooperate. Those groups have relatively higher initial contribution and though a relatively higher percentage of individuals that fully contribute to the public good (without any mechanism). It may explain why they are more sensitive to the establishment of a mechanism enabling them to express their disapproval and, in so doing, their social expectations, which leads to relatively greater cooperation.

Other results might help to understand the framing effect. First subjects have more difficulties in establishing the payoffs under the negative frame. It is reflected by the lower understanding score observed. However, the cooperation dynamics generated by the frame cannot solely be explained by the initial difficulty in establishing gains. The comprehension test responses were automatically displayed to ensure that subjects had the right gains in mind before starting MCV. Moreover, we control for the comprehension score in every analysis, and it does not affect the contribution's dynamic.

Furthermore, the stated conditional contribution, reveal that a large majority of subjects announce that they would fully contribute if others did. However, we have never observed such a level of cooperation in our voluntary contribution experiment. Besides, this latter analysis provides another interesting result, namely that the stated conditional contribution is influenced by framing, as it is lower in the negative. This finding is consistent with the experiment of Fosgaard et al. (2014), Gächter et al. (2017) and Gächter et al. (forthcoming) which show that the frame has an impact on the types of subjects (Fischbacher et al., 2001). Specifically, the percentage of free-riders is higher in the take frame (i.e. when actions can only have negative externalities on others). Moreover, Gächter et al. (forthcoming), replicating the stated conditional contribution test defined by Fosgaard et al. (2014), find a lower percentage of stated full contributors in the negative frame. As Gächter et al. (2017), we state that, reciprocity can be defined as a "form of conditional cooperation : the willingness to cooperate provided others do the same." As a consequence, these results suggest that the frame affects the willingness to reciprocate.

To conclude, framing shapes the perception of the game, both in the subjects' perception of the effects of other people's actions, but also in the behavior they say they want to adopt in the face of other people's actions. It gives credence to the analysis developed by Kahneman (1992), who considers that the way in which a situation is described strongly influences what is defined as acceptable behavior. It invites us, in addition to economic incentives, to take better account of how individuals perceive the problem of collective action they face, and in particular, how they perceive the actions of others.

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Appendices of chapter 2

3.A Instructions

Here are presented the translation of the experiment instructions we used. There were given in french originally.

3.A.1 Announcement

The experiment you are about to participate aims to study decision making.

Please read the instructions carefully. They should help you understand the experiment. Once all participants have read it, an experimenter will read them aloud.

All your decisions will be treated anonymously. You will indicate your choices on the computer you are sitting in front of.

From now on, we ask you not to speak anymore. If you have a question, raise your hand and an experimenter will come and answer you in private.

Over the course of the experiment, you will accumulate earnings expressed in the experimental currency unit (ECU).

At the end of the experiment, your **ECU** will be converted into **euros** at a conversion rate which is specified at the end of these instructions.

The experiment has **three parts**. The attached instructions are those in **Part 1**. The instructions in part 2, then 3 will be distributed at the end of the previous games.

3.A.2 Public good game

Investment game

A.1.1.1 Negative Frame

This experiment is a study of group and individual investment behavior. The instructions are simple. If you follow them carefully and make good investment decisions, you may earn a non negligible amount of money. The money you earn will be paid to you, in euros, at the end of the experiment.

MAKING CASH EARNING FROM YOUR INVESTMENT RETURN

In the experiment you will make a series of 10 investment decisions. For each investment decision you will be placed in a group of four other subjects (you included). The group composition will remain the same during all this game. Your investment returns will depend on the investment decison that you and the other three members of your group make.

Each investment decision you make will result in an investment return. Your investment return from each decision will be turned into cash earnings. The exchange rate is 0.025. Meaning that 100 ECU equal 2.5 euros. For example, if your investment return from one investment decision is 30 ECU, your earnings will be 0.75 euros. If your investement return is 20 ECU, your earnings will be 0.5 euros. In the following pages, we will describe how your investment returns are determined.

THE INVESTMENT OPPORTUNITIES

You have been assigned to a group of 4 people. Each person will get an endowment of 20 tokens. You will have to choose how to divide your tokens between two investment opportunities :

1. The Individual Exchange

Every token you invest in the Individual Exchange will yield you a return of one ECU. However, each token you invest in the individual exchange will reduce the earnings of every other players by 0.4 ECU.

Example : Suppose you invested 20 tokens in the Individual Exchange. Then you would get a return of 20 ECU. However, each of the three other members of your group would have their earnings reduced by 8 each.

Example : Suppose you invested 10 tokens in the Individual Exchange. Then you would get a return of 10 ECU. However, each of the three other members of your group would have their earnings reduced by 4 each.

Example : Suppose you invested 0 tokens in the Individual Exchange. Then you would get no return for this exchange. Likewise, the other three members of your group would not have their earnings reduced.

It will also be true that when the other members of your group invest in the Individual Exchange, then your earnings will be reduced by 0.4 times their investment in the Individual exchange. This is illustrated below :

Example : Suppose that the other 3 members of your group invested a total of 35 tokens in the Individual Exchange. Then this would reduce your earnings by 14 ECU.

Example : Suppose that the other 3 members of your group invested a total of 35 tokens in the Individual Exchange. Then this would reduce your earnings by 12 ECU.

Example : Suppose that the other 3 members of your group invested no tokens the Individual Exchange. Then this would not reduce your earnings at all.

2. The Group Exchange

Every token you invest in the Group Exchange yields a return of 0.4 for you. The other menbers of your group are not affected by your investment in the Group Exchange.

Example : Suppose that you decided to invest no tokens in the Group Exchange. Then your return from the Group Exchange would be 0.

Example : Suppose that you decided to invest 10 tokens in the Group Exchange. Then your return from the Group Exchange would be 4.

Example : Suppose that you decided to invest 20 tokens in the Group Exchange. Then your return from the Group Exchange would be 8.

Automatic Earnings

In addition to the earnings you accumulate from the Individual Exchange and the Group Exchange, you will also get automatic earnings each round. These automatic earnings will not depend on any decisions you make, and will be the same each round. Your automatic earnings will be 24 ECU each round. Hence, your total earnings each round will be your earnings from the Individual Exchange plus your earnings from the Group Exchange plus 24 ECU in automatic earnings.

The Investment Decision

Your task is to decide how many of your tokens to invest in the Individual Exchange and how many to invest in the Group Exchange. You are free to put some tokens into the Indivudal Exchange and some into the Group Exchange. Alternatively, you can put all of them into the Group Exchange or all of them into the Individual Exchange.

Your Investment Account

You and every other member of your group will get an endowment of 20 tokens every period. The total number of tokens in each group in every period is 80.

Stages of Investment

During 10 periods, you will be asked to make investment decision. In every period, the sum of your investment decisions has to be equal to your endowment 20 tokens.

In every period, you will get a EARNINGS REPORT.

This earnings report tells you the total investment in the Group Exchange, your investment return, and your cash earnings. Your Earnings Report does not tell you the investment decisions or earnings of the other members of your group. YOUR INVESTMENT DECISIONS AND EARNINGS ARE CONFIDENTIAL.

Your Group

The composition of your group will **remain the same during this game**. In every period, you will interact with the 3 **same people**.

At no point in the experiment will the identities of the other members of the group be made known to you, nor will your identity be made know to them.

Your Cash Earnings

Your investment return determines your earnings in euros. For example, if you get 100 ECU, your earnings will be 2.5 euros.

GOOD LUCK !

A.1.1.2. Positive Frame

The positive frame instructions are identical to the negative frame, except for the investment opportunities and the automatic earning.

THE INVESTMENT OPPORTUNITIES

You have been assigned to a group of 4 people. Each person will get an endowment of 20 tokens. You will have to choose how to divide your tokens between two investment opportunities :

1. The Individual Exchange

Every token you invest in the Individual Exchange will yield you a return of one ECU. The other members of your group are not affected by your investment in the Individual Exchange.

Example : Suppose you invested 20 tokens in the Individual Exchange. Then you would get a return of 20 ECU.

Example : Suppose you invested 10 tokens in the Individual Exchange. Then you would get a return of 10 ECU.

Example : Suppose you invested 0 tokens in the Individual Exchange. Then you would get no return for this exchange.

2. The Group Exchange

Your return from the Group Exhange will depend on the total number of tokens that you and the other three members of your group invest in the Group Exchange. The more the group invests in the Group Exchange, the greater the return to each member of the group.

Every token invested in the Group Exchange yields a return of 0.4 for each member of the group, not just the person who invested it.

Example : Suppose that you decided to invest 0 tokens in the Group Exchange, but that the three other members invested a total of 30 tokens. Then your return from the Group Exchange would be 12 ECU. Everyone else in your group would also get a return of 12.

Example : Suppose that you invested 10 tokens in the Group Exchange, but that the other three members of the group invest 30 tokens. This makes a total of 40 tokens. Your return from the Group Exchange would be 16. The other three members of the group would also get a return of 16.

Example : Suppose that you invested 20 tokens in the Group Exchange, but that the other three members of the group invest nothing. Then you, and everyone else in the group, would get a return from the Group Exchange of 8 .

As you can see, every token invested in the Group Exchange will yield a return of 0.4 for every member of the group, not just the person who invested it. It does no matter who invests tokens in the Group Exchange. Everyone will get a return from every token invested whether they invest in the Group Exchange or not.

Peer pressure

During this game, you stay with the **same group**, you are interacting with the **same people** than in the **precedent game**.

The **functioning of the two accounts**, the **conversion rate** are the same than in the **precedent experiment**. The earnings you will get in this game will be added to thoses of the two precedents games.

This experiment also has 10 periods. However, each period is composed by two stages :

— **The first stage** is identical to the action you made during a period in the precedent experiment : you have to decide how much tokens you invest in the Individual Exchange and in the Group Exchange. In the same way, when all the members of your group have taken their decisions, the SUMMARY screen is displayed. This screen reminds you of the same information as in the previous section.

— **During the second stage**, after having taken note of the investment decisions of each of the other 3 members of your group in the Group Exchange, you may decide to send them sanction points.

Description of the second stage

You get informed about the amount that each of the three other members contributed in the Group Exchange in the first stage of the game. **Please notice that** the order in which the decisions of the three other members of your group are displayed, is randomly modified every period. Thereby, the investment of the first "Other member" which will appear on your screen, will not be the same player each time. It will be the same for the invesments which appear in the second and the third place.

You have to take a decision about the number of sanction points you send to **each** of the three members of your group. You can impose untill 5 **sanctions points** to **each of your group members** every **period**. Likewise, **every other member of your group** can impose you sanction points every period. For every subject, you must enter a value between 0 and 5 points. If you do not want to decrease the earnings of another subject, you must enter 0.

Once all group members have made their decisions, your screen will display your total number of sanction points received, your total sanction points sent, and the associated costs ; as well as your gain for the period.

3.A.3 Social Value Orientation test

In this experiment, you have to decide how to share an amont between you and "another person". This other person is in this room, and will be randomly selected at the end of the experiment. You cannot identify her and she cannot identify you. All your choices are completely confidential.

Concretely, you have to select one between 9 distributions proposed. There are no right or wrong answers. You have to choose the distribution you prefered. You have to make this choice 15 times through 15 screens that present differents distribution proposal.

Once all the people present in this room, have answer the question, the computer will randomly select one of the 15 propositions. This will be paid depending of your choice. The part dedicated to the "other person" will be sent to a subject selected randomly.

You will also receive the "Other Person" share resulting from the choices of another individual present in this room who will also be selected randomly at the end of the game.

The results of this experiment will be communicated to you at the end of the session, and you will receive at that time the amount corresponding to your winnings.

In this experiment we used an experimental currency : ECU. The ECU you accumulate during the experiment will be converted into euros with a conversion rate of 0.025. One hundred ECU will therefore correspond to 2.5 euros.

3.A.4 Understanding questions

1. How many players are they in your group (including yourself) ?
— i. 3 players
— ii. 4 players
— iii. 5 players
Answer posted : The correct answer was 4 people : you and 3 other members

2. Do the composition of your groupe change every period ?
— i. Right
— ii. Wrong
Answer posted : The correct answer was Wrong. You keep the same group during the 10 periods of this game.

3. How many tokens do you individually have to invest every period between the Individual Exchange and the Group Exchange ?
— i. 20 tokens
— ii. 80 tokens
— iii. It depends on previous periods
Answer posted : Every period you must invest 20 tokens between the Group account and the Individual account.

4. If none of the four members of your group (including you) invest in the Group account, and therefore each member invests 20 tokens in the Individual account : What is your return on investment for the period ?
— i. 0 ECU
— ii. 20 ECU
— iii. 24 ECU
Answer posted [POSITIVE FRAME] : Via the Group account you get 0.4 * 0 = 0 ecu. Via the Individual account you get 1 * 20 = 20 ECU. Your return on investment for the period is 0 + 20 = 20 ECU.

Answer posted [NEGATIF FRAME] : Via the Group account you get 0.4 * 0 = 0 ecu. Via the Individual account you get 1 * 20 - 0.4 * (20 * 3) = -4 ECU. In addition, each period you benefit from an automatic gain of 24 ECU. Your return on investment for the period is 0 - 4 + 24 = 20 ECU.

5. If each of the four members of your group (including you) invests 20 tokens in the Group account, and therefore no member invests in the individual account : What is your return on investment for the period ?
— i. 0 ECU
— ii. 20 ECU
— iii. 32 ECU
Answer posted [POSITIVE FRAME] : Via the Group account you get 0.4 * (20 * 4) = 32 ECU. Via the Individual account you get 1 * 0 = 0 ECU. Your return on investment for the period is 32 + 0 = 32 ECU.

Answer posted [NEGATIF FRAME] : Via the Group account you get 0.4 * (20) = 8 ECU. Via the Individual account you get 1 * 0 - 0.4 * 0 = 0 ecu. In addition, each period you benefit from an automatic gain of 24 ECU. Your return on investment for the period is 8 + 0 + 24 =

32 ECU.

6. If the sum of the investments in the group account of the other 3 members is 30 tokens, and therefore 30 tokens in the individual account ; What do you decide to invest 0 tokens in the Group account and 20 tokens in the individual account : What is your return on investment for the period ?

— i. 20 ECU
— ii. 26 ECU
— iii. 32 ECU

Answer posted [POSITIVE FRAME] : Via the Group account you get 0.4 * (30) = 12 ECU. Via the Individual account you get 1 * 20 = 20 ECU. Your return on investment for the period is 20 + 12 = 32 ECU.

Answer posted [NEGATIF FRAME] : Via the Group account you get 0.4 * (0) = 0 ECU. Via the Individual account you get 1 * 20 - 0.4 * 30 = 8 ECU. In addition, each period you benefit from an automatic gain of 24 ECU. Your return on investment for the period is 0 + 8 + 24 = 32 ECU.

7. If the sum of the investments in the group account of the other 3 members is 30 tokens, and therefore 30 tokens in the individual account ; that you decide to invest 20 tokens in the Group account and 0 tokens in the individual account : What is your return on investment for the period ?

— i. 20 ECU
— ii. 26 ECU
— iii. 32 ECU

Answer posted [POSITIVE FRAME] : Via the Group account you get 0.4 * (20 + 30) = 20 ECU. Via the Individual account you get 1 * 0 = 0 ecu. Your return on investment for the period is 20 + 0 = 20 ECU.

Answer posted [NEGATIF FRAME] : Via the Group account you get 0.4 * 20 = 8 ECU. Via the Individual account you get 1 * 0 - 0,4 * 30 = -12 ECU. In addition, each period you benefit from an automatic gain of 24 ECU. Your return on investment for the period is 8 - 12 + 24 = 20 ECU.

8. If the sum of the investments in the group account of the other 3 members is 30 tokens, and therefore 30 tokens in the individual account ; you invest 10 tokens in the Group account and 10 in the Individual account : What is your return on investment for the period ?

— i. 20 ECU
— ii. 26 ECU
— iii. 32 ECU

Answer posted [POSITIVE FRAME] : Via the Group account you get 0.4 * (40) = 16 ECU. Via the Individual account you get 1 * 10 = 10 ECU. Your return on investment for the period is 16 + 10 = 26 ECU.

Answer posted [NEGATIF FRAME] : Via the Group account you get 0.4 * (10) = 4 ECU. Via the Individual account you get 1 * 10 - 0,4 * 30 = -2 ECU. In addition, each period you benefit from an automatic gain of 24 ECU. Your return on investment is 4 - 2 + 24 = 26 ECU.

3.B Characteristics of Experimental Sessions for symbolic sanctions experiment

Table 3.B.1 – Characteristics of experimental sessions in Symbolic sanction experiment

Session Number	Number of Subjects	Number of groups	Framing	Periods 1-10	Periods 11-20
3 (7)	16	4	Negative	Baseline	Sanction
5 (9)	12	3	Negative	Baseline	Sanction
13 (22)	12	3	Negative	Baseline	Sanction
7 (13)	16	4	Negative	Sanction	Baseline
13 (21)	12	3	Negative	Sanction	Baseline
1 (5)	16	4	Positive	Baseline	Sanction
2 (6)	8	2	Positive	Baseline	Sanction
4 (8)	12	3	Positive	Baseline	Sanction
6 (12)	16	4	Positive	Sanction	Baseline
12 (20)	16	4	Positive	Sanction	Baseline
8 (14)	16	4	Negative	Baseline	Baseline
9 (15)	16	4	Negative	Baseline	Baseline
10 (16)	16	4	Positive	Baseline	Baseline
11 (17)	12	3	Positive	Baseline	Baseline

3.C Description of demographics variables for symbolic sanctions experiment

Looking at gender and age there are no differences between frames (chi2 tests). Futhermore, there are no differences between frames concerning the social value orientations of subjects (ttest, Epps Singleton).

Table 3.C.1 – Gender summary statistics in Symbolic sanction experiment

Treatment	Number of women		Chi 2 p-value
	Negative Framing	Positive Framing	
Baseline Treatment	15(/32)	15(/28)	0.605
Introduction condition	23(/40)	18(/36)	0.512
Removal condition	13(/28)	11(/32)	0.342
All data	51(/100)	44(/96)	0.469

Table 3.C.2 – Age summary statistics in Symbolic sanction experiment

Treatment	Framing	Obs	Mean	Std. Dev.	t-test
Baseline Treatment	Negative	32	22.375	3.37	non-significant
	Positive	28	21.82	2.48	
Introduction condition	Negative	40	22.25	3.37	non-significant
	Positive	36	22.83	3.69	
Removal condition	Negative	28	23.03	4.48	non-significant
	Positive	32	23.12	3.79	
All data	Negative	100	22.51	3.69	non-significant
	Positive	96	22.63	3.42	

TABLE 3.C.3 – SVO_score summary statistics in Symbolic sanction experiment

Treatment	Framing	Obs	Mean	Std. Dev.	Epps Singleton p-value
Baseline Treatment	Negative	32	0.506	0.194	non significant
	Positive	28	0.523	0.182	
Introduction condition	Negative	40	0.484	0.183	non significant
	Positive	36	0.462	0.197	
Removal condition	Negative	28	0.509	0.155	non significant
	Positive	32	0.454	0.212	
All data	Negative	100	0.498	0.178	non significant
	Positive	96	0.488	0.198	

TABLE 3.C.4 – SVO type summary statistics in Symbolic sanction experiment

Treatment	Framing	Prosocial	Individualist	Competitive
Baseline Treatment	Negative	14	17	1
	Positive	15	13	0
Introduction condition	Negative	17	23	0
	Positive	14	22	0
Removal condition	Negative	15	12	1
	Positive	11	18	3
All data	Negative	46	52	2
	Positive	40	53	3

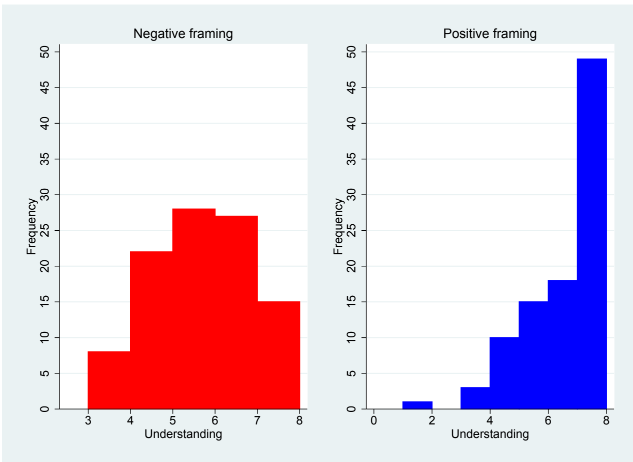


FIGURE 3.C.1 – Distribution of understanding score by framing in Symbolic sanction experiment

Looking at the understanding score obtained by framing, we clearly see that the negative frame leads to lower understanding level. The difference is significant according to the ttest and Epps-Singleton test. The higher complexity of this game, with more source of earnings can be an explanation of the lower understanding score.

TABLE 3.C.5 – Understanding summary statistics in Symbolic sanction experiment

Treatment	Framing	Obs	Mean	Std. Dev.	Epps Singleton p-value
Baseline Treatment	Negative	32	5.40	1.29	0.003
	Positive	28	6.60	1.39	
Introduction condition	Negative	40	5.35	1.16	0.030
	Positive	36	6.19	1.41	
Removal condition	Negative	28	4.82	1.21	0.001
	Positive	32	5.93	1.68	
All data	Negative	100	5.22	1.23	
	Positive	96	6.22	1.51	0.000

3.D Non parametrics tests for symbolic sanctions experiment

Mann Whitney's tests that compare the framing effect for given conditions (under a defined condition and sequence).

TABLE 3.D.1 – Mann Whitney analysis in Symbolic sanction experiment

Treatment		Mann Whitney p-value
Baseline Treatment	Sequence 1 Baseline	0.121
	Sequence 2 Baseline	0.685
Introduction condition	Sequence 1 Baseline	0.186
	Sequence 2 Sanctions	0.034**
Removal condition	Sequence 1 Sanctions	0.355
	Sequence 2 Baseline	0.418

Wilcoxon tests that compare the contributions between Sequence 1 and Sequence 2 for a given treatment.

TABLE 3.D.2 – Wilcoxon analysis in Symbolic sanction experiment

Treatment		Wilcoxon p-value
Baseline Treatment	Negative Framing	0.017**
	Positive Framing	0.237
Introduction condition	Negative Framing	0.446
	Positive Framing	0.767
Removal condition	Negative Framing	0.018**
	Positive Framing	0.012**

3.E Robustness check for symbolic sanctions experiment

3.E.1 Supplementary analysis for symbolic sanctions experiment

TABLE 3.E.1 – Individual contributions to the group account in Symbolic sanction experiment(panel regressions random effects with clusters by groups).

	(1) All_data	(2) All_data	(3) All_data	(4) Without_Sanction	(5) Symbolic sanction
Framing	-0.126	0.198	0.110	0.231	-1.724
	(1.067)	(1.073)	(1.061)	(1.070)	(1.665)
Symbolic sanctions	2.638***	3.106***	3.117***		
	(0.516)	(0.772)	(0.771)		
Period	-0.269***	-0.271***	-0.271***	-0.332***	-0.541***
	(0.0344)	(0.0343)	(0.0343)	(0.0468)	(0.0836)
Symbolic × Framing		-0.934	-0.908		
		(1.039)	(1.040)		
SVO_score			6.619***	6.546***	4.750**
			(1.875)	(2.099)	(2.331)
Gender			1.584***	1.287**	2.387***
			(0.569)	(0.622)	(0.869)
Age			-0.111	-0.0776	-0.164
			(0.0836)	(0.0852)	(0.131)
Understanding			0.310	0.189	0.651
			(0.267)	(0.253)	(0.488)
_cons	9.381***	9.236***	6.006**	6.690**	12.56***
	(0.825)	(0.833)	(2.901)	(3.019)	(4.852)
N	3920	3920	3920	2560	1360
R^2	0.067	0.070	0.112	0.108	0.059

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

TABLE 3.E.2 – Individual contributions to the group account discriminating for Removal and Introduction conditions in Symbolic sanction experiment (panel regressions random effects with clusters by groups).

	(1) Removal + Bsl	(2) Removal + Bsl	(3) Removal + Bsl	(4) Introduction + Bsl	(5) Introduction + Bsl	(6) Introduction + Bsl
Framing	2.274*	2.264*	2.216*	-0.825	-0.825	-1.028
	(1.278)	(1.272)	(1.203)	(1.142)	(1.142)	(1.096)
Symbolic sanctions	0.668	0.647	0.680	5.463***	5.463***	5.496***
	(0.631)	(0.594)	(0.584)	(1.213)	(1.213)	(1.209)
Period	-0.329***	-0.329***	-0.326***	-0.369***	-0.369***	-0.371***
	(0.0513)	(0.0514)	(0.0511)	(0.0572)	(0.0572)	(0.0573)
Symbolic × Framing		0.0377	0.101	-1.601	-1.601	-1.576
		(0.898)	(0.888)	(1.497)	(1.497)	(1.503)
SVO_score			8.917***			6.994***
			(2.435)			(2.189)
Gender			0.924			1.814***
			(0.672)			(0.689)
Age			0.0129			-0.203**
			(0.0968)			(0.0928)
Understanding			0.229			0.267
			(0.269)			(0.271)
_cons	8.977***	8.982***	2.517	10.41***	10.41***	9.104***
	(0.902)	(0.901)	(3.409)	(1.022)	(1.022)	(3.319)
N	2400	2400	2400	2720	2720	2720
R^2	0.103	0.103	0.159	0.076	0.086	0.140

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

TABLE 3.E.3 – Individual contributions to the group account without interaction variable in Symbolic sanction experiment (panel regressions random effects with clusters by groups).

	(1) All data	(2) Removal + Bsl	(3) Introduction + Bsl
Framing	-0.207	2.241*	-1.481
	(1.047)	(1.190)	(1.060)
Symbolic sanction	2.662***	0.734	4.752***
	(0.515)	(0.623)	(0.922)
period	-0.269***	-0.326***	-0.371***
	(0.0344)	(0.0511)	(0.0572)
SVO_score	6.655***	8.911***	7.058***
	(1.879)	(2.442)	(2.220)
Gender	1.601***	0.922	1.845***
	(0.569)	(0.672)	(0.684)
Age	-0.112	0.0130	-0.208**
	(0.0835)	(0.0967)	(0.0934)
Understanding	0.314	0.229	0.281
	(0.267)	(0.269)	(0.272)
_cons	6.133**	2.507	9.295***
	(2.902)	(3.400)	(3.321)
N	3920	2400	2720
R^2	0.110	0.159	0.131

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

TABLE 3.E.4 – Individual contributions to the group account without interaction variable in Symboolic sanction experiment (panel tobit estimation random effects).

	(1) All data	(2) Removal	(3) Introduction
Framing	-0.708	3.615**	-2.929**
	(1.370)	(1.769)	(1.405)
Symbolic sanctions	5.306***	1.766**	8.905***
	(0.436)	(0.780)	(0.717)
period	-0.530***	-0.604***	-0.708***
	(0.0323)	(0.0487)	(0.0486)
SVO_score	15.02***	19.95***	14.90***
	(3.450)	(4.438)	(3.596)
Gender	3.502***	2.337	3.877***
	(1.293)	(1.659)	(1.331)
Age	-0.222	-0.0371	-0.347*
	(0.181)	(0.230)	(0.203)
Understanding	0.556	0.413	0.419
	(0.472)	(0.581)	(0.513)
_cons	2.080	-4.295	7.674
	(5.382)	(6.777)	(6.040)
sigma_u			
_cons	8.598***	8.627***	7.197***
	(0.507)	(0.658)	(0.513)
sigma_e			
_cons	10.05***	9.534***	9.825***
	(0.188)	(0.230)	(0.215)
N	3920	2400	2720

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

3.E.2 Contribution dynamics taking into account the group's initial contribution for symbolic sanctions experiment

The variable "Initial group contribution" represents the group's contribution to the public good in the first period of the first sequence.

TABLE 3.E.5 – Panel regressions of individual contributions taking into account the initial contribution of the group in Symbolic sanction experiment (random effects, cluster by group, first period of sequence 1 excluded).

	(1) All_data	(2) Without_Sanction	(3) Sanction	(4) Removal + Bsl	(5) Introduction + Bsl
Framing	1.036	1.295	0.0461	1.737*	0.137
	(0.925)	(0.936)	(1.774)	(1.015)	(0.887)
Symbolic sanctions	3.046***			0.345	5.576***
	(0.797)			(0.562)	(1.227)
Period	-0.255***	-0.320***	-0.489***	-0.322***	-0.374***
	(0.0368)	(0.0477)	(0.0949)	(0.0514)	(0.0582)
Initial group contribution	0.129***	0.149***	0.117**	0.135***	0.110***
	(0.0294)	(0.0309)	(0.0458)	(0.0436)	(0.0260)
Symbolic × Framing	-0.754			0.601	-1.541
	(1.072)			(0.922)	(1.558)
SVO_score	5.067***	4.752***	4.437**	7.453***	4.964**
	(1.617)	(1.812)	(2.076)	(2.178)	(2.044)
Gender	1.279**	0.952*	2.191***	0.537	1.443**
	(0.524)	(0.552)	(0.836)	(0.672)	(0.613)
Age	-0.100	-0.0626	-0.164	-0.00109	-0.186**
	(0.0798)	(0.0728)	(0.130)	(0.0917)	(0.0858)
Understanding	0.130	-0.00418	0.480	0.156	0.00321
	(0.252)	(0.232)	(0.447)	(0.278)	(0.270)
_cons	1.485	1.396	7.397	-1.828	6.365*
	(2.963)	(2.593)	(5.981)	(3.092)	(3.283)
N	3724	2424	1300	2340	2644
R^2	0.173	0.168	0.110	0.202	0.192

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

TABLE 3.E.6 – Panel tobit estimation of individual contributions taking into account the initial contribution of the group in Symbolic sanction experiment (random effects, first period of sequence 1 excluded).

	(1) All_data	(2) Without_Sanction	(3) Sanction	(4) Removal + Bsl	(5) Introduction + Bsl
Framing	1.490	2.003	-0.547	2.575	-0.438
	(1.336)	(1.322)	(2.175)	(1.716)	(1.359)
Symbolic sanctions	5.938***			1.799*	9.909***
	(0.626)			(1.028)	(0.889)
Symbolic × Framing	-1.188			0.600	-2.241**
	(0.883)			(1.254)	(1.084)
Period	-0.512***	-0.607***	-1.047***	-0.565***	-0.690***
	(0.0349)	(0.0484)	(0.113)	(0.0515)	(0.0508)
Initial group contribution	0.229***	0.264***	0.219***	0.246***	0.183***
	(0.0394)	(0.0404)	(0.0612)	(0.0642)	(0.0382)
SVO_score	12.22***	12.53***	9.401*	16.89***	10.93***
	(3.239)	(3.307)	(5.073)	(4.237)	(3.340)
Gender	2.953**	2.795**	4.259**	1.613	3.092**
	(1.205)	(1.230)	(1.910)	(1.572)	(1.216)
Age	-0.201	-0.134	-0.303	-0.0605	-0.315*
	(0.168)	(0.172)	(0.252)	(0.216)	(0.184)
Understanding	0.222	-0.117	1.043	0.284	-0.0647
	(0.442)	(0.450)	(0.694)	(0.548)	(0.474)
_cons	-6.016	-6.310	5.703	-12.41*	3.225
	(5.176)	(5.286)	(7.950)	(6.705)	(5.557)
sigma_u					
_cons	7.916***	7.854***	10.27***	8.074***	6.445***
	(0.479)	(0.518)	(0.827)	(0.623)	(0.474)
sigma_e					
_cons	10.05***	9.156***	10.39***	9.512***	9.810***
	(0.194)	(0.218)	(0.352)	(0.233)	(0.217)
N	3724	2424	1300	2340	2660

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

3.E.3 Average contribution over time by group for symbolic sanctions experiment

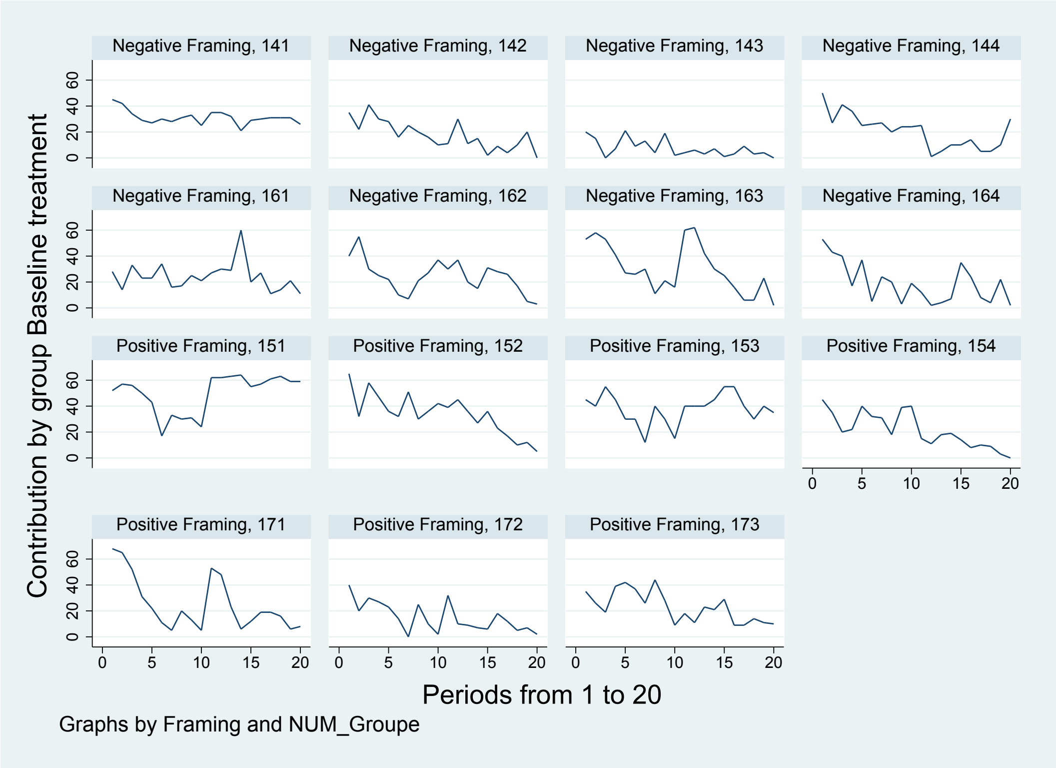


FIGURE 3.E.1 – Average contribution over time by group (Baseline).

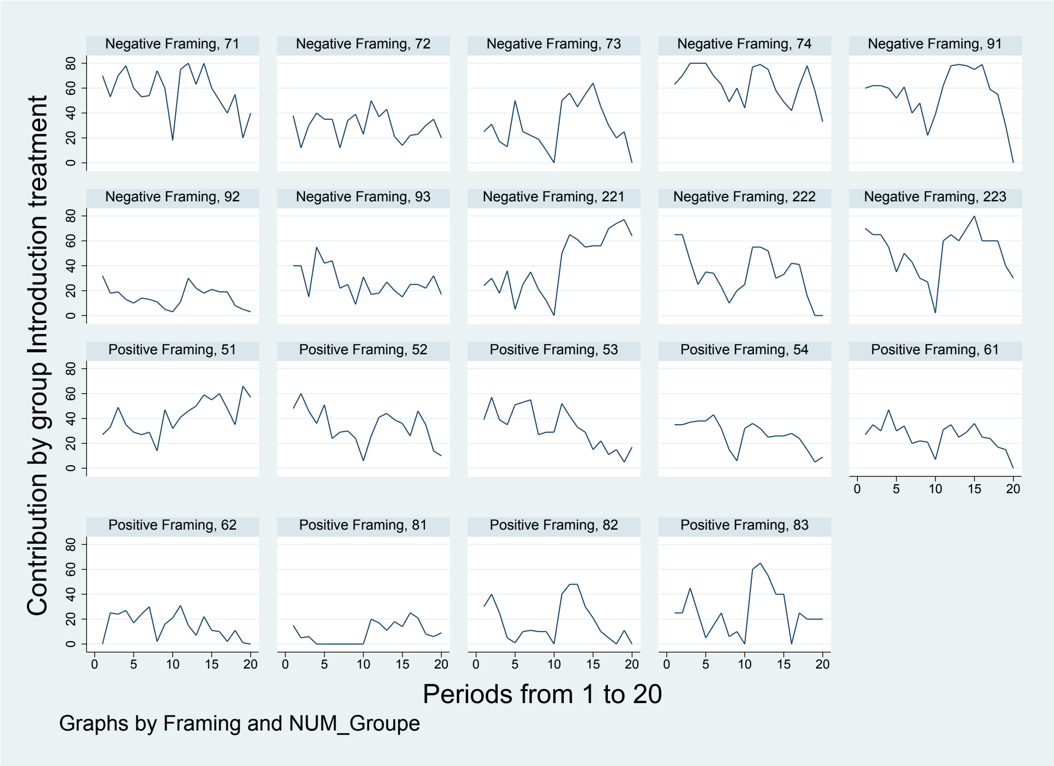


FIGURE 3.E.2 – Average contribution over time by group for symbolic sanctions experiment (Introduction condition).

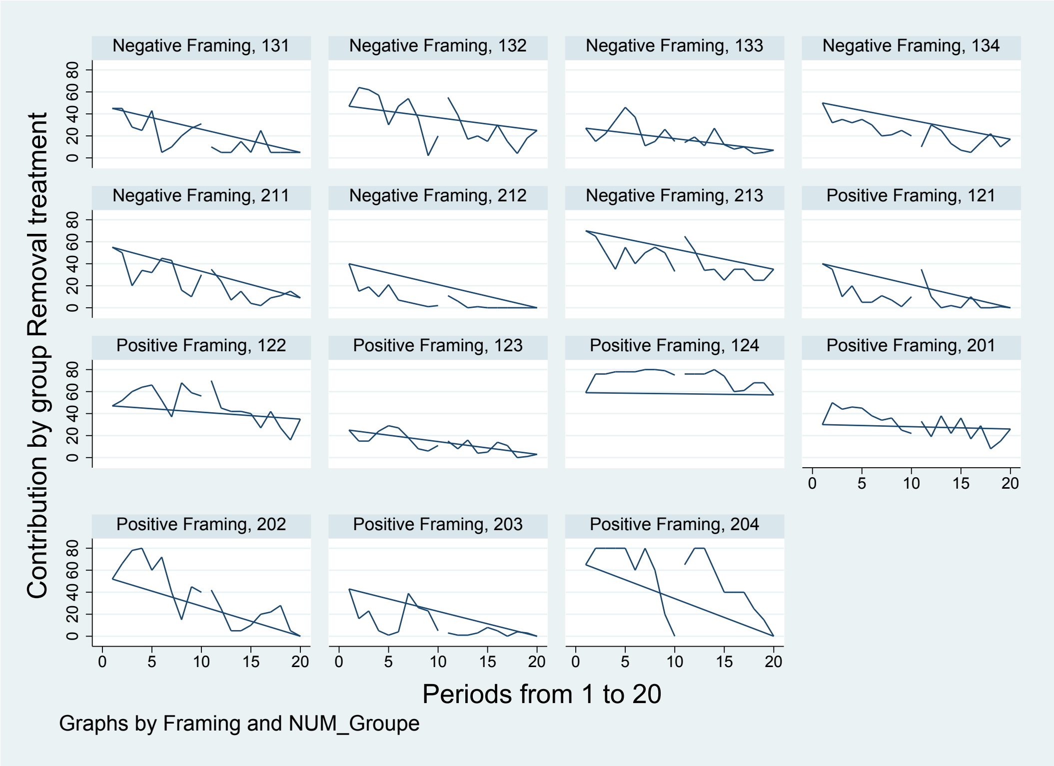


FIGURE 3.E.3 – Average contribution over time by group for symbolic sanctions experiment (Removal condition).

3.E.4 Without the highly cooperative groups for symbolic sanctions experiment

TABLE 3.E.7 – Individual contributions to the group account in Symbolic sanction experiment (panel regression with clusters by groups, cooperative groups excluded).

	(1)	(2)	(3)	(4)	(5)
	All_data	All_data	All_data	Without_Sanction	Symbolic sanction
Framing	0.805	1.115	1.202	1.321	-0.0102
	(0.975)	(0.972)	(0.933)	(0.935)	(1.624)
Symbolic sanctions	2.582***	3.090***	3.098***		
	(0.559)	(0.920)	(0.919)		
Period	-0.258***	-0.257***	-0.257***	-0.313***	-0.518***
	(0.0364)	(0.0365)	(0.0366)	(0.0460)	(0.0876)
Symbolic × Framing		-0.929	-0.903		
		(1.148)	(1.149)		
SVO_score			7.476***	7.783***	5.334**
			(1.740)	(1.884)	(2.211)
Gender			1.250**	1.022*	1.832**
			(0.527)	(0.523)	(0.913)
Age			-0.0967	-0.0625	-0.153
			(0.0830)	(0.0822)	(0.132)
Understanding			0.0950	-0.0197	0.285
			(0.248)	(0.226)	(0.457)
_cons	8.351***	8.182***	5.537*	5.893**	12.54***
	(0.652)	(0.669)	(2.877)	(2.950)	(4.839)
N	3680	3680	3680	2440	1240
R^2	0.067	0.069	0.116	0.110	0.069

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

TABLE 3.E.8 – Individual contributions to the group account discriminating for Removal and Introduction conditions in Symbolic sanction experiment (panel regression with clusters by groups, cooperative groups excluded).

	(1) Removal + Bsl	(2) Removal + Bsl	(3) Removal + Bsl	(4) Introduction + Bsl	(5) Introduction + Bsl	(6) Introduction + Bsl
Framing	2.274*	2.264*	2.216*	0.385	0.385	0.356
	(1.278)	(1.272)	(1.203)	(0.982)	(0.982)	(0.937)
Symbolic sanctions	0.668	0.647	0.680	5.615***	5.615***	5.639***
	(0.631)	(0.594)	(0.584)	(1.599)	(1.599)	(1.588)
Period	-0.329***	-0.329***	-0.326***	-0.338***	-0.338***	-0.339***
	(0.0513)	(0.0514)	(0.0511)	(0.0556)	(0.0556)	(0.0558)
Symbolic × Framing		0.0377	0.101	-2.074	-2.074	-2.057
		(0.898)	(0.888)	(1.827)	(1.827)	(1.826)
SVO_score			8.917***			8.025***
			(2.435)			(2.036)
Gender			0.924			1.520**
			(0.672)			(0.683)
Age			0.0129			-0.183**
			(0.0968)			(0.0909)
Understanding			0.229			0.0347
			(0.269)			(0.283)
_cons	8.977***	8.982***	2.517	8.955***	8.955***	8.146**
	(0.902)	(0.901)	(3.409)	(0.752)	(0.752)	(3.321)
N	2400	2400	2400	2480	2480	2480
R^2	0.103	0.103	0.159	0.049	0.058	0.124

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

TABLE 3.E.9 – Individual contributions to the group account in Symbolic sanction experiment (panel tobit estimation, cooperative groups excluded).

	(1) All data	(2) All data	(3) All data	(4) Without sanction	(5) Sanctions
Framing	0.954	1.457	1.692	1.987	-0.591
	(1.340)	(1.372)	(1.370)	(1.398)	(2.050)
Symbolic sanctions	5.022***	5.798***	5.827***		
	(0.438)	(0.644)	(0.642)		
Period	-0.499***	-0.498***	-0.499***	-0.591***	-0.979***
	(0.0319)	(0.0319)	(0.0319)	(0.0452)	(0.0983)
Symbolic × Framing		-1.440*	-1.401		
		(0.871)	(0.869)		
SVO_score			16.42***	17.96***	11.22**
			(3.298)	(3.466)	(5.002)
Gender			2.907**	3.042**	3.427*
			(1.245)	(1.306)	(1.902)
Age			-0.195	-0.130	-0.269
			(0.170)	(0.179)	(0.241)
Understanding			0.191	-0.0489	0.610
			(0.454)	(0.475)	(0.690)
_cons	7.519***	7.247***	1.024	0.955	14.06*
	(1.026)	(1.038)	(5.085)	(5.349)	(7.259)
sigma_u					
_cons	8.715***	8.702***	7.963***	8.152***	9.820***
	(0.529)	(0.528)	(0.490)	(0.549)	(0.790)
sigma_e					
_cons	9.715***	9.710***	9.712***	9.118***	9.645***
	(0.185)	(0.185)	(0.185)	(0.215)	(0.323)
N	3680	3680	3680	2440	1240

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

TABLE 3.E.10 – Individual contributions to the group account discriminating for Removal and Introduction conditions in Symbolic sanction experiment (panel tobit estimation, cooperative groups excluded).

	(1) Removal + Bsl	(2) Removal + Bsl	(3) Removal + Bsl	(4) Introduction + Bsl	(5) Introduction + Bsl	(6) Introduction + Bsl
Framing	3.543**	3.488*	3.528**	-0.673	0.156	0.159
	(1.802)	(1.833)	(1.799)	(1.393)	(1.408)	(1.363)
Symbolic sanctions	1.612**	1.504	1.595	8.072***	9.832***	9.899***
	(0.782)	(1.022)	(1.019)	(0.720)	(0.951)	(0.944)
Period	-0.609***	-0.609***	-0.604***	-0.628***	-0.626***	-0.629***
	(0.0487)	(0.0487)	(0.0487)	(0.0470)	(0.0469)	(0.0468)
Symbolic × Framing		0.205	0.327		-3.205***	-3.210***
		(1.261)	(1.257)		(1.122)	(1.116)
SVO_score			19.96***			16.51***
			(4.437)			(3.323)
Gender			2.344			3.317***
			(1.659)			(1.240)
Age			-0.0373			-0.299
			(0.230)			(0.182)
Understanding			0.413			0.0308
			(0.581)			(0.477)
_cons	8.331***	8.358***	-4.258	9.203***	8.782***	5.483
	(1.417)	(1.427)	(6.777)	(1.074)	(1.074)	(5.501)
sigma_u						
_cons	9.521***	9.520***	8.624***	7.372***	7.286***	6.290***
	(0.716)	(0.716)	(0.658)	(0.547)	(0.542)	(0.481)
sigma_e						
_cons	9.532***	9.532***	9.534***	9.357***	9.340***	9.343***
	(0.230)	(0.230)	(0.230)	(0.210)	(0.210)	(0.210)
N	2400	2400	2400	2480	2480	2480

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

3.F Diff and Diff analysis for symbolic sanctions experiment

Syb_sanc_Seq1 and Syb_sanc_Seq2 are dummy variables which are equal to 1 whenever symbolic sanction are introduced respectively in sequence 1 or 2.

TABLE 3.F.1 – DiD between baseline and introduction of symbolic sanction in sequence 1 in the positive frame (panel tobit estimation two sided, random effects).

	(1) pbl	(2) pbl
Syb_sanc_Seq1	-0.695	1.443
	(2.977)	(3.067)
Sequence	-2.677***	-2.684***
	(0.988)	(0.988)
Symbolic sanctions	5.476***	5.469***
	(1.396)	(1.396)
SVO_score		17.25**
		(7.092)
Gender		4.550
		(2.882)
Age		-0.0797
		(0.427)
Understanding		-0.105
		(0.896)
_cons	5.992***	-3.066
	(2.159)	(12.15)
sigma_u		
_cons	10.79***	10.13***
	(1.135)	(1.077)
sigma_e		
_cons	10.57***	10.57***
	(0.369)	(0.369)
N	1200	1200

Standard errors in parentheses
* p<0.10, ** p<0.05 ,*** p<0.01

TABLE 3.F.2 – DiD between baseline and introduction of symbolic sanction in sequence 1 in the negative frame (panel tobit estimation two sided, random effects).

	(1) pbl	(2) pbl
Syb_sanc_Seq1	-0.981	0.227
	(2.356)	(1.912)
Sequence	-3.699***	-3.703***
	(0.836)	(0.835)
Symbolic sanctions	3.725***	3.734***
	(1.232)	(1.231)
SVO_score		31.64***
		(5.456)
Gender		-0.285
		(1.798)
Age		-0.166
		(0.227)
Understanding		2.188***
		(0.745)
_cons	3.968**	-20.02***
	(1.598)	(7.242)
sigma_u		
_cons	8.371***	6.236***
	(0.919)	(0.728)
sigma_e		
_cons	9.327***	9.323***
	(0.312)	(0.312)
N	1200	1200

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

TABLE 3.F.3 – DiD between baseline and introduction of symbolic sanction in sequence 2 in the positive frame (panel tobit estimation two sided, random effects)

	(1) pbl	(2) pbl
Syb_sanc_Seq2	-3.042	-1.739
	(1.874)	(1.690)
Sequence	-2.502∗∗∗	-2.507∗∗∗
	(0.862)	(0.862)
Symbolic sanctions	3.262∗∗∗	3.270∗∗∗
	(1.147)	(1.147)
SVO_score		14.66∗∗∗
		(4.390)
Gender		3.295∗∗
		(1.656)
Age		-0.467∗
		(0.247)
Understanding		-0.345
		(0.584)
_cons	6.435∗∗∗	9.475
	(1.406)	(7.862)
sigma_u		
_cons	6.699∗∗∗	5.563∗∗∗
	(0.699)	(0.607)
sigma_e		
_cons	9.303∗∗∗	9.309∗∗∗
	(0.285)	(0.285)
N	1280	1280

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

TABLE 3.F.4 – DiD between baseline and introduction of symbolic sanction in sequence 2 in the negative frame (panel tobit estimation two sided, random effects)

	(1) pbl	(2) pbl
Syb_sanc_Seq2	5.759***	5.767***
	(2.211)	(2.095)
Sequence	-4.024***	-4.030***
	(1.010)	(1.009)
Symbolic sanctions	6.978***	6.986***
	(1.337)	(1.336)
SVO_score		13.68**
		(5.412)
Gender		3.167
		(1.991)
Age		-0.132
		(0.295)
Understanding		1.106
		(0.834)
_cons	3.428**	-8.021
	(1.654)	(8.850)
sigma_u		
_cons	8.420***	7.801***
	(0.830)	(0.780)
sigma_e		
_cons	11.24***	11.23***
	(0.353)	(0.353)
N	1440	1440

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

TABLE 3.F.5 – DiD between baseline and introduction of symbolic sanction in sequence 2 in the negative frame when cooperative groups are excluded (panel tobit estimation two sided, random effects).

	(1) pbl	(2) pbl
Syb_sanc_Seq2	1.685	2.133
	(2.149)	(1.990)
Sequence	-3.845***	-3.852***
	(0.918)	(0.918)
Syb_sanc	7.557***	7.566***
	(1.314)	(1.314)
SVO_score		17.02***
		(5.067)
Gender		2.672
		(1.851)
Age		-0.0946
		(0.261)
Understanding		0.389
		(0.803)
_cons	3.759**	-6.121
	(1.478)	(8.178)
sigma_u		
_cons	7.490***	6.655***
	(0.820)	(0.744)
sigma_e		
_cons	10.25***	10.24***
	(0.340)	(0.340)
N	1200	1200

t statistics in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

3.G Number of symbolic sanctions sent by sequence

3.G.1 Propensity to send symbolic sanction

TABLE 3.G.1 – Subject's i propensity to send symbolic sanctions to subject j (probit estimation with cluster by suject).

	(1) All data	(2) All data	(3) Removal	(4) Removal	(5) Introduction	(6) Introduction
Framing	-0.414***	-0.408***	-0.258**	-0.279**	-0.553***	-0.503***
	(0.104)	(0.104)	(0.130)	(0.130)	(0.167)	(0.172)
(absolute) Negative Deviation $y_j - y_i < 0$	0.150***	0.139***	0.146***	0.138***	0.163***	0.149***
	(0.0168)	(0.0170)	(0.0218)	(0.0224)	(0.0287)	(0.0291)
Positive Deviation $y_j - y_i > 0$	-0.0671***	-0.0520***	-0.0619***	-0.0513**	-0.0759***	-0.0575***
	(0.0114)	(0.0135)	(0.0181)	(0.0219)	(0.0134)	(0.0158)
Own contribution	-0.0876***	-0.0779***	-0.0870***	-0.0799***	-0.0918***	-0.0790***
	(0.00858)	(0.00975)	(0.0125)	(0.0144)	(0.0133)	(0.0159)
Period	-0.00713	0.000271	-0.0121	-0.00769	-0.00386	0.00737
	(0.0127)	(0.0138)	(0.0168)	(0.0179)	(0.0191)	(0.0215)
Sequence	0.344**	0.278				
	(0.166)	(0.171)				
Age	0.0142	0.0137	0.00727	0.00634	0.0176	0.0193
	(0.0159)	(0.0157)	(0.0211)	(0.0207)	(0.0233)	(0.0239)
Gender	-0.182	-0.184	-0.0798	-0.0790	-0.291**	-0.293*
	(0.113)	(0.112)	(0.162)	(0.159)	(0.148)	(0.150)
SVO_score	-0.109	-0.0990	0.297	0.269	-0.484	-0.427
	(0.253)	(0.251)	(0.336)	(0.338)	(0.353)	(0.355)
Understanding	-0.00432	-0.00464	-0.0641	-0.0621	0.0666	0.0652
	(0.0406)	(0.0403)	(0.0562)	(0.0556)	(0.0478)	(0.0493)
Positive deviation from others two $y_j - \bar{y}_{-i-j} > 0$		-0.0232**		-0.0163		-0.0259*
		(0.0105)		(0.0153)		(0.0147)
Negative deviation from others two $y_j - \bar{y}_{-i-j} < 0$		0.0121		0.00854		0.0147
		(0.0114)		(0.0156)		(0.0175)
_cons	0.717	0.616	0.890	0.854	0.873	0.531
	(0.464)	(0.470)	(0.635)	(0.626)	(0.700)	(0.781)
N	3720	3720	1800	1800	1920	1920

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

3.G.2 Number of symbolic sanctions sent by deviation level

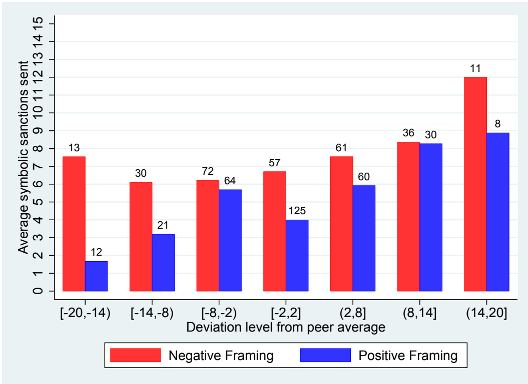


FIGURE 3.G.1 – Number of symbolic sanctions sent by deviation level (Removal condition).

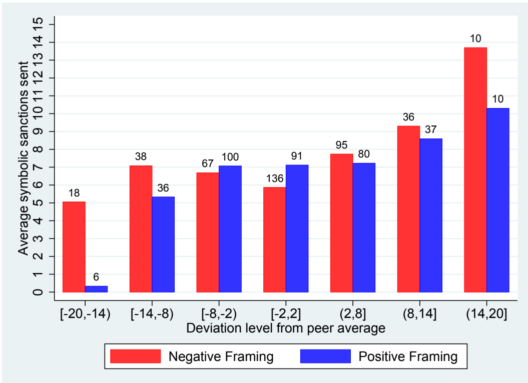


FIGURE 3.G.2 – Number of symbolic sanctions sent by deviation level (Introduction condition).

3.H Number of symbolic sanctions received by sequence

3.H.1 Symbolic sanctions received in Removal conditions

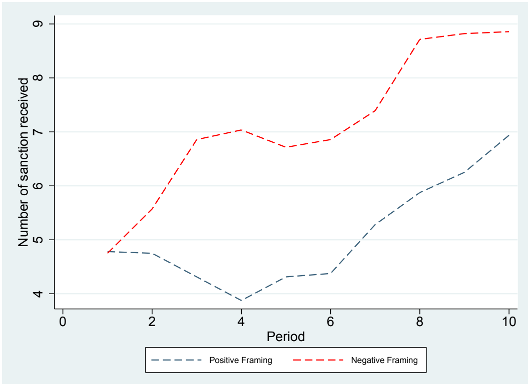


FIGURE 3.H.1 – Evolution of the number of symbolic sanctions received (Removal condition).

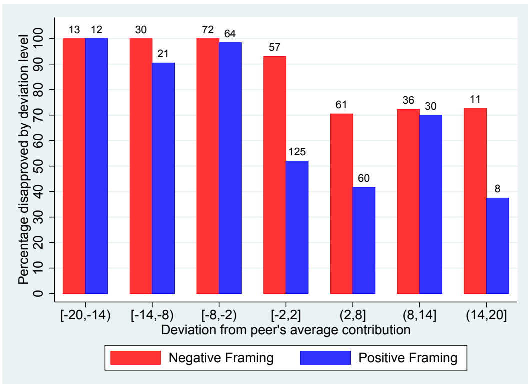


FIGURE 3.H.2 – Likelihood of being disapproved by deviation level (with number of observations in Removal condition).

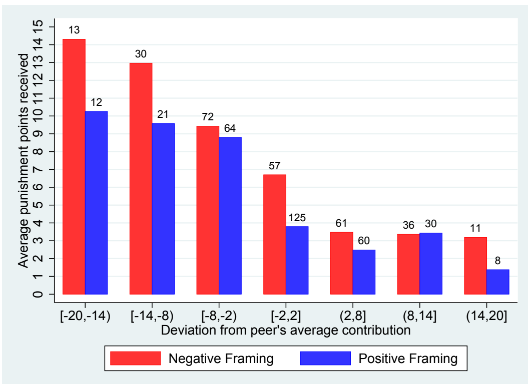


FIGURE 3.H.3 – Average number of symbolic sanctions received from deviation level (with number of observations in Removal condition).

3.H.2 Symbolic sanctions received in Introduction conditions

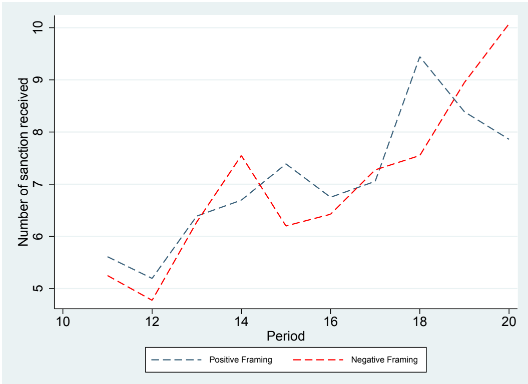


FIGURE 3.H.4 – Evolution of the number of symbolic sanctions received (Introduction condition).

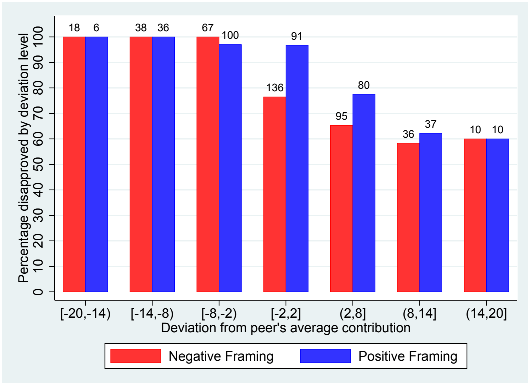


FIGURE 3.H.5 – Likelihood of being disapproved by deviation level (with number of observations in Introduction condition).

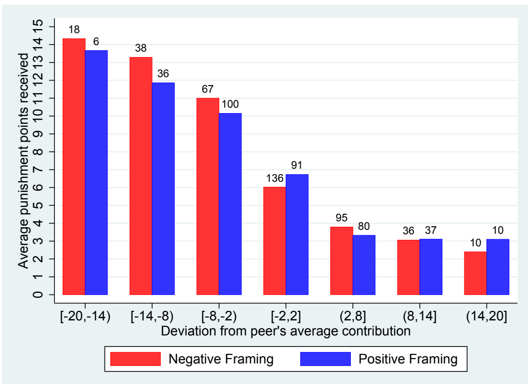


FIGURE 3.H.6 – Average number of symbolic sanctions received by deviation level (with number of observations in Introduction condition).

3.I Contribution's change for symbolic sanctions experiment

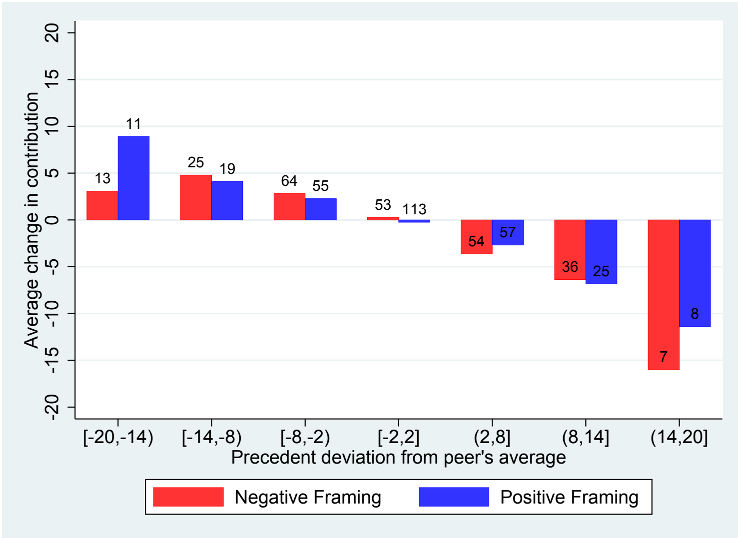


FIGURE 3.I.1 – Average contribution change with respect to deviation from peer average over previous period in Symbolic sanction experiment (Removal condition).

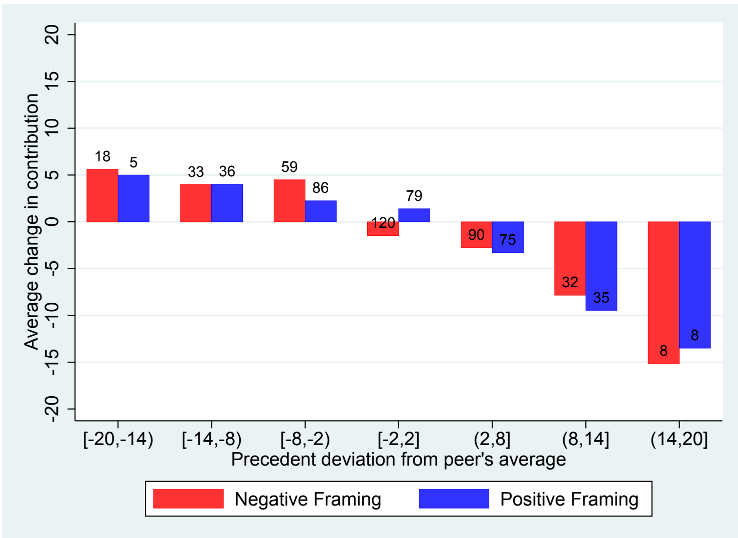


FIGURE 3.I.2 – Average contribution change with respect to deviation from peer average over previous period in Symbolic sanction experiment (Introduction condition).

TABLE 3.I.1 – Contribution change (t) in Symbolic sanction experiment (panel analysis random effects with clusters by group).

	(1) All data	(2) Removal	(3) Introduction
Framing	0.481	1.581	-0.0811
	(0.678)	(1.020)	(0.855)
Symbolic santions received in $t-1$	0.153**	0.270**	0.0520
	(0.0773)	(0.126)	(0.0936)
Peers'average in $t-1$	-0.131***	-0.177***	-0.165***
	(0.0385)	(0.0551)	(0.0620)
Positive Deviation in $t-1$	-0.784***	-0.748***	-0.858***
	(0.0807)	(0.122)	(0.0867)
Negative Deviation in $t-1$	0.327***	0.304***	0.383***
	(0.0733)	(0.0991)	(0.106)
Period	-0.254***	-0.246**	-0.291***
	(0.0647)	(0.105)	(0.0874)
Sequence	2.119***		
	(0.638)		
Symbolic santions received in period $t-1$ × Framing	-0.0723	-0.149	-0.0428
	(0.102)	(0.177)	(0.114)
SVO_score	2.973***	3.792*	2.504*
	(1.003)	(1.965)	(1.301)
Age	-0.0230	0.0359	-0.0785
	(0.0543)	(0.0882)	(0.0550)
Gender	0.873*	0.567	1.148*
	(0.483)	(0.738)	(0.628)
Understanding	0.166	0.400	-0.0851
	(0.194)	(0.298)	(0.238)
_cons	0.358	-3.264	7.065*
	(2.051)	(2.479)	(3.605)
N	1224	540	684
R^2	0.348	0.338	0.371

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

TABLE 3.I.2 – Contribution change (t) by type in Symbolic sanction experiment, with interaction variable (panel analysis random effects with clusters by group).

	High_Contributors ($x_i^{t-1} - \overline{x}_{-i}^{t-1} > 0$)			Low_Contributors ($x_i^{t-1} - \overline{x}_{-i}^{t-1} \leq 0$)		
	All data	Removal	Introduction	All data	Removal	Introduction
Framing	0.161	1.086	0.200	1.567	2.646	0.754
	(0.628)	(0.807)	(0.939)	(1.291)	(1.949)	(1.620)
Symbolic santions received in $t-1$	0.101	0.141	0.0957	0.276**	0.382**	0.190
	(0.105)	(0.154)	(0.154)	(0.113)	(0.187)	(0.143)
Peers'average in $t-1$	-0.0905	-0.158*	-0.0570	-0.296***	-0.268***	-0.352***
	(0.0653)	(0.0831)	(0.0998)	(0.0611)	(0.0986)	(0.105)
Deviation in $t-1$	-0.811***	-0.806***	-0.798***	-0.463***	-0.458***	-0.484***
	(0.105)	(0.184)	(0.109)	(0.0728)	(0.108)	(0.108)
Period	-0.387***	-0.491***	-0.320**	-0.265***	-0.101	-0.418***
	(0.0977)	(0.161)	(0.134)	(0.100)	(0.123)	(0.155)
Sequence	3.235***			2.458**		
	(1.232)			(0.965)		
Symbolic santions received in period $t-1$ × Framing	-0.0531	0.0326	-0.210	-0.179	-0.186	-0.181
	(0.163)	(0.194)	(0.229)	(0.145)	(0.230)	(0.143)
_cons	3.511**	4.052*	5.517**	2.765**	0.0752	9.389***
	(1.402)	(2.117)	(2.558)	(1.376)	(1.175)	(3.508)
N	587	250	337	637	290	347
R^2	0.233	0.238	0.240	0.115	0.142	0.104

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

3.J Emergence of a common contribution standard with symbolic sanctions

3.J.1 Full contributors for symbolic sanctions experiment

TABLE 3.J.1 – Percentage of full contributors per treatment in sequence 1 of Symbolic sanction experiment.

Treatment	Framing : period	1	2	3	4	5	6	7	8	9	10
Baseline treatment	Negative	25	16	9	9	3	6	9	3	6	6
	Positive	32	21	11	14	11	4	4	14	0	7
Introduction condition	Negative	33	28	33	35	28	23	23	18	18	10
	Positive	8	17	17	6	3	3	11	0	3	6
Removal condition	Negative	29	21	11	11	14	11	14	7	11	14
	Positive	25	31	38	47	38	34	34	31	22	22

TABLE 3.J.2 – Percentage of full contributors per treatment in sequence 2 of Symbolic sanction experiment.

Treatment	Framing : period	11	12	13	14	15	16	17	18	19	20
Baseline treatment	Negative	13	13	6	9	9	6	3	3	13	6
	Positive	18	14	7	11	18	11	11	7	7	11
Introduction condition	Negative	38	43	35	33	35	30	33	33	28	15
	Positive	19	14	11	8	6	0	3	3	8	8
Removal condition	Negative	14	11	4	4	4	7	4	4	4	4
	Positive	38	22	25	28	22	16	13	3	3	3

3.J.2 Free riders for symbolic sanctions experiment

TABLE 3.J.3 – Percentage of free riders per treatment in sequence 1 of Symbolic sanction experiment.

Treatment	Framing : period	1	2	3	4	5	6	7	8	9	10
Baseline treatment	Negative	22	22	28	38	31	41	50	41	41	50
	Positive	11	21	11	21	21	36	50	36	36	46
Introduction condition	Negative	13	15	20	18	30	20	35	25	38	58
	Positive	33	28	19	36	39	39	33	50	42	67
Removal condition	Negative	14	18	25	32	25	36	43	36	43	46
	Positive	16	22	28	25	28	22	25	31	44	47

TABLE 3.J.4 – Percentage of free riders per treatment in sequence 2 of Symbolic sanction experiment.

Treatment	Framing : period	11	12	13	14	15	16	17	18	19	20
Baseline treatment	Negative	38	34	44	47	53	41	47	56	56	75
	Positive	29	32	29	36	32	36	39	43	43	61
Introduction condition	Negative	10	5	3	13	18	20	25	28	48	63
	Positive	22	17	22	28	33	42	36	53	56	75
Removal condition	Negative	36	39	54	46	64	54	54	61	54	50
	Positive	25	34	38	44	50	44	44	53	47	72

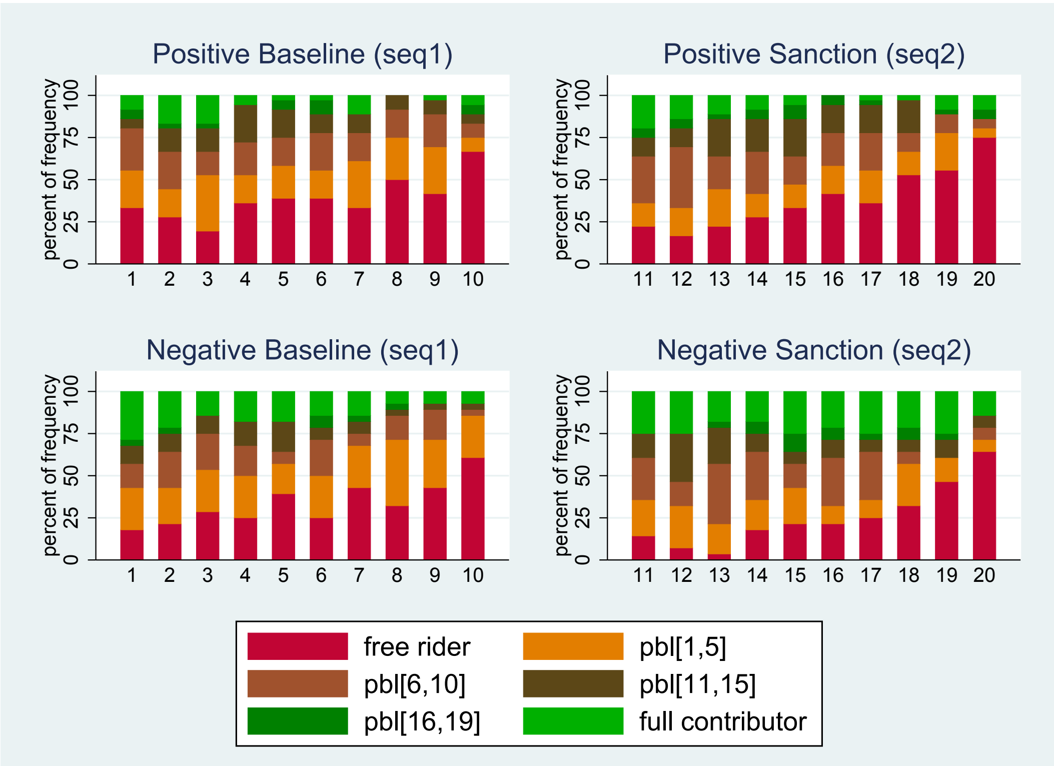


FIGURE 3.J.1 – Evolution of contribution categories in Symboolic sanction experiment (Introduction condition, cooperative groups excluded).

3.K Payoffs complementary analysis for symbolic sanctions experiment

Table 3.K.1 presents panel regression on payoffs without the interaction variable Framing × Sanction.

TABLE 3.K.1 – Panel regression of individuals payoffs in Symbolic sanction experiment, without the interaction variable, random effects.

	(1) All data	(2) Removal	(3) Introduction
Framing	-0.349	1.289*	-1.150*
	(0.561)	(0.733)	(0.662)
Symbolic sanctions	1.583***	0.379	2.815***
	(0.193)	(0.343)	(0.332)
Period	-0.161***	-0.198***	-0.221***
	(0.0141)	(0.0215)	(0.0220)
SVO_score	-1.709	-1.520	-2.609
	(1.410)	(1.832)	(1.691)
Gender	-0.328	-0.671	-0.334
	(0.529)	(0.688)	(0.627)
Age	0.0597	0.134	0.0558
	(0.0744)	(0.0954)	(0.0958)
Understanding	0.212	0.0385	0.365
	(0.193)	(0.240)	(0.242)
_cons	24.20***	23.26***	24.63***
	(2.208)	(2.814)	(2.850)
N	3920	2400	2720
R^2	0.042	0.066	0.055

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

3.L Others potential effects of the frame for symbolic sanctions experiment

3.L.1 Judgment complementary analysis for symbolic sanctions experiment

At the end of the experiment, subjects had to describe their perceptions concernning the effect of others'actions on their own payoff. They could qualify them as generating :"i) important losses, ii) losses, iii) no gains or losses, iv) gains and v) important gains". These perception score compose the following variable "QF_Perception_Effects". In table 4.L.2 we pool the results into three levels : 1) losses, 2) no gains or losses, 3) gains to generate a perception score "QF Perception Effects2". *Symbolic sanctions applied* is a dummy variable that is equal to one when material sanctions were available during the experiment. *Average Peer Contributions (sum)* represents the average sum of contributions from the subject's peers (other group members).

TABLE 3.L.1 – Perception of others actions in Symbolic sanction experiment (ordered logit analysis, perception is reduced to 3 levels).

	(1) QF_Perception_Effects2	(2) QF_Perception_Effects2	(3) QF_Perception_Effects2
Framing	0.698**	0.782**	0.880***
	(0.281)	(0.308)	(0.314)
Symbolic sanctions applied	1.298**	1.197*	1.237*
	(0.600)	(0.622)	(0.644)
Treatment order	-0.708**	-0.656*	-0.818**
	(0.333)	(0.340)	(0.356)
SVO_score		0.822	0.606
		(0.763)	(0.778)
Gender		-0.289	-0.375
		(0.285)	(0.292)
Age		0.0133	0.0173
		(0.0388)	(0.0401)
Understanding		-0.0684	-0.119
		(0.105)	(0.108)
Average Peer Contributions (sum)			0.0451***
			(0.0133)
cut1			
_cons	0.611**	0.824	1.346
	(0.298)	(1.172)	(1.225)
cut2			
_cons	1.247***	1.468	2.027*
	(0.309)	(1.175)	(1.230)
N	196	196	196

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

3.L.2 Strategic understanding for symbolic sanctions experiment

In order to get a better idea of subjects the level of strategical understanding, we replicate Fosgaard et al.(2014) final questionnary at the end of the experiment.

There are two kinds of questions, representing two kinds of objectives. The first type of question asks what ould be their contribution in order to maximize their own payoffs (a). The second type of question asks what would be their contribution in order to maximize the group earning (b). For both objectives, they were presented with two situations concerning the contribution of the other members of the group.

As a result, it seems that subjects do not get the strategical aspect of the game. Indeed, their behavior seem to be driven by reciprocity. All the subjects in the two frames declare that they will not contribute to the public good if others do not contribute for both objectives (individual and group maximization).

Conversely, in both frames a majority of subjects declare that they will fully contribute to the public good if other's are full contributors. These results corroborate the fact that subjects behave as conditionnal cooperators.

Nevertheless, it seems that the frame also impacts their stated willingness to reciprocate to others' contributions. The percentage of subjects who declare that they will fully contribute is lower in the negative frame.

The questions specified that they had to answer how much they will contribute to public good when there were no sanctions that could be delivered :

a) To maximize individual earning, if others fully contribute :

FIGURE 3.L.1 – Stated contributions declared if others fully contribute in order to maximize individual payoff in Symbolic sanction experiment (all data presented in this chapter)

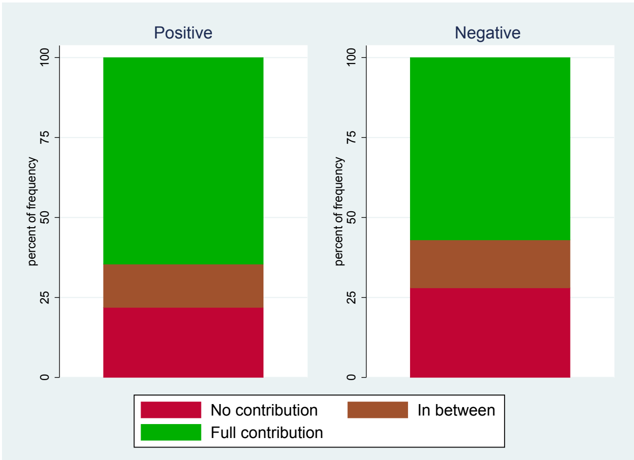


FIGURE 3.L.2 – Stated contributions if others fully contribute in order to maximize individual payoff in Symbolic sanction experiment (Removal conditions)

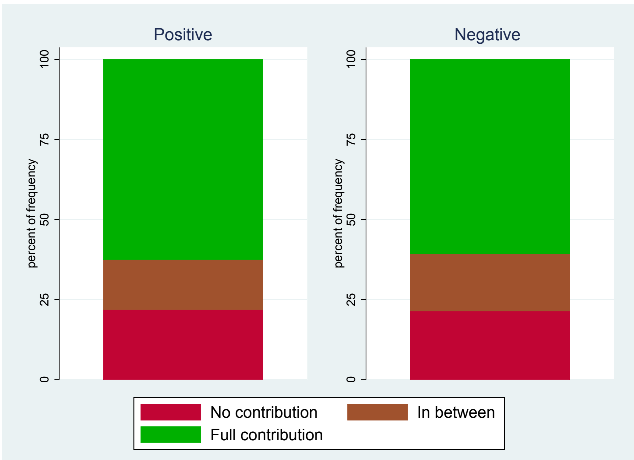


FIGURE 3.L.3 – Stated contributions if others fully contribute in order to maximize individual payoff in Symbolic sanction experiment (Introduction conditions)

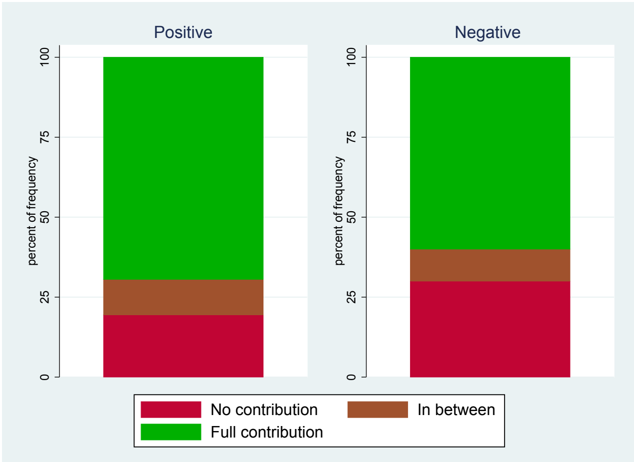
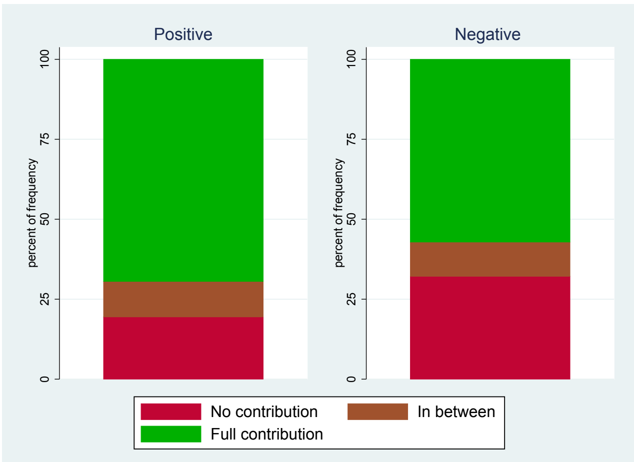


FIGURE 3.L.4 – Stated contributions if others fully contribute in order to maximize individual payoffs in Symbolic sanction experiment (Introduction conditions cooperative groups excluded)



b) To maximize group earning, if others fully contribute :

FIGURE 3.L.5 – Stated contributions if others fully contribute in order to maximize group payoff in Symbolic sanction experiment (Introduction conditions, cooperative groups excluded)

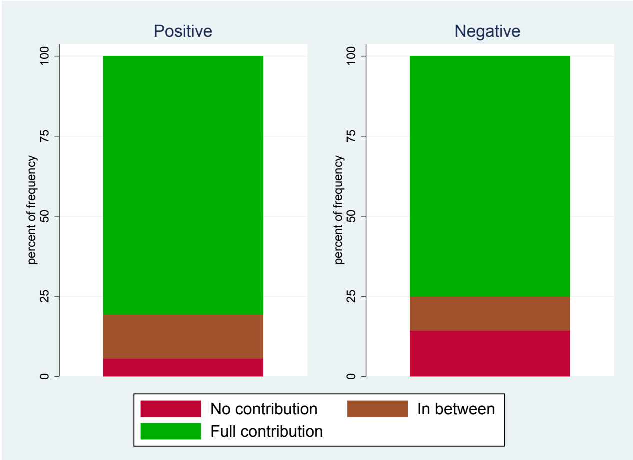


TABLE 3.L.2 – Percentage by stated contribution to maximize group payoff when others fully contribute in Symbolic sanction experiment

Data considered	All data		Removal		Introduction		Introduction without cooperative groups	
	Positive	Negative	Positive	Negative	Positive	Negative	Positive	Negative
No contribution	8.33	16	9.38	21.43	5.56	12.50	5.56	14.29
In between	11.46	14	6.25	14.29	13.89	10.00	13.89	10.71
Full contribution	80.21	70	84.38	64.29	80.56	77.50	80.56	75.00

TABLE 3.L.3 – Percentage by stated contribution to maximize individual payoff when others fully contribute in Symbolic sanction experiment

Data considered	All data		Removal		Introduction		Introduction without cooperative groups	
	Positive	Negative	Positive	Negative	Positive	Negative	Positive	Negative
No contribution	21.88	28.00	21.88	21.43	19.44	30.00	19.44	32.14
In between	13.54	15.00	15.63	17.86	11.11	10.00	11.11	10.71
Full contribution	64.58	57.00	62.50	60.71	69.44	60.00	69.44	57.14

TABLE 3.L.4 – Kolmogorov-Smirnov test of the conditionnal contribution answer comparing the two frames in Symbolic sanction experiment

Data considered	Kolmogorov-Smirnov p-value	
	To maximize individual gain	To maximize group gain
All data presented in this chapter	0.941	0.687
When symbolic sanctions are applied	1.000	0.864
All data cooperative groups are excluded	0.067*	0.019**

3.L.3 Framing effect by subjects'type for symbolic sanctions experiment

Although the number of observations is quite small compared to Park (2000)'s experiment (cf table 5.B.5), I made some statistical tests.

Mann Whitney test on the average contribution by type for symbolic sanctions experiment

The average contribution rate is defined as follows the average contribution by subject and by sequence. This is the observation used to run these tests.

The difference of behavior depending on the **frame in baseline conditions** is **only significant for individualist subjects**. This seems to corroborate Park (2000)'s argument that they are sensitive to framing and that is the main driver of the different dynamics. Nevertheless, it seems that these differences of behavior do not persist during the second sequence of the Baseline treatment.

However, in this set of data under symbolic sanction condition, **individualist subjects** contribute **more under the negative framing** than under the positive one. This runs counter to the findings in the literature and to our own results when considering the data set (of these two chapters). When we remove the highly cooperative groups, we do not find this effect any longer.

Table 3.L.5 – Mann Whitney analysis of the average contribution by subjects types in Symbolic sanction experiment

Treatment			Mann Whitney p-value by Type	
			Prosocial	Individualist
Baseline Treatment		Sequence 1 Baseline	0.930	0.071*
		Sequence 2 Baseline	0.162	0.834
Symbolic sanctions	Introduction conditions	Sequence 1 Baseline	0.937	0.006***
		Sequence 2 Symbolic	0.068*	0.001***
	Removal conditions	Sequence 1 Symbolic	0.058*	0.204
		Sequence 2 Baseline	0.102	0.115

Table 3.L.6 – Mann Whitney analysis of the average contribution by subjects types in Symbolic sanction experiment, excluding cooperative groups

Treatment			Mann Whitney p-value by Type	
			Prosocial	Individualist
Symbolic sanctions	Introduction conditions	Sequence 1 Baseline	0.571	0.183
		Sequence 2 Symbolic	0.396	0.041*
	Removal conditions	Sequence 1 Symbolic	0.058*	0.204
		Sequence 2 Baseline	0.102	0.115

Mann Whitney test on the average contribution by type in the first period of each sequence for symbolic sanctions experiment

TABLE 3.L.7 – Mann Whitney analysis of contribution in the first period by types in Symbolic sanction experiment

Treatment			Mann Whitney p-value by Type	
			Prosocial	Individualist
Baseline Treatment		Sequence 1 Baseline	0.823	0.206
		Sequence 2 Baseline	0.340	0.776
Symbolic sanctions	Introduction conditions	Sequence 1 Baseline	0.109	0.010***
		Sequence 2 Symbolic	0.872	0.026**
	Removal conditions	Sequence 1 Symbolic	0.728	0.560
		Sequence 2 Baseline	0.491	0.031**

TABLE 3.L.8 – Mann Whitney analysis excluding cooperative groups on the first period contribution in Symbolic sanction experiment

Treatment			Mann Whitney p-value by Type	
			Prosocial	Individualist
Symbolic sanctions	Introduction conditions	Sequence 1 Baseline	0.248	0.157
		Sequence 2 Symbolic	0.402	0.239

4

Effectiveness of peer's punishment under negative framing

This chapter is based on joint work with and Katherine Farrow, David Masclet and Marc Willinger

Abstract

Robust evidence demonstrates the effectiveness of peer punishment in encouraging cooperation in public good games. However, little is known concerning the robustness of this mechanism to contextual changes. We investigate whether peer sanctioning is equally effective in promoting cooperation, when strategic interactions are negatively framed rather than positively framed as in the standard presentation of the public good game. We rely on Andreoni (1995) 's experimental design and introduce monetary sanctions in the negative and positive frames. In the absence of peer-punishment, we replicate previous findings of the framing effect, i.e. lower group contributions under negative than under positive framing. When peer punishment is feasible, we observe nearly full group cooperation under positive framing. On the contrary, under negative framing, the average group contributions remain stable at around 45%. Slightly more punishment points are inflicted under negative framing. However, we do not observe differences in sanctioning motives between frames : the same determinants are observed in both frames. We suggest that the lower cooperation observed under negative framing despite the availability of punishment is due to the lower effectiveness of received punishment points than under positive framing.

Keywords : cooperation, public good, framing, peer punishment.

4.1 Introduction

How to promote and maintain cooperation in order to produce public goods, stays one of the most debated economic issues. Advances in behavioral and experimental economics showed that subjects contribute between 40 and 60 percent of their endowments to the public good in the early periods of a repeated public good game, thus contradicting standard economic predictions. Nevertheless, contributions decrease with repetition of the game, reaching nearby zero, tending to confirm the Nash prediction (Chaudhuri, 2011). Various mechanisms were identified to prevent the tendency to free ride, and doing so, to overcome the under-provision of public goods. There are based on approval and disapproval such as communication (Ostrom et al., 1994), peer pressure (Masclet et al., 2003) and peer punishment (Fehr & Gächter, 2000) and rewards (Sefton et al., 2007). Among all these mechanisms, punishment seems to be the strongest device to promote cooperation.

However, little is known about the robustness of punishment mechanisms with respect to institutional changes. Evidence has shown that subjects' perception about the collective action issue, more particularly about the functioning of the resource or the public good and actions of others, influences their willingness to cooperate. In other words, when they have a poor perception of how the resource or collective game works, and the impact of others' actions on it, they are less likely to support the implementation of actions/policies for the well-being of all (Ostrom, 1990 ; Kuziemko et al., 2015 ; Alesina et al., 2018). The way the voluntary contribution mechanism (VCM), is framed, i.e. formulated ceteris paribus, affects individual and group contributions (Andreoni, 1995 ; Cox, 2015 ; Cubitt et al., 2011 ; Dufwenberg et al., 2011 ; Fosgaard et al., 2014 ; Fujimoto & Park, 2010 ; Khadjavi & Lange, 2015 ; Park, 2000). The reason seems to be that framing affects subjects' perception of the social dilemma that underlies the VCM and therefore, their willingness to cooperate. This aspect has great relevance to team production, where there is reason to believe that how individuals perceive the dynamics of collective production and the actions of team members can influence their response to peer punishment and thus the dynamics of the group.

In this paper, we investigate whether the framing of the VCM affects the effectiveness of peer punishment to promote cooperation among group members. Does the way the collective issue is framed influence the capacity of the group to generate and maintain a high level of contribution to the public good when material sanctions can be inflicted ? We conjecture that if subjects interpret the actions of others as having positive externalities on themselves, they will be more inclined to cooperate, but also to bear the cost of punishment in order to foster collective action ; than if they interpret them as having negative externalities.

We add a new perspective to the existing literature by testing the role of framing as defined by Andreoni (1995), rather than the "give and take frame", on the effectiveness of sanctions. As discussed in Cartwright (2016) the "positive versus negative" framing is distinct from the Give and Take Frame with respect to three aspects : i) the initial allocation of the endowment, ii) the choice presented to subject and iii) the way externalities generated are presented. In the Give (Take) frame, the endowment is initially allocated in the private (public) account, and subjects have to decide how much they transfer to the public (private) account. Their choices, therefore, increase (decrease) the amount in the public account in the Give (Take) frame.

Andreoni (1995) 's frame is valence framing, more precisely a goal frame as defined by Levin et al. (1998). In one case, it presents the positive consequences of doing an action ; and in the other, the negative ones of not doing this action or of doing the alternative action. In both frames, the set of actions and their impact on payoffs are strictly identical. Players' initial endowments are not allocated in any account. In both the positive and the negative frame, they individually have to decide the amount they invest in the public account and the private account. The sum of these two amounts has to be equal to their endowment. Frames only differ in the way the consequences of each choice are described. In the positive frame, investing in the public account is presented as having a positive impact on other players' payoffs, whereas in the negative frame investing in one's private account is presented as having a negative impact on other players' payoffs [1]. Experiments based on "positive vs negative" framing, i.e. Andreoni (1995), Park (2000) and Fujimoto and Park (2010), found that the contribution level is higher in the positive frame than in the negative one. According to Andreoni (1995), the difference comes from the fact that individuals prefer doing good to others than prevent from doing bad. The strength of the "warm glow" effect is higher than the "cold-prickle" to induce cooperation. We aim to try to understand how the framing of identical strategic interactions can influence the effectiveness of sanctions.

We contribute to the existing literature by investigating the effect of framing in the context of a VCM with punishment. Previous studies have shown the effectiveness of punishment mechanisms in the context of common pools (Ostrom et al., 1994) as well as public goods (e.g. Fehr & Gächter, 2000 ; Sefton et al., 2007). Fehr and Gächter (2000) 's interpretation of punishment efficiency is that it enables subjects to coordinate on a common group standard. One of their main results is that : *" full cooperation emerges as the dominant behavioral standard for individual contributions whereas in the absence of punishment opportunities full free riding is the focal action*". Nevertheless, existing conclusions on how framing can influence the creation of a common standard of contribution, and more importantly, the effectiveness of sanctions in achieving it, are unclear. Gächter et al. (2017) and Ramalingam et al. (2019) ran public good experiments with punishment using the "Give and Take" frame. They showed that in both frames, the introduction of sanctions generates a high level of cooperation that is maintained until the last period. Gächter et al. (2017) also found that punishment is more extensive in the take frame since cooperation is lower in this frame compared to the give frame. Cubitt et al. (2011a) found that punishment is not sensitive to the give versus take framing manipulation after controlling for differences in contribution levels between frames. Their analysis indicates that the main determinant of punishment behavior is the difference between the contributions of the punisher and the punished. In contrast, Ramalingan et al. (2019), found that low contributors receive punishment more often in the take frame than in the give frame. In this chapter, we try to answer the question : "Does the fact of presenting the effects on others' actions as having positive vs negative consequences impact the effectiveness of monetary sanction ?". In other words, does framing affect the level of provision of the public good, and the convergence toward a common contribution norm ?

We reproduce Andreoni (1995) 's framing by adding the possibility of expressing disapproval by sending monetary sanctions which are costly to send and generate a payoff loss for the recipient. Besides, we control for the order effect, with a treatment in which the monetary sanctions are applied from the first period of the game and are then removed (Removal condition) ; and a treatment in which they are only introduced in the second sequence (Introduction condition). Our findings are consistent with those of Andreoni (1995), contributions are higher in the positive framing than in the negative framing. The availability of monetary sanctions increases contributions under boh frames. Nevertheless, monetary sanctions are more effective when they are introduced after subjects have experienced a baseline sequence in which they were not able

1. Recently, Cartwright and Ramalingam (2019), tried to disentangle the effect of presenting action as having positive or negative consequences on others' payoffs. However, they use a "Give and Take Frame" and show that within each kind of frame (the give and the take one), presenting actions as having positive versus negative externalities has no effect. Nevertheless, in this experiment, there were no punishment opportunities.

to express their disapproval. Furthermore, the effectiveness of monetary punishment is strongly influenced by the frame, as it is significantly higher in the positive framing. It is particularly true in the Introduction condition where, in the positive framing, monetary sanctions lead the vast majority of groups to contribute fully until the last period of the game. In comparison, in the negative framing, the increase is limited to half of the subjects' allocations on average. In the positive framing, from the first period after the introduction of sanctions, a high percentage of subjects become full contributors, and this percentage continues to increase over time. There is no such convergence towards full contribution in the negative framing where, on the contrary, contributions are more dispersed. Paradoxically, the number of sanctions sent is slightly higher in this frame. As the factors explaining the sending of sanctions are similar in both frames, they are mainly related to a lower contribution than that of peers. We argue that the frame has an impact on the ease with which groups converge towards a standard of contribution. These results support our hypothesis that the perception created by framing strongly influences the group's ability to overcome a collective action problem.

The rest of the chapter proceeds as follow. Section 2 describes the experimental design. In section 3, we discuss our theoretical predictions. Section 4 presents the results. Section 5 discusses the main findings.

4.2 Experimental Design

The experiment is based on a repeated voluntary contribution game with or without a peer punishment option. Subjects were assigned to partner groups of $n = 4$ players. The test treatments rely on a 2×2 factorial design : 2 framings (*positive* versus *negative*) $\times$ 2 conditions (with or without sanctions).

Table 4.1 summarizes our experimental design. Each treatment is broken into two successive sequences of 10 periods each. The Baseline corresponds to the standard contribution game without punishment, either with positive framing (T1) or negative framing (T4). In all other treatments, a punishment stage is either introduced in sequence 1 or sequence 2. It is important to control for the ordering of the sequences. For instance, in the case where sanctions are introduced in sequence 2, we observe the joint effect of experience and sanctions on the level of group contributions. We, therefore, match each treatment for which sanctions are introduced in sequence 1 (T2 and T5, called Removal condition) with a treatment where sanctions are removed in sequence 2 (T3 and T6, called Introduction condition).

Table 4.1 – Numbers of subjects per treatment in Monetary sanction experiment [number of groups]

Treatment	Framing	Part 1 period$(1-10)$	Part 2 period$(11-20)$	Number of subjects [groups]
T1		Baseline	Baseline	28[7]
T2	Positive	Baseline	Sanctions (Introduction)	32[8]
T3		Sanctions	Baseline (Removal)	28[7]
T4		Baseline	Baseline	32[8]
T5	Negative	Baseline	Sanctions (Introduction)	36[9]
T6		Sanctions	Baseline (Removal)	32[8]

The baseline condition replicates Andreoni (1995) 's experimental design. In both frames, subjects had to decide how to allocate their endowment between an *Individual Exchange* (x_i) and a *Group Exchange* (y_i). The sum of their investments in the two accounts had to be strictly equal to their endowment of 20 tokens in each period. In the positive framing, group members' contributions to the group account are presented as having a positive influence on one's own payoff. The exact statement of the instructions was : "*Every token you invest in the Individual Exchange will yield a return of one. [...] Every token invested in the Group Exchange will yield a return of* $\beta = 0.4$ *for each member of the group, not just the person who invested it.*" This statement makes it explicit that each member of the group has a positive influence on others through his contribution to the group account. After stage 1, player i's earning under positive framing can therefore be written :

$$\Pi_i^1(y_i, y_{-i}) = x_i + \beta(y_i + y_{-i}) \tag{4.1}$$

In contrast, under negative framing, the instructions stated : *"Every token you invest in the Individual Exchange will yield a return of one. However, each token invested in the Individual Exchange will reduce the earnings of other players by* $\beta = 0.4$*. It will also be true that when the other members of your group invest in the Individual Exchange, then your earnings will be reduced by* 0.4 *times their investment in the Individual Exchange.[...] Every token invested in the Group Exchange will yields a return of* $\beta = 0.4$." This statement was intended to induce a negative perception of others' investments in their private account. Each token invested in his private account by a group member has a negative impact onto others' payoffs. The negative externality of others' investments in their private account correspond to $(-\beta x_{-i})$. For payoffs to be strictly identical, for the same action in both frames, in the negative frame players received an automatic earning in each period, equal to $\beta(n-1)e$. Given the parameters, this amount is 24 ECU ($0.4 \times 3 \times 20$). From equation *(4.2)* it is easy to see that payoffs are the same under both frames, since $y_{-i} = (n-1)e - x_{-i}$. Gives the formal expression of player i's payoff under negative framing :

$$\Pi_i^1(x_i, x_{-i}) = x_i - \beta x_{-i} + \beta y_i + \beta(n-1)e \tag{4.2}$$

Both frames are strategically equivalent : the players' strategy sets and payoff functions are strictly identical.

In treatments with sanctions, each period is divided into two stages : a contribution stage followed by a sanctioning stage. After observing others' contributions, each participant has to decide about the number of punishment points he wants to assign to each other group member. Each punishment point received by a member of the group reduces his stage 1 payoff by 3 ecu and costs 1 ecu to the punisher. Subjects can send between 0 and 5 punishment points to each other member of their group. Let p_{ij} be the number of punishment points assigned by player i to player j ($j \in [1,4]$; and $j \neq i$). After the sanctioning stage, player i's final payoff at the end of the period equals :

$$\Pi_i^f(y_i, y_{-i}) = x_i + \beta(y_i + y_{-i}) - \sum p_{ij} - 3\sum p_{ji} \tag{4.3}$$

$$\Pi_i^f(x_i, x_{-i}) = x_i - \beta x_{-i} + \beta y_i + \beta e(n-1) - \sum p_{ij} - 3\sum p_{ji} \tag{4.4}$$

Note that individuals' contributions are observed by all members of the group at the end of step 1. However, in order to avoid reputational effects, subjects cannot identify their peers. This was ensured by displaying individual contributions in random order at each new period.

Each participant's "Social value orientation (SVO)" was elicited based on Murphy et al. (2011) 's method at the beginning of each session. Subjects had to make 15 allocation decisions between themselves and an anonymous receiver. For each decision, 9 options were proposed. One of the fifteen allocation decisions was randomly selected to be paid at the end of each session. In order not to influence subjects' willingness to cooperate in the VCM, they were informed of their SVO's results only at the end of the experiment.

The experiment was conducted in the Laboratory of Experimental Economics of Montpellier (LEEM) between May and December 2018. In total 188 subjects participated in this experiment (see table 4.1 for details). Upon arrival at the laboratory, each participant chose a cubicle in which he was seated in front of a computer terminal. Subjects were informed that the experiment consisted of *3 parts* . They were informed that each of the three parts would be paid at the end of the session. Subjects received specific instructions at the beginning of each part. They were invited to first read the instructions privately, after which they were read one more time loudly by the person in charge of the experiment. Before starting the experiment, each participant had to answer eight control questions. After each question, the correct answer and a detailed explanation were displayed. This part aimed to help participants understanding the game and how contributions translated into earnings and vice versa. The answers to the comprehension questionnaire were used by the experimenter to compute an understanding score.

An experimental session lasted approximately one hour and a half. The average payment was 16.01 euros in addition to a show-up fee of 2 or 6 euros depending on the distance of the subject's location to the LEEM. The experiments were conducted using zTree (Fischbacher, 2007). The SVO software was adapted from Crosetto et al. (2012).

4.3 Behavioral predictions for material sanctions

Under the assumption of purely selfish rational agents, players should never sanction and always contribute zero to the group account in each period. However, there is evidence that the way the collective issue is presented and perceived can favor the emergence of a common contribution norm (Fehr & Fischbacher, 2004). Making subjects perceive that their choices will generate gains vs losses could induce different behaviors (Tversky & Kahneman, 1981). The way a situation is presented also impacts the moral judgment subjects have about it, changing what is defined as an acceptable or reprehensible behavior (Kahneman, 1992). Cubitt et al. (2011b)'s experiment showed that in a public good game using the Give and Take frame, acting as a free rider is more strongly condemned in the give frame than in the take frame. This observation provides the basis for Prediction 1.

Prediction 1 : Contributions to the public good are larger in the positive frame than in the negative frame.

Regarding punishment, the null hypothesis is that subjects should not send monetary sanctions because it is costly to do so. However, it has been shown that punitive behavior is induced by non-selfish interest and normative behavior. Experimental evidence has shown that people punish for non-selfish reasons, also called altruistic punishment (Fehr & Gächter, 2002 ; Carpenter, 2007). Moreover, as Fehr and Schmidt (1999) demonstrate that, if subjects are inequality averse, they might bear the cost of punishment. Consequently, if the proportion of subjects who are averse to inequality is sufficient, cooperation will appear [2]. For Carpenter et al. (2006) and Carpenter et al. (2009), the output of a team depends strongly "*on the willingness of some team members to contribute altruistically to a common project and to bear the costs in order to*

2. confere Proposition 4 c page 839 and proposition 5 p 841

discipline other members who do not contribute". It brings us to Prediction 2.

Prediciton 2 **: The availability of peer punishment increases contributions.**

Perceiving others' actions as having negative externalities can decrease the willingness to contribute and to bear costs. Moreover, we also state the hypothesis that the group dynamic not only depends on the willingness of cooperators to punish shirkers but also on the willingness of shirkers to respond to punishment by increasing their level of cooperation. That is why we consider that the perception of others' actions also impacts the responsiveness to sanctions. In linear public good games, under the Give frame, the type of feedback affects subjects' reaction to received punishment (Ramalingam et al., 2018 ; Nikiforakis, 2010). Ramalingam et al. (2018) show that lower information in the instructions, leads to a lower understanding of the game, but also a higher level of sanctions send and lower responsiveness to sanctions. Nikiforakis (2010) 's experiment shows that the feedback format of others' actions, revealing their contributions, their earnings or both, affects the group members' ability to converge toward a common contribution standard [3]. In the treatment in which subjects had the two kinds of information, the severity of punishment is slightly higher for low contributors, whereas they are less likely to increase their contributions when they get punished. We state the hypothesis that under negative framing, the higher contributor will be less willing to bear the cost of punishment and that low contributors are less likely to reciprocate positively by increasing their contributions. It will impact the effectiveness of peers' punishment. In other words, if subjects perceive the actions of others as generating negative externalities, it is more difficult for groups to converge towards a common standard of contribution.

Prediction 3 **: In the negative frame, sanctions result in a smaller increase in contributions.**

4.4 Experimental Results

In this section, we report on how framing affects contributions to the group's account and how it interacts with the implementation of monetary sanctions. Next, we analyze how framing affects punishment behavior and the response to it. We also analyze how other effects of framing on perception and stated reciprocity, may explain the observed differences. We conclude by analyzing the effect of framing on the effectiveness of sanctions.

4.4.1 Voluntary contributions under different framing with and without punishment

Result 1 : *Contributions to the public good are larger under positive framing.*

Result 1 is illustrated in figures 4.2 and 4.3 where contributions remain slightly higher in the positive frame in the Baseline, even though the decline of the average contribution is similar in both frames. Mann Withney tests confirm that in the first sequence of the Baseline treatment

3. Confere results in part 3.3 Convergence of contributions p 696 : "*If feedback format affects the ability of participants to establish common contribution standards, providing feedback in two different formats that highlight the conflict between private and collective interest should retard the convergence of contributions* ".

but also of the Introduction condition, the average group contribution is higher in the positive frame than in the negative frame ($p = 0.004$ and $p = 0.020$, respectively). Moreover, the result 1 is supported by the panel tobit estimation presented in table 4.2. The dummy variable *Framing* has a positive and significant effect on contributions. We, therefore, conclude that cooperation is larger in the positive frame.

Result 2 : *The availabililty of sanctions increases contributions in both frames. Negative framing leads to a lower increase in contributions in the Introduction condition.*

The possibility of inflict material sanctions increases individual contributions, independently of the sequence in which they are introduced. This result is supported by the significance and positive sign of the variable sanction presented in table 4.2, and illustrated in figures 4.2 and 4.3 representing the average group contribution by treatment. As a robustness check, the double-difference analysis (DiD) also supports the positive effect of sanctions on the contribution increase (cf. appendix 4.F.1, 4.F.2, 4.F.3 and 4.F.4).

Nevertheless, in the Introduction condition, sanctions are more effective under the positive frame. The interaction variable *Sanction*×*Framing* has a strong positive and significant impact on contributions, meaning that the introduction of sanctions leads to higher contributions in the positive frame than in the negative frame (cf tables 4.2 and 4.3). In sequence 2, the contribution path in the positive frame contrasts sharply with the contribution path in the negative frame (as illustrated in figure 4.2). The introduction of monetary sanctions leads groups' contributions to come close to the socially optimum level of contribution. In comparison, in the negative frame, the introduction of monetary sanctions allows group contributions to be maintained at a level which is half of the socially optimum level and the Nash equilibrium level. This difference of contribution is also significant, according to the Mann Whitney test in the Introduction condition ($p = 0.002$).

Looking at individual determinants of cooperation, our results show that subjects with higher SVO scores are also those who contribute the most to the public good.

TABLE 4.2 – Individual contributions to the group account in Monetary sanction experiment (panel tobit estimation two sided, random effects).

	(1) All data	(2) All data	(3) All data	(4) Without sanction	(5) Sanctions
Framing	6.074***	4.608***	3.633***	4.917***	7.418***
	(1.159)	(1.187)	(1.206)	(1.380)	(1.696)
Material sanctions	11.23***	9.272***	9.320***		
	(0.433)	(0.571)	(0.570)		
Period	-0.313***	-0.309***	-0.310***	-0.643***	0.194***
	(0.0307)	(0.0305)	(0.0305)	(0.0458)	(0.0749)
Material × Framing		4.258***	4.301***		
		(0.842)	(0.841)		
SVO_score			13.34***	15.51***	4.697
			(2.922)	(3.450)	(4.276)
Gender			0.949	1.022	-0.122
			(1.092)	(1.284)	(1.616)
Age			-0.0437	0.0787	0.0322
			(0.153)	(0.181)	(0.208)
Understanding			0.681*	-0.150	2.035***
			(0.378)	(0.446)	(0.543)
_cons	4.313***	5.002***	-4.341	-0.766	-4.386
	(0.863)	(0.868)	(4.469)	(5.332)	(6.084)
sigma_u					
_cons	7.533***	7.487***	6.991***	8.102***	8.349***
	(0.451)	(0.449)	(0.424)	(0.536)	(0.649)
sigma_e					
_cons	9.651***	9.603***	9.603***	9.278***	7.636***
	(0.179)	(0.178)	(0.178)	(0.216)	(0.236)
N	3760	3760	3760	2480	1280

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

TABLE 4.3 – Individual contributions to the group account discriminating for Removal and Introduction conditions in Monetary sanction experiment (panel tobit estimation two sided, random effects).

	(1) Removal + Bsl	(2) Removal + Bsl	(3) Removal + Bsl	(4) Introduction + Bsl	(5) Introduction + Bsl	(6) Introduction + Bsl
Framing	3.686**	4.174***	4.073**	6.762***	4.295***	2.526*
	(1.559)	(1.595)	(1.604)	(1.306)	(1.300)	(1.339)
Material sanctions	7.276***	8.131***	8.233***	14.37***	10.02***	10.20***
	(0.756)	(0.944)	(0.942)	(0.722)	(0.849)	(0.844)
Period	-0.508***	-0.509***	-0.504***	-0.478***	-0.470***	-0.477***
	(0.0474)	(0.0474)	(0.0474)	(0.0462)	(0.0453)	(0.0452)
Material × Framing		-1.851	-1.763		9.561***	9.515***
		(1.211)	(1.210)		(1.106)	(1.100)
SVO_score			13.47***			17.28***
			(3.927)			(3.238)
Gender			0.346			2.008*
			(1.502)			(1.163)
Age			-0.0982			-0.0328
			(0.206)			(0.178)
Understanding			0.205			0.705
			(0.505)			(0.439)
_cons	7.800***	7.570***	1.835	5.320***	6.496***	-5.516
	(1.231)	(1.242)	(6.127)	(0.974)	(0.957)	(5.242)
sigma_u						
_cons	8.162***	8.178***	7.741***	6.969***	6.779***	5.986***
	(0.608)	(0.609)	(0.581)	(0.515)	(0.503)	(0.455)
sigma_e						
_cons	9.424***	9.420***	9.422***	9.391***	9.221***	9.220***
	(0.222)	(0.221)	(0.221)	(0.207)	(0.203)	(0.203)
N	2400	2400	2400	2560	2560	2560

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

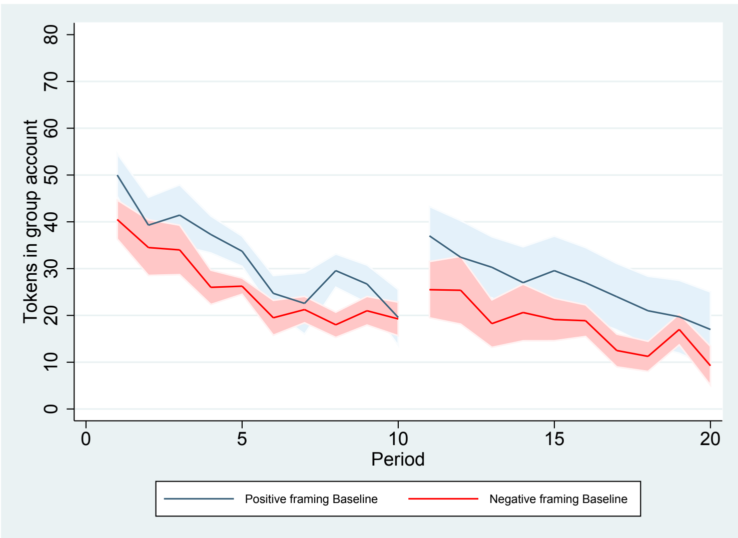


FIGURE 4.1 – Evolution of the average group contribution in the Baseline.

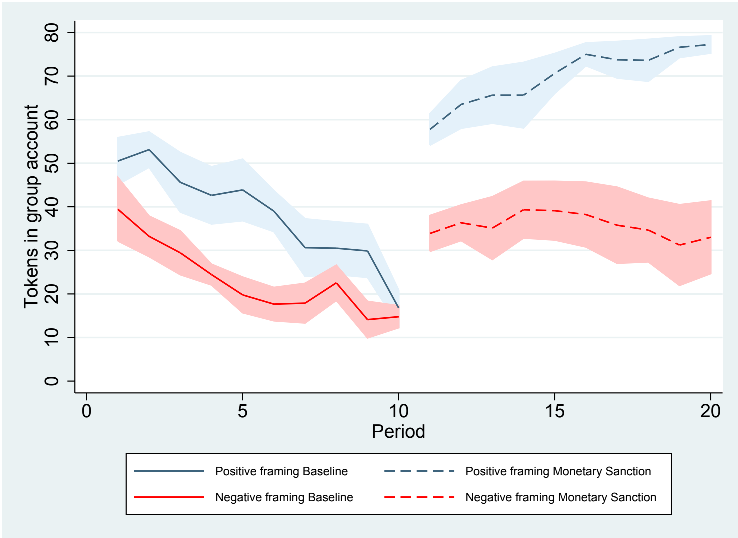


FIGURE 4.2 – Evolution of the average group contribution in the Introduction condition in Monetary sanction experiment.

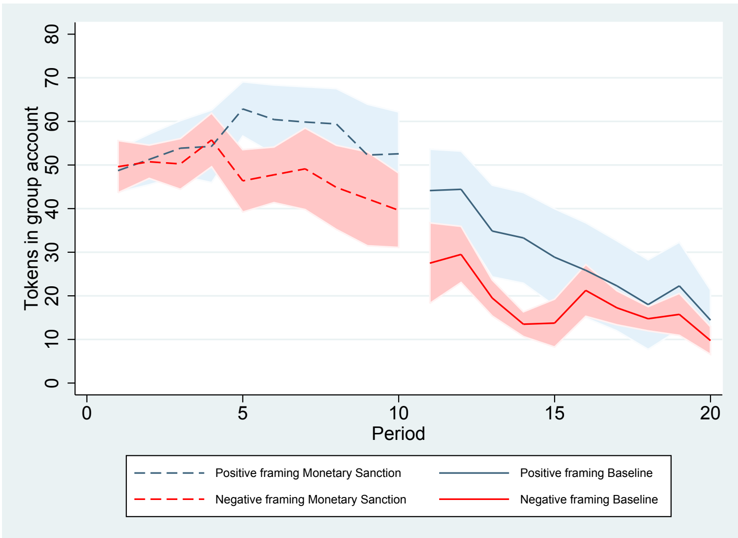


FIGURE 4.3 – Evolution of the average group contribution in the Removal condition in Monetary sanction experiment.

In order to understand what drives this effect, we explore how sanctioning behavior and the response to it are affected by framing. This analysis will allow us to make conjectures on why the effectiveness of different sanctions is also affected by the sequence in which they are implemented (Removal vs Introduction condition).

4.4.2 Sanctioning behavior

In this subsection, we address the question of whether sanctioning behavior differs across frames? Are punishers more likely to sanction deviations from peer average under positive framing than under negative framing? Furthermore, is a given deviation from peer average more severely sanctioned under positive than under negative framing?

We analyze sanctions from two points of view : first, from the point of view of the punishers and second, from the point of view of the sanctioned group members. The first analysis is based on subjects' punishment vectors, i.e. the three punishment decisions taken by subject i towards subject $j \neq i$. For the second analysis, we consider the level of sanctions received by a subject, which is the sum of sanctions sent to him by each other member of the group ($\sum p_{ji}$).

Is the propensity to send monetary sanctions frame-dependent?

Result 2.1 : *The likelihood to inflict sanctions is higher in the negative frame due to a lower contribution level. Nevertheless, the punishment drivers and the severity are similar in both frames.*

Result 2.1 is supported by the probit regressions presented in table 4.4, where the variable Framing has a negative and significant impact on the propensity to send sanctions.

However, the **drivers of sanctioning** and its **dynamic** are similar in both frames. The individual contribution level y_i, is not itself a determinant of the decision to punish. Indeed, this decision is in both frames driven by **social comparisons**.

The major driver of sent punishment points is the contribution deviation from peer's average. Subject i sanctions the more heavily subject j the larger the absolute negative deviation $|y_j - y_i|$, with $y_j - y_i < 0$. Besides, the comparison with other group members (excluding i and j) also plays a role in the decision to inflict punishment points. The lower a player's contribution compared to the average of the two other players ($\bar{y}_{-i-j}$), the higher is his likelihood of being punished by i. The lower a subject's contribution, the more likely it is that the other contributors, who consequently have a higher contribution, will bear the cost of the punishment. These results lend credence to the conjecture that some high contributors bear the costs of punishing shirkers. Nevertheless, there is also antisocial punishment and sanctions are also send to subjects who had a higher level of contribution $y_j - y_i > 0$.

TABLE 4.4 – Subject's i propensity to send monetary sanction to subject j (probit analysis with cluster by subject).

	(1) All data	(2) All data	(3) Removal	(4) Removal	(5) Introduction	(6) Introduction
Framing	-0.136	-0.239*	-0.354*	-0.393*	0.150	0.0118
	(-0.95)	(-1.66)	(-1.75)	(-1.96)	(0.67)	(0.05)
(absolute) Negative Deviation $y_j - y_i < 0$	0.0944***	0.0667***	0.0913***	0.0569***	0.110***	0.0867***
	(7.38)	(4.50)	(5.62)	(2.83)	(5.73)	(3.89)
Positive Deviation $y_j - y_i > 0$	-0.00326	0.0333**	0.00415	0.0441*	-0.0133	0.0147
	(-0.28)	(2.01)	(0.27)	(1.81)	(-0.77)	(0.62)
Own contribution	-0.0160*	0.00817	-0.0178*	0.0115	-0.0274**	-0.00688
	(-1.95)	(0.78)	(-1.93)	(0.80)	(-2.07)	(-0.44)
Period	-0.0672***	-0.0609***	-0.0816***	-0.0722***	-0.0520**	-0.0477**
	(-4.63)	(-4.00)	(-3.96)	(-3.34)	(-2.54)	(-2.23)
Sequence	0.811***	0.776***				
	(4.28)	(3.89)				
Positive deviation from others two $y_j - \bar{y}_{-i-j} > 0$		-0.0310**		-0.0308		-0.0220
		(-2.02)		(-1.22)		(-1.26)
Negative deviation from others two $y_j - \bar{y}_{-i-j} < 0$		0.0557***		0.0641***		0.0451**
		(4.48)		(3.70)		(2.51)
_cons	-0.714***	-1.109***	-0.539**	-1.050***	-0.138	-0.460
	(-4.21)	(-5.43)	(-2.50)	(-3.74)	(-0.40)	(-1.17)
N	3840	3840	1800	1800	2040	2040

t statistics in parentheses

* p<0.10 ; ** p<0.05 ; *** p<0.01

Monetary sanctions received

As illustrated by figure 4.4, the number of monetary sanctions received are slightly higher in the negative frame. However, as illustrated in figure 4.5, the likelihood of being punished, depends on the deviation from peer average $y_i - \bar{y}_{-i}$. There are no strong differences between the two frames, except for high contributors (between 14 and 20) who are not punished in the positive frame, whereas they are in the negative one.

The severity of received punishment is also linked to the level of negative deviation from the peer average. As illustrated in figure 4.6, the shirkers, who have a strong negative deviation from the peer average, are more severely punished. However, there is no framing effect on the severity of punishment, and the number of sanctions sent decreases in both frames over time. These results are supported by the tobit analysis of the number of sanctions received presented in table 4.5.

These results lead us to argue that punishment drivers are the same in both settings. However, due to a higher contribution dispersion, illustrated by the considerably smaller number of observations in the interval $[-2; 2]$ in the negative frame, the penalties sent are higher. Having a higher spread of contribution in each group, and a higher number of sanctions sent seem to signal that subjects have more difficulties to coordinate in the negative frame under sanctions.

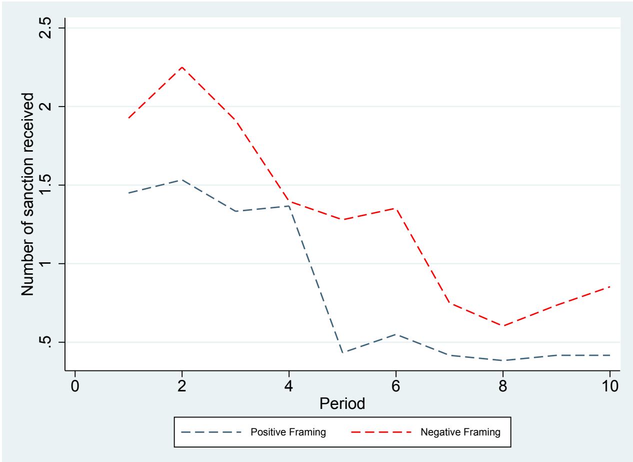


FIGURE 4.4 – Evolution of the number of monetary sanctions received.

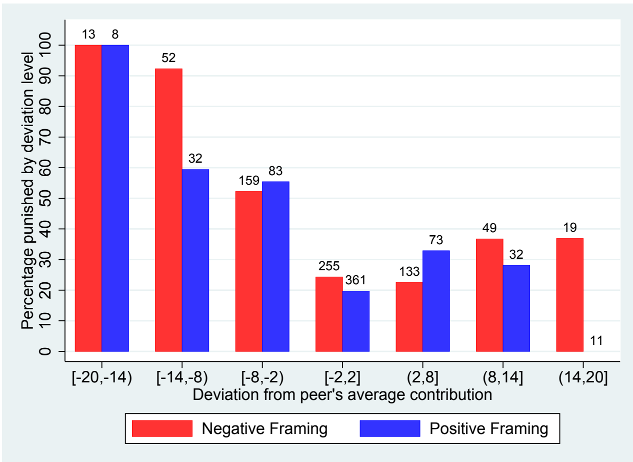


FIGURE 4.5 – Likelihood of receiving monetary sanctions by deviation level (with the number of observations).

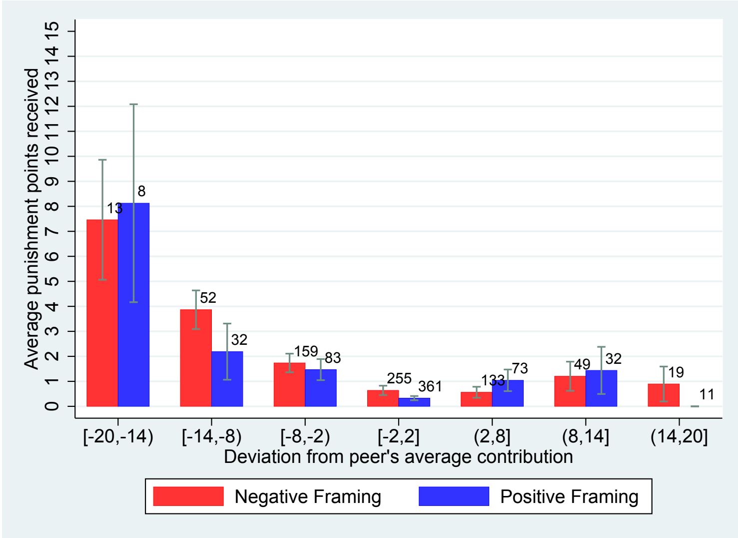


FIGURE 4.6 – Average number of monetary sanctions received by deviation level (with the number of observation).

TABLE 4.5 – Number of monetary sanctions received (panel tobit estimation two sided, random effects).

	(1) All data	(2) All data	(3) Removal	(4) Removal	(5) Introduction	(6) Introduction
Framing	-0.147	-1.486*	-1.359*	-1.640	1.100	-0.256
	(0.514)	(0.882)	(0.772)	(1.141)	(0.720)	(1.707)
Positive Deviation $y_i - \bar{y}_{-i} > 0$	0.0308	0.00573	0.0585	-0.0420	0.00610	0.0351
	(0.0380)	(0.0437)	(0.0638)	(0.0794)	(0.0458)	(0.0498)
Negative Deviation $y_i - \bar{y}_{-i} \leq 0$	0.579***	0.575***	0.580***	0.574***	0.609***	0.605***
	(0.0342)	(0.0424)	(0.0524)	(0.0622)	(0.0462)	(0.0605)
Peers' average contribution	-0.0622*	-0.0749**	-0.0841	-0.0717	-0.0870*	-0.124**
	(0.0331)	(0.0353)	(0.0531)	(0.0535)	(0.0446)	(0.0503)
Period	-0.268***	-0.318***	-0.341***	-0.317***	-0.203***	-0.264***
	(0.0388)	(0.0477)	(0.0649)	(0.0848)	(0.0487)	(0.0640)
Sequence	3.074***	3.052***				
	(0.618)	(0.615)				
Period × Framing		0.119*		-0.0729		0.122
		(0.0633)		(0.128)		(0.101)
Positive Deviation × Framing		0.0753		0.281**		-0.187
		(0.0789)		(0.121)		(0.115)
Negative Deviation × Framing		0.0185		0.000385		0.0356
		(0.0688)		(0.108)		(0.0921)
_cons	-0.626	0.102	0.195	0.185	1.417	2.595**
	(0.617)	(0.730)	(0.980)	(1.069)	(0.933)	(1.194)
sigma_u						
_cons	2.387***	2.367***	2.540***	2.562***	2.201***	2.238***
	(0.219)	(0.217)	(0.354)	(0.362)	(0.265)	(0.270)
sigma_e						
_cons	2.888***	2.881***	3.237***	3.190***	2.587***	2.574***
	(0.111)	(0.111)	(0.192)	(0.190)	(0.130)	(0.130)
N	1280	1280	600	600	680	680

Standard errors in parentheses

* p<0.10 ; ** p<0.05 ; *** p<0.01

4.4.3 Responsiveness to monetary sanctions

We now analyze how framing affects the response to received sanctions. When sanctions are introduced in the second sequence, the reaction to sanctions differs sharply according to the frame. This difference is observable from the first period, i.e. before subjects received their eventual first sanctions. In positive framing, the majority of the subjects invest more than half of their endowment in the public good in the first period. Only 25 percent of the subjects do the same in the negative frame (figure 4.9). The threat of sanctions generates a higher increase of contributions in the positive frame than in the negative one. Moreover, the trend of contributions also differs according to the frame. Under positive framing, average contributions increase, while they remain at a stable level in the negative framing as illustrated in figure 4.2. In order to understand why we analyze how frames affect contribution changes and the common contribution standard.

Do monetary sanctions received affect the changes in contributions ?

Result 2.2 : *Low Types increase more their contributions under positive framing than under negative framing.*

We distinguish subjects' reactions to sanctions depending of their type. Let us define subject i in period $t-1$ as a *High Type* if $y_i^{t-1} - \overline{y}_{-i}^{t-1} > 0$ and as a *Low Type* if $y_i^{t-1} - \overline{y}_{-i}^{t-1} < 0$. Framing has a positive and significant effect on the contribution change of Low types. Low types increase significantly more their contributions in the positive frame.

This result is supported by the panel regressions presented in table 4.6 and illustrated by figures 4.7 and 4.8. In these regressions, we analyze individuals' contribution changes between periods t and $t-1$, depending on the monetary sanctions received in $t-1$, the contribution deviation in $t-1$ with respect to peers' average contribution $(y_i^{t-1} - \overline{y}_{-i}^{t-1})$ and framing. Moreover, as the capacity to increase one's contribution depends on one's current contribution level - the higher the contribution the lower the possibility of increase - we take into account the variable peers' average in $t-1$.

As expected, the other driver of the contribution's change is the level of received sanctions in period $t-1$.

TABLE 4.6 – Panel regression of individuals contribution change (t) by contributor type in Monetary sanction experiment (random effects with clusters by group).

	High_Contributors ($x_i^{t-1} - \overline{x}_{-i}^{t-1} > 0$)			Low_Contributors ($x_i^{t-1} - \overline{x}_{-i}^{t-1} \leq 0$)		
	All data	Removal	Introduction	All data	Removal	Introduction
Framing	1.479*	1.754	0.813	1.323***	1.267**	2.184***
	(0.798)	(1.368)	(1.221)	(0.457)	(0.633)	(0.752)
Monetary sanctions received in period $t-1$	-0.0123	0.223	-0.297**	0.579***	0.565***	0.666***
	(0.204)	(0.407)	(0.145)	(0.158)	(0.210)	(0.236)
Peers' average in $t-1$	-0.178***	-0.246**	-0.107	-0.161***	-0.149**	-0.242***
	(0.0680)	(0.111)	(0.0894)	(0.0379)	(0.0632)	(0.0551)
Deviation from peer average in $t-1$	-0.723***	-0.938***	-0.567***	-0.257**	-0.320**	-0.169
	(0.0955)	(0.148)	(0.0937)	(0.104)	(0.128)	(0.173)
Period	-0.266**	-0.284	-0.230	-0.0193	-0.109	0.101
	(0.133)	(0.195)	(0.185)	(0.0743)	(0.0964)	(0.110)
Sequence	2.435			0.526		
	(1.629)			(0.724)		
Monetary sanctions in period $t-1$ × Framing	0.00856	-0.187	0.348	-0.216	-0.573*	-0.0562
	(0.224)	(0.402)	(0.328)	(0.204)	(0.314)	(0.265)
SVO_score	1.961	0.658	3.554	2.154**	3.547**	0.435
	(2.144)	(3.078)	(2.739)	(0.963)	(1.423)	(1.578)
Age	0.221*	0.314	0.103	-0.101**	-0.120*	-0.0946
	(0.125)	(0.256)	(0.101)	(0.0430)	(0.0691)	(0.0608)
Gender	0.0161	-0.0414	0.579	0.282	0.425	-0.0993
	(0.593)	(0.915)	(1.006)	(0.430)	(0.871)	(0.431)
Understanding	0.347*	0.252	0.538	0.0330	0.0596	-0.0498
	(0.187)	(0.265)	(0.352)	(0.124)	(0.206)	(0.141)
_cons	-4.112	-3.341	-2.795	2.461	2.403	3.078
	(3.479)	(7.036)	(6.094)	(1.542)	(2.526)	(2.698)
N	451	224	227	701	316	385
R^2	0.219	0.226	0.256	0.212	0.220	0.226

Standard errors in parentheses

* p<0.10 ; ** p<0.05 ; *** p<0.01

TABLE 4.7 – Panel regression of individuals contributions change, global (t) in Monetary sanction experiment (random effects with clusters by group).

	(1) All data	(2) Removal	(3) Introduction
Framing	1.251***	1.207***	1.292**
	(0.334)	(0.388)	(0.645)
Monetary sanctions received in $t-1$	0.426***	0.474**	0.399**
	(0.152)	(0.235)	(0.199)
Peers'average in $t-1$	-0.112***	-0.130**	-0.111**
	(0.0293)	(0.0515)	(0.0484)
Positive Deviation in $t-1$	-0.570***	-0.601***	-0.544***
	(0.0959)	(0.172)	(0.107)
Negative Deviation in $t-1$	0.289***	0.301**	0.255*
	(0.0882)	(0.118)	(0.133)
Period	-0.119*	-0.169	-0.0719
	(0.0679)	(0.104)	(0.0864)
Sequence	1.421*		
	(0.749)		
Monetary sanctions received in period $t-1$ × Framing	-0.215	-0.453*	0.0124
	(0.185)	(0.260)	(0.264)
_cons	1.703*	2.342	2.286
	(0.882)	(1.554)	(1.729)
N	1152	540	612
R^2	0.279	0.269	0.297

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

Figures 4.7 and 4.8 present the contribution change in period t depending on the deviation level in the previous period, distinguishing treatments where sanctions are introduced in the first or the second sequence.

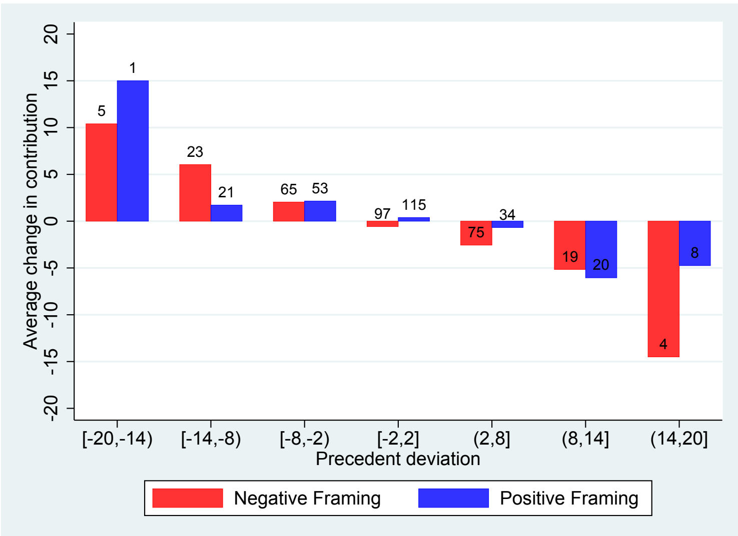


FIGURE 4.7 – Average contribution change with respect to deviation from peer average over previous period in Monetary sanction experiment (Removal condition).

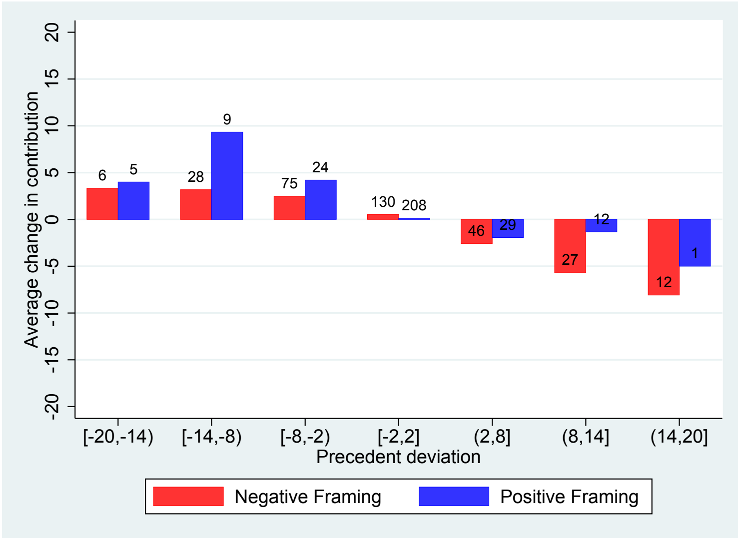


FIGURE 4.8 – Average contribution change with respect to deviation from peer average over previous period in Monetary sanction experiment (Introduction condition).

Emergence of a common contribution standard ?

Result 2.3 : *In the Introduction condition, positive framing leads to the convergence to the full contribution. In the negative frame, there is no obvious convergence towards a contribution standard.*

Do sanctions trigger the emergence of a common contribution standard, i.e. the convergence of individual contributions toward a given level ? To answer this question, we analyze the evolution of the frequencies of different contribution levels, and their dispersion by group and individual.

In the positive frame in the Introduction condition, **full contribution becomes the most common behavior**. From period 3, following the introduction of sanctions, a majority of subjects is fully contributing. This proportion keeps on increasing until the last period of the game to reach over 84 percent of full contributors. In comparison, there is no such dynamic in the negative frame, where the dispersion of contributions is higher than in the positive frame throughout the sanctioning sequence (as illustrated in figure 4.9).

In the Removal condition, we also observe a stronger convergence to full contribution in the positive frame. From the fifth period to the end of the first sequence, around 46 percent of subjects invest their whole endowment in the public account. In comparison in the negative frame, less than 30 percent do so.

Moreover, we observe that the contribution inequality at the group level, as measured by the Gini index, is significantly higher in the negative frame than in the positive one. This inequality decreases when sanctions are introduced. However, the decrease is significantly stronger in the positive frame. Those results are provided by the panel tobit analysis of the Gini index presented in table 4.8. In comparison, individuals' spread of contributions are larger in the negative frame, showing that each subject has more difficulty to set a target contribution level. We argue that it seems relatively easy and quick for subjects to identify a contribution norm in the positive frame. In contrast, it is not the case in the negative frame, for which subjects have more difficulties to coordinate (cf appendix 4.J.2, 4.J.3 and 4.J.4).

Conjecture 1 *: In the negative frame, subjects perceive others' actions as a negative externality. As a consequence, they have more difficulties in identifying what should be the appropriate behavior. They are, therefore, less likely to react to punishment by increasing their contributions. It hampers the convergence of contributions towards a common contribution norm.*

Conjecture 2 *: The effect of sanctions is more effective in the Introduction condition. Because sanctions are unavailable in sequence 1, the Introduction condition provides an appropriate context for perceptions to reinforce over time and stabilize. In contrast, in the Removal condition, subjects can express their disapproval, and thereby reveal their expectations about others' actions. This possibility may counter the negative perception generated by framing.*

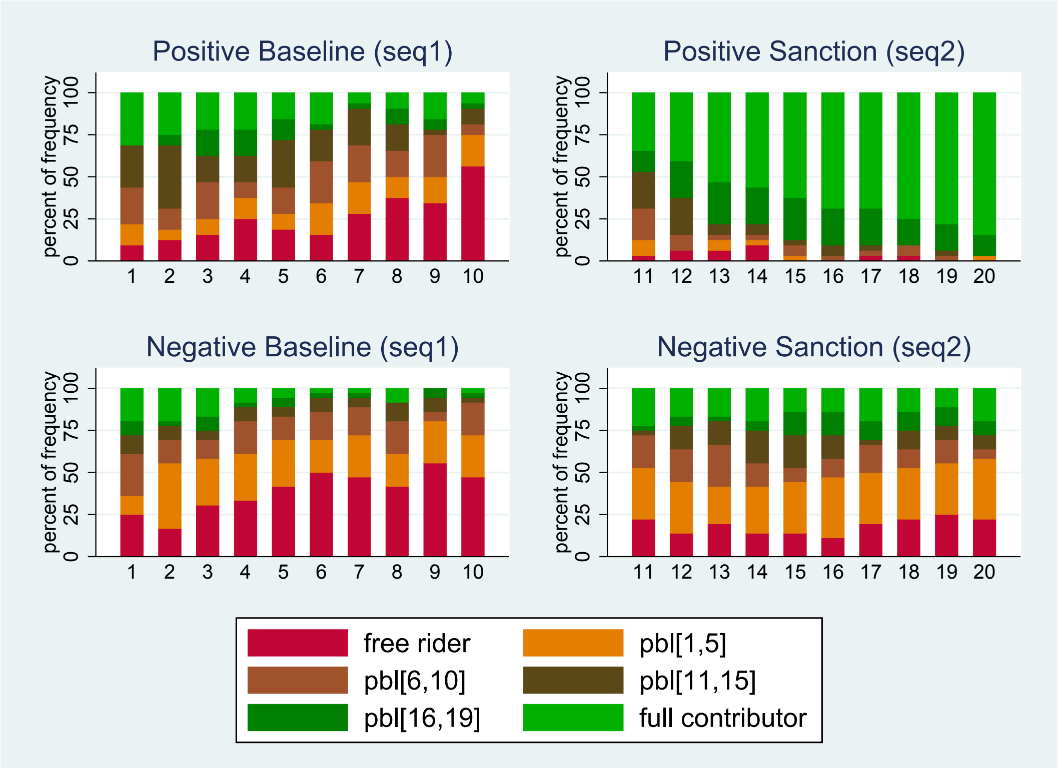


FIGURE 4.9 – Evolution of contribution categories in Monetary sanction experiment (Introduction condition).

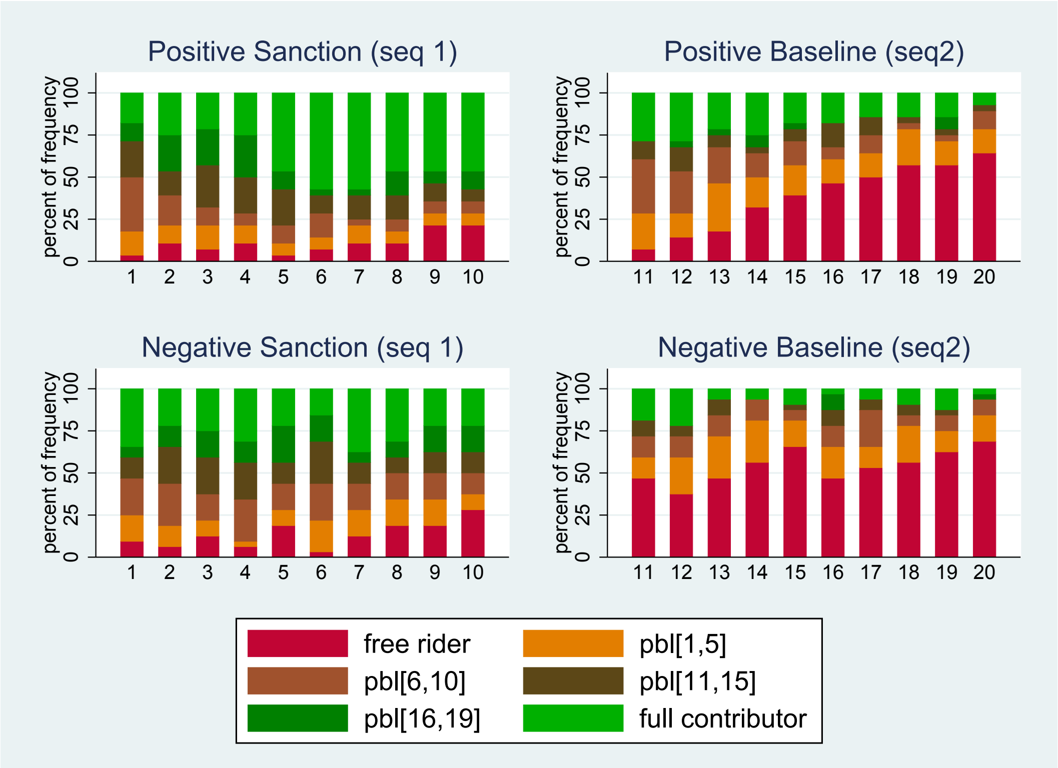


FIGURE 4.10 – Evolution of contribution categories in Monetary sanction experiment (Removal condition).

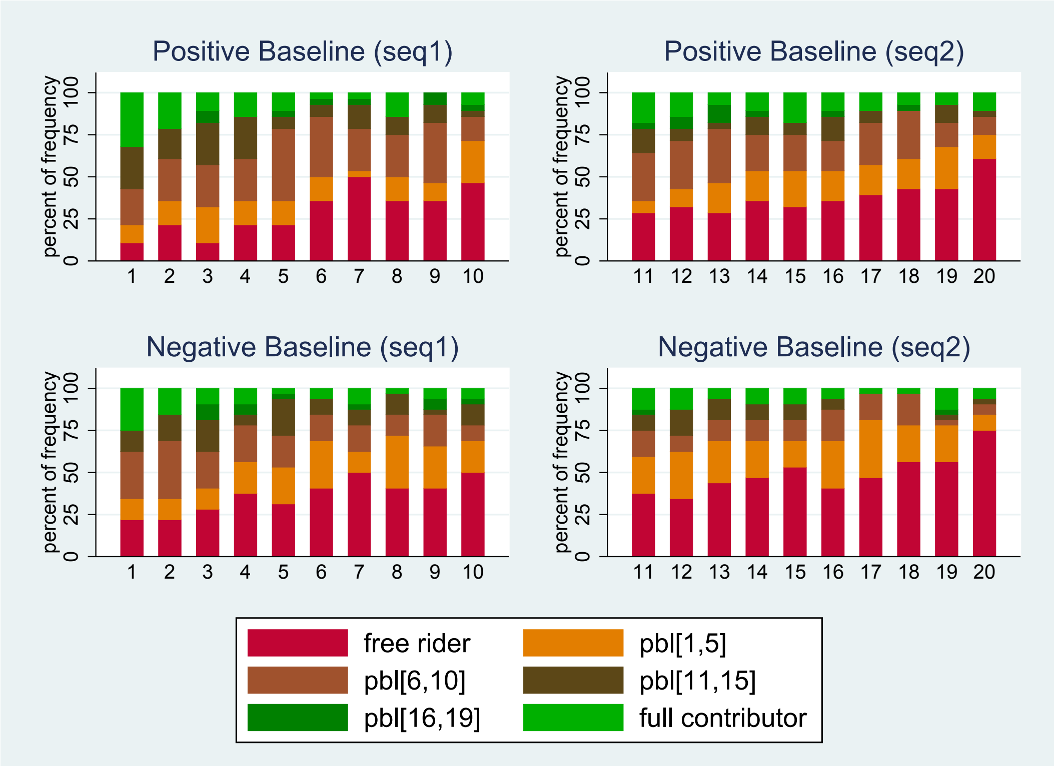


FIGURE 4.11 – Evolution of contribution categories (Baseline).

Table 4.8 – Gini analysis in Monetary sanction experiment (panel tobit estimation two sided with one observation per group per period, random effects)

	(1) All data	(2) All data	(3) Without Sanctions	(4) Sanctions	(5) Removal	(6) Introduction
Framing	-0.137***	-0.129***	-0.132***	-0.160**	-0.205	-0.113*
	(0.0391)	(0.0400)	(0.0394)	(0.0721)	(0.135)	(0.0637)
Sanctions	-0.287***	-0.276***			-0.198***	-0.252***
	(0.0132)	(0.0178)			(0.0461)	(0.0411)
Period	0.0145***	0.0145***	0.0280***	-0.0109***	0.0150***	0.00421
	(0.00189)	(0.00189)	(0.00199)	(0.00301)	(0.00364)	(0.00326)
Sequence	-0.110***	-0.110***	-0.199***	0.0753		
	(0.0217)	(0.0217)	(0.0249)	(0.0715)		
Number of women (0 : 4)	-0.00387	-0.00475	-0.00467	-0.000490	-0.0693	0.00148
	(0.0213)	(0.0213)	(0.0215)	(0.0405)	(0.107)	(0.0278)
Average age of the group	0.00618	0.00624	-0.00168	0.0215	0.0359	-0.00260
	(0.0109)	(0.0108)	(0.0110)	(0.0180)	(0.0225)	(0.0169)
Number of cooperators (0 : 4)	-0.0111	-0.0112	-0.00862	-0.0271	0.0200	-0.0398
	(0.0198)	(0.0198)	(0.0199)	(0.0378)	(0.0446)	(0.0350)
Sanctions × Framing		-0.0240			0.118***	-0.143***
		(0.0264)			(0.0420)	(0.0378)
_cons	0.335	0.331	0.412*	-0.110	-0.373	0.594
	(0.244)	(0.244)	(0.247)	(0.409)	(0.466)	(0.384)
sigma_u						
_cons	0.121***	0.121***	0.121***	0.174***	0.144***	0.107***
	(0.0138)	(0.0138)	(0.0146)	(0.0236)	(0.0285)	(0.0207)
sigma_e						
_cons	0.162***	0.162***	0.138***	0.145***	0.172***	0.166***
	(0.00410)	(0.00410)	(0.00419)	(0.00693)	(0.00805)	(0.00715)
N	911	911	596	315	284	332

Standard errors in parentheses

* $p<0.10$; ** $p<0.05$; *** $p<0.01$

4.4.4 What are the potential effects of the frame on perception and stated conditional contributions ?

How does framing affects the perception of others' actions ?

Did the frame influence subjects perception of others' actions ? At the end of the experiment, we ask subjects a multiple choice question about how they would qualify the effect of others' actions on their earnings. The possible responses were : 1) Important gains, 2) Gains, 3) No gain or loss, 4) Losses and 5) Important losses. As illustrated in figure 4.12, in the positive frame, a higher percentage of subjects qualifies others' actions as generators of gains or important gains. When sanctions are available, the positive frame leads to significantly higher contributions and, therefore, higher earnings. However, this argument is less relevant in Baseline conditions where contributions are only slightly higher in positive framing while positive qualifications are twice as frequent in positive framing than negative framing.

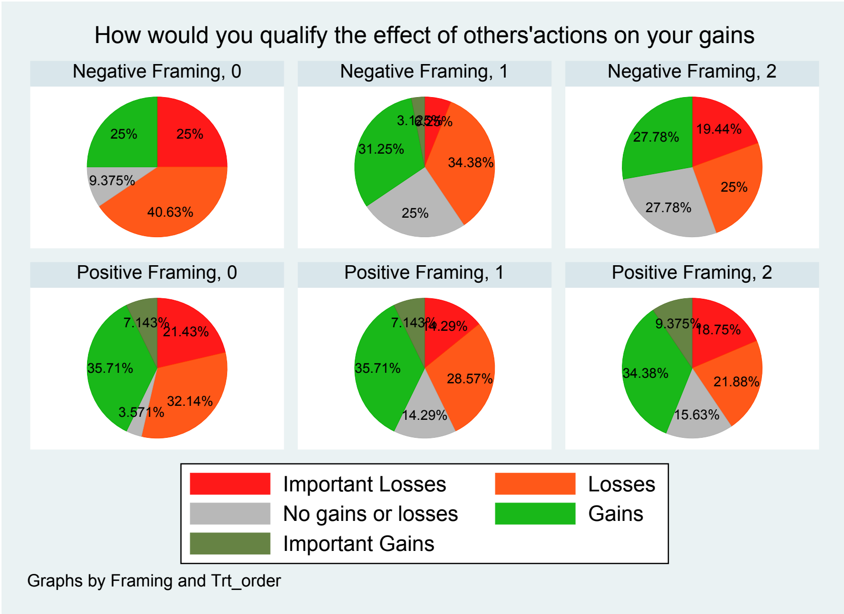


FIGURE 4.12 – Perception of others'actions by framing in Monetary sanction experiment.

What are the potential effects of the frame on stated conditional contribution ?

We also tried to understand if the frame impacts the reciprocity. Following Gächter et al. (2017) we consider that reciprocity can be defined as a "*form of conditional cooperation : the willingness to cooperate provided others do the same.*" We replicate Fosgaard et al. (2014)'s question at the end of the experiment. Subjects are asked what their contributions should be in order to maximize the group's payoff, exposing them to two situations regarding the contributions of others. Moreover, we also try to figure out if the frame affects reciprocity depending on subjects' type. Indeed, Park (2000), who replicated Andreoni (1995)'s frame, found that subjects who are categorized as individualist according to SVO drive the significant contribution difference between the two frames. Conversely, there is no differences in contribution between the two frames for subjects with a prosocial orientation [4]. In order to check whether our data is consistent with these findings, we conducted a reciprocity analysis based on subjects' types.

In the first situation of the Fosgaard et al. (2014) question, subjects were asked what their contribution would be if the other members of the group did not contribute. In this case, all subjects in both settings responded that they would not contribute either.

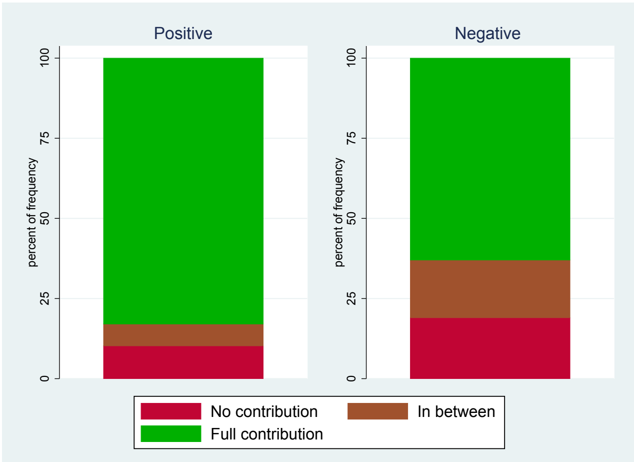
In the second situation, they were told that other members fully contribute to the public good. In this case, as it is illustrated in figure 4.13 a vast majority of subjects, respectively 63% in the negative frame and 83% in the positive frame answered that they would also fully contribute.

First of all, it should be pointed out that the majority of subjects do not seem to be approaching the game strategically. Their willingness to contribute to the public good depends on the contributions of others. This result gives credit to the argument developed by Fischbacher et al. (2001) that most subjects are conditional contributors.

4. In this experiment, Park (2000) applied an older version of Murphy's social orientation test.

However, the negative frame presents both : i) a lower percentage of full contributors and ii) a higher percentage of free-riders with 19% vs 10% in the positive frame (distribution are significantly different, $p = 0.038$ Kolmogorov-Smirnov). If we consider that this answer reflects the preference for cooperation, we should conclude that the frame impacts the willingness to cooperate. This result is in line with the finding of Fosgaard et al. (2014), Gächter et al. (2017) and Gächter et al. (forthcoming), which show that in the take frame, where the collective action issue is presented as having negative externalities, there are less conditional cooperators.

FIGURE 4.13 – Stated contribution conditional on others' full contribution in Monetary sanction experiment (all data presented in this chapter)



When we distinguish the framing effect according to the type of subject, we observe that subjects with an individualistic social orientation are those on whom it has the greatest impact. Their average contribution to the group account in the first sequence and without sanctions is significantly smaller in the negative frame ($p = 0.070$ in the first sequence of Baseline Treatment and $p = 0.004$ in the first sequence of the Introduction condition, Mann Whitney). Conversely, we do not find a significant difference when we do the same analysis for subjects who are categorized as prosocial. This confirms Park (2000) 's findings that prosocial subjects do not seem to be sensitive to framing, whereas individualists are.

Furthermore, it also seems that individualists react differently to the introduction of sanctions according to the frame. Indeed, when we compare the average contribution of the individualists in sequences in which there are material sanctions, we find a significant difference between the two frames in both conditions (Removal $p = 0.048$ and Introduction $p = 0.000$, Mann Whitney). In comparison, for prosocial, we only find a significant difference in the Introduction condition ($p = 0.000$).

It seems therefore plausible that individualistic subjects are those who induce the difference in effectiveness of sanctions according to the frame. Once again, it corroborates the fact that for these subjects, the frame has a stronger impact on their contribution decision. They react differently to the introduction of sanctions since the beginning.

4.4.5 Framing, punishment and group payoffs

Result 3 : *Under negative framing sanctions affect negatively group payoff due to lower contributions and higher sanctions costs.*

Result 3 is supported the panel regressions reported in table 4.9. The variable framing has a significant positive impact on payoffs. Despite the fact that the introduction of monetary sanctions generally has a negative effect on payoffs, the interaction variable Sanction × Framing has a positive effect on payoffs. The introduction of sanction in the positive frame generates relatively higher payoffs than in the negative frame. This effect is due to the fact that the negative frame leads to **lower contributions to the public good**, but also to **larger sanctions** and therefore to higher sanctioning costs (as illustrated in figure 4.14). It is mainly observed in the Introduction condition where reactions to sanctions are extremely different depending on the frame. In conclusion, the **effectiveness of peer's punishment is reduced by the negative frame**.

TABLE 4.9 – Panel regression on individual payoffs in Monetary sanction experiment (random effects).

	(1) All data	(2) All data	(3) All data	(4) Without sanction	(5) Sanctions
Framing	2.791***	1.660***	1.152**	1.303**	4.624***
	(0.533)	(0.549)	(0.572)	(0.566)	(0.961)
Material sanctions	-0.574**	-2.129***	-2.134***		
	(0.228)	(0.310)	(0.310)		
Period	-0.0457***	-0.0461***	-0.0461***	-0.202***	0.471***
	(0.0166)	(0.0165)	(0.0165)	(0.0205)	(0.0503)
Material × Framing		3.319***	3.329***		
		(0.452)	(0.452)		
SVO_score			-3.764***	-4.109***	-3.606
			(1.374)	(1.411)	(2.424)
Gender			-0.00265	0.0129	-0.107
			(0.515)	(0.528)	(0.913)
Age			0.0166	0.0247	-0.0379
			(0.0721)	(0.0744)	(0.118)
Understanding			0.519***	0.400**	0.529*
			(0.178)	(0.183)	(0.305)
_cons	23.13***	23.67***	22.37***	24.56***	15.80***
	(0.410)	(0.413)	(2.108)	(2.179)	(3.462)
N	3760	3760	3760	2480	1280
R^2	0.043	0.058	0.081	0.070	0.113

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

TABLE 4.10 – Panel regression on individual payoffs discriminating for Removal and Introduction conditions in Monetary sanction experiment (random effects).

	(1) Removal + Bsl	(2) Removal + Bsl	(3) Removal + Bsl	(4) Introduction + Bsl	(5) Introduction + Bsl	(6) Introduction + Bsl
Framing	1.817***	1.352*	0.764	2.926***	1.692***	1.537**
	(0.677)	(0.694)	(0.706)	(0.649)	(0.653)	(0.723)
Material sanctions	-1.361***	-2.229***	-2.219***	0.00815	-2.176***	-2.219***
	(0.389)	(0.485)	(0.485)	(0.380)	(0.468)	(0.468)
Period	-0.111***	-0.111***	-0.111***	-0.0903***	-0.0904***	-0.0887***
	(0.0245)	(0.0245)	(0.0245)	(0.0247)	(0.0244)	(0.0244)
Material × Framing		1.861***	1.855***		4.645***	4.651***
		(0.625)	(0.624)		(0.594)	(0.593)
SVO_score			-4.315**			-3.780**
			(1.720)			(1.741)
Gender			-0.402			-0.296
			(0.659)			(0.626)
Age			-0.0567			0.177*
			(0.0907)			(0.0966)
Understanding			0.514**			0.274
			(0.222)			(0.236)
_cons	24.24***	24.45***	25.34***	23.54***	24.12***	20.61***
	(0.565)	(0.569)	(2.694)	(0.493)	(0.488)	(2.831)
N	2400	2400	2400	2560	2560	2560
R^2	0.026	0.030	0.062	0.052	0.080	0.105

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

The total sanctioning cost presented in figure 4.14 represents the total cost of payoffs decrease due to the sanctions received and the total cost of sending sanctions ($\sum p_{ij} + 3 \sum p_{ji}$).

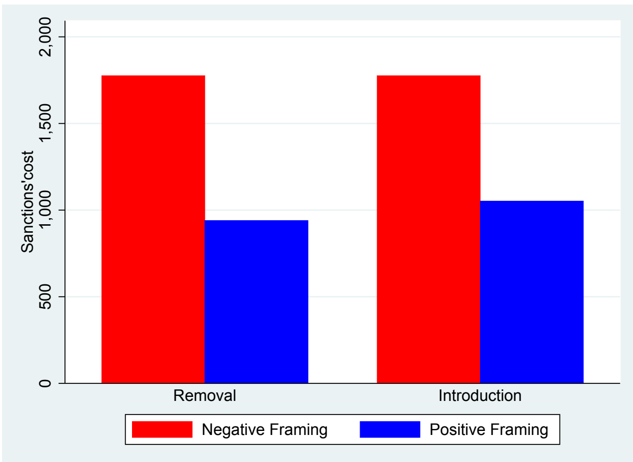


FIGURE 4.14 – Total cost of monetary sanctions by framing.

4.5 Discussion

In this experiment, we replicate Andreoni (1995) 's frame of the voluntary contribution mechanism with the addition of monetary sanctions (Fehr and Gächter, 2000). We control for the order effect by applying these monetary sanctions from the first period of the voluntary contribution mechanism and removing them in the second sequence or introducing them only in the second sequence. Our results show that highlighting the potential positive or negative effects for the same collective action problem has an impact on the subjects' willingness to cooperate. In this sense, we corroborate Andreoni (1995)'s argument that individuals are more inclined to cooperate if they perceive that they are doing good than to prevent harming (warm glow vs cold prickle effects).

Monetary sanctions significantly increase contributions with respect to the baseline condition, for both frames, and whenever they are introduced. The number of sanctions sent is slightly higher in the negative frame. Nevertheless, the drivers of punishment are identical in both frames. Comparison with peers is decisive in the decision to send sanctions. The likelihood of being punished and the severity of the sentence are mainly determined by having a relatively lower contribution than peers. These results seem to partially substantiate Carpenter (2006) 's thesis, according to which team production is carried by strong contributors who also support the cost of monitoring.

However, we find that framing strongly affects the efficiency of sanctions. In the positive frame, they lead to a significantly higher increase in contributions. It is even more obvious in the Introduction condition in which they lead the vast majority of the groups to fully contribute and though until the last period of the game. Conversely, under negative framing, monetary sanctions lead to a contribution increase that reaches half of the endowment on average.

This different reaction to sanctions is observed since the first period after their introduction and before subjects eventually receive their first sanctions. Indeed, in the positive frame, 34 percent of the subjects become full contributors. This percentage rise to reach 84 percent in the last period of the experiment. In the negative frame, only 22 percent of subjects become full contributors in the first period after the introduction of sanctions, and this percentage remains constant until the last period. Paradoxically, the number of sanctions sent is higher in the negative frame. Low contributors are less willing to increase their contributions in this frame.

We contend that negative framing presents the game in a more complex way, making it more difficult to understand. This is evidenced by the fact that in the negative frame, participants initially have more difficulties in correctly estimating payoffs, getting lower understanding scores. It has been shown that the level of details about the payoffs structure, and so the ease with which subjects can determine the economic incentives, affect cooperation. Saijo and Nakamura (1995) 's, experiment demonstrates that providing more details about the payoffs structure makes subjects more likely to behave as predicted by standard theory, and there is less spite. More recently, Ramalingam et al. (2018), showed that lower details about the payoffs structure lead to a lower contribution to the public good but also higher levels of sanctions sent. If subjects have more difficulties to figure out the earnings, they are more likely to behave in an antisocial way, being more spiteful.

Nevertheless, framing cannot be reduced to a difference of understanding, in the sense that subjects have more difficulties initially to figure out the payoffs structure. First, during the comprehension questionnaire, they are informed about the right answer after each question, followed by a short explanation. Second, at the end of every period, subjects receive detailed feedback about their payoffs and therefore get experienced about the economic incentives. Third, we control for the comprehension score in every analysis. Thus, while it affects contributions and payoffs, it remains a marginal explanatory factor. Finally, at the end of the experiment, we asked subjects how much they should invest in the group account in order to make the highest possible group payoff when their peers invest their whole endowment. In both frames, the majority of subjects answered that they would fully contribute. This outcome is even more questioning, as we never observed a majority of subjects fully contributing under the negative framing.

Our results suggest that subject's behaviors concerning public good contribution or reaction to punishment, strongly depends on their perception of the behavior of their peers. Presenting others' actions as having negative effects on one's payoffs impacts their reactions to sanctions. We find that the positive frame enables subjects to coordinate on full contribution, which is one of the possible equilibrium under peer punishment if there is a sufficient number of subjects who are inequality averse (Fehr & Schmidt, 1999). This equilibrium is not reached in the negative frame. We also explain the weaker framing effect on sanctions' efficiency in the Removal condition by the fact that in these treatments, subjects can early express their expectations about others' actions. Indeed, in these treatments, subjects receive signals of willingness to cooperate from the outset, which can alleviate their misperceptions about the actions of others. In comparison, when the perception created by the frame gets reinforced during a sequence in which they cannot express social disapproval, we do observe strong differences in the reaction to peers' pressure.

Given that people have limited rationality, specifically limited computational skills, it seems crucial to better understand how their perceptions of a collective action problem, and the effects of the actions of their peers, can influence their behavior. It seems relevant to think that the information strongly influences their perceptions. Nikiforakis (2010) demonstrates that the type of information feedback delivered influences subjects' behavior. When they get information about other's contributions and earnings, groups also have more difficulties in establishing a common norm of contribution. Putting more attention in these aspects is needed to improve our understanding about the sensitivity of mechanisms, that are known to strengthen cooperation to institutional changes.

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Appendices of chapter 3

4.A Instructions

Here are presented the translation of the experiment instructions we used. There were given in french originally.

4.A.1 Announcement

The experiment you are about to participate aims to study decision making.

Please read the instructions carefully. They should help you understand the experiment. Once all participants have read it, an experimenter will read them aloud.

All your decisions will be treated anonymously. You will indicate your choices on the computer you are sitting in front of.

From now on, we ask you not to speak anymore. If you have a question, raise your hand and an experimenter will come and answer you in private.

Over the course of the experiment, you will accumulate earnings expressed in the experimental currency unit (ECU).

At the end of the experiment, your **ECU** will be converted into **euros** at a conversion rate which is specified at the end of these instructions.

The experiment has **three parts**. The attached instructions are those in **Part 1**. The instructions in part 2, then 3 will be distributed at the end of the previous games.

4.A.2 Public good game

Investment game

A.1.1.1 Negative Frame

This experiment is a study of group and individual investment behavior. The instructions are simple. If you follow them carefully and make good investment decisions, you may earn a non negligible amount of money. The money you earn will be paid to you, in euros, at the end of the experiment.

MAKING CASH EARNING FROM YOUR INVESTMENT RETURN

In the experiment you will make a series of 10 investment decisions. For each investment decision you will be placed in a group of four other subjects (you included). The group composition will remain the same during all this game. Your investment returns will depend on the investment decison that you and the other three members of your group make.

Each investment decision you make will result in an investment return. Your investment return from each decision will be turned into cash earnings. The exchange rate is 0.025. Meaning that 100 ECU equal 2.5 euros. For example, if your investment return from one investment decision is 30 ECU, your earnings will be 0.75 euros. If your investement return is 20 ECU, your earnings will be 0.5 euros. In the following pages, we will describe how your investment returns are determined.

THE INVESTMENT OPPORTUNITIES

You have been assigned to a group of 4 people. Each person will get an endowment of 20 tokens. You will have to choose how to divide your tokens between two investment opportunities :

1. The Individual Exchange

Every token you invest in the Individual Exchange will yield you a return of one ECU. However, each token you invest in the individual exchange will reduce the earnings of every other players by 0.4 ECU.

Example : Suppose you invested 20 tokens in the Individual Exchange. Then you would get a return of 20 ECU. However, each of the three other members of your group would have their earnings reduced by 8 each.

Example : Suppose you invested 10 tokens in the Individual Exchange. Then you would get a return of 10 ECU. However, each of the three other members of your group would have their earnings reduced by 4 each.

Example : Suppose you invested 0 tokens in the Individual Exchange. Then you would get no return for this exchange. Likewise, the other three members of your group would not have their earnings reduced.

It will also be true that when the other members of your group invest in the Individual Exchange, then your earnings will be reduced by 0.4 times their investment in the Individual exchange. This is illustrated below :

Example : Suppose that the other 3 members of your group invested a total of 35 tokens in the Individual Exchange. Then this would reduce your earnings by 14 ECU.

Example : Suppose that the other 3 members of your group invested a total of 35 tokens in the Individual Exchange. Then this would reduce your earnings by 12 ECU.

Example : Suppose that the other 3 members of your group invested no tokens the Individual Exchange. Then this would not reduce your earnings at all.

2. The Group Exchange

Every token you invest in the Group Exchange yields a return of 0.4 for you. The other menbers of your group are not affected by your investment in the Group Exchange.

Example : Suppose that you decided to invest no tokens in the Group Exchange. Then your return from the Group Exchange would be 0.

Example : Suppose that you decided to invest 10 tokens in the Group Exchange. Then your return from the Group Exchange would be 4.

Example : Suppose that you decided to invest 20 tokens in the Group Exchange. Then your return from the Group Exchange would be 8.

Automatic Earnings

In addition to the earnings you accumulate from the Individual Exchange and the Group Exchange, you will also get automatic earnings each round. These automatic earnings will not depend on any decisions you make, and will be the same each round. Your automatic earnings will be 24 ECU each round. Hence, your total earnings each round will be your earnings from the Individual Exchange plus your earnings from the Group Exchange plus 24 ECU in automatic earnings.

The Investment Decision

Your task is to decide how many of your tokens to invest in the Individual Exchange and how many to invest in the Group Exchange. You are free to put some tokens into the Indivudal Exchange and some into the Group Exchange. Alternatively, you can put all of them into the Group Exchange or all of them into the Individual Exchange.

Your Investment Account

You and every other member of your group will get an endowment of 20 tokens every period. The total number of tokens in each group in every period is 80.

Stages of Investment

During 10 periods, you will be asked to make investment decision. In every period, the sum of your investment decisions has to be equal to your endowment 20 tokens.

In every period, you will get a EARNINGS REPORT.

This earnings report tells you the total investment in the Group Exchange, your investment return, and your cash earnings. Your Earnings Report does not tell you the investment decisions or earnings of the other members of your group. YOUR INVESTMENT DECISIONS AND EARNINGS ARE CONFIDENTIAL.

Your Group

The composition of your group will **remain the same during this game**. In every period, you will interact with the 3 **same people**.

At no point in the experiment will the identities of the other members of the group be made known to you, nor will your identity be made know to them.

Your Cash Earnings

Your investment return determines your earnings in euros. For example, if you get 100 ECU, your earnings will be 2.5 euros.

GOOD LUCK !

A.1.1.2. Positive Frame

The positive frame instructions are identical to the negative frame, except for the investment opportunities and the automatic earning.

THE INVESTMENT OPPORTUNITIES

You have been assigned to a group of 4 people. Each person will get an endowment of 20 tokens. You will have to choose how to divide your tokens between two investment opportunities :

1. The Individual Exchange

Every token you invest in the Individual Exchange will yield you a return of one ECU. The other members of your group are not affected by your investment in the Individual Exchange.

Example : Suppose you invested 20 tokens in the Individual Exchange. Then you would get a return of 20 ECU.

Example : Suppose you invested 10 tokens in the Individual Exchange. Then you would get a return of 10 ECU.

Example : Suppose you invested 0 tokens in the Individual Exchange. Then you would get no return for this exchange.

2. The Group Exchange

Your return from the Group Exhange will depend on the total number of tokens that you and the other three members of your group invest in the Group Exchange. The more the group invests in the Group Exchange, the greater the return to each member of the group.

Every token invested in the Group Exchange yields a return of 0.4 for each member of the group, not just the person who invested it.

Example : Suppose that you decided to invest 0 tokens in the Group Exchange, but that the three other members invested a total of 30 tokens. Then your return from the Group Exchange would be 12 ECU. Everyone else in your group would also get a return of 12.

Example : Suppose that you invested 10 tokens in the Group Exchange, but that the other three members of the group invest 30 tokens. This makes a total of 40 tokens. Your return from the Group Exchange would be 16. The other three members of the group would also get a return of 16.

Example : Suppose that you invested 20 tokens in the Group Exchange, but that the other three members of the group invest nothing. Then you, and everyone else in the group, would get a return from the Group Exchange of 8 .

As you can see, every token invested in the Group Exchange will yield a return of 0.4 for every member of the group, not just the person who invested it. It does no matter who invests tokens in the Group Exchange. Everyone will get a return from every token invested whether they invest in the Group Exchange or not.

Peer sanctions

During this game, you stay with the **same group**, you are interacting with the **same people** than in the **precedent game**.

The **functioning of the two accounts**, the **conversion rate** are the same than in the **precedent experiment**. The earnings you will get in this game will be added to thoses of the two precedents games.

This experiment also has 10 periods. However, each period is composed by two stages :

— **The first stage** is identical to the action you made during a period in the precedent experiment : you have to decide how much tokens you invest in the Individual Exchange and in the Group Exchange. In the same way, when all the members of your group have taken their decisions, the SUMMARY screen is displayed. This screen reminds you of the same information as in the previous section.
— **During the second stage**, after having taken note of the investment decisions of each of the other 3 members of your group in the Group Exchange, you may decide to send them sanction points.

Description of the second stage

You get informed about the amount that each of the three other members contributed in the Group Exchange in the first stage of the game. **Please notice that** the order in which the decisions of the three other members of your group are displayed, is randomly modified every period. Thereby, the investment of the first "Other member" which will appear on your screen, will not be the same individual each time. It will be the same for the invesments which appear in the second and the third place.

You have to take a decision about the number of sanction points you send to **each** of the three members of your group. You can impose untill 5 **sanctions points** to **each of your group members** every **period**. Likewise, **every other member of your group** can impose you sanction points every period. For every subject, you must enter a value between 0 and 5 points. If you do not want to decrease the earnings of another subject, you must enter 0.

If you send sanctions points, you incur a cost that depends on the total number of points sent. Every sanction point you send to a member of your group, cost you 1 ECU. Your cost of sanction send is equal to the sum of the points sent to every member of your group.

Every sanction point received, decreases the earning of the first stage by 3 ECU. As an example, if a member of the group receives a total of 3 sanctions points, his earning from the first stage will decreased by 9 ECU. if he receives a total of 4 sanctions points, his earnings from the first satge will decreased by 12 ECU.

Nevertheless, there is an execption to this rule. If the cost of the total number of penalties received by a group member exceeds his Stage 1 win, his Step 1 win is considered nil. However, even in this case this group member has to bear the cost of the sanctions he has sent.

Your final earnings in each period is computed this way :

If your earnings at the first stage is higher or equal to the total cost of the sanctions points received.
Period Earnings = earnings in the first stage $-3\times$ (number of sanctions received) $-1\times$ (number of sanction sent)
If your earnings at the first stage is lower than the total cost of the sanctions points received.
Period Earnings $= 0 - 1\times$ (number of sanction sent)

Please note that your period gain at the end of step 2 may be negative, if the cost of the number of points you have sent exceeds your gain in step 1 minus the cost of points received.

Once all group members have made their decisions, your screen will display your total number of sanction points received, your total sanction points sent, and the associated costs ; as well as your gain for the period.

4.A.3 Social Value Orientation test

In this experiment, you have to decide how to share an amont between you and "another person". This other person is in this room, and will be randomly selected at the end of the experiment. You cannot identify her and she cannot identify you. All your choices are completely confidential.

Concretely, you have to select one between 9 distributions proposed. There are no right or wrong answers. You have to choose the distribution you prefered. You have to make this choice 15 times through 15 screens that present differents distribution proposal.

Once all the people present in this room, have answer the question, the computer will randomly select one of the 15 propositions. This will be paid depending of your choice. The part dedicated to the "other person" will be sent to a subject selected randomly.

You will also receive the "Other Person" share resulting from the choices of another individual present in this room who will also be selected randomly at the end of the game.

The results of this experiment will be communicated to you at the end of the session, and you will receive at that time the amount corresponding to your winnings.

In this experiment we used an experimental currency : ECU. The ECU you accumulate during the experiment will be converted into euros with a conversion rate of 0.025. One hundred ECU will therefore correspond to 2.5 euros.

4.A.4 Understanding questions

1. How many players are they in your group (including yourself) ?
— i. 3 players
— ii. 4 players
— iii. 5 players
Answer posted : The correct answer was 4 people : you and 3 other members

2. Do the composition of your groupe change every period ?
— i. Right
— ii. Wrong
Answer posted : The correct answer was Wrong. You keep the same group during the 10 periods of this game.

3. How many tokens do you individually have to invest every period between the Individual Exchange and the Group Exchange ?
— i. 20 tokens
— ii. 80 tokens
— iii. It depends on previous periods
Answer posted : Every period you must invest 20 tokens between the Group account and the Individual account.

4. If none of the four members of your group (including you) invest in the Group account, and therefore each member invests 20 tokens in the Individual account : What is your return on investment for the period ?
— i. 0 ECU
— ii. 20 ECU
— iii. 24 ECU
Answer posted [POSITIVE FRAME] : Via the Group account you get 0.4 * 0 = 0 ECU. Via the Individual account you get 1 * 20 = 20 ECU. Your return on investment for the period is 0 + 20 = 20 ECU.

Answer posted [NEGATIF FRAME] : Via the Group account you get 0.4 * 0 = 0 ECU. Via the Individual account you get 1 * 20 - 0.4 * (20 * 3) = -4 ECU. In addition, each period you benefit from an automatic gain of 24 ECU. Your return on investment for the period is 0 - 4 + 24 = 20 ECU.

5. If each of the four members of your group (including you) invests 20 tokens in the Group account, and therefore no member invests in the individual account : What is your return on investment for the period ?
— i. 0 ECU
— ii. 20 ECU
— iii. 32 ECU
Answer posted [POSITIVE FRAME] : Via the Group account you get 0.4 * (20 * 4) = 32 ECU. Via the Individual account you get 1 * 0 = 0 ECU. Your return on investment for the period is 32 + 0 = 32 ECU.

Answer posted [NEGATIF FRAME] : Via the Group account you get 0.4 * (20) = 8 ECU. Via the Individual account you get 1 * 0 - 0.4 * 0 = 0 ECU. In addition, each period you benefit from an automatic gain of 24 ECU. Your return on investment for the period is 8 + 0 + 24 =

32 ECU.

6. If the sum of the investments in the group account of the other 3 members is 30 tokens, and therefore 30 tokens in the individual account ; What do you decide to invest 0 tokens in the Group account and 20 tokens in the individual account : What is your return on investment for the period ?
— i. 20 ECU
— ii. 26 ECU
— iii. 32 ECU
Answer posted [POSITIVE FRAME] : Via the Group account you get 0.4 * (30) = 12 ECU. Via the Individual account you get 1 * 20 = 20 ECU. Your return on investment for the period is 20 + 12 = 32 ECU.

Answer posted [NEGATIF FRAME] : Via the Group account you get 0.4 * (0) = 0 ECU. Via the Individual account you get 1 * 20 - 0.4 * 30 = 8 ECU. In addition, each period you benefit from an automatic gain of 24 ECU. Your return on investment for the period is 0 + 8 + 24 = 32 ECU.

7. If the sum of the investments in the group account of the other 3 members is 30 tokens, and therefore 30 tokens in the individual account ; that you decide to invest 20 tokens in the Group account and 0 tokens in the individual account : What is your return on investment for the period ?
— i. 20 ECU
— ii. 26 ECU
— iii. 32 ECU
Answer posted [POSITIVE FRAME] : Via the Group account you get 0.4 * (20 + 30) = 20 ECU. Via the Individual account you get 1 * 0 = 0 ECU. Your return on investment for the period is 20 + 0 = 20 ECU.

Answer posted [NEGATIF FRAME] : Via the Group account you get 0.4 * 20 = 8 ECU. Via the Individual account you get 1 * 0 - 0,4 * 30 = -12 ECU. In addition, each period you benefit from an automatic gain of 24 ECU. Your return on investment for the period is 8 - 12 + 24 = 20 ECU.

8. If the sum of the investments in the group account of the other 3 members is 30 tokens, and therefore 30 tokens in the individual account ; you invest 10 tokens in the Group account and 10 in the Individual account : What is your return on investment for the period ?
— i. 20 ECU
— ii. 26 ECU
— iii. 32 ECU
Answer posted [POSITIVE FRAME] : Via the Group account you get 0.4 * (40) = 16 ECU. Via the Individual account you get 1 * 10 = 10 ECU. Your return on investment for the period is 16 + 10 = 26 ECU.

Answer posted [NEGATIF FRAME] : Via the Group account you get 0.4 * (10) = 4 ECU. Via the Individual account you get 1 * 10 - 0,4 * 30 = -2 ECU. In addition, each period you benefit from an automatic gain of 24 ECU. Your return on investment is 4 - 2 + 24 = 26 ECU.

4.B Characteristics of Experimental Sessions for monetary sanctions experiment

Table 4.B.1 – Characteristics of experimental sessions in Monetary sanction experiment

Session Number	Number of Subjects	Number of groups	Framing	Periods 1-10	Periods 11-20
1	20	5	Negative	Baseline	Sanction
3	16	4	Negative	Baseline	Sanction
6	16	4	Negative	Sanction	Baseline
12	16	4	Negative	Sanction	Baseline
2	20	5	Positive	Baseline	Sanction
4	12	3	Positive	Baseline	Sanction
5	16	4	Positive	Sanction	Baseline
11	12	3	Positive	Sanction	Baseline
7	16	4	Negative	Baseline	Baseline
9	16	4	Negative	Baseline	Baseline
8	16	4	Positive	Baseline	Baseline
10	12	3	Positive	Baseline	Baseline

4.C Description of demographics variables for monetary sanctions experiment

Looking at gender and age there are no differences between frame (chi2 tests). There are neither differences between frame concerning the social value orientations of subjects (ttest).

Presentation of gender by framing.

Table 4.C.1 – Gender summary statistics in Monetary sanction experiment

Treatment	Number of women		Chi 2 p-value
	Negative Framing	Positive Framing	
Baseline Treatment	15(/32)	15(/28)	0.605
Introduction condition	18(/36)	14(/32)	0.606
Removal condition	17(/32)	7(/28)	0.027
All data	50(/100)	36(/88)	0.212

Looking at the understanding score obtained by framing, we clearly see that the negative frame leads to lower understanding level. This difference is significant doing ttest and Epps-singleton test. There is an higher complexity in the negative frame, due to more sources of earning. This may account for the increased difficulty subjects have in establishing gain in this framing.

Table 4.C.2 – Age summary statistics in Monetary sanction experiment

Treatment	Framing	Obs	Mean	Std. Dev.	t-test
Baseline Treatment	Negative	32	22.375	3.377	non-significant
	Positive	28	21.821	2.48	
Introduction condition	Negative	36	22.833	3.517	non-significant
	Positive	32	22.719	3.391	
Removal condition	Negative	32	23.406	4.812	non-significant
	Positive	28	22.25	3.362	
All data	Negative	100	22.87	3.920	non-significant
	Positive	88	22.284	3.107	

Table 4.C.3 – SVO_score summary statistics in Monetary sanction experiment

Treatment	Framing	Obs	Mean	Std. Dev.	Epps Singleton p-value
Baseline Treatment	Negative	32	0.506	0.195	0.768
	Positive	28	0.524	0.182	
Introduction condition	Negative	36	0.438	0.171	0.529
	Positive	32	0.509	0.181	
Removal condition	Negative	32	0.477	0.206	0.661
	Positive	28	0.439	0.181	
All data	Negative	100	0.472	0.190	0.716
	Positive	88	0.491	0.183	

Table 4.C.4 – SVO type summary statistics in Monetary sanction experiment

Treatment	Framing	Prosocial	Individualist	Competitive
Baseline Treatment	Negative	14	17	1
	Positive	15	13	0
Introduction condition	Negative	11	23	2
	Positive	15	17	0
Removal condition	Negative	12	18	2
	Positive	9	17	2
All data	Negative	37	58	5
	Positive	39	47	2

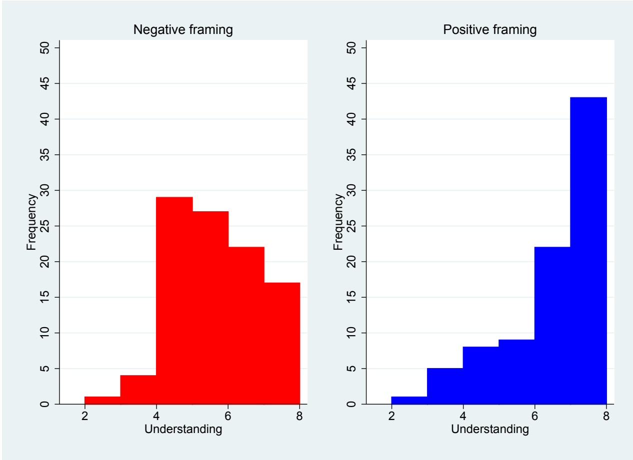


FIGURE 4.C.1 – Comprehension score by framing in Monetary sanction experiment.

TABLE 4.C.5 – Understanding summary statisticsin Monetary sanction experiment

Treatment	Framing	Obs	Mean	Std. Dev.	Epps-Singleton p-value
Baseline Treatment	Negative	32	5.406	1.292	0.003
	Positive	28	6.607	1.397	
Introduction condition	Negative	36	5.028	1.028	0.000
	Positive	32	6.594	1.643	
Removal condition	Negative	32	5.188	1.491	0.028
	Positive	28	5.75	1.669	
All data	Negative	100	5.2	1.271	0.000
	Positive	88	6.329	1.609	

4.D Non parametric tests on group contribution to public good for monetary sanctions experiment

The following Mann Whitney tests compare the framing effect for given conditions (under a defined treatment and sequence).

TABLE 4.D.1 – Mann Whitney test in Monetary sanction experiment

Treatment		Mann Whitney p-value
Baseline Treatment	Sequence 1 Baseline	0.004
	Sequence 2 Baseline	0.350
Introduction condition	Sequence 1 Baseline	0.021
	Sequence 2 Sanctions	0.002
Removal condition	Sequence 1 Sanctions	0.355
	Sequence 2 Baseline	0.643

The following Wilcoxon tests compare the contributions between Sequence 1 and Sequence 2 for a given treatment and framing.

TABLE 4.D.2 – Wilcoxon tests in Monetary sanction experiment

Treatment	Framing	Wilcoxon p-value
Baseline Treatment	Negative	0.017**
	Positive	0.237
Introduction condition	Negative	0.086*
	Positive	0.012**
Removal condition	Negative	0.012**
	Positive	0.028**

4.E Robustness analysis for monetary sanctions experiment

In order to make a robtness check, we present here panel tobit estimation without the interaction variable Framing × Sanction and also panel analysis with clusters by group. These results also confirmed the positive effect of sanction introduction on public good contribution. Moreover, we also confirmed that when sanctions are introduced in sequence 2 their marginal effect on public good contribution are higher in the positive frame.

4.E.1 Supplementary analysis for monetary sanctions experiment

TABLE 4.E.1 – Individual contributions to the group account in Monetary sanction experiment (panel regression random effects with clusters by group).

	(1) All data	(2) All data	(3) All data	(4) Without sanctions	(5) Sanctions
Framing	3.572***	2.775***	2.263**	2.721***	4.364***
	(0.949)	(0.975)	(0.969)	(0.968)	(1.558)
Material sanctions	6.277***	5.180***	5.206***		
	(0.785)	(1.027)	(1.028)		
Period	-0.182***	-0.182***	-0.182***	-0.339***	0.0391
	(0.0489)	(0.0479)	(0.0480)	(0.0484)	(0.102)
Material × Framing		2.342	2.356		
		(1.539)	(1.537)		
SVO_score			6.641***	6.929***	3.615
			(1.720)	(1.843)	(2.264)
Gender			0.398	0.343	-0.0100
			(0.528)	(0.567)	(0.793)
Age			-0.0183	0.0162	-0.0178
			(0.0731)	(0.0653)	(0.121)
Understanding			0.359*	-0.0357	0.940***
			(0.197)	(0.183)	(0.287)
_cons	6.817***	7.192***	2.401	5.180**	3.874
	(0.676)	(0.686)	(2.512)	(2.483)	(3.687)
N	3760	3760	3760	2480	1280
R^2	0.217	0.225	0.255	0.127	0.184

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

TABLE 4.E.2 – Individual contributions to the group account discriminating for Removal and Introduction conditions in Monetary sanction experiment (panel regression random effects with clusters by group).

	(1) Removal + Bsl	(2) Removal + Bsl	(3) Removal + Bsl	(4) Introduction + Bsl	(5) Introduction + Bsl	(6) Introduction + Bsl
Framing	2.106*	2.259*	2.146	2.826***	2.826***	1.895**
	(1.248)	(1.350)	(1.312)	(0.903)	(0.903)	(0.865)
Material sanction	4.280***	4.565***	4.612***	5.702***	5.702***	5.796***
	(1.011)	(1.275)	(1.274)	(1.640)	(1.640)	(1.652)
Period	-0.282***	-0.282***	-0.280***	-0.271***	-0.271***	-0.274***
	(0.0481)	(0.0482)	(0.0483)	(0.0512)	(0.0512)	(0.0514)
Material × Framing		-0.612	-0.577	5.008**	5.008**	4.981**
		(1.946)	(1.943)	(1.979)	(1.979)	(1.984)
SVO_score			6.031***			9.039***
			(2.341)			(1.833)
Gender			0.0358			0.884
			(0.680)			(0.663)
Age			-0.0687			0.00830
			(0.0926)			(0.0730)
Understanding			0.126			0.381*
			(0.240)			(0.223)
_cons	8.746***	8.675***	6.562*	7.819***	7.819***	0.979
	(0.793)	(0.801)	(3.440)	(0.634)	(0.634)	(2.712)
N	2400	2400	2400	2560	2560	2560
R^2	0.189	0.189	0.215	0.256	0.256	0.301

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

TABLE 4.E.3 – Individual contributions to the group account without interaction variable in Monetary sanction experiment (panel regression random effects with clusters by group).

	(1) All data	(2) Removal + Bsl	(3) Introduction + Bsl
Framing	3.065***	2.001*	3.163***
	(0.950)	(1.214)	(0.920)
Material sanctions	6.309***	4.344***	8.140***
	(0.785)	(1.014)	(1.202)
Period	-0.182***	-0.280***	-0.274***
	(0.0490)	(0.0483)	(0.0514)
SVO_score	6.647***	6.058***	9.333***
	(1.712)	(2.333)	(1.790)
Gender	0.337	0.0608	0.828
	(0.531)	(0.673)	(0.686)
Age	-0.0182	-0.0678	0.0167
	(0.0749)	(0.0924)	(0.0758)
Understanding	0.354*	0.131	0.413*
	(0.198)	(0.242)	(0.220)
_cons	2.073	6.552*	-0.111
	(2.551)	(3.431)	(2.685)
N	3760	2400	2560
R^2	0.247	0.215	0.275

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

TABLE 4.E.4 – Individual contributions to the group account without the interaction variable in Monetary sanction experiment (panel tobit estimation, random effects).

	(1)	(2)	(3)	(4)
	All data	All data	Removal + Bsl	Introduction + Bsl
Framing	6.074∗∗∗	5.136∗∗∗	3.596∗∗	4.908∗∗∗
	(1.159)	(1.180)	(1.566)	(1.348)
Material sanction	11.23∗∗∗	11.30∗∗∗	7.422∗∗∗	14.53∗∗∗
	(0.433)	(0.433)	(0.757)	(0.719)
Period	-0.313∗∗∗	-0.313∗∗∗	-0.503∗∗∗	-0.485∗∗∗
	(0.0307)	(0.0307)	(0.0474)	(0.0461)
SVO_score		13.36∗∗∗	13.53∗∗∗	17.83∗∗∗
		(2.944)	(3.917)	(3.325)
Gender		0.838	0.416	1.890
		(1.100)	(1.498)	(1.194)
Age		-0.0405	-0.0973	-0.0186
		(0.154)	(0.206)	(0.183)
Understanding		0.655∗	0.229	0.746∗
		(0.381)	(0.504)	(0.450)
_cons	4.313∗∗∗	-4.928	1.846	-7.424
	(0.863)	(4.503)	(6.110)	(5.380)
sigma_u				
_cons	7.533∗∗∗	7.047∗∗∗	7.719∗∗∗	6.158∗∗∗
	(0.451)	(0.427)	(0.579)	(0.466)
sigma_e				
_cons	9.651∗∗∗	9.651∗∗∗	9.425∗∗∗	9.389∗∗∗
	(0.179)	(0.179)	(0.222)	(0.207)
N	3760	3760	2400	2560
adj. R^2				

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

4.E.2 Average contribution over time by group for monetary sanctions experiment

FIGURE 4.E.1 – Average contribution over time by group (Baseline).

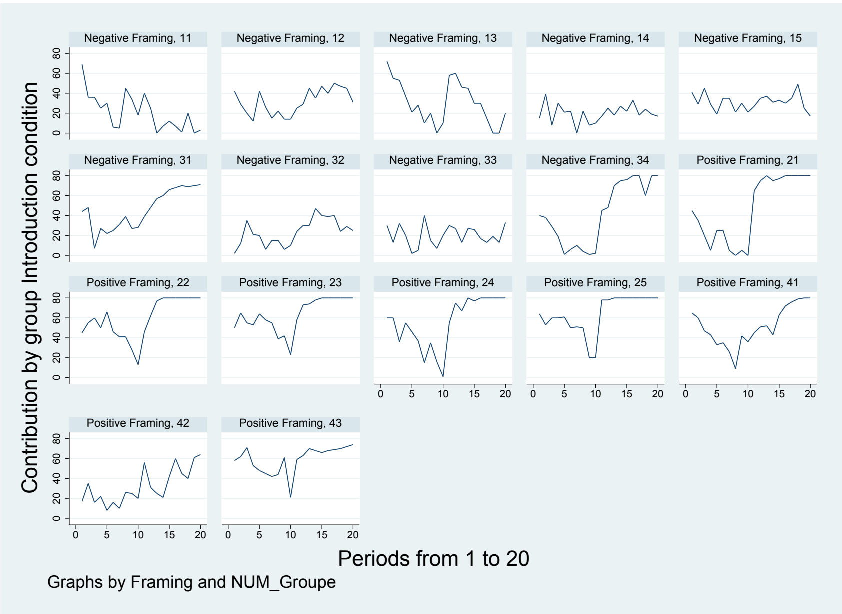


FIGURE 4.E.2 – Average contribution over time by group for monetary sanctions experiment (Introduction condition).

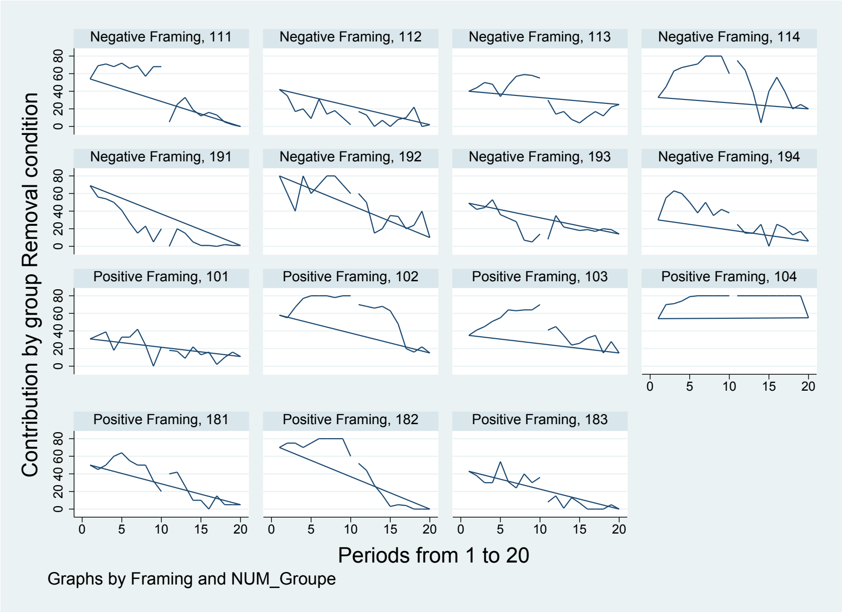


FIGURE 4.E.3 – Average contribution over time by group for monetary experiment (Removal condition).

4.F Diff and Diff analysis for monetary sanctions experiment

Mat_sanc_Seq1 and Mat_sanc_Seq2 are dummy variables which are equal to 1 to distinguish treatments where monetary sanction are introduced ; whenever respectiveley in sequence 1 (Mat_sanc_Seq1) or 2 (Mat_sanc_Seq2).

TABLE 4.F.1 – DiD between baseline and introduction of sanction in sequence 1 in the positive frame (panel tobit estimation, random effects).

	(1) pbl	(2) pbl
Mat_sanc_Seq1	1.734	4.590*
	(2.519)	(2.656)
Sequence	-2.537***	-2.530***
	(0.878)	(0.878)
Material sanctions	8.666***	8.676***
	(1.264)	(1.264)
SVO_score		11.19
		(6.829)
Gender		2.286
		(2.520)
Age		-0.531
		(0.421)
Understanding		1.197
		(0.762)
_cons	6.296***	2.882
	(1.774)	(12.16)
sigma_u		
_cons	8.778***	8.085***
	(0.943)	(0.877)
sigma_e		
_cons	9.433***	9.434***
	(0.321)	(0.321)
N	1120	1120

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

TABLE 4.F.2 – DiD between baseline and introduction of sanction in sequence 1 in the negative frame (panel tobit estimation, random effects).

	(1) pbl	(2) pbl
Mat_sanc_Seq1	-0.274	0.0382
	(2.112)	(2.014)
Sequence	-3.788***	-3.794***
	(0.886)	(0.887)
Material sanctions	9.626***	9.619***
	(1.264)	(1.265)
SVO_score		14.65***
		(4.993)
Gender		0.683
		(1.920)
Age		0.0308
		(0.228)
Understanding		-0.275
		(0.703)
_cons	3.849***	-3.122
	(1.484)	(6.910)
sigma_u		
_cons	7.587***	6.957***
	(0.792)	(0.736)
sigma_e		
_cons	9.900***	9.904***
	(0.322)	(0.323)
N	1280	1280

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

TABLE 4.F.3 – DiD between baseline and introduction of sanction in sequence 2 in the positive frame (panel tobit estimation, random effects).

	(1) pbl	(2) pbl
Mat_sanc_Seq2	2.506	3.401*
	(1.994)	(1.798)
Sequence	-2.514***	-2.509***
	(0.870)	(0.870)
Material sanctions	17.51***	17.50***
	(1.261)	(1.260)
SVO_score		19.62***
		(5.142)
Gender		4.331**
		(1.838)
Age		-0.197
		(0.293)
Understanding		0.821
		(0.559)
_cons	6.403***	-7.316
	(1.460)	(8.489)
sigma_u		
_cons	6.997***	5.994***
	(0.756)	(0.670)
sigma_e		
_cons	9.384***	9.384***
	(0.309)	(0.309)
N	1200	1200

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

TABLE 4.F.4 – DiD between baseline and introduction of sanction in sequence 2 in the negative frame (panel tobit estimation, random effects).

	(1) pbl	(2) pbl
Mat_sanc_Seq2	-0.723	0.705
	(1.781)	(1.690)
Sequence	-3.699∗∗∗	-3.706∗∗∗
	(0.844)	(0.844)
Material sanctions	9.139∗∗∗	9.131∗∗∗
	(1.139)	(1.139)
SVO_score		17.50∗∗∗
		(4.458)
Gender		0.516
		(1.568)
Age		-0.00214
		(0.225)
Understanding		0.590
		(0.713)
_cons	4.033∗∗∗	-8.231
	(1.302)	(7.117)
sigma_u		
_cons	6.537∗∗∗	5.793∗∗∗
	(0.673)	(0.612)
sigma_e		
_cons	9.461∗∗∗	9.460∗∗∗
	(0.281)	(0.281)
N	1360	1360

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

4.G Number of monetary sanctions sent by sequence

4.G.1 Probit analysis of the number of monetary sanctions sent

TABLE 4.G.1 – Subject i's propensity to send monetary sanctions to subject j with demographics variables (probit analysis with cluster by suject).

	(1) All data	(2) All data	(3) Removal	(4) Removal	(5) Introduction	(6) Introduction
Framing	-0.130	-0.223	-0.370*	-0.383*	0.171	0.0363
	(0.148)	(0.146)	(0.224)	(0.217)	(0.251)	(0.263)
(absolute) Negative Deviation $y_j - y_i < 0$	0.0939***	0.0658***	0.0899***	0.0502**	0.111***	0.0893***
	(0.0134)	(0.0155)	(0.0160)	(0.0199)	(0.0197)	(0.0226)
Positive Deviation $y_j - y_i > 0$	-0.00460	0.0322**	0.00254	0.0481**	-0.0161	0.0116
	(0.0113)	(0.0164)	(0.0159)	(0.0239)	(0.0158)	(0.0227)
Own contribution	-0.0153*	0.00915	-0.0175*	0.0171	-0.0268*	-0.00722
	(0.00878)	(0.0112)	(0.00920)	(0.0141)	(0.0137)	(0.0169)
Period	-0.0679***	-0.0617***	-0.0834***	-0.0740***	-0.0534***	-0.0489**
	(0.0144)	(0.0151)	(0.0202)	(0.0209)	(0.0201)	(0.0211)
Sequence	0.825***	0.792***				
	(0.190)	(0.198)				
Age	0.00157	0.00322	-0.00271	0.0113	0.00299	-0.00235
	(0.0196)	(0.0197)	(0.0208)	(0.0208)	(0.0301)	(0.0316)
Gender	-0.0243	-0.0181	-0.135	-0.136	0.00120	0.0287
	(0.142)	(0.143)	(0.222)	(0.221)	(0.190)	(0.189)
SVO_score	-0.227	-0.114	-0.00263	0.143	-0.559	-0.440
	(0.366)	(0.357)	(0.501)	(0.500)	(0.508)	(0.494)
Understanding	-0.0106	-0.0194	-0.0381	-0.0538	0.00384	0.00583
	(0.0567)	(0.0559)	(0.0752)	(0.0765)	(0.0894)	(0.0891)
Positive deviation from others two $y_j - \bar{y}_{-i-j} > 0$		-0.0310**		-0.0345		-0.0202
		(0.0151)		(0.0225)		(0.0195)
Negative deviation from others two $y_j - \bar{y}_{-i-j} < 0$		0.0556***		0.0689***		0.0430**
		(0.0123)		(0.0171)		(0.0171)
_cons	-0.583	-1.029**	-0.197	-1.098*	0.0362	-0.236
	(0.512)	(0.512)	(0.589)	(0.589)	(0.895)	(0.926)
N	3840	3840	1800	1800	2040	2040

Standard errors in parentheses

* p<0.10 ; ** p<0.05 ; *** p<0.01

4.H Number of monetary sanctions received by sequence

4.H.1 Removal condition for monetary sanctions experiment

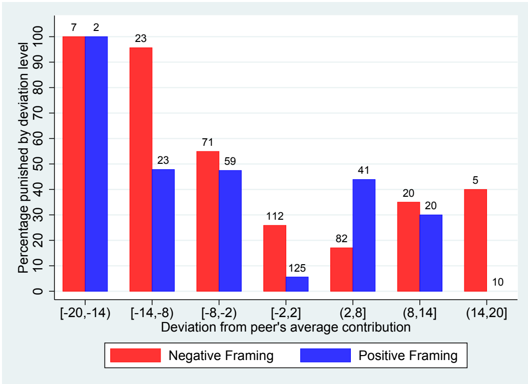


FIGURE 4.H.1 – Likelihood of receiving monetary sanctions by deviation level (with number of observations in Removal condition).

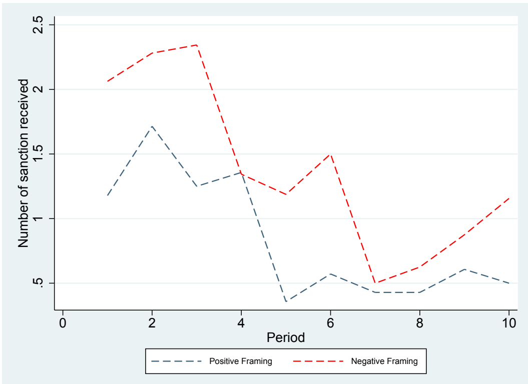


FIGURE 4.H.2 – Evolution of the number of monetary sanctions received (Removal condition).

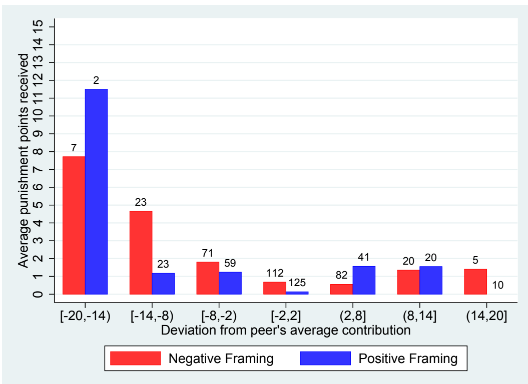


FIGURE 4.H.3 – Average number of monetary sanctions received from deviation level (with numbers of observations in Removal condition).

4.H.2 Introduction condition for monetary sanctions experiment

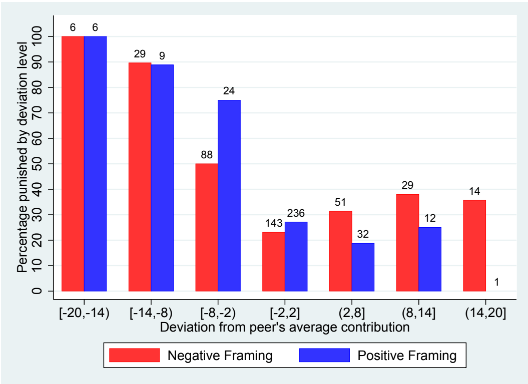


FIGURE 4.H.4 – Likelihood of receiving monetary sanctions by deviation level (with number of observations in Introduction condition).

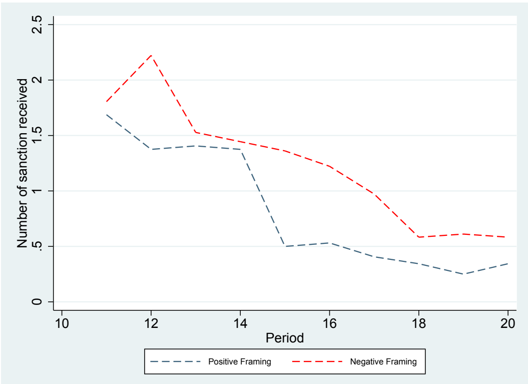


FIGURE 4.H.5 – Evolution of the number of monetary sanctions received (Introduction condition).

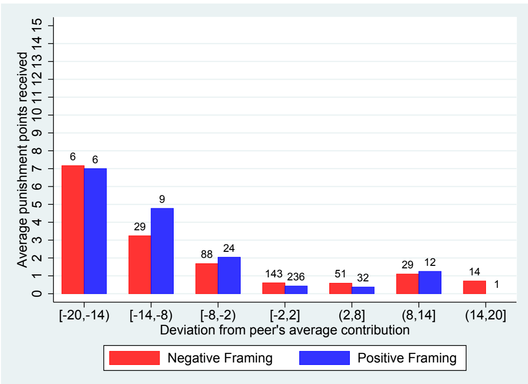


FIGURE 4.H.6 – Average number of monetary sanctions received from deviation level (with observations numbers in Introduction condition).

4.H.3 Tobit analysis of the number of monetary sanctions received

TABLE 4.H.1 – Number of monetary sanction received without interaction variables (panel tobit estimation two sided, random effects).

	(1) All data	(2) Removal condition	(3) Introduction condition
Framing	-0.354	-1.687**	1.114
	(0.535)	(0.809)	(0.784)
Positive Deviation $y_i - \bar{y}_{-i} > 0$	0.0320	0.0607	0.00720
	(0.0380)	(0.0637)	(0.0460)
Negative Deviation $y_i - \bar{y}_{-i} \leq 0$	0.587***	0.588***	0.613***
	(0.0346)	(0.0528)	(0.0471)
Others average contribution	-0.0647*	-0.0963*	-0.0805*
	(0.0332)	(0.0536)	(0.0450)
Period	-0.267***	-0.340***	-0.205***
	(0.0388)	(0.0648)	(0.0488)
Sequence	3.036***		
	(0.615)		
SVO_score	1.603	1.125	1.394
	(1.303)	(1.982)	(1.753)
Age	-0.0716	-0.0931	-0.0838
	(0.0634)	(0.0922)	(0.0895)
Gender	-0.279	-0.533	-0.373
	(0.491)	(0.808)	(0.620)
Understanding	0.0942	0.219	-0.122
	(0.165)	(0.245)	(0.230)
_cons	-0.0265	1.116	3.462
	(1.880)	(2.946)	(2.676)
sigma_u			
_cons	2.341***	2.481***	2.149***
	(0.216)	(0.347)	(0.262)
sigma_e			
_cons	2.887***	3.231***	2.589***
	(0.111)	(0.192)	(0.130)
N	1280	600	680

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

TABLE 4.H.2 – Number of monetary sanction received with interaction variables and demographics variables (panel tobit estimation two sided, random effects).

	(1) All data	(2) Removal condition	(3) Introduction condition
Framing	-1.731*	-1.993*	-0.231
	(0.895)	(1.182)	(1.757)
Positive Deviation $y_i - \bar{y}_{-i} > 0$	0.00642	-0.0401	0.0367
	(0.0437)	(0.0792)	(0.0500)
Negative Deviation $y_i - \bar{y}_{-i} \leq 0$	0.579***	0.576***	0.608***
	(0.0426)	(0.0624)	(0.0608)
Others average contribution	-0.0767**	-0.0820	-0.118**
	(0.0355)	(0.0541)	(0.0507)
Period	-0.318***	-0.318***	-0.264***
	(0.0478)	(0.0846)	(0.0640)
Sequence	3.026***		
	(0.612)		
Period × Framing	0.122*	-0.0682	0.118
	(0.0636)	(0.128)	(0.101)
Positive Deviation × Framing	0.0775	0.285**	-0.189*
	(0.0790)	(0.121)	(0.115)
Negative Deviation × Framing	0.0270	0.0184	0.0375
	(0.0690)	(0.109)	(0.0925)
SVO_score	1.453	1.306	1.403
	(1.300)	(2.002)	(1.779)
Age	-0.0815	-0.101	-0.0820
	(0.0632)	(0.0934)	(0.0907)
Gender	-0.318	-0.362	-0.435
	(0.490)	(0.820)	(0.629)
Understanding	0.0726	0.184	-0.0988
	(0.165)	(0.248)	(0.234)
_cons	1.136	1.312	4.490
	(1.968)	(3.025)	(2.793)
sigma_u			
_cons	2.322***	2.518***	2.184***
	(0.214)	(0.356)	(0.266)
sigma_e			
_cons	2.880***	3.182***	2.576***
	(0.111)	(0.189)	(0.130)
N	1280	600	680

Standard errors in parentheses

* p<0.10 ; ** p<0.05 ; *** p<0.01

4.I Contribution change for monetary sanctions experiment

TABLE 4.I.1 – Panel regressions of individuals contributions change in Monetary sanction experiment, with demographics variables (random effects with clusters by group.

	(1) All data	(2) Removal condition	(3) Introduction condition
Framing	1.213***	1.286***	0.991
	(0.351)	(0.392)	(0.692)
Monetary sanctions received in $t-1$	0.430***	0.495**	0.382*
	(0.149)	(0.211)	(0.204)
Peers'average in $t-1$	-0.118***	-0.122**	-0.114**
	(0.0343)	(0.0560)	(0.0538)
Positive Deviation in $t-1$	-0.544***	-0.568***	-0.523***
	(0.0943)	(0.171)	(0.0956)
Negative Deviation in $t-1$	0.284***	0.289**	0.263*
	(0.0996)	(0.132)	(0.154)
Period	-0.116*	-0.164	-0.0676
	(0.0699)	(0.104)	(0.0930)
Sequence	1.332*		
	(0.803)		
Monetary sanctions received in period $t-1$ × Framing	-0.255	-0.502**	0.00492
	(0.186)	(0.243)	(0.272)
SVO_score	1.744*	1.555	1.961
	(0.949)	(1.242)	(1.556)
Age	0.0396	0.0617	0.000327
	(0.0469)	(0.0738)	(0.0430)
Gender	0.142	-0.0722	0.321
	(0.314)	(0.478)	(0.427)
Understanding	0.123	0.130	0.153
	(0.121)	(0.198)	(0.137)
_cons	-0.685	-0.687	0.403
	(1.705)	(2.647)	(2.739)
N	1152	540	612
R^2	0.284	0.275	0.303

Standard errors in parentheses

* p<0.10 ; ** p<0.05 ; *** p<0.01

TABLE 4.I.2 – Contribution change (t) by contributor type in Monetary sanction experiment, without demographics variables (panel analysis random effects with clusters by group).

	High_Contributors ($x_i^{t-1} - \overline{x}_{-i}^{t-1} > 0$)			Low_Contributors ($x_i^{t-1} - \overline{x}_{-i}^{t-1} \leq 0$)		
	All data	Removal	Introduction	All data	Removal	Introduction
Framing	1.763**	1.277	2.010*	1.272***	0.589	2.105***
	(0.828)	(1.231)	(1.114)	(0.419)	(0.590)	(0.802)
Monetary sanctions received in $t-1$	-0.0401	0.0683	-0.176	0.542***	0.444**	0.649***
	(0.122)	(0.188)	(0.157)	(0.123)	(0.188)	(0.180)
Peers'average in $t-1$	-0.181***	-0.281**	-0.104	-0.177***	-0.139**	-0.248***
	(0.0695)	(0.115)	(0.0884)	(0.0338)	(0.0580)	(0.0545)
Deviation from peer average in $t-1$	-0.772***	-1.002***	-0.593***	-0.288***	-0.313***	-0.215
	(0.101)	(0.164)	(0.0944)	(0.0997)	(0.121)	(0.157)
Period	-0.269**	-0.284	-0.245	0.0228	-0.110	0.0990
	(0.129)	(0.187)	(0.167)	(0.0388)	(0.101)	(0.113)
Sequence	2.504					
	(1.591)					
_cons	3.756***	6.190***	4.291	1.507*	2.070	0.972
	(1.360)	(2.328)	(2.915)	(0.877)	(1.290)	(2.165)
N	451	224	227	701	316	385
R^2	0.190	0.184	0.209	0.197	0.189	0.221

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01)

4.J Emergence of a common contribution standard for monetary sanctions experiment

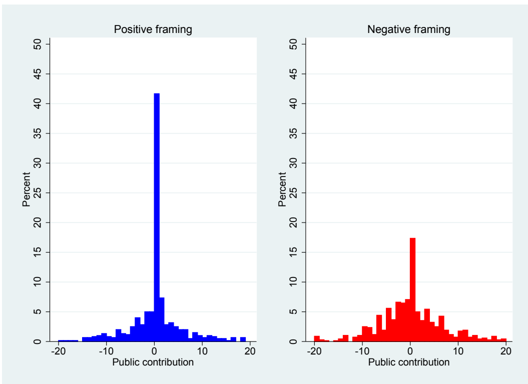


FIGURE 4.J.1 – Percentage of deviation from peers contributions by framing in Monetary sanction experiment

4.J.1 Full contributors for monetary sanctions experiment

The dependent variable is a dummy variable representing full contribution.

TABLE 4.J.1 – Full contribution depending on frame in Monetary sanction experiment (probit regression).

	(1) All data	(2) All data	(3) No Sanctions	(4) Sanctions	(5) Removal	(6) Introduction
full_contri						
Framing	0.544∗∗∗	0.430∗∗	0.265	0.659∗∗	0.281	0.746∗∗∗
	(2.80)	(2.26)	(1.37)	(2.26)	(0.68)	(3.34)
Sanctions	0.831∗∗∗	0.863∗∗∗			0.592∗∗∗	0.998∗∗∗
	(5.56)	(5.75)			(3.01)	(4.32)
Period	-0.0237∗	-0.0235∗	-0.0870∗∗∗	0.0565∗∗	-0.00504	-0.00859
	(-1.85)	(-1.81)	(-6.04)	(2.20)	(-0.26)	(-0.39)
Sequence	0.313∗∗	0.305∗∗	0.912∗∗∗	-0.473		
	(2.19)	(2.14)	(4.71)	(-1.24)		
SVO_score		0.222	0.515	-0.206	-0.618	0.235
		(0.64)	(1.17)	(-0.43)	(-1.13)	(0.39)
Gender		0.0602	0.137	-0.0113	0.0128	0.000404
		(0.59)	(0.99)	(-0.07)	(0.09)	(0.00)
Age		0.0182	0.0219	0.0194	-0.00767	0.0381∗
		(1.31)	(1.36)	(0.92)	(-0.34)	(1.88)
Understanding		0.116∗∗∗	0.0590	0.192∗∗∗	0.130∗	0.124∗∗∗
		(2.81)	(1.24)	(3.36)	(1.88)	(2.69)
_cons	-1.391∗∗∗	-2.569∗∗∗	-2.068∗∗∗	-2.511∗∗∗	-1.435∗	-3.263∗∗∗
	(-8.13)	(-5.02)	(-3.34)	(-3.78)	(-1.72)	(-5.47)
N	3760	3760	2480	1280	1200	1360

t statistics in parentheses
* $p<0.10$; ** $p<0.05$; *** $p<0.01$

TABLE 4.J.2 – Probit to get full contributors depending on the frame in Monetary sanction experiment, with interaction variable.

	(1) All data	(2) Removal	(3) Introduction
full_contri			
Framing	0.179	0.316	0.199
	(0.91)	(0.58)	(1.18)
Sanctions	0.569***	0.623***	0.462
	(3.01)	(3.08)	(1.52)
Period	-0.0233*	-0.00501	-0.00682
	(-1.78)	(-0.25)	(-0.31)
Sequence	0.297**		
	(2.04)		
Sanctions × Framing	0.551*	-0.0587	0.892**
	(1.84)	(-0.13)	(2.00)
SVO_score	0.215	-0.619	0.230
	(0.62)	(-1.13)	(0.38)
Gender	0.0721	0.0125	-0.00700
	(0.71)	(0.08)	(-0.04)
Age	0.0176	-0.00766	0.0378*
	(1.30)	(-0.34)	(1.90)
Understanding	0.119***	0.130*	0.131***
	(2.82)	(1.88)	(2.65)
_cons	-2.434***	-1.453*	-2.969***
	(-4.95)	(-1.70)	(-5.32)
N	3760	1200	1360

t statistics in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

4.J.2 Full contributors for monetary sanctions experiment

TABLE 4.J.3 – Percentage of full contributors per treatment in sequence 1 of Monetary sanction experiment.

Treatment	Framing : period	1	2	3	4	5	6	7	8	9	10
Baseline treatment	Negative	25	15.6	9.4	9.4	3.1	6.3	9.4	3.1	6.3	6.3
	Positive	32.1	21.4	10.7	14.3	10.7	3.6	3.6	14.3	0	7.1
Introduction condition	Negative	19.4	19.4	16.7	8.3	5.6	2.8	2.8	8.3	0	2.8
	Positive	31.3	25	21.9	21.9	15.6	18.8	6.3	9.4	15.6	6.3
Removal condition	Negative	34.4	21.9	25	31.3	21.9	15.6	37.5	31.3	21.9	21.9
	Positive	17.9	25	21.4	25	46.4	57.1	57.1	46.4	46.4	46.4

TABLE 4.J.4 – Percentage of full contributors per treatment in sequence 2 of Monetary sanction experiment.

Treatment	Framing : period	11	12	13	14	15	16	17	18	19	20
Baseline treatment	Negative	12.5	12.5	6.3	9.4	9.4	6.3	3.1	3.1	12.5	6.3
	Positive	17.9	14.3	7.1	10.7	17.9	10.7	10.7	7.1	7.1	10.7
Introduction condition	Negative	22.2	16.7	16.7	19.4	13.9	13.9	19.4	13.9	11.1	19.4
	Positive	34.4	40.6	53.1	56.3	62.5	68.8	68.8	75	78.1	84.4
Removal condition	Negative	18.9	21.9	6.3	6.3	9.4	3.1	6.3	9.4	12.5	3.1
	Positive	28.6	28.6	21.4	25	17.9	17.9	14.3	14.3	14.3	7.1

4.J.3 Free riders for monetary sanctions experiment

TABLE 4.J.5 – Percentage of free riders per treatment in sequence 1 of Monetary sanction experiment.

Treatment	Framing : period	1	2	3	4	5	6	7	8	9	10
Baseline treatment	Negative	21.9	21.9	28.1	37.5	31.3	40.6	50	40.6	40.6	50
	Positive	10.7	21.4	10.7	21.4	21.4	35.7	50	35.7	35.7	46.4
Introduction condition	Negative	25	16.7	30.6	33.3	41.7	50	47.2	41.7	55.6	47.2
	Positive	9.4	12.5	15.6	25	18.8	15.6	28.1	37.5	34.4	56.3
Removal condition	Negative	9.4	6.3	12.5	6.3	18.8	3.1	12.5	18.8	18.8	28.1
	Positive	3.6	10.7	7.1	10.7	3.6	7.1	10.7	10.7	21.4	21.4

TABLE 4.J.6 – Percentage of free riders per treatment in sequence 2 of Monetary sanction experiment.

Treatment	Framing : period	11	12	13	14	15	16	17	18	19	20
Baseline treatment	Negative	37.5	34.4	43.8	46.9	53.1	40.6	46.9	56.3	56.3	75
	Positive	28.6	32.1	28.6	35.7	32.1	35.7	39.3	42.9	42.9	60.7
Introduction condition	Negative	22.2	13.9	19.4	13.9	13.9	11.1	19.4	22.2	25	22.2
	Positive	3.1	6.3	6.3	9.4	0	0	3.1	3.1	0	0
Removal condition	Negative	46.9	37.5	46.9	56.3	65.6	46.9	53.1	56.3	62.5	68.8
	Positive	7.1	14.3	17.9	32.1	39.3	46.4	50	57.1	57.1	64.3

4.J.4 Analysis of the spread of individual contributions for monetary sanctions experiment

In order to better analyze how framing and the availability of sanctions impact the spread of individual contributions, we replicate the figure presented in Ramalingam et al. (2019).

The figures below use boxplot to present the spread of contributions of each individual within a particular treatment. It enables us to get an idea of the ease with which subjects define a fixed rate of contribution. Once again, it seems that in sequence 2 of the Introduction condition the spread of contributions by subject is lower in the positive frame than in the negative frame. This means that subjects have less difficulty in defining behavior which can be considered as a common standard of contribution and so as a norm of contribution.

FIGURE 4.J.2 – Spread of individual contributions in Monetary sanction experiment (Removal condition)

Each boxplot represents the dispersion of a subject's contributions (defining quartiles). The red point corresponds to the average extraction. The blue points represent isolated observations. The order of presentation of the subjects is random.

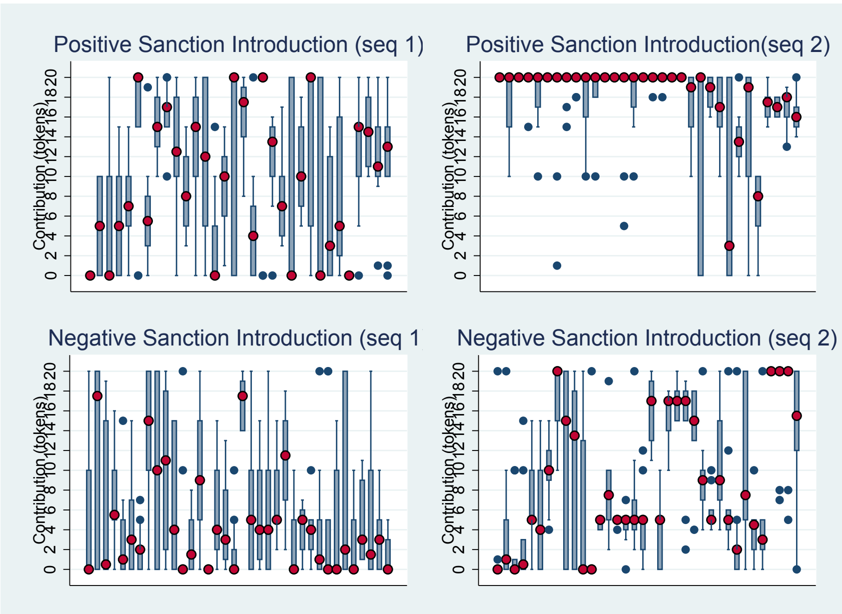


FIGURE 4.J.3 – Spread of individual contributions in Monetary sanction experiment (Introduction condition)

Each boxplot represents the dispersion of a subject's contributions (defining quartiles). The red point corresponds to the average extraction. The blue points represent isolated observations. The order of presentation of the subjects is random.

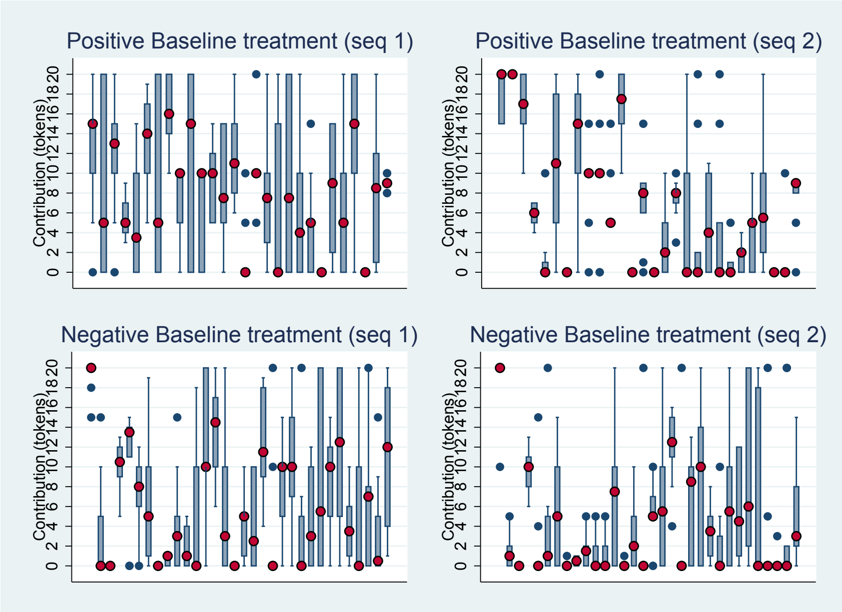


FIGURE 4.J.4 – Spread of individual contributions in Monetary sanction experiment (Baseline treatment)

Each boxplot represents the dispersion of a subject's contributions (defining quartiles). The red point corresponds to the average extraction. The blue points represent isolated observations. The order of presentation of the subjects is random.

4.J.5 Gini analysis for monetary sanctions experiment

The Gini index was calculated using the formula :

$$Gini = \frac{\sum_{i=1}^{n} \sum_{j=1}^{n} |x_i - x_j|}{2 \times n \times \sum_{k=1}^{n} x_k}$$

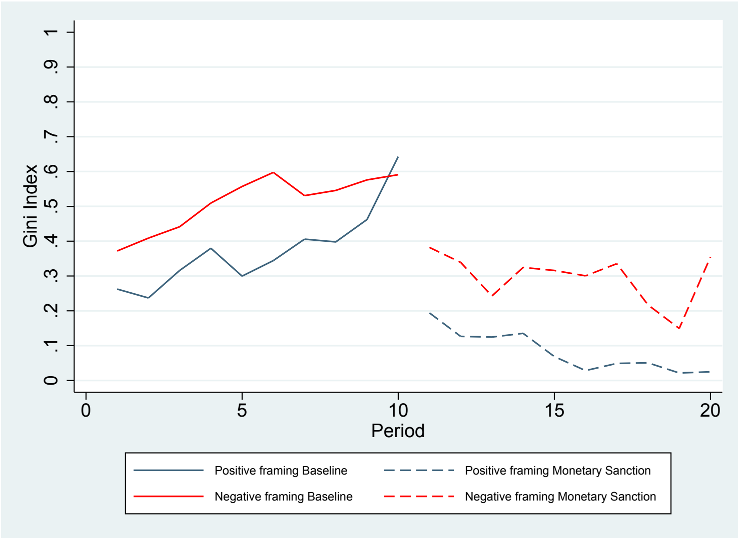


FIGURE 4.J.5 – Evolution of the Gini index in the Introduction condition in Monetary sanction experiment.

FIGURE 4.J.6 – Evolution of the Gini index in the Removal condition in Monetary sanction experiment.

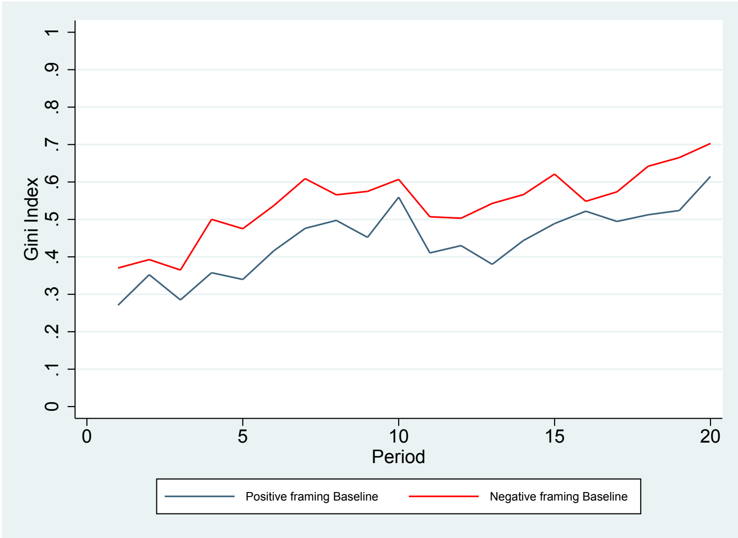


FIGURE 4.J.7 – Evolution of the Gini index in the Baseline treatment.

TABLE 4.J.7 – Gini index by period, by treatment in Monetary sanction experiment

Treatment Framing : period		1	2	3	4	5	6	7	8	9	10
Baseline treatment	Negative	0.370	0.393	0.365	0.500	0.475	0.537	0.609	0.566	0.575	0.607
	Positive	0.271	0.352	0.285	0.358	0.340	0.417	0.476	0.497	0.452	0.559
Introduction condition	Negative	0.372	0.409	0.441	0.510	0.557	0.598	0.531	0.546	0.576	0.591
	Positive	0.262	0.237	0.316	0.380	0.300	0.344	0.406	0.398	0.462	0.643
Removal condition	Negative	0.272	0.213	0.265	0.170	0.286	0.178	0.215	0.281	0.244	0.316
	Positive	0.200	0.234	0.203	0.225	0.134	0.179	0.202	0.189	0.160	0.286

Treatment Framing : period		11	12	13	14	15	16	17	18	19	20
Baseline treatment	Negative	0.507	0.503	0.543	0.566	0.621	0.548	0.574	0.642	0.665	0.703
	Positive	0.410	0.430	0.380	0.444	0.489	0.522	0.495	0.512	0.524	0.615
Introduction condition	Negative	0.382	0.339	0.243	0.325	0.316	0.301	0.335	0.217	0.149	0.355
	Positive	0.194	0.127	0.125	0.135	0.069	0.028	0.049	0.051	0.022	0.025
Removal condition	Negative	0.448	0.474	0.538	0.616	0.573	0.569	0.532	0.651	0.642	0.704
	Positive	0.190	0.265	0.323	0.444	0.463	0.376	0.476	0.464	0.566	0.574

TABLE 4.J.8 – Gini analysis in Monetary sanction experiment (panel tobit estimation one observation per group per period (two sided, random effects))

	(1) All data	(2) All data	(3) Without Sanctions	(4) Sanctions	(5) Removal	(6) Introduction
Framing	-0.142∗∗∗	-0.134∗∗∗	-0.132∗∗∗	-0.179∗∗∗	-0.173∗∗	-0.140∗∗
	(0.0374)	(0.0384)	(0.0376)	(0.0658)	(0.0875)	(0.0605)
Sanctions	-0.286∗∗∗	-0.275∗∗∗			-0.198∗∗∗	-0.252∗∗∗
	(0.0131)	(0.0177)			(0.0461)	(0.0411)
Period	0.0144∗∗∗	0.0144∗∗∗	0.0280∗∗∗	-0.0109∗∗∗	0.0149∗∗∗	0.00420
	(0.00189)	(0.00189)	(0.00199)	(0.00301)	(0.00364)	(0.00326)
Sequence	-0.110∗∗∗	-0.110∗∗∗	-0.199∗∗∗	0.0701		
	(0.0217)	(0.0217)	(0.0249)	(0.0720)		
Sanctions × Framing		-0.0235			0.118∗∗∗	-0.142∗∗∗
		(0.0264)			(0.0421)	(0.0377)
_cons	0.452∗∗∗	0.448∗∗∗	0.351∗∗∗	0.352∗∗∗	0.350∗∗∗	0.489∗∗∗
	(0.0284)	(0.0287)	(0.0288)	(0.0591)	(0.0821)	(0.0451)
sigma_u						
_cons	0.122∗∗∗	0.122∗∗∗	0.122∗∗∗	0.179∗∗∗	0.159∗∗∗	0.113∗∗∗
	(0.0138)	(0.0138)	(0.0146)	(0.0241)	(0.0310)	(0.0215)
sigma_e						
_cons	0.162∗∗∗	0.162∗∗∗	0.138∗∗∗	0.145∗∗∗	0.172∗∗∗	0.166∗∗∗
	(0.00410)	(0.00410)	(0.00419)	(0.00694)	(0.00806)	(0.00716)
N	911	911	596	315	284	332

Standard errors in parentheses

* p<0.10 ; ** p<0.05 ; *** p<0.01

4.K Payoffs complementary analysis for monetary sanctions experiment

Table 4.K.1 presents panel regression on payoffs without the interaction variable Framing × Sanction.

TABLE 4.K.1 – Panel regression of individuals payoffs without the interaction variable in Monetary sanction experiment (random effects).

	(1) All data	(2) Removal	(3) Introduction
Framing	2.285∗∗∗	1.232∗	2.721∗∗∗
	(0.558)	(0.688)	(0.725)
Material sanctions	-0.574∗∗	-1.356∗∗∗	-0.0291
	(0.227)	(0.389)	(0.380)
Period	-0.0457∗∗∗	-0.111∗∗∗	-0.0888∗∗∗
	(0.0166)	(0.0245)	(0.0247)
SVO_score	-3.756∗∗∗	-4.401∗∗	-3.505∗∗
	(1.390)	(1.719)	(1.786)
Gender	-0.0886	-0.482	-0.349
	(0.520)	(0.659)	(0.642)
Age	0.0167	-0.0597	0.185∗
	(0.0729)	(0.0907)	(0.0991)
Understanding	0.513∗∗∗	0.496∗∗	0.304
	(0.180)	(0.222)	(0.242)
_cons	21.90∗∗∗	25.38∗∗∗	19.59∗∗∗
	(2.132)	(2.694)	(2.901)
N	3760	2400	2560
R^2	0.066	0.058	0.077

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

4.L Others potential effects of the frame for monetary sanctions experiment

4.L.1 Judgment complementary analysis for monetary sanctions experiment

At the end of the experiment, subjects had to describe their perceptions concernning the effect of others'actions on their own payoff. They could qualify them as generating :"i) important losses, ii) losses, iii) no gains or losses, iv) gains and v) important gains". These perception score compose the following variable "QF Perception Effects". In table 4.L.2 we pool the results into three levels : 1) losses, 2) no gains or losses, 3) gains to generate a perception score "QF Perception Effects2". *Material sanctions applied* is a dummy variable that is equal to one when material sanctions were available during the experiment. *Average Peer Contributions (sum)* represents the average sum of contributions from the subject's peers (other group members).

TABLE 4.L.1 – Perception of others actions in Monetary sanction experiment (ordered logit analysis).

	(1) QF_Perception_Effects	(2) QF_Perception_Effects	(3) QF_Perception_Effects
Framing	0.359	0.431	-0.227
	(0.266)	(0.285)	(0.318)
Material sanctions applied	0.791	0.592	0.229
	(0.560)	(0.577)	(0.592)
Treatment order	-0.199	-0.0966	-0.347
	(0.315)	(0.320)	(0.328)
SVO_score		0.928	1.129
		(0.724)	(0.733)
Gender		-0.673**	-0.736***
		(0.271)	(0.277)
Age		-0.00360	0.000272
		(0.0368)	(0.0379)
Understanding		-0.132	-0.246**
		(0.0920)	(0.0980)
Average Peer Contributions (sum)			0.0743***
			(0.0150)
cut1			
_cons	-1.081***	-1.841*	-1.350
	(0.287)	(1.099)	(1.121)
cut2			
_cons	0.410	-0.300	0.300
	(0.274)	(1.089)	(1.115)
cut3			
_cons	1.099***	0.422	1.094
	(0.284)	(1.088)	(1.117)
cut4			
_cons	3.647***	3.028***	3.941***
	(0.442)	(1.137)	(1.176)
N	188	188	188

Standard errors in parentheses
* $p<0.10$, ** $p<0.05$, *** $p<0.01$

TABLE 4.L.2 – Perception of others actions in Monetary sanction experiment (ordered logit analysis, perception is reduced to 3 levels).

	(1) QF_Perception_Effects2	(2) QF_Perception_Effects2	(3) QF_Perception_Effects2
Framing	0.378	0.458	-0.157
	(0.279)	(0.308)	(0.348)
Material sanctions applied	0.629	0.451	0.00796
	(0.592)	(0.616)	(0.648)
Treatment order	-0.0792	0.0196	-0.169
	(0.328)	(0.338)	(0.355)
SVO_score		0.721	0.875
		(0.788)	(0.816)
Gender		-0.821***	-0.946***
		(0.289)	(0.302)
Age		-0.00480	-0.00743
		(0.0406)	(0.0424)
Understanding		-0.147	-0.264**
		(0.101)	(0.110)
Average Peer Contributions (sum)			0.0713***
			(0.0163)
cut1			
_cons	0.440	-0.525	-0.195
	(0.295)	(1.203)	(1.242)
cut2			
_cons	1.131***	0.201	0.607
	(0.304)	(1.202)	(1.243)
N	188	188	188

Standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.01

4.L.2 Strategic understanding for monetary sanctions experiment

To understand the subjects' level of strategic understanding of the game, we replicate Fosgaard et al. (2014) final questionnary at the end of the experiment.

There are two kinds of questions, representing two kinds of objectives. The first type of questions asks what their contribution would be in order to maximize their own payoffs (a). The second type of question asks what their contribution would be in order to maximize the group earning (b). For both objectives, they were presented with two situations concerning the contribution of the other members of the group.

As a result, it seems that subjects do not get the strategic aspect of the game. Indeed, their behavior seem to be driven by reciprocity. All the subjects in the two frames declare that they will not contribute to the public good if others do not contribute for both objectives (individual and group maximization).

Conversely, under both frames a majority of subjects declare that they will fully contribute to the public good if other's are full contributors. These results corroborate the fact that subjects behave as conditionnal cooperators.

Nevertheless, it seems that the frame also impacts their stated willingness to reciprocate to others' contributions. The percentage of subjects who declare that they will fully contribute is lower in the negative frame.

The questions specified that they had to answer how much they will contribute to public good when there were no sanctions that could be delivered :

a) To maximize individual earning, if others fully contribute :

FIGURE 4.L.1 – Stated contributions if others fully contribute in order to maximize individual payoffs in Monetary sanction experiment (all data presented in this chapter)

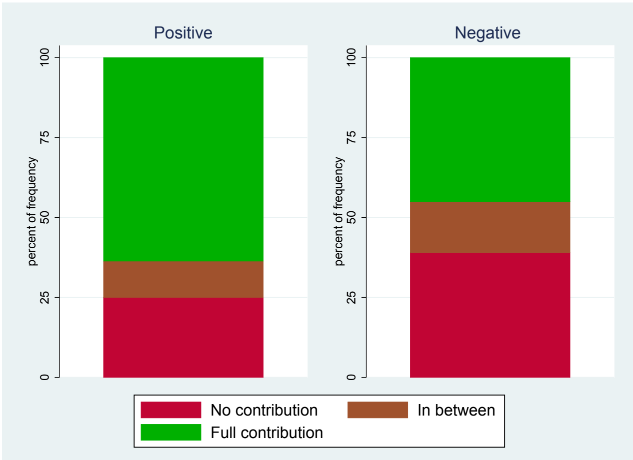


FIGURE 4.L.2 – Stated contributions if others fully contribute in order to maximize individual payoffs in Monetary sanction experiment (Removal condition)

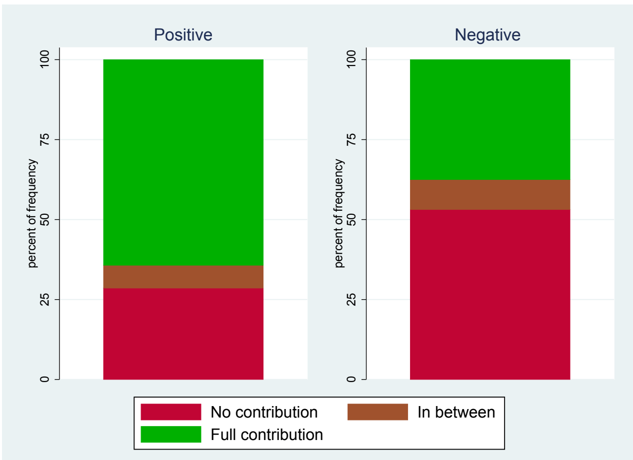
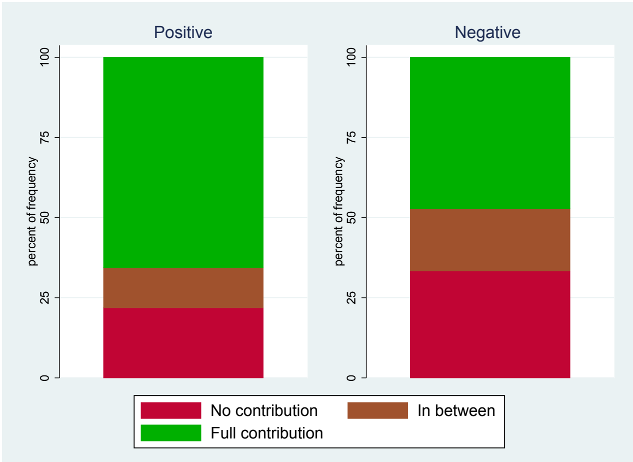


FIGURE 4.L.3 – Stated contributions if others fully contribute in order to maximize individual payoffs in Monetary sanction experiment (Introduction condition)



b) <u>To maximize group earning, if others fully contribute</u> :

FIGURE 4.L.4 – Stated contributions if others fully contribute in order to maximize group payoff in Monetary sanction experiment (Removal condition)

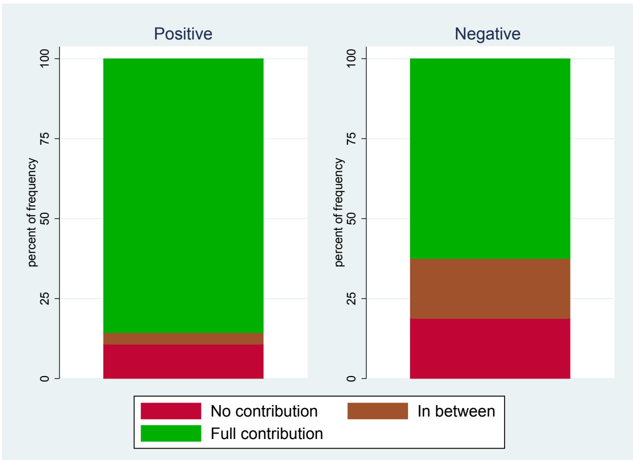


FIGURE 4.L.5 – Stated contributions if others fully contribute in order to maximize group payoff in Monetary sanction experiment (Introduction condition)

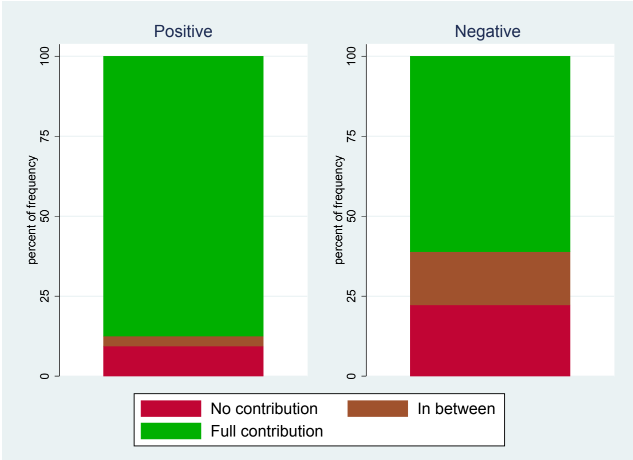


TABLE 4.L.3 – Percentage by stated contribution to maximize group payoff when others fully contribute in Monetary sanction experiment

Data considered	All data		Removal		Introduction	
	Positive	Negative	Positive	Negative	Positive	Negative
No contribution	10.23	19.00	10.71	18.75	9.38	22.22
In between	6.82	18.00	3.57	18.75	3.13	16.67
Full contribution	82.95	63.00	85.71	62.50	87.50	61.11

TABLE 4.L.4 – Percentage by stated contribution to maximize individual payoff when others fully contribute in Monetary sanction experiment

Data considered	All data		Removal		Introduction	
	Positive	Negative	Positive	Negative	Positive	Negative
No contribution	25.00	39.00	28.57	53.13	21.88	33.33
In between	11.36	16.00	7.14	9.38	12.50	19.44
Full contribution	63.64	45.00	64.29	37.50	65.63	47.22

TABLE 4.L.5 – Kolmogorov-Smirnov test of the conditionnal contribution answerin Monetary sanction experiment

Data considered	Kolmogorov-Smirnov p-value	
	To maximize individual gain	To maximize group gain
All data presented in this chapter	0.077*	0.048**
When sanctions are applied	0.083*	0.038**

4.L.3 Framing effect by subjects' type for monetary sanctions experiment

Although the number of observations is quite small compared to Park (2000)'s experiment (cf table 5.B.5), I made some statistical tests.

Mann Whitney test on the average contribution by type for monetary sanctions experiment

The average contribution rate is defined as follows the average contribution by subject and by sequence. This is the observation used to run these tests.

The difference of behavior depending on the **frame in baseline conditions** is **only significant for individualist subjects**. This seems to corroborate Park (2000)'s argument that they are sensitive to framing and that is the main driver of the different dynamics. Nevertheless it seems that these differences of behavior do not persist during the second sequence of the Baseline treatment.

Concerning behavior linked to the availability of sanction :

— In the Introduction condition : The behaviors are significantly different depending on the frame for both types.
— In the Removal condition : It seems that the difference in contribution between the two framings is mainly induced by the difference in behavior of individualistic subjects between the two framings.

Mann Whitney analysis of the framing effect by type.

TABLE 4.L.6 – Mann Whitney analysis of the average contribution by subjects types in Monetary sanction experiment

Treatment			Mann Whitney p-value by Type	
			Prosocial	Individualist
Baseline Treatment		Sequence 1 Baseline	0.930	0.071*
		Sequence 2 Baseline	0.162	0.834
Material sanctions	Introduction condition	Sequence 1 Baseline	0.146	0.004***
		Sequence 2 Sanctions	0.000 ***	0.000***
	Removal condition	Sequence 1 Sanctions	0.620	0.048**
		Sequence 2 Baseline	0.320	0.086*

Mann Whitney test on the average contribution by type in the first period of each sequence for monetary sanctions experiment

TABLE 4.L.7 – Mann Whitney analysis of contribution in the first period by types in Monetary sanction experiment

Treatment			Mann Whitney p-value by Type	
			Prosocial	Individualist
Baseline Treatment		Sequence 1 Baseline	0.823	0.206
		Sequence 2 Baseline	0.340	0.776
Material sanctions	Introduction condition	Sequence 1 Baseline	0.398	0.230
		Sequence 2 Sanctions	0.377	0.004***
	Removal condition	Sequence 1 Sanctions	0.511	0.853
		Sequence 2 Baseline	0.035**	0.100

5 Discussion of chapters 2 and 3

This part is based on joint work with and Katherine Farrow, David Masclet and Marc Willinger

The pooled data of chapters 2 and 3 replicate the framing effect found by Andreoni (1995). Subjects contribute more when the collective action issue is presented as having positive externalities, than when it is presented as having negative ones. However, Andreoni (1995)'s framing effect as most of the framing effects, is fragile. Indeed, even under the Give and Take frame, the higher level of contributions under the Give frame is not always observed and is not always significant (Cox et al., 2013 ; Cox, 2015 ; Cubitt et al., 2010 ; Dufwenberg et al., 2011 ; Fosgaard et al., 2014 ; Sell & Son, 1997 and Sell et al., 2002). In our data, the lack of robustness of the results is partly due to three groups [1], that have significantly higher contributions than others (without any mechanism to foster cooperation). Nevertheless, the framing effect also depends heavily on the inherent propensity of groups to cooperate. Once again, the groups that make up the negative framing with symbolic sanctions in the Introduction condition seem to have a strong willingness to cooperate, since they have a relatively high level of contribution in the first period of the game and a relatively high stated willingness to contribute.

Mechanisms that enable subjects to express their disapproval through cheap talk (symbolic sanctions) or mechanism that can change the monetary incentives (monetary sanctions) significantly increase contributions compared to Baseline conditions. It is worth noticing that those two mechanisms are more effective in the Introduction condition, i.e. when they are introduced after subjects first experienced a sequence in which disapproval of others' actions was unavailable. It is in line with Masclet et al. (2003) whose results about symbolic sanctions were found in the same conditions, i.e. sanctions were introduced after a first sequence in which subjects were unable to express their disapproval. Nevertheless, the efficiency of these two ways to express disapproval is different. The level of symbolic sanctions sent out keeps increasing until the end of the game while it decreases for monetary sanctions. Also, with symbolic sanctions, the increase in contributions is lower than with monetary sanctions.

Moreover, the lesser effectiveness of known mechanisms for promoting cooperation, in a frame that emphasises negative externalities, is only observed for monetary sanctions in the Introduction condition. In the positive frame, after monetary sanctions are introduced, groups converge

1. These groups compose the treatment negative framing with symbolic sanctions under Introduction condition

to full contribution. In contrast, such a dynamic is not observed in the negative frame : in the Introduction condition, groups contribute on average half on their endowment to the public good. It is worth noticing that in the negative frame and under all conditions, groups' contributions are more dispersed. Paradoxically, the frequency of disapproval (symbolic or monetary ones) is higher in the negative frame. To sum up, the availability of sanctions in the positive frame enables groups to converge to full contribution. This does not happen in the negative frame. In a sense, we are partly replicating the results of Messer et al. (2013) who found that voting, and communication were less effective under what they called negatively framed social dilemma. Nevertheless, in our set of data, symbolic sanctions seem to be more efficient under the negative frame. We argue that the greater effectiveness in these circumstances is mainly due to the fact that some groups had a greater inherent propensity to cooperate, which is why they responded strongly to mechanisms that promote cooperation.

We try to go further in our understanding of how the frame impacts behaviors. From others experiments, there is evidence that framing affects subjects' perception (misperception), their conditional cooperation, their reciprocity dynamics and their beliefs (Dufwenberg et al., 2011 ; Fosgaard et al., 2014 ; Gächter et al., 2017 ; Gächter et al., (forthcoming) [2]). In this experiment, we did not elicit beliefs. However, we analyzed how framing affects the perception of the game, the conditional willingness to cooperate and the reciprocity dynamic.

5.1 Does framing affect the perception of others' decisions ?

To understand subjects' perception of the game, we analyze i) the ease with which subjects establish the payoffs and ii) their perception about the effects of others actions.

We measure and control the ease with which subjects determine the structure of earnings according to the frame. To do so, before starting the public good game, we asked subjects to answer multiple-choice questions about their winnings in different situations. The responses were recorded to allow us to establish a comprehension score. After each question, the correct answer and an explanation were posted to ensure that they had the correct answer in mind before starting the main part of the experiment. As illustrated in figure 5.1, subjects had more difficulties to initially figure out the payoffs in the negative frame. The difference is significant using Epps Singleton test ($p = 0.000$). It reflects that the earnings are more complex to figure out in this frame, due to the three sources of income. However, the framing effect cannot be completely reduced to greater difficulty in calculating earnings. Indeed after each question, the correct answer and detailed explanations were displayed to ensure that subjects had the correct answer in mind before starting the VCM. Nevertheless, we hypothesize that the difficulty in calculating earnings contributes to the negative perception created by the frame. It may interact with the mechanisms that are supposed to foster cooperation, making cooperation more difficult.

2. This article was presented in ESA Europe 2019 in Dijon. They use Fischbacher et al. (2001) to elicit subject's type, and they also replicate Fosgaard et al. (2014) questions.

FIGURE 5.1 – Understanding score by framing (All data of chapters 2 and 3)

To analyze the impact of framing on the subjects' perception, we ask subjects to qualify the effect of others' actions on their own gains at the end of the experiment. They could qualify them as generating "i) important losses, ii) losses, iii) no gains or losses, iv) gains and v) important gains". We pooled the results into three levels : 1) losses, 2) no gains or losses, 3) gains, to generate a perception score. The ordered logit analysis presented in table 5.1 shows that the perceptions of others' actions are significantly better in the positive frame. This result remains true when we control for the actual cooperation levels, adding the average sum of contributions from the subject's peers which is represented by the variable Average Peer Contributions (sum). It seems to confirm the conjecture we made about the framing effects on perception.

TABLE 5.1 – Perception of others actions for all framing data (ordered logit estimation).

	(1) QF_Perception_Effects2	(2) QF_Perception_Effects2	(3) QF_Perception_Effects2	(4) QF_Perception_Effects2
Framing	0.523**	0.525**	0.614***	0.471**
	(0.213)	(0.214)	(0.232)	(0.238)
Symbolic sanctions applied	0.207	0.831*	0.692	0.684
	(0.310)	(0.477)	(0.491)	(0.502)
Material sanctions applied	0.515*	1.130**	1.019**	0.753
	(0.310)	(0.475)	(0.490)	(0.501)
Treatment order		-0.400*	-0.330	-0.469*
		(0.234)	(0.239)	(0.247)
SVO_score			1.024*	0.953
			(0.585)	(0.597)
Gender			-0.448**	-0.527**
			(0.218)	(0.224)
Age			0.00843	0.0138
			(0.0295)	(0.0301)
Understanding			-0.111	-0.174**
			(0.0771)	(0.0807)
Average Peer Contributions (sum)				0.0447***
				(0.0100)
cut1				
_cons	0.499*	0.498*	0.381	0.810
	(0.283)	(0.283)	(0.903)	(0.926)
cut2				
_cons	1.219***	1.223***	1.125	1.598*
	(0.289)	(0.290)	(0.905)	(0.929)
N	324	324	324	324

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

5.2 How does framing affect the willingness to reciprocate ?

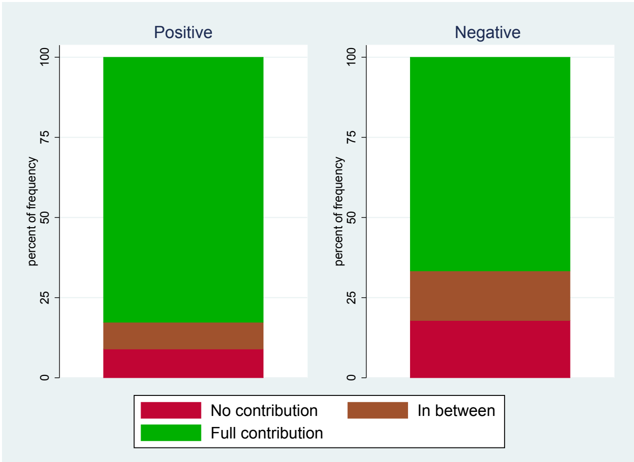
Since the dynamics of reciprocity are stated to be one of the main drivers of group contributions and the effectiveness of symbolic and monetary sanctions, we analyse whether they have been affected by the frame. As Messer et al. (2013) and Gächter et al. (2017) we states that reciprocity reflect in the conditional cooperation, as it is the "*willingness to cooperate provided others do the same*". We first determine how the frame affects the stated conditional contribution. Second, we show how the frame affects the response to the contribution of others according to subjects' types regarding their social orientation (Murphy et al., 2011). Indeed, in these two chapters, we show that the stronger subjects' preference for equal sharing, the more they contribute to the public good. In his replication of Andreoni (1995) 's experiment, Park (2000) found that depending on their social orientation subjects react differently to the frame [3]. Individualists have a significantly lower level of contribution under the negative frame, whereas the frame does not influence prosocial individuals. He concludes that individualists mainly drive the framing effect. In order to find out whether this is also the case in our data, we analyze subjects' i) average contribution, ii) stated conditional contribution ; iii) the way they modify their contributions according to their type and for each frame. For the latter, we adapt the learning analysis of Bigoni and Suetens (2012), which was firstly introduced by Huck et al. (1999). This analysis aims to determine which strategy best explains the way subjects update their contribution after each period.

To identify the impact of the frame on the stated willingness to replicate, we reproduce Fosgaard et al. (2014)'s questions at the end of the experiment. These questions determine the willingness of subjects to contribute depending on the contribution of others. Subjects are asked what they would do to (i) maximize their own income and (ii) maximize the income of the group. For both objectives, they were presented with two situations regarding the contribution of their peers. In the first situation, they were told that the other subjects did not contribute. In the second situation, they were told that the other members of the group contributed fully to the public good. For both framings, regardless of the objective, when subjects are asked to respond to, they all state that they will not contribute if the other subjects do not contribute either. Conversely, when they are told that others will fully contribute, a majority of subjects answer that they will also fully contribute, in both frames and regardless of the objective they are asked to respond. We conclude that subjects do not approach the game strategically, but that a reciprocity dynamic strongly drives their behavior. Indeed, if they behaved strategically, they would not contribute in order to maximize their personal income and would contribute fully in order to maximize the group's income, regardless of the contributions of others. These results are in accordance with Fischbacher et al. (2001), who showed that for a majority of subjects are conditional cooperators.

However, it should be pointed out that the frame also impacts the percentage of subjects who declare that they will fully contribute if others do so. When asked what they would do to maximize the group's benefits, the percentage of full contributors is significantly lower in the negative frame with 63% versus 83% in the positive frame. (see figure 5.2, $p = 0.001$, Kolmogorov Smirnov test). If we consider that this answer reflects a preference for cooperation, we should conclude that the negative frame deters cooperation. This is in line with the results of Fosgaard et al. (2014), Gächter et al. (2017) and Gächter et al. (forthcoming) who showed that in the take frame there is a low percentage of conditional cooperators and a higher percentage of free riders.

3. Park (2000) applied an older version of Murphy's social orientation test

FIGURE 5.2 – Stated contributions if others fully contribute in Baseline



Is the reaction of different types of subjects to sanctions affected by framing ?

First note that the distribution of types is frame independent (see table 5.2). Thus, the difference between the two frames is not due to a difference in the distribution of types. We, therefore, analyze whether the reaction to the frame is different depending on subjects' types, as suggested by Park (2000)'s experiment. To do so, we make three kinds of analyses, distinguishing between prosocial and individualistic subjects. Competitive subjects cannot be considered because their number is too small.

TABLE 5.2 – SVO type summary statistics for all framing data

Treatment		Prosocial	Individualist	Competitive
Symbolic sanctions	Negative Framing	32	35	1
	Positive Framing	25	40	3
Monetary sanctions	Negative Framing	33	41	4
	Positive Framing	24	34	2
Baseline Treatment	Negative Framing	14	17	1
	Positive Framing	15	13	0
All data	Negative Framing	69	93	6
	Positive Framing	64	87	5

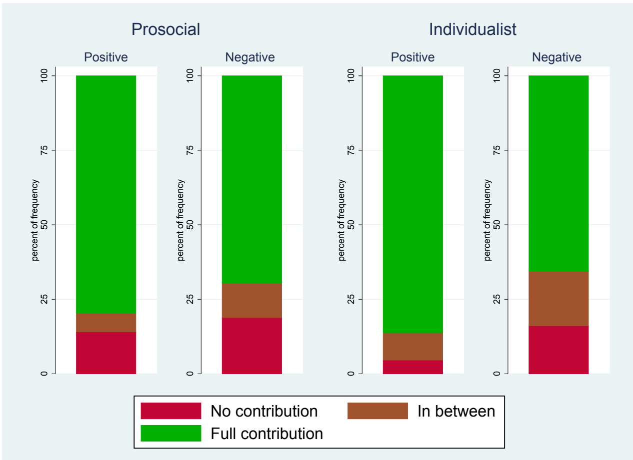
Firstly, we compare the average contribution in the first sequence without sanctions between subjects' types. It appears that our results are in line with Park (2000). The difference of contributions between the two frames is mostly due to individualistic subjects, who have a significantly lower contribution in the negative frame.

— If we consider all the data, we do not observe a difference in average contributions to the public good based on framings. This effect is partly explained by three groups composing the negative framing with symbolic sanctions in the Introduction condition, which have a high level of contribution in the first sequence (baseline) even though they are mainly composed of individualists. If we exclude these three groups, we find a small significant difference between the two frames for individualistic subjects ($p = 0.068$, Mann Whitney) and no difference for prosocial subjects ($p = 0.187$, Mann Whitney).

— If we consider the first sequence of the Baseline treatment and of the Monetary sanctions in the Introduction condition, we also find a significant difference for individualistic subjects (Baseline $p = 0.071$ and Monetary sanctions Introduction $p = 0.004$, Mann Whitney) but not for prosocial subjects.

Secondly, the variation of the stated conditional contribution is larger for individualistic subjects. As illustrated in figure 5.3, individualistic subjects are relatively more willing to fully cooperate under the positive frame and relatively less willing to fully contribute under the negative frame. For this type, the difference between the two frames is significant using Kolmogorov Smirnov test $p = 0.044$, whereas it is not $p = 0.886$ for prosocial subjects.

FIGURE 5.3 – Stated contributions by type when others fully contribute for all framing data



Lastly, to study how subjects update their contribution over time, we adopt the method of Huck et al.(1999) and Bigoni and Suetens (2012). We analyze how different learning strategies can explain contribution changes occurring between two successive periods (t and $t-1$). The analysis is described by the following equation :

$$y_{it} - y_{it-1} = \beta_0 + \beta_1 DAverage_{it} + \beta_2 DMin_{it} + \beta_3 DMax_{it} \tag{5.1}$$

y_{it} refers to subject i's contribution to the group account in the period t. $DAverage_{it}$ is the difference between the group's average contribution and subject i contribution in period $(t-1)$. If subject i's contribution change between period t and $t-1$ corresponds to the $DAverage_{it}$, we consider that he expresses a taste for conformity. Following Luzzati (1999), we hypothesise that the willingness to conform to social norms strongly influences economic decisions. As a consequence, conformity preference shapes subjects utility functions. Carpenter (2004) 's experiment demonstrates that the taste for conformity is a strong driver of groups' dynamic in public good games, and the reason why the display of individual contributions can lead to a faster decrease of contributions.

$DMin_{it}$ is the difference between the lowest contribution in the group and subject i contribution in the previous period. In the absence of disapproval ratings (symbolic or monetary sanctions), individual contributions were not displayed. In this case, we consider the lowest possible contribution (i.e. zero = free-riding). Moreover, in our voluntary contribution mechanism, not contributing is the best response to any group contribution, under the standard assumption.

In comparison, $DMax_{it}$ refers to the difference between the highest contribution of the group minus subject i's contribution in the previous period. When individual contributions were not displayed, we consider that the highest possible contribution is the full contribution. The full contribution represents one of the possible equilibriums when monetary sanctions are applied only if there is a sufficient number of subjects who are opposed to inequality (Fehr & Smith, 1999).

In order to analyze whether the frame impacts the contribution dynamics, we include interactions variables of the framing with $DAverage_{it}$,$DMin_{it}$ and $DMax_{it}$. Note that for this analysis, we need to exclude the first period of each sequence.

Looking at the first sequence without symbolic or monetary sanctions, the main drivers of group dynamics are the "imitation of the average" and the adoption of "free-riding behavior". Both of these learning patterns are positively and significantly correlated with the change in contribution, as shown in table 5.3. Note that the adoption of free-riding behavior appears to be slightly less important in the positive frame, as the interaction variable Free rider × Framing is negatively and significantly correlated with the change in contribution. It confirms our results regarding the lower contributions in the negative frame. This difference seems to be generated by Prosocial individuals who are relatively less likely to adopt free-riding behavior. Nevertheless, in these conditions we observe that the main drivers of contribution changes are identical for Prosocial and Individualist subjects (as illustrated in tables 5.4 and 5.5).

TABLE 5.3 – Learning analysis of Sequence 1, panel tobit estimations two sided random effects (All data).

	(1) extct_adjtmt	(2) extct_adjtmt	(3) extct_adjtmt	(4) extct_adjtmt
Imitate the Average	1.019***	1.027***	1.030***	1.030***
	(0.0169)	(0.0227)	(0.0227)	(0.0228)
Free rider	0.868***	0.868***	0.891***	0.888***
	(0.0141)	(0.0141)	(0.0184)	(0.0191)
Full contributor	0	0	0	0
	(.)	(.)	(.)	(.)
Imitate the Average × Framing		-0.0169	-0.0234	-0.0226
		(0.0335)	(0.0337)	(0.0337)
Free rider × Framing			-0.0485**	-0.0534**
			(0.0247)	(0.0272)
Full contributor × Framing				0.0101
				(0.0232)
_cons	-7.013***	-7.013***	-7.006***	-6.911***
	(0.233)	(0.233)	(0.233)	(0.316)
sigma_u				
_cons	2.774***	2.775***	2.769***	2.768***
	(0.165)	(0.165)	(0.164)	(0.164)
sigma_e				
_cons	3.283***	3.282***	3.280***	3.280***
	(0.0596)	(0.0596)	(0.0596)	(0.0596)
N	1836	1836	1836	1836

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

TABLE 5.4 – Learning analysis of Sequence 1 for Prosocial subjects, panel tobit estimations two sided random effects (All data)

	(1) extct_adjtmt	(2) extct_adjtmt	(3) extct_adjtmt	(4) extct_adjtmt
Imitate the Average	1.010***	1.047***	1.056***	1.056***
	(0.0267)	(0.0370)	(0.0372)	(0.0372)
Free rider	0.880***	0.881***	0.922***	0.916***
	(0.0213)	(0.0213)	(0.0281)	(0.0300)
Full contributor	0	0	0	0
	(.)	(.)	(.)	(.)
Imitate the Average × Framing		-0.0769	-0.0905*	-0.0899*
		(0.0521)	(0.0524)	(0.0524)
Free rider × Framing			-0.0804**	-0.0876**
			(0.0362)	(0.0384)
Full contributor × Framing				0.0193
				(0.0347)
_cons	-7.674***	-7.683***	-7.661***	-7.468***
	(0.349)	(0.351)	(0.348)	(0.490)
sigma_u				
_cons	2.534***	2.558***	2.519***	2.515***
	(0.238)	(0.240)	(0.237)	(0.237)
sigma_e				
_cons	3.342***	3.335***	3.331***	3.330***
	(0.0934)	(0.0932)	(0.0930)	(0.0930)
N	774	774	774	774

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

TABLE 5.5 – Learning analysis of Sequence 1 for Individualist subjects, panel tobit estimations two sided random effects.

	(1) extct_adjtmt	(2) extct_adjtmt	(3) extct_adjtmt	(4) extct_adjtmt
Imitate the Average	1.016***	1.000***	1.000***	1.001***
	(0.0220)	(0.0291)	(0.0291)	(0.0291)
Free rider	0.858***	0.859***	0.865***	0.865***
	(0.0190)	(0.0190)	(0.0245)	(0.0253)
Full contributor	0	0	0	0
	(.)	(.)	(.)	(.)
Imitate the Average × Framing		0.0366	0.0350	0.0349
		(0.0439)	(0.0441)	(0.0442)
Free rider × Framing			-0.0133	-0.0130
			(0.0337)	(0.0378)
Full contributor × Framing				-0.000588
				(0.0310)
_cons	-6.575***	-6.580***	-6.579***	-6.585***
	(0.310)	(0.311)	(0.311)	(0.418)
sigma_u				
_cons	2.856***	2.862***	2.865***	2.865***
	(0.226)	(0.226)	(0.227)	(0.227)
sigma_e				
_cons	3.223***	3.221***	3.221***	3.221***
	(0.0781)	(0.0781)	(0.0781)	(0.0781)
N	1035	1035	1035	1035

Standard errors in parentheses
* p<0.10 ; ** p<0.05 ; *** p<0.01

When monetary sanctions are available, the imitation of the average remains the principal driver of the group contribution dynamic, as illustrated in tables 5.6, 5.7 and 5.8. Nevertheless, we find a strong difference in the learning strategies adopted depending on the frame.

In the Positive frame, there is less imitation of the average, more imitation of the highest and, in a lesser proportion, of the lowest contribution displayed by the group. The interaction variables $DAverage \times Framing$, $DMin \times Framing$ and $DMax \times Framing$ have a significant effect on the contribution dynamics, which are respectively negative for the former and positive for the two latter. It reflects the fact that whith monetary sanctions in the positive frame, the trend is less driven by the average and subjects are more likely to imitate the highest and in a lesser extend the lower contribution contribution.

This effect is mainly explained by subjects characterized as individualistic with regards to their SVO score, who change their contribution strategies according to the frame. They are less likely to follow the average in the positive frame, but more likely to adopt the highest or the lowest contribution displayed. In comparison, the contribution strategy of Prosocial individual does not seem to be frame dependent, because in both cases, they mainly follow the average contribution. Moreover, it is important to note that in the Introduction condition, the different reaction to monetary sanctions of individualist subjects is observed since the first period after their introduction. For this type of subjects, their first period contributions are significantly different depending on the frame ($p = 0.005$, Mann Whitney), whereas we do not observe a difference for prosocial subjects. This result might explain why the introduction of monetary sanctions enables groups to converge towards full contribution in the positive frame but not in the negative frame, although the proportion of prosocial subjects is equivalent in both frames. Indeed, if we assume that pro-sociability is a proxy for inequality aversion, both frames present a relatively high number of subjects who should have an interest in being cooperative enforcers when monetary sanctions are available. As a consequence, full contribution might also become one of the possible equilibrium (Fehr & Smith, 1999). However, individualist subjects do not react the same way to the introduction of sanctions depending on the frame. They are less likely to imitate the highest contribution displayed in the negative frame.

TABLE 5.6 – Learning analysis when monetary sanctions are available, panel tobit estimations two sided random effects (All data).

	(1)	(2)	(3)	(4)
	extct_adjtmt	extct_adjtmt	extct_adjtmt	extct_adjtmt
Imitate the Average	0.868***	0.903***	0.879***	1.039***
	(0.106)	(0.108)	(0.110)	(0.125)
Lowest contribution	-0.0966*	-0.0960*	-0.0744	-0.142**
	(0.0528)	(0.0527)	(0.0568)	(0.0624)
Maximal contribution	-0.0825	-0.0841*	-0.0855*	-0.161***
	(0.0514)	(0.0511)	(0.0510)	(0.0590)
Imitate the Average × Framing		-0.116*	-0.0594	-0.602***
		(0.0690)	(0.0890)	(0.228)
Lowest contribution × Framing			-0.0573	0.198*
			(0.0569)	(0.114)
Maximal contribution × Framing				0.291**
				(0.113)
_cons	0.0406	0.0500	0.0518	0.0521
	(0.247)	(0.243)	(0.242)	(0.250)
sigma_u				
_cons	1.091***	1.013***	0.974***	1.143***
	(0.312)	(0.328)	(0.339)	(0.312)
sigma_e				
_cons	4.669***	4.676***	4.679***	4.638***
	(0.112)	(0.112)	(0.113)	(0.111)
N	1152	1152	1152	1152

Standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.01

TABLE 5.7 – Learning analysis when monetary sanctions are available for Prosocial subjects, panel tobit estimations two sided random effects.

	(1) extct_adjtmt	(2) extct_adjtmt	(3) extct_adjtmt	(4) extct_adjtmt
Imitate the Average	1.173***	1.216***	1.184***	1.280***
	(0.160)	(0.165)	(0.169)	(0.194)
Lowest contribution	-0.251***	-0.254***	-0.227***	-0.264***
	(0.0775)	(0.0776)	(0.0846)	(0.0921)
Maximal contribution	-0.137*	-0.137*	-0.140*	-0.183**
	(0.0788)	(0.0785)	(0.0786)	(0.0904)
Imitate the Average × Framing		-0.120	-0.0303	-0.360
		(0.109)	(0.158)	(0.373)
Lowest contribution × Framing			-0.0757	0.0704
			(0.0960)	(0.178)
Maximal contribution × Framing				0.192
				(0.198)
_cons	0.0890	0.0989	0.0895	0.0651
	(0.393)	(0.389)	(0.391)	(0.407)
sigma_u				
_cons	1.537***	1.504***	1.527***	1.688***
	(0.346)	(0.347)	(0.350)	(0.387)
sigma_e				
_cons	3.857***	3.857***	3.850***	3.816***
	(0.147)	(0.147)	(0.147)	(0.148)
N	423	423	423	423

Standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.01

TABLE 5.8 – Learning analysis when monetary sanctions are available for Individualist subjects, panel tobit estimations two sided random effects.

	(1) extct_adjtmt	(2) extct_adjtmt	(3) extct_adjtmt	(4) extct_adjtmt
Imitate the Average	0.676***	0.707***	0.675***	0.910***
	(0.137)	(0.141)	(0.143)	(0.161)
Lowest contribution	-0.00321	-0.00257	0.0284	-0.0740
	(0.0699)	(0.0699)	(0.0756)	(0.0820)
Maximal contribution	0.00680	0.00400	0.00175	-0.122
	(0.0682)	(0.0680)	(0.0677)	(0.0781)
Imitate the Average × Framing		-0.0876	-0.0144	-0.853***
		(0.0908)	(0.114)	(0.292)
Lowest contribution × Framing			-0.0802	0.312**
			(0.0753)	(0.146)
Maximal contribution × Framing				0.451***
				(0.145)
_cons	-0.0906	-0.0878	-0.0777	-0.0345
	(0.327)	(0.325)	(0.320)	(0.325)
sigma_u				
_cons	1.044**	0.992**	0.892*	0.958**
	(0.440)	(0.456)	(0.499)	(0.459)
sigma_e				
_cons	4.865***	4.869***	4.880***	4.833***
	(0.152)	(0.152)	(0.154)	(0.151)
N	675	675	675	675

Standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.01

To conclude, the frame affects the willingness to contribute to the public good. In this sense, we partly replicated Andreoni (1995) 's results, showing that "warm glow" is relatively more efficient in promoting cooperation than the "cold prickle". However, the framing effect is fragile and depends on the inherent group's willingness to cooperate. Moreover, as others have shown, we find that enabling subjects to express their disapproval (through symbolic and monetary sanctions) increases contributions. More interestingly, we found that the frame interacts with the efficiency of monetary sanctions.

Framing impacts subjects' perception of others' actions and their willingness to reciprocate to others' contributions. In the negative frame, they have more difficulties to figure out the payoffs, and they consider that others' actions generate losses to them. Moreover, the frame influences the stated willingness to reciprocate to others contributions, as the percentage of subjects who declare they would fully contribute if others do so is lower in the negative frame. Those results are in line with other framing effects, such as the give and take frame, which seems to impacts perception (misperception), conditional cooperation and beliefs (Dufwenberg et al., 2011 ; Fosgaard et al., 2014 ; Gächter et al., 2017 ; Gächter et al., forthcoming).

The fact that the way the game is framed and perceived can affect the ability of groups to cooperate is an interesting result. More investigations have to be done to better understand how the details about the payoffs structure and the kind of information delivered to the subjects may impact their perception and their willingness to cooperate.

Additionally, as Park (2000), we also find that the framing effect is stronger for individualists. They have a significantly lower level of contribution in the negative frame without any disapproval ratings. They present a stronger difference in their stated conditional answer, and they react differently to the introduction of monetary sanctions depending on the frame.

This is why taking into account individual heterogeneity, and more specifically, the interaction between social preferences and the frame seems to offer a fruitful avenue for future research. It could enable to better understand, if individualistic subjects act as they do because they have a better understanding of economic incentives or, on the contrary, because they are more sensitive to any message that highlights potential gains or losses in social interactions. In other words, they are less likely to bear the cost (or take the risk) of social interactions that are presented as having potential negative externalities.

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Appendices of the discussion of chapters 2 and 3

5.A Perception

The results were transformed to generate a perception score. The ordered logit analysis presented in table 5.A.1, shows that the perceptions of others actions is significantly better in the positive frame. It seems to confirm the conjecture we made about the framing effects on perception. However, it can be objected that the perception is mainly due to a level of cooperation and thus gains that is relatively higher in the positive frame. Nevertheless, in the baseline treatment the positive perception of others actions, represent the double than the negative one, whereas there is no such a difference between the contributions of those two frames. Moreover, we control for the group real cooperation, adding the average of peer contribution by subjects. This variable reduces the framing effect. However, if we pool the levels of answer, only considering : 1) gains, 2) no gains or losses, 3) losses ; the framing effect on perception remain positive and significant (a illustrated in table 5.1). *Symbolic sanctions applied* and *Material sanctions applied* are a dummy variables that is equal to one when respectively material sanctions or symbolic sanctions were available during the experiment. *Average Peer Contributions (sum)* represents the average sum of contributions from the subject's peers (other group members) It seems to confirm the conjecture we made about the framing effects on perception.

TABLE 5.A.1 – Perception of others actions for all framing data (ordered logit analysis).

	(1) QF_Perception_Effects	(2) QF_Perception_Effects	(3) QF_Perception_Effects	(4) QF_Perception_Effects
Framing	0.449**	0.449**	0.546**	0.373*
	(0.202)	(0.203)	(0.215)	(0.220)
Symbolic sanctions applied	0.225	0.910**	0.746	0.737
	(0.284)	(0.453)	(0.464)	(0.467)
Material sanctions applied	0.500*	1.161***	1.018**	0.779*
	(0.288)	(0.447)	(0.458)	(0.464)
Treatment order		-0.432*	-0.359	-0.526**
		(0.223)	(0.226)	(0.230)
SVO_score			0.986*	0.941*
			(0.546)	(0.550)
Gender			-0.363*	-0.416**
			(0.204)	(0.206)
Age			0.00974	0.0183
			(0.0273)	(0.0277)
Understanding			-0.116	-0.185**
			(0.0711)	(0.0736)
Average Peer Contributions (sum)				0.0481***
				(0.00935)
cut1				
_cons	-1.074***	-1.082***	-1.233	-0.737
	(0.268)	(0.269)	(0.838)	(0.849)
cut2				
_cons	0.454*	0.455*	0.341	0.902
	(0.261)	(0.261)	(0.835)	(0.849)
cut3				
_cons	1.172***	1.179***	1.082	1.688**
	(0.268)	(0.268)	(0.837)	(0.852)
cut4				
_cons	3.715***	3.736***	3.661***	4.416***
	(0.377)	(0.379)	(0.878)	(0.901)
N	324	324	324	324

Standard errors in parentheses
* $p<0.10$; ** $p<0.05$; *** $p<0.01$

5.B Strategic understanding

To understand the subjects' strategical understaning of the game, we replicate Fosgaard et al. (2014) final questionnary at the end of the experiment.

There are two kinds of questions, representing two kinds of objectives. The first type of question asks what will be their contribution in order to maximize their own payoffs. The second type of question asks what would be their contribution in order to maximize the group earning. For both objectives, they were presented with two situations concerning the contribution of the other members of the group.

As a result, it seems that subjects do not get the strategical aspect of the game. Indeed, their behavior seem to be driven by reciprocity. All the subjects in the two frames declare that they will not contribute to the public good if others do not contribute for both objectives (individual and group maximization).

Conversely, in both frames a majority of subjects declare that they will fully contribute to the public good if others are full contributors. These results corroborate the fact that subjects behave as conditionnal cooperators.

Nevertheless, it seems that the frame also impacts their stated willingness to reciprocate to others contributions. The percentage of subjects who declare that they will fully contribute is lower in the negative frame.

The questions specified that they had to answer how much they will contribute to public good when there were no sanctions that can be delivered :

FIGURE 5.B.1 – Stated contributions if others fully contribute for all framing data (in order to maximize individual payoff)

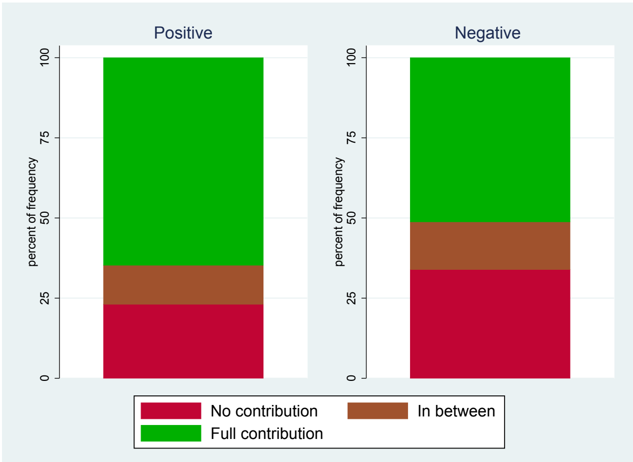

FIGURE 5.B.2 – Stated contributions by type when others fully contribute for all framing data (in order to maximize individual payoff)

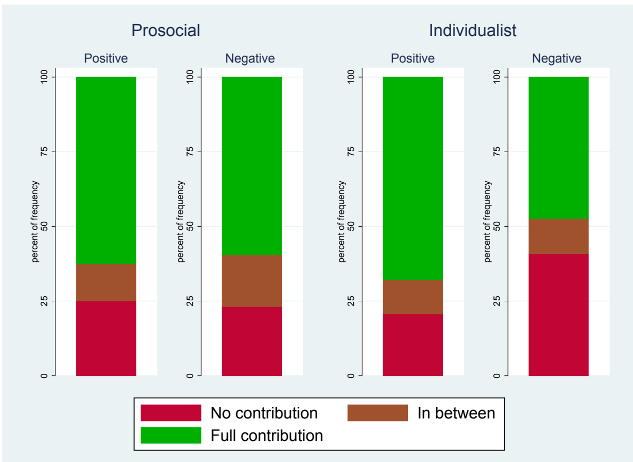

TABLE 5.B.1 – Percentage of stated contribution categories by contributor types, to maximize group payoff when others fully contribute

Data considered	All data		Prosocial		Individualist	
	Positive	Negative	Positive	Negative	Positive	Negative
No contribution	8.97	17.86	14.06	18.84	4.60	16.13
In between	8.33	15.48	6.25	11.59	9.20	18.28
Full contribution	82.69	66.67	79.69	69.57	86.21	65.59

TABLE 5.B.2 – Percentage of stated contribution by contributor types to maximize individual payoff when others fully contribute

Data considered	All data		Prosocial		Introduction	
	Positive	Negative	Positive	Negative	Positive	Negative
No contribution	23.08	33.93	25.00	23.19	20.69	40.86
In between	12.18	14.88	12.50	17.39	11.49	11.83
Full contribution	64.74	51.19	62.50	59.42	67.82	47.31

TABLE 5.B.3 – Kolmogorov-Smirnov test of the conditionnal contribution answer by frame

Data considered	Kolmogorov-Smirnov p-value	
	To maximize individual gain	To maximize group gain
All data	0.102	0.031**
Prosocial individual	1.000	0.886
Individualist	0.046**	0.044**

TABLE 5.B.4 – Mann Whitney test on the average contribution by subject for Baseline in the first sequence (p-value)

Data considered	Mann Whitney p-value
All data	0.133
Prosocial individual	0.333
Individualist	0.486
All data cooperative groups excluded	0.007**
Prosocial individual cooperative groups excluded	0.187
Individualist cooperative groups excluded	0.068*

TABLE 5.B.5 – SVO type number by treatment in Park (2000)'s experiment

Treatment		Prosocial	Individualist	Competitive	Other
Baseline Treatment (All data)	Negative Framing	30	68	1	1
	Positive Framing	34	63	0	3

General conclusion

In this concluding part we firstly sum up the main results of the two lines of inquiry we developed in the thesis, namely i) the effect of the disclosure of individuals' actions in a common pool context and ii) how the way the collective action issue is presented influences group dynamic in a public good context. For these two topics, we propose a debate about the specific limits and potential extensions that could have been done in the laboratory. We strongly believe that the laboratory has considerable advantages in identifying and disentangling the effects of the measure under study, in our case : social information. With the same force we believe that, while this work is absolutely necessary to try to capture generalities in human behavior, it is not sufficient to presuppose the effects of a measure in a given concrete situation. To do so, a deep understanding of the micro situational context is necessary. As we will briefly argue at the end of this discussion, tools and methods to achieve this, have yet to be developed. In the last part of this discussion, we will identify common issues arising from the two themes developed in this thesis on the effect of information on collective action when natural resource management is at stake.

Chapter 1 results and perspectives from the literature

In the first chapter, we show that the mechanism based on the voluntary display of extractions is not efficient to promote cooperation. Nevertheless, in the early periods following its introduction, voluntary disclosure is used to signal a willingness to cooperate. Subjects who are in favour of display have significantly lower extractions than those who are against it. Thus, the effectiveness of communication (cheap talk) in bringing collective action to a successful conclusion is not only explained by the fact that it allows subjects to signal their type, nor by the fact that it allows a majority of subjects to agree on their willingness to disclose their extractions. These voluntary mechanisms cannot influence the increase in extraction when applied alone, and cannot prevent overexploitation of the resource.

In this experiment, we also demonstrate that an important part of the subjects does have social preferences, more precisely preferences for equal sharing. Those preferences lead them to have relatively lower extraction levels. However, these social preferences alone are not sufficient to generate and maintain cooperation. Through the game, the extraction keeps on increasing. This result is nevertheless consistent with the theoretical predictions, which show that preferences for inequality aversion or conformity can lead group extraction to increase when this latter is displayed. The analysis of the extractions' evolution shows that the learning models that best explain group dynamics are : the imitation of the average and the self-interested best response.

Nevertheless, we must highlight that when individuals' extractions are automatically disclosed (Compulsory treatment), we observe a difference in the extraction strategies according to the orientation value of the subjects. This difference cannot be observed when subjects obtain only aggregate extraction. When all extractions are displayed, individualistic subjects are more likely to imitate the *Highest extraction* and are less likely to follow the *Average extraction*. Whereas for prosocial subjects, extraction dynamic is mainly explained by a combination of the imitation of the *Average extraction* displayed and the *Self-interested best response*. To a lesser extent, they also imitate the *Exemplary*. Though, this last strategy is not adopted to a sufficient extent by all group members to affect group extraction dynamics. This adoption of the *Highest extraction* displayed (worst behavior) by some group members gives credit to the thesis that displaying individual extractions and / or individual payoffs can worsen the tragedy of the commons making it faster to appear (Villena & Zecchetto, 2011).

With regard to the limitations and possible extensions of this chapter, it would have been advisable, to study the effects of 1) a complete information (displaying individuals payoffs), 2) an injunctive norm, with information reflecting social expectations of behavior, on group dynamics in the context of a common pool resource management.

Regarding the effect of delivering complete information, Weimann (1994) considers that it does not affect contributions in a public good context. Nevertheless, Bigoni and Suetens (2012) refute this result showing that delivering complete information accelerates the collapse of co-operation. High contributors tend to imitate the best payoffs. In an oligopoly Cournot market experiment, Offerman et al. (2002) also show that delivering a complete information lead to more competitive behaviors. Those results are in line with Villena and Zecchetto (2011), who demonstrate that in a common pool context delivering complete information can worsen common tragedy, accelerating it. It would have been interesting to analyze whether we obtain the same result as Villena and Zecchetto (2011) in our CPR context, which is characterized by dependency on the resource. This analysis would have enabled us to disentangle the potentially different effects of delivering i) aggregated extraction, ii) individual extractions, iii) a complete information, on group dynamics. To achieve such objectives, it might be interesting to introduce these different treatments since the first sequence of the experiment. Indeed, Croson (1995) 's experiment has shown that differences in behavior between treatment where aggregated or individuals' information are displayed can take time to appear. To finish, going a step forward in increasing our knowledge on the motives of self-governance, it would have been interesting to analyze if delivering complete information in a common pool context could impact the efficiency of peer punishment. The starting point for this questioning comes from the experiment of Nikiforakis (2010). In this article, he compared three treatments regarding the feedback delivered to subjects : i) others' contributions, ii) others' earnings and iii) both, and concluded that peer punishment is less efficient when subjects get the individuals' earnings of their peers and especially when they get the two kinds of information. Doing the proposed treatments would have allowed us to determine whether the effectiveness of peer punishment is affected by the type of social information feedback provided in a common pool resource context.

There is evidence that the disclosing of information about the average behavior, also called the descriptive norm, generally leads to convergence of behavior towards it (Ferraro & Price, 2013 ; Schultz, 1999 ; Schultz et al., 2007). Moreover, it should be highlighted that when the feedbacks about others' actions are manipulated, they strongly influence group dynamic (Fleishman, 1988 ; Weimann, 1994 ; Frey & Meier, 2004 ; Croson & Shang, 2008). Subjects are more likely to have a high level of contribution when they are told that others do so, confirming a willingness to conform to the social norm. Schultz et al. (2007) also show that the addition of a symbol which signals to subjects if they have a good or bad behavior regarding social expectation (injunctive social norm), enables to avoid the "Boomerang effect". It would have been interesting to investigate how this nudge may impact behaviors in a common pool context. More widely, it would be interesting to keep on investigating how manipulating social information, for example, by delivering only information about the most virtuous behaviors, impacts subjects' behaviors.

Finally, another research path could be to investigate how these different formats of social information influence behavior according to the social orientations of the subjects. These researches might enable us to identify better what can shatter group' dynamics. We will develop this aspect more in details in the last part of this discussion.

Chapter 2 and 3 results and perspectives from the literature :

Chapters 2 and 3 show that the way to present a collective action issue, by making salient the potential positive vs negative externalities of the social interaction ceteris paribus, influences the willingness to cooperate. Considering all data that composed those chapters 2 and 3, we partly replicate Andreoni (1995b) 's result. Subjects are more willing to contribute to a public good when they perceive that they are doing good ("warm glow") compared to case where they perceive that they are doing bad ("cold prickle"). Nevertheless, the framing effect is strongly dependent on groups' inherent capacity to cooperate, and that is why, as in the give and take frame, this effect is fragile.

The introduction of disapproval ratings, symbolic or materials, enable contributions to the public good to significantly increase compared to Baseline conditions. For the two kinds of sanctions, the determinants of punishment are similar in both frames ; they are mostly driven by comparison to peers' contributions. The less a subject contributes compared to his peers, the more he will be disapproved. Nevertheless, the number of symbolic and monetary sanctions sent are slightly higher in the negative frame. This higher number of sanctions sent is related to a greater dispersion of contributions within the groups.

More interestingly, we find that when monetary sanctions are introduced after a sequence in which subjects were unable to express their disapproval, the frame strongly influences the ability of the group to reach a high level of contribution. The different reaction to sanctions introduction is observed since the first period after their introduction. In the positive frame, a substantial percentage (34 %) of subjects decide to fully contribute, and this percentage keeps on increasing until the last period. Whereas, in the negative frame, the percentage is lower (22 %) and it remains constant. Paradoxically, the number of sanctions sent is higher in the negative frame.

When we try to go further in our understanding of how the frame impacts behavior, it results that it impacts perception and the stated willingness to reciprocate to others' actions. In our experiment, we demonstrate that negative frame of Andreoni (1995b) makes it more difficult for subjects to figure out the payoffs. We make the conjecture that this difficulty participates in the negative perception of the actions of their peers that they obtain through this framing.

Nevertheless, the framing effect cannot be reduced to a lower understanding of economic incentives. It seems important to remind that even in the negative frame, a majority of subjects declare that they would fully contribute if others do so, whereas we never observe such a percentage in groups dynamic. As a consequence, other interesting results is that subjects willingness to cooperate depends on others' contributions, confirming that a majority can be qualified as conditional cooperators, as Fischbacher et al. (2001) showed. Though, it is worth noticing that the percentage of subjects who declared that they will fully contribute if others do so is also affected by the frame. Unconditional free riders are slightly more numerous when the potential negative externalities of social interaction are highlighted (Fosgaard et al., 2014 ; Gächter et al., 2017 ; Gächter et al., Forthcoming). We confirm this result in our experiment.

Additionally, another interesting result, which was initially found by Park (2000), is that the frame seems to affect more strongly subjects who have an individualist social orientation. In the first sequence in Baseline conditions, Individualistic subjects have a lower contribution under the negative frame, whereas we do not observe such a difference for prosocial subjects. Moreover, their stated conditional cooperation is more strongly affected by the frame, as they are significantly less willing to fully contribute under the negative frame. Finally, they are the ones who react differently to the introduction of sanctions in the negative frame as they are less willing to imitate the best behavior displayed. To sum up, how the issue of collective action is presented and perceived strongly affects group dynamics. When monetary sanctions are introduced, negative framing strongly restricts the ability of groups to converge towards a full contribution, while the number of prosocially oriented subjects is equivalent in both frameworks. Therefore, the number of subjects willing to bear the cost of cooperation should be the same.

As far as limitations and possible extensions are concerned, we could have better determined the effects of framing, if our database was drained of groups that cooperate fully without any mechanism, even though they are mainly composed of individualistic subjects. These results are particularly odd and questioning. Also, to better understand how the frame affects group dynamics, it would be interesting to display individual actions in the Baseline conditions. This would also increase the comparison with treatments in which disapproval ratings are introduced and for which individual actions are displayed. Furthermore, to improve our understanding of the effects of framing, it would be necessary to elicit subjects' beliefs about the actions of others. Framing has been shown to have a consistent effect on beliefs (Dufwenberg et al., 2011 ; Fosgaard et al., 2014 ; Gächter et al., 2017). Moreover, if we consider, as our learning analysis tends to confirm it, that subjects conform to others' action and in a lesser extent best reply to them ; then their belief about others' actions must strongly influence their behaviors. More investigations are needed to better understand how the frame may affect the expected or reprehensible behavior (Kahneman, 1992). Integrating the judgment test as defined by Cubitt et al. (2011) in Andreoni (1995b)'s experiment, could be a lead. To finish, it would be interesting to further investigate how the framing affects behavior depending on subjects' types. Doing so, we will have more insights to confirm that individualistic subjects are particularly sensitive to the change of perception created by the frame. This brings us to the common questions arising from the lines of inquiry developed in this thesis.

Common questions and proposed extensions :

In this last part, we will discuss the common findings resulting from the three chapters of this thesis. Namely, the effect of social preferences in collective action and how they influence the way subjects react to the information displayed. For each of them, we confront them to the literature, and finally, we propose further paths of investigations.

Conditional cooperation, conformity and social preferences as drivers of the group's dynamic

A common result which appears from those three chapters is that the behavior of the majority of subjects depends strongly on the behavior of their peers. That is why they can be qualified as conditional cooperators (Fischbacher et al., 2001). A recent comparative study shows that this behavioral pattern is replicable and therefore, a consistent result (Thöni & Volk, 2018). This behavior can be qualified as a taste of conformity because subjects conform to others' actions. Our learning analysis also shows that in both, common-pool resource and public good issues, the taste of conformity (i.e. the imitation the average action), is a reliable driver of group dynamics.

Furthermore, our results also make salient that social preferences are an important driver of collective action issues. Subjects with prosocial preferences are more likely to cooperate in both common pool and public good issues. Those results are in line with both experimental and theoretical results, which pledge for the consideration of social preferences as an important driver for group dynamics. Fischbacher and Gächter (2010), in a public experiment conducted under stranger conditions, demonstrate that (i) the type of subjects, defined by their willingness to contribute depending on the contributions of others (Fischbacher et al., 2001) ; and (ii) the fact that subjects update their beliefs about the actions of others in a non-naïve way, explain the observed decrease in contributions. In other words, taking into account how different subjects declare that they will react (reciprocate) to the actions of others and how they update their beliefs, helps to explain group dynamics when there is no mechanism to foster cooperation. Ambrus and Pathak (2011) propose to explain the initial contribution and their progressive decrease through the heterogeneity of the subjects' social preferences.

These findings raise the question of the potential link between social preferences and the taste for conformity. More specifically : Is the willingness to conform to the social norm a result of social preferences or the reverse ? This point calls for much more evidence before being able to state an explanation. Considering our results, we will be tempted to give credit to the arguments developed by Fehr and Williams (2018). They state that the will to conform, the norm of conditional cooperation, cannot explain : i) the will to punish free-riders ii) the preferences for a context that allows peer punishment. That is why they consider that "*norm compliance arises if individuals have an intrinsic desire for equity or fairness*". Our learning analysis shows that when individuals' extractions are displayed, prosocial individuals have a higher tendency to continue to conform to the average extraction displayed and in a lesser extent to best reply to it. This behavior is consistent with the imperfect conditional cooperation behavior. Conversely, individualistic subjects have a higher tendency to imitate the worst extraction displayed, and they seem more sensitive to perception bias in the way they react to peer pressure.

Based on these results, we consider that more attention should be given on how social preferences can explain group dynamics. More particularly, if we consider that a substantial percentage of subjects is driven by a desire or fairness and conformity ; the following question arises : "How can we build institutions that regulate the actions of less prosocial individuals ?" Besides the actions that change monetary incentives, it would be interesting to go further in the investigation on the effect of non-monetary incentives and more particularly information effects such as complete information or injunctive norm.

Information details, heuristics and subjects' type

As our computational capacity is limited, we can make the hypothesis that giving more information about the structure of the game can change the behavior. Some will say that Apesteguia (2006), seems to contradict this rule, as he considers that giving or not giving information about winnings leads subjects to reach Nash's equilibrium in all cases. Nevertheless, the information he delivers in his two treatments is limited. In one case, there is no information at all and, in the other case, there is a basic description of the payoff function and some illustrations. He is not delivering the payoff structure, i.e. the details about how their earnings will change according to their actions but also the actions of others.

Besides, Saijo and Nakamura (1995) show that when subjects have relatively low information about the payoff structure, they are more likely to be spiteful. It means that they are less willing to contribute even when it is a dominant strategy. Instead, they are more sensitive to social comparison (the ranking among them). Additionally, Ramalingam et al. (2018) recently demonstrated that in a VCM, shorter instructions lead to a lower contribution level and a relatively higher level of punishment. Those are important results, as in real life, cases in which subjects can have in mind the full payoff matrix are rare. So we have to take into consideration that, in most of the situations, people are likely to be more spiteful and paying more attention to social comparison than what theory predicts. This sensitivity to social comparison is corroborated by the experiment of Andreoni (1995a), who shows that adding information on the subject's ranking in a VCM reduces the subjects' contributions. In other words, when they have information that explicitly makes a social comparison, they are less likely to cooperate.

In another experiment, Huck et al. (2017) show that in a complete information situation, the fact to enable subjects to calculate what would have been their payoffs in the previous period for alternative choices leads to less cooperative behaviors. For these results, we consider that more attention should be paid to the format in which the information is provided (whether or not to add the earnings matrix, whether or not to allow subjects to calculate their earnings). It will allow us to better understand what type of information can reduce the "spite effect" or, on the contrary, make subjects less cooperative.

Moreover, we consider that these results reinforce the intuition that the provision of social information can have a significant impact on behavior ; and that it is useful to deepen our understanding trying to disentangle its effects. It would be interesting to better figure out how the different types of information (aggregated, individual actions, complete information and the addition of an injunctive dimension) influence the subjects' willingness to cooperate by distinguishing them by their social orientation. A field experiment shows that manipulating the aggregated information might mainly affect the behavior of subjects that could be qualified as conditional cooperators (Frey & Meier, 2004). Further investigations need to be conducted to understand how different types of subjects react to various kind of information that might modify their perceptions about others' action. To this end, continuing to study learning analysis to better study subject heuristics may be an interesting line of research.

Further investigation paths to characterize a given context.

Cultural contexts strongly influence social preferences. Through a cross-cultural study, Henrich et al. (2004), demonstrated that social preferences (measured via dictator and ultimatum games) reflect people connection through a market and their social dependency. Whalers, whose survival depends on others, had the highest social preferences ; while isolated hunter-gatherers had the lowest. Moreover, Andersen et al. (2008) show that the cultural context could have a strong influence on the contribution behavior in a voluntary contribution mechanism. They observe a significantly lower percentage of free riders in Matrilineal society. This difference is mainly driven by men, who are more cooperative in a matrilineal society. Another interesting result is that the context influences subjects' sensitivity to the way the collective action issue is framed. In nonmatrilineal societies, subjects' contributions are lower in the negative frame as defined by Andreoni (1995b). While there is no difference in contribution between the two framing for matrilineal societies. Besides these extreme cases, this study calls for a better understanding of how the cultural context shape social preferences and so subjects willingness to reciprocate. As we showed, social preferences might be important elements to take into consideration as they can influence how subjects react and use social information.

Moreover, it seems important to better figure out the perceptions people have about the collective action issue they are facing and of others' action effect. These perceptions might impact their willingness to cooperate and the regulatory mechanisms they are in favor of (Alesina et al., 2018). Also, perceptions might have an impact on how they respond to peer pressure or peer punishment. We demonstrate that the perception created by the frame can impact the way subjects react to peer punishment. More widely, Nikiforakis (2010) demonstrated that the kind of information delivered concerning others' actions also has an important influence on the efficiency of peer punishment. It is worth noticing that these different effects due to different perception or social information displayed do not always appear when there are no mechanisms that may foster cooperation, but they clearly appear when they are introduced. As a consequence, investigations are needed to better understand how, in a given context, subjects perceive the functioning of the collective action issue they are facing, others' actions effects and what they consider to be the sustainable and acceptable behavior.

Additionally, in most of the common pool or public good real situations, people are heterogeneous regarding their endowment and production functions. More has to be understood regarding how this heterogeneity might affect collective action issue, through : i) their perception of others' actions effects, ii) their willingness to cooperate, iii) the way they define the acceptable behavior and iv) their reaction to social information. Indeed, there is heavy reason to think that this heterogeneity might make the definition of a sustainable and acceptable behavior more complex. Finally, in most concrete actions issues regarding natural resource management, subjects are facing risk and uncertainty, which impact their payoffs. More investigations are needed to better understand how these aspects might impact group dynamic, and more particularly, how they might interact with social information delivered. Social information might change subjects' beliefs about others' actions, and what they perceive to be the desirable behavior, thereby reinforcing the social norm. Cialdini et al. (1990) defined norms as : « *sets of beliefs about what other people are doing or what they approve or disapprove of doing*». Moreover, several experiments show that the more subjects trust others, the more they are likely to adapt their behavior in case of resource variation and uncertainty regarding this latter (Brann & Foddy, 1987 ; Baggio et al., 2015). These results call for more investigations regarding how different informational systems might help to manage natural resources, in a global context where risk and uncertainty will increase due to climate change.

To conclude, this thesis provides new evidence that delivering social information and the way the collective action is presented, and so perceived through the way it is framed, impact groups capacity to cooperate. Moreover, it also sheds light on the fact that social preferences are important drivers of group dynamics, bringing explanations of why delivering detailed information about subjects' actions can worsen the tragedy of the commons. It invites us to develop further investigations on how different kinds of social information such as a complete information, adding injunctive norm, ranking or more detailed information about the payoff might promote virtuous behaviors or at the contrary increase the competitive ones. Considering that most of the subjects are conditional cooperators, this findings will help to better identify what type of information (in nudges) leads to cooperative behaviors. Finally, this may enable to identify what kind of social information could be provided to strengthen the trust, and thus the social capital, of resource-dependent groups.

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Traductions en français

Introduction générale

La plupart des ressources naturelles sont surexploitées et leur gouvernance nécessite la mise en place d'une action collective. Cependant, comment promouvoir et maintenir l'action collective est l'une des questions économiques les plus débattues. Dans un contexte de production d'un bien public tout comme dans la gestion d'une ressource commune, lorsque l'intérêt individuel entre en conflit avec l'intérêt collectif, la coopération survient difficilement. L'individu est incité à ne pas supporter le coût de la contribution, ou à en extraire le plus possible, alors que l'intérêt du groupe est de réguler le comportement afin de fournir et de maintenir la ressource. En conséquence, cela conduit théoriquement à une sous-provision dans le cas d'un bien public (Olson, 2009), et la surexploitation de la ressource commune, également connue sous le nom de "tragédie des biens communs" dans le cas de la gestion d'une ressource commune (Hardin, 1968).

Réfutant ces conclusions, Ostrom (1990), dans son travail séminal, démontre que les groupes locaux sont capables de gérer durablement des ressources communes sans une définition stricte de la propriété ou du contrôle de l'État. Sur la base de ce travail, elle a identifié huit principes de gouvernance qui permettent d'éviter la tragédie des biens communs : (i) une définition claire des limites du groupe, (ii) une répartition proportionnelle des coûts et des bénéfices, (iii) des arrangements établis sur une base collective, (iv) la mise en place d'un système de surveillance et de contrôle, (v) l'établissement de sanctions graduées, (vi) l'existence d'un mécanisme de règlement des différends à bas coûts, (vii) la reconnaissance du droit d'organisation, (viii) l'application de ces règles à des échelles multiples (entreprises imbriquées). Allant plus loin dans les recherches sur la manière dont les aspects comportementaux pourraient expliquer pourquoi les groupes réussissent ou échouent à coopérer, elle a été une pionnière dans l'utilisation de l'économie expérimentale pour étudier ces aspects. Grâce à ses travaux, elle a démontré que des mécanismes qui ne devraient pas avoir d'incidence sur la dynamique de groupe, tels que la communication ("cheap talk"), permettent aux groupes de générer et de maintenir la coopération (Ostrom et al., 1994). Dans la continuité de ces travaux, les progrès de l'économie comportementale et expérimentale révèlent que d'autres mécanismes sont également efficaces pour générer et maintenir la coopération, tels que : les sanctions monétaires (Fehr et Gächter, 2000), les sanctions symboliques (Masclet et al., 2003) et la récompense (Sefton et al., 2007). Ces mécanismes sont basés sur l'expression de l'approbation ou de la désapprobation des actions d'autrui et ne devraient pas avoir d'impact sur le comportement si nous avons une interprétation restrictive de l'intérêt économique. Néanmoins, ils sont présents dans la plupart des fonctions de groupe.

Poursuivant les travaux d'Ostrom, Dietz et al. (2003) considèrent que pour parvenir à une gouvernance efficace, il est, entre autres, nécessaire, que i) les informations sur les ressources et les actions des utilisateurs soient disponibles à un faible prix ; et ii) les communautés maintiennent une communication fréquente et un réseau social dense (capital social). La question de l'effet de ces dimensions sur la capacité effective des communautés à maintenir une ressource est très actuelle et de première importance. Institutions impliquées dans la gestion des ressources mettent progressivement en place des systèmes qui délivrent des informations sur les actions des utilisateurs et l'état des ressources afin de faciliter leur gouvernance.

Par exemple, en termes de gestion de l'eau, la Compagnie d'Aménagement des Coteaux de Gascogne (CACG), qui est un organisme qui distribue de l'eau aux agriculteurs pour l'irrigation, a mis en place un système connecté conçu pour mieux identifier la consommation réelle de leurs utilisateurs (et leur calendrier) et ainsi optimiser leur gestion. En effet, dans le cadre de la loi sur l'eau de 2006 et du décret d'août 2007, la CACG doit veiller à ce que les engagements pris pour atteindre un bon état écologique des cours d'eau soient respectés. A ce titre, elle doit veiller au maintien d'un débit minimum ("Débit Objectif d'Etiage" et a fortiori un "Débit de Crise") dans les milieux impactés par les prélèvements dédiés à l'irrigation. La mise en place de compteurs télérelevés permet d'obtenir des informations plus précises (quotidiennes) sur les besoins (retraits réels) des agriculteurs et leurs temporalités. Ces informations doivent permettre à l'entreprise mieux gérer les prélèvements dans ses différents réservoirs d'eau. En effet, si les lâchers ne correspondent pas aux besoins, l'eau fournie n'est pas utilisée par les agriculteurs et n'est donc pas facturée. En outre, cette eau non utilisée est rendue au milieu. Elle n'est plus distribuable ce qui risque de générer une pénurie à la fin de la saison agricole, lorsque le manque d'eau se fait généralement plus ressentir. La fonction initiale du système est ici de faciliter la coordination entre les actions du gestionnaire et celles des agriculteurs. La mise en œuvre de ce système et son acceptation a été fortement influencée par les différents niveaux de pression sur la ressource. C'est un instrument qui contribue à la création d'une nouvelle relation entre l'eau et la société (Burger-Leenhardt et al., 2018 ; Collard et al., 2019). En effet, il a également été utilisé pour diffuser des informations sociales, en affichant le taux moyen de consommation d'eau.

Un autre exemple est la mise en place d'une plateforme d'information appelée Système d'Information sur l'Eau du Marais Poitevin (SIEMP) par l'Etablissement public de l'eau et de la biodiversité sur le Marais Poitevin (EPMP). L'EPMP est un établissement public dont la mission est de coordonner la gestion de l'espace géographique appelé Marais Poitevin. Il a été créé suite à la condamnation de la France par l'Europe en raison de la dégradation de l'environnement en 1999 (non respect de la Directive Oiseaux). Cette dégradation a été générée par un fort développement de l'irrigation dans cette zone, qui est maintenant identifiée comme générant une forte tension sur la ressource en eau (Zones de Répartition des Eaux (ZRE)). Cette zone se caractérise par une forte diversité des acteurs impliqués dans la gestion de l'environnement (associations de protection de la nature, pêcheurs, associations de syndicats de marais, services de l'Etat, collectivités locales, etc). Le système d'information SIEMP fournit des informations sur l'état de la ressource mais aussi sur les prélèvements collectifs actuels des agriculteurs à tous les acteurs concernés ; il est divisé en deux parties. Le premier système est dédié au grand public et fournit des informations sur l'état des ressources. Il a pour objectif de permettre une meilleure compréhension du fonctionnement du Marais Poitevin et ainsi de créer un climat de confiance et de faciliter le dialogue entre les différents acteurs concernés. La deuxième partie est consacrée aux acteurs impliqués dans l'établissement des règles de gestion. Ce second système leur permet surveiller les niveaux d'extraction réels du groupe d'agriculteurs.

De nombreux questionnements émergent du fait de la mise en œuvre de ce type de systèmes d'information. Par exemple, le fait de fournir des informations sur les actions d'autres utilisateurs facilitera-t-il la gestion d'une ressource ? De nombreuses questions se posent également sur la forme, le niveau de détail et la manière dont ces informations doivent être fournies et sur leurs effets. Comment ces informations seront-elles utilisées par l'individu ? Ces informations peuvent-elles modifier ses comportements ? En d'autres termes, ces informations peuvent-elles favoriser l'émergence d'une norme de coopération, ou au contraire la rendre plus difficile ? De plus, quelle peut être l'influence de la perception des sujets de l'effet des actions des autres sur la capacité du groupe à coopérer ? Cette interrogation découle des résultats d'Andreoni (1995b), qui souligne que les sujets sont plus disposés à coopérer lorsqu'ils perçoivent les actions des autres comme ayant des effets positifs que lorsqu'ils les perçoivent comme ayant des aspects négatifs. Enfin, dans quelle mesure cette perception, créée par les informations fournies dans le framing d'Andreoni, peut interagir avec la capacité du groupe à coopérer ?

Cette thèse vise à apporter de nouvelles perspectives concernant les effets de la fourniture d'informations sur les actions des utilisateurs sur la gestion des ressources naturelles, dans des contextes de ressource commune et de bien public. Nous concentrons plus particulièrement notre étude sur l'effet de l'information sur les actions des pairs et leurs effets potentiels sur la dynamique de groupe. Nous analysons d'abord l'effet de l'affichage d'informations sociales selon différentes modalités sur la dynamique de groupe. Dans une deuxième partie, nous examinons l'effet de la perception que les sujets ont des actions des autres sur la dynamique de groupe en présentant les actions de leurs pairs comme ayant des externalités potentielles positives ou négatives. Dans cette partie, nous analysons plus particulièrement comment l'effet de framing interagit avec les mécanismes qui sont fréquents dans les dynamiques de groupe, tels que la pression des pairs et la punition des pairs. L'effet de l'interaction du framing avec ces deux mécanismes compose respectivement nos chapitres 2 et 3. De plus, à travers toute la thèse, nous essayons d'analyser comment les préférences sociales affectent la sensibilité des sujets à l'information sociale. Les questions soulevées par ces trois aspects seront présentées plus en détail dans les paragraphes suivants.

Information sociale

Nous considérons que la non-exclusivité et la rivalité sont à la source de la plupart des problèmes liés à la gestion des ressources naturelles. En conséquence, nous choisissons dans notre premier chapitre un jeu qui représente une ressource commune. Nous adoptons pour notre analyse le protocole établi par Herr et al. (1997) qui représente une gestion des eaux souterraines. Ce chapitre est consacré à l'analyse de l'effet de l'information sociale. Plus précisément, nous analysons l'effet d'afficher les actions des individus sur la dynamique de groupe.

Dans son cadre conceptuel comportemental, Ostrom (1998) affirme que la diffusion d'informations sur l'action des autres membres du groupe est nécessaire pour établir confiance et réputation. Elle considère comme des facteurs déterminants pour le succès de la coopération du groupe. Cependant, de nombreux travaux de terrain ont montré que la diffusion d'informations sur les actions des autres utilisateurs, loin de générer une augmentation de la coopération, induit une convergence des comportements vers le comportement moyen affiché (Schultz, 1999 ; Schultz et al., 2007 ; Croson & Shang, 2008 ; Ferraro & Price, 2013). Des travaux expérimentaux démontrent également que l'affichage d'actions individuelles, ou de gains individuels (informations complètes), peut aggraver l'action collective, car les sujets sont plus tentés d'imiter le comportement le plus compétitif affiché (Carpenter, 2004 ; Offerman et al., 2002 ; Villena & Zecchetto, 2011 ; Bigoni & Suetens,2012).

Afin d'éclairer la question de l'effet des informations sociales sur la gestion des ressources communes, et plus précisément sur l'effet de l'affichage des actions des individus, nous comparons des traitements dans lesquels seule l'extraction agrégée du groupe est affichée avec un traitement dans lequel les extractions individuelles sont affichées. En outre, nous analysons l'effet de différentes modalités dans la manière de fournir des informations sociales. Kreitmair (2015) soutient que la dimension volontaire de la divulgation d'informations peut jouer un rôle important dans la volonté de coopérer. Dans son expérience sur la contribution au bien public, elle propose un mécanisme qui permet aux sujets de signaler leur volonté de rendre publique leur propre action avant de faire leurs choix. De plus, comme le montre l'expérience de Chaudhuri et Paichayontvijit (2006), les sujets contribuent davantage lorsqu'ils sont informés qu'une majorité de sujets de leur groupe sont prêts à le faire. Nous décidons donc d'ajouter une dimension majoritaire dans ce mécanisme de divulgation d'informations. Grâce à ces traitements, nous testons si la dimension volontaire permet aux sujets de signaler leur volonté de coopérer. Ces traitements nous permettent de fournir des résultats sur la manière dont la volonté d'afficher l'extraction des sujets est liée à une volonté de coopérer en réduisant leurs extractions. En d'autres termes, ces résultats nous permettent de mieux comprendre si la dimension volontaire est utilisée comme un signal de la volonté de coopérer. Par ailleurs, ce travail nous permet de mieux connaître l'effet d'avoir une majorité de sujets déclarant leur volonté de rendre leurs actions publiques sur la capacité du groupe à coopérer.

Enfin, nous analysons l'impact de la fourniture informations sociales en divulguant les actions des individus sur la dynamique des groupes. Plus précisément, nous examinons si le fait de fournir des informations agrégées ou individuelles a un impact sur les stratégies d'extraction. Pour ce faire, nous utilisons l'analyse de l'apprentissage telle que définie dans Huck et al. (1999), qui détermine quelles stratégies expliquent le mieux les changements de contributions d'une période à l'autre. Pour établir les différentes stratégies d'extraction, nous adaptons celles définies dans Villena et Zecchetto (2011), qui est le premier article qui examine l'effet de l'apprentissage dans un contexte de ressources communes. Le chapitre 1 donne des indications pour comprendre les moteurs de la dynamique de groupe et comment le niveau d'agrégation concernant les informations sociales divulguées peut l'influencer. En d'autres termes, nous fournissons de nouveaux résultats pour comprendre comment les sujets peuvent modifier leurs stratégies d'extraction en fonction du type d'informations disponibles concernant les actions des autres.

Dans la suite de la thèse, nous analysons une autre dimension des effets de la fourniture d'informations sociales. Nous examinons comment les informations fournies pour décrire les questions d'action collective et les effets des actions par les pairs ont un impact sur la coopération de groupe et l'efficacité des mécanismes qui sont identifiés comme favorisant la coopération.

Présenter les actions des autres comme ayant des externalités positives ou négatives et des mécanismes de désapprobation

De nombreuses expériences démontrent que la manière de présenter un problème d'action collective influence fortement la coopération de groupe (Andreoni, 1995b ; Cox, 2015 ; Cubitt et al., 2011a ; Cubitt et al., 2011b ; Dufwenberg et al., 2011 ; Fosgaard et al., 2014 ; Fujimoto & Park, 2010 ; Messer et al., 2007 ; Messer et al., 2013 ; Gachter et al., 2017). Dans la plupart des cas, les sujets sont plus disposés à contribuer lorsque l'interaction sociale est décrite comme ayant des externalités positives plutôt que négatives. Dans son expérience, Andreoni (1995b) démontre que les sujets sont plus disposés à coopérer lorsqu'ils perçoivent qu'ils font du bien que lorsqu'ils perçoivent qu'ils font du mal. Il conclut que l'effet du "warm glow" est plus efficace pour promouvoir la coopération que l'effet "cold prickle". Nous analysons si cette perception peut interagir avec les mécanismes qui sont présents dans la plupart des groupes et qui ont prouvé leur efficacité pour favoriser la coopération : la désapprobation par les pairs.

Par désapprobation des pairs, nous entendons un mécanisme qui permet aux sujets d'exprimer leur insatisfaction/ désaccord avec les actions d'autres individus de leur groupe (leurs pairs). La punition par les pairs (Fehr & Gächter, 2000 ; Ostrom et al., 1994) et la pression des pairs (Masclet et al., 2003) ont démontré leur efficacité pour promouvoir et maintenir la coopération. Considérant que les individus sont strictement égoïstes, ils ne devraient pas supporter le coût de l'envoi de sanctions monétaires et ne devraient pas non plus modifier leur comportement lorsqu'ils reçoivent la désapprobation symbolique d'autrui (pour les sanctions symboliques). Cependant, des preuves expérimentales démontrent que lorsque ces mécanismes sont introduits, la majorité agit de manière coopérative alors que ce n'est pas le cas lorsqu'ils sont absents. Fehr et Fischbacher (2004) affirment que les sanctions permettent d'activer une norme sociale de coopération. Néanmoins, l'expérience de Messer et al. (2013) montre que des mécanismes tels que la communication et d'autres mécanismes de "cheap talk" sont moins efficaces dans un framing qui met en évidence les aspects négatifs des interactions sociales. Dans les chapitres 2 et 3, nous examinons si l'efficacité des mécanismes de désapprobation et la norme commune de coopération qu'ils activent pourraient être affectés par le framing.

Pour ce faire, nous reproduisons strictement les framings de l'expérience de contribution volontaire créée par Andreoni (1995). Nous distinguons ainsi un framing positif qui met en évidence l'externalité positive potentielle de l'interaction sociale et un framing négatif qui met en évidence l'externalité négative potentielle de cette dernière. Pour ces deux framings, nous ajoutons la possibilité d'envoyer des sanctions symboliques au chapitre 2 et des sanctions monétaires au chapitre 3 (entre les conditions). Nous contrôlons également l'effet d'ordre de ces mécanismes de désapprobation en les introduisant dans la première séquence ou dans la deuxième séquence en fonction du traitement.

Ces deux chapitres fournissent de nouveaux résultats concernant l'effet de cadrage d'Andreoni sur la contribution des groupes et les facteurs qui peuvent expliquer sa fragilité. De plus, nous apportons de nouvelles perspectives sur la robustesse des mécanismes de désapprobation aux changements contextuels. Notre travail permet de mieux comprendre comment la mise en évidence des externalités positives ou négatives de l'interaction sociale influe sur la volonté de désapprobation, la réaction à la désapprobation et, par conséquent, sur la capacité du groupe à définir une norme de contribution. Nous fournissons également de nouveaux résultats qui sont cohérents avec ce qui est identifié comme les principaux effets du framing, à savoir la perception (ou la mauvaise perception) et la réciprocité.

Enfin, à travers toute cette thèse, nous analysons comment la préférence sociale des sujets pourrait affecter leur réponse à l'information sociale.

Préférences sociales

Si la compréhension stratégique et la confusion sont des explications importantes de la coopération de groupe, Andreoni (1995a) nous invite également à considérer les préférences sociales comme des moteurs importants de la dynamique de groupe. Dans cette thèse, nous analysons tout d'abord comment les préférences sociales influencent la coopération tant au niveau des ressources communes que des biens publics. Pour ce faire, dans toutes les expériences présentées, nous mesurons l'orientation des sujets vers les valeurs sociales à l'aide du test de Murphy et al. (2011). Cela permet d'obtenir un score individuel d'orientation vers les valeurs sociales qui reflète la préférence des sujets pour un partage, et donc d'analyser leur effet sur le comportement coopératif.

De plus, dans le contexte du bien public et de la ressource commune, nous mettons en lumière la manière dont les préférences sociales interagissent avec les informations sociales. Plus précisément, nous analysons comment les préférences sociales peuvent interagir avec la réaction à la divulgation d'informations sur les actions d'autrui. Ensuite, nous analysons comment les préférences sociales interagissent avec la façon dont la problématique d'action collective est présentée. En d'autres termes, l'orientation sociale des sujets influence-t-elle de manière positive ou négative leur réaction à la présentation de l'action collective ? Dans cette réplique du framing d'Andreoni (1995b), les incitations économiques restent strictement identiques.

Dans le premier chapitre, nous développons un cadre théorique pour identifier comment les préférences sociales telles que l'altruisme (Levine, 1997), la réciprocité (Sugden, 1984), l'aversion pour l'inégalité (Fehr & Schmidt, 1999) ou le goût du conformisme (Luzzati, 1999) peuvent influencer la manière dont les individus réagissent à la divulgation des actions d'autrui. En même temps, nous effectuons une analyse de l'apprentissage afin de déterminer comment les individus modifient réellement leurs stratégies en fonction des informations disponibles. De plus, comme Bigoni et Suetens (2012), nous allons plus loin dans cette analyse de l'apprentissage en distinguant différents types de sujets. La principale différence réside dans le fait que nous utilisons les catégories définies par le test de Murphy et al.(2011) pour établir les différents types. Cette analyse nous permet de fournir de nouvelles preuves sur la manière dont les préférences sociales influencent la façon dont les sujets réagissent aux informations sur les actions des autres.

Dans les chapitres 2 et 3, nous analysons comment les préférences sociales influencent la volonté de réciprocité selon le framing. En effet, Park (2000) constate que les orientations des valeurs sociales influencent la façon dont les sujets réagissent au framing. L'analyse globale des chapitres 2 et 3 fournit des résultats concernant l'impact de l'orientation sociale sur la sensibilité des sujets à un framing qui met en évidence les externalités positives et négatives potentielles des interactions sociales. En outre, nous fournissons de nouveaux résultats qui permettent de mieux comprendre comment ces préférences sociales influencent leurs volonté de réciprocité en fonction du framing.

Enfin, Fehr et Schmidt (1999) démontrent que, lorsque des sanctions matérielles sont appliquées, la pleine contribution au bien public peut être un équilibre. Nous fournissons des résultats qui montrent qu'il peut être affecté par le framing. En d'autres termes, le chapitre 3 fournit des résultats permettant de mieux comprendre comment le framing pourrait affecter la capacité du groupe à converger vers la pleine contribution lorsque des sanctions matérielles sont appliquées. Pour mieux comprendre ces résultats, nous analysons comment les sujets réagissent à l'introduction des sanctions, en changeant leurs stratégies d'extraction, en distinguant les sujets en fonction de leur valeur d'orientation sociale.

En résumé, cette thèse contribue à la littérature en apportant des éléments sur l'impact de l'information sociale sur la dynamique des groupes face aux dilemmes sociaux. Dans une première partie, nous analysons les effets de la diffusion d'informations sociales sur l'extraction dans le contexte d'une ressource commune. Dans une deuxième partie, nous analysons les effets d'un cadrage mettant en évidence respectivement les effets positifs ou négatifs des actions des pairs sur la contribution à un bien public. Pour chacune de ces deux parties, nous accordons une attention particulière à la manière dont les préférences sociales influencent d'une part la volonté de coopérer et d'autre part la réaction à l'information sur les actions des pairs et leurs effets.

Chapitre 1

Résumé

La gestion d'une ressource naturelle, plus particulièrement d'une ressource en eau, renvoie le plus souvent à une problématique de gestion d'une ressource commune. Dans ce cadre, Ostrom (1998) et Dietz (2003) mettent en avant l'importance de diffuser des informations sur les actions des co-usagers de façon à faciliter sa gouvernance. Néanmoins, nombre d'expériences montrent que loin de faciliter la coopération, la diffusion d'information sociale a pour effets d'induire la convergence vers le comportement moyen (Ferraro & Price, 2013 ; Schultz, 1999 ; Schultz et al., 2007 ; Croson & Shang, 2008), ce qui peut accélérer la prédation de la ressource (Janssen, 2013 ; Janssen et al., 2014 ; Villena & Zecchetto 2011).

Dans cette expérience, nous cherchons à déterminer l'effet de la révélation d'informations sociales sur l'extraction d'une ressource commune. Pour ce faire, nous reproduisons l'expérience de Walker et al. (2000) qui décrit le fonctionnement d'une nappe phréatique, et nous testons les effets de différents niveaux d'information sociale (agrégée, individuels) et différents mécanismes de partage de cette dernière (volontaire, majoritaire ou obligatoire) (Kreitmair, 2015).

Nous produisons également un cadre théorique pour déterminer comment, en raison des différentes préférences sociales, la diffusion d'informations sociales peut induire différents effets de sur la dynamique d'extraction. Enfin, nous étudions comment les différents niveaux d'information fournis affectent les changements d'extraction effectifs en mobilisant les modèles d'apprentissage tel que définis par (Huck et al., 1999 ; Bigoni & Suetens, 2012).

Il ressort, au niveau agrégé, que les différents traitements donc les différents types d'information sociale fournis n'améliorent pas la gestion de la ressource. L'ensemble des groupes abouti à un niveau d'extractions proche de l'équilibre de Nash. Le cadre théorique fournit un élément d'explication en montrant que lorsque les sujets ont des préférences pour la réciprocité ou pour la conformité, cela peut induire une augmentation de l'extraction. L'analyse des modèles d'apprentissage confirme ce résultat en montrant que le goût pour la conformité ainsi qu'une best-reply strictement individualiste sont des moteurs importants de la dynamique d'extraction. Ces analyses montrent également que lorsque l'ensemble des extractions individuelles sont affichées, les individus ayant des orientations individualistes ou compétitives, estimées d'après le test de Murphy et al. (2011) ont tendance à imiter les comportements les plus extractifs.

Ces résultats montrent l'importance de la dynamique d'imitation et du goût pour la conformité dans les dynamiques de groupes. Ils nous invitent à mieux prendre en compte les préférences sociales pour comprendre les effets de la diffusion d'information sociale et plus précisément de l'impact des différents types feedback sur la gestion des ressources naturelles.

Mots clefs : ressource commune, information sociale, feedback, partage volontaire

Chapitre 2

Résumé

Andreoni (1995) a montré que des effets de framing peuvent influencer la contribution dans les mécanismes de contribution volontaire (MCV) en comparant un jeu de biens publics appelé condition de framing positive, avec une condition de framing négative. Les contributions au compte de groupe (bien public) sont plus élevées lorsque l'interaction sociale leur est présentée comme générant des externalités positives plutôt que négatives. Andreoni (1995) défend l'idée que les sujets préfèrent faire du bien aux autres ("warm glow") que faire du mal ("cold prickle").

Ce chapitre étudie si ces effets de framing influencent l'efficacité de mécanismes qui se sont avérés favoriser la coopération, en particulier la pression exercée par les pairs. Il y a à ce jour peu de connaissances sur ce sujet. Messer et al. 2013 ont démontré que l'efficacité de mécanismes qualifiés de cheap talk tels que la communication et le vote est moindre lorsque le mécanisme de contribution volontaire est présenté en utilisant un framing négatif. Notre expérience varie à la fois du fait du framing utilisé mais également de la possibilité ou non d'envoyer des désapprobations symboliques qui sont gratuites pour l'expéditeur et le destinataire.

Nous n'avons pas reproduit les conclusions d'Andreoni dans cet ensemble de données. Cela s'explique en partie par le fait trois groupes ont des niveaux de contributions significativement plus élevés que les autres, et ce sans qu'aucun mécanisme favorisant la coopération soit mis en place. Mais il en résulte également que l'effet du framing d'Andreoni est fragile et dépend fortement de la volonté inhérente du groupe de coopérer. Néanmoins, nous avons constaté que le framing a un impact sur la perception que les sujets ont des actions des autres ; ainsi que sur leur réciprocité déclarée. Ces deux éléments sont moins élevés dans le framing négatif. Ces résultats nous amènent à considérer avec plus d'attention la perception que les utilisateurs d'une même ressource ont des actions des autres ; cet élément pouvant se révéler déterminant pour l'efficacité de la gouvernance de cette dernière.

Mots clefs : coopération sociale, bien public, framing, pression par les pairs

Résumé

De résultats importants montrent l'efficacité des mécanismes de sanction monétaires par les pairs pour inciter à la coopération dans les jeux de bien public. Dans cette expérience, nous étudions si l'efficacité des sanctions peut être affecté par le framing du jeu, i.e. la façon de présenter les résultats d'une action sans en altérer les effets économiques, (Levin et al., 1998). Pour ce faire, nous reproduisons le plan d'expérience défini par Andreoni (1995) qui présente les interactions stratégiques comme générant des externalités positives ou au contraire négatives ; et nous y introduisons des sanctions monétaires (Fehr & Gächter, 2000). Ces dernières sont couteuses pour l'envoyeur et pour le destinataire. Lorsqu'il n'y a pas de sanction par les pairs, nous confirmons les résultats obtenus par Andreoni. Les contributions au compte de groupe sont plus faibles dans le framing négatif que dans le framing positif.

Lorsque la punition par les pairs est possible, on observe une forte augmentation des contributions dans le framing positif, où la quasi-totalité des groupes aboutissent à des niveaux de contributions correspondant à leurs entières dotations. En comparaison, l'augmentation des contributions est moindre dans le framing négatif ; les niveaux de contributions avoisinent les 45% des dotations. Cette réaction différente aux sanctions est observée dès la première période suivant leur introduction et avant que les sujets ne reçoivent leurs premières sanctions.

Un plus grand nombre de pénalité est infligée dans le framing négatif. Cependant, les mêmes déterminants des décisions de sanction sont observés entre les deux framing. Le principal facteur étant un moindre niveau de contribution que les autres individus du groupe. Nous suggérons que la plus faible coopération observée lorsque les sanctions sont possibles dans le framing négatif, est due à une plus faible efficacité des points de sanction reçus. Le fait de présenter les actions des autres comme ayant des effets négatifs sur les gains rend plus difficile l'établissement d'une norme de contribution. La dispersion des contributions est plus élevée dans le framing négatif que le framing positif où cette dernière induit une convergence vers l'entière contribution.

Mots clefs : coopération sociale, bien public, framing, punition par les pairs

Conclusion

Dans cette conclusion, nous résumons tout d'abord les principaux résultats des deux axes d'investigation que nous avons développés dans la thèse, à savoir i) l'effet de la divulgation des actions des individus dans un contexte de ressource commune et ii) l'effet de la présentation de la problématique de l'action collective sur la dynamique de groupe dans un contexte de bien public. Pour chacun de ces deux sujets, nous proposons un débat sur les limites spécifiques et les extensions potentielles qui auraient pu être faites en laboratoire. Nous croyons fermement que les expérimentations en laboratoire présente des avantages considérables pour identifier et démêler les effets de la mesure étudiée, dans notre cas : l'information sociale. Avec la même force, nous pensons que, si ce travail est absolument nécessaire pour tenter de saisir les généralités du comportement humain, il n'est pas suffisant pour présupposer les effets d'une mesure dans une situation concrète donnée. Pour ce faire, une compréhension approfondie du contexte micro-situationnel est nécessaire. Comme nous l'expliquerons brièvement à la fin de cette discussion, les outils et les méthodes pour y parvenir restent à développer. Dans la dernière partie de cette discussion, nous identifierons les questions communes résultant des deux thèmes développés dans cette thèse sur l'effet de l'information sur l'action collective lorsque la gestion des ressources naturelles est en jeu.

Chapitre 1 : Résultats et mise en perspectives

Dans le premier chapitre, nous montrons que le mécanisme basé sur l'affichage volontaire des extractions n'a pas été efficace pour promouvoir la coopération. Néanmoins, dans les premières périodes suivant son introduction, la divulgation volontaire est utilisée pour signaler la volonté de coopérer. Les sujets qui sont en faveur de l'affichage ont des extractions nettement inférieures à ceux qui sont contre. Par conséquent, l'efficacité de la communication ("cheap talk") pour mener à bien une action collective ne s'explique pas seulement par le fait qu'elle permet aux sujets de signaler leur type (volonté de coopérer), ni par le fait qu'elle permet à une majorité de sujets de s'entendre sur leur volonté de divulguer leurs extractions. Ces mécanismes volontaires ne peuvent pas infléchir l'augmentation de l'extraction lorsqu'ils sont appliqués seuls, et ne peuvent éviter la surexploitation de la ressource.

Dans cette expérience, nous démontrons également qu'une partie importante des sujets a effectivement des préférences sociales, plus précisément des préférences pour un partage égal. Ces préférences les amènent à avoir des niveaux d'extraction relativement plus faibles. Mais ces préférences sociales ne suffisent pas à elles seules à générer et à maintenir la coopération. Au cours du jeu, l'extraction ne cesse d'augmenter. Ce résultat est néanmoins cohérent avec les prédictions théoriques, qui montrent que les préférences pour l'aversion aux inégalités ou pour la conformité peuvent conduire à une augmentation de l'extraction des groupes lorsque cette dernière est affichée. L'analyse de l'évolution des extractions montre que les modèles d'apprentissage qui expliquent le mieux la dynamique de groupe sont : l'imitation de la moyenne et la meilleure réponse intéressée.

Néanmoins, nous devons souligner que lorsque les extractions des individus sont automatiquement divulguées, nous observons une différence dans les stratégies d'extraction selon la valeur d'orientation des sujets. Cette différence ne peut être observée lorsque les sujets n'obtiennent que l'extraction globale. Lorsque toutes les extractions sont affichées, les sujets individualistes sont plus susceptibles d'imiter *l'extraction la plus élevée* et sont moins susceptibles de suivre l' *extraction moyenne*. Alors que pour les sujets pro sociaux, la dynamique de l'extraction s'explique principalement par une combinaison de l'imitation du *extraction moyenne* affiché et de la meilleure réponse *self-interested*. Dans une moindre mesure, ils imitent également l' *exemple*. Cependant, cette dernière stratégie n'est pas adoptée dans une mesure suffisante par tous les membres du groupe pour affecter la dynamique d'extraction du groupe. L'adoption de la plus forte extraction affichée (le pire comportement) par certains membres du groupe donne du crédit à la thèse selon laquelle l'affichage d'extractions individuelles et/ou de gains individuels peut aggraver la tragédie des ressources communes en le faisant apparaître plus rapidement (Villena & Zecchetto, 2011).

En ce qui concerne les limites et les prolongements possibles de ce chapitre, il aurait été souhaitable d'étudier les effets 1) d'une information complète (en affichant les gains des individus), 2) d'une norme injonctive, avec des informations reflétant les attentes sociales en matière de comportement ; sur la dynamique de groupe dans le cadre d'une gestion des ressources communes.

Concernant l'effet de la divulgation d'une information complète, Weimann (1994) considèrent que cela n'a aucun effet sur les contributions dans un contexte de bien public. Néanmoins, Bigoni et Suetens (2012) réfutent ce résultat en montrant que la fourniture d'une information complète accélère l'effondrement de la coopération. Les grands contributeurs ont tendance à imiter les meilleurs résultats. Dans une expérience de marché oligopolistique à la Cournot, Offerman et al. (2002) montrent également que la fourniture d'une information complète conduit à des comportements plus compétitifs. Ces résultats sont conformes à ceux de Villena et Zecchetto (2011), qui démontrent que dans un contexte de pool commun, la fourniture d'une information complète peut aggraver une tragédie commune, en l'accélérant. Il aurait été intéressant d'analyser si nous obtenons le même résultat que Villena et Zecchetto (2011) dans notre contexte de ressources communes qui est caractérisé par une dépendance à la ressource. De plus, cette analyse nous aurait permis de démêler les différents effets potentiels de la fourniture i) d'une extraction agrégée, ii) d'extractions individuelles, iii) d'une information complète, sur la dynamique de groupe. Pour ce faire, il pourrait être intéressant d'introduire ces différents traitements dès la première séquence de l'expérience. En effet, l'expérience de Croson (1995) a montré que les différences de comportement entre les traitements où des informations agrégées ou individuelles sont affichées peuvent prendre du temps à apparaître. Pour finir, en allant un peu plus loin, afin d'accroître nos connaissances sur le fonctionnement des gouvernances autonomes, il aurait été intéressant d'analyser si le fait de fournir une information complète dans un contexte de pool commun pouvait avoir un impact sur l'efficacité de la punition par les pairs. Le point de départ de cette interrogation est l'expérience de Nikiforakis (2010). Dans cet article, il a comparé trois traitements concernant le retour d'information fourni aux sujets : i) les contributions des autres, ii) les revenus des autres et iii) les deux, et a conclu que la punition par les pairs est moins efficace lorsque les sujets reçoivent les revenus de leurs pairs et surtout lorsqu'ils obtiennent les deux types d'informations. Faire cette expérience nous aurait permis de déterminer si l'efficacité de la punition par les pairs est affectée par le type de retour d'informations sociales fournies, dans un contexte de ressources communes.

De nombreux résultats d'expérimentation montrent que la fourniture d'informations sur le comportement moyen, également appelé norme descriptive, conduit généralement à une convergence des comportements vers celui-ci (Ferraro & Price, 2013 ; Schultz, 1999 ; Schultz et al., 2007). Il convient également de souligner que lorsque les "feedbacks" concernant aux actions des autres sont manipulées, ils influencent fortement la dynamique de groupe (Fleishman, 1988 ; Weimann, 1994 ; Frey & Meier, 2004 ; Croson & Shang, 2008). Les sujets sont plus susceptibles d'avoir un niveau élevé de contribution lorsqu'on leur dit que d'autres le font, confirmant ainsi une volonté de se conformer à la norme sociale. Schultz et al. (2007) montrent également que l'ajout d'un symbole, qui signale aux sujets s'ils ont un bon ou un mauvais comportement en matière d'attente sociale (une norme sociale injonctive), permet d'éviter l'"effet Boomerang". Il aurait été intéressant d'étudier comment ce "nudge" peut impacter les comportements dans un contexte de pool commun. Plus largement, il serait intéressant de continuer à étudier comment la manipulation de l'information sociale a un impact sur les comportements des sujets, en ne délivrant que des informations sur les comportements les plus vertueux.

Enfin, une autre voie de recherche pourrait consister à étudier comment ces différents formats d'informations sociales influencent le comportement selon les orientations sociales des sujets. Ces recherches pourraient nous permettre de mieux identifier ce qui peut briser la dynamique de groupe. Nous développerons cet aspect plus en détail dans la dernière partie de cette discussion.

Chapitres 2 et 3 résultats et mise en perspectives

Dans les chapitres 2 et 3, nous montrons que la manière de présenter une problématique d'action collective, en mettant en évidence les externalités positives ou négatives potentielles de l'interaction sociale, peut influencer la volonté de coopérer (ceteris paribus). En considérant les données qui ont composé ces chapitres 2 et 3, nous reproduisons en partie le résultat d'Andreoni (1995b). Les sujets sont plus disposés à contribuer à un bien public lorsqu'ils perçoivent qu'ils font du bien ("warm glow") que lorsqu'ils perçoivent qu'ils font du mal ("cold prickle"). Néanmoins, l'effet de framing est fortement dépendant de la capacité inhérente des groupes à coopérer, et c'est pourquoi, comme d'autres framing tel que le "give and take", cet effet est fragile.

L'introduction de mécanismes de désapprobation, symbolique et matériel, permet d'augmenter de manière significative les contributions au bien public par rapport Baseline. Pour les deux types de sanctions, les déterminants de la punition sont similaires dans les deux framings ; ils sont principalement déterminés par une comparaison avec les contributions des pairs. Moins un sujet contribue par rapport à ses pairs, plus il sera désapprouvé. Néanmoins, le nombre de sanctions symboliques et monétaires envoyées est légèrement plus élevé dans le framing négatif. Ceci est lié à une plus grande dispersion des contributions au sein des groupes.

Plus intéressant encore, nous constatons que lorsque les sanctions monétaires sont introduites après une séquence dans laquelle les sujets n'ont pas pu exprimer leur désapprobation, le framing influence fortement la capacité du groupe à atteindre un fort niveau de contribution. La réaction différente à l'introduction des sanctions est observée dès la première période suivant leur introduction. Dans le framing positif, un pourcentage important (34 %) de sujets décident de contribuer pleinement et ce pourcentage continue à augmenter jusqu'à la dernière période. En revanche, dans le framing négatif, le pourcentage est plus faible (22 %) et il reste constant. Paradoxalement, le nombre de sanctions envoyées est plus élevé dans le framing négatif.

Lorsque nous essayons d'aller plus loin dans notre compréhension de l'impact du framing sur le comportement, il en résulte qu'il a un impact sur la perception et la volonté déclarée de rendre la pareille aux actions des autres. Dans notre expérience, nous démontrons clairement que le framing négatif d'Andreoni (1995b) rend plus difficile pour les sujets d'établir les gains. Nous faisons la conjecture que cette difficulté participe à la perception négative des actions des autres qu'ils obtiennent à travers ce framing. Néanmoins, l'effet de framing ne peut être réduit à une compréhension plus faible des incitations économiques. Il semble important de rappeler que même dans le framing négatif, une majorité de sujets déclarent qu'ils contribueraient pleinement si les autres le faisaient, alors que nous n'observons jamais un tel pourcentage dans les groupes dynamiques. En conséquence, un autre résultat intéressant est que la volonté des sujets de coopérer dépend des contributions des autres, ce qui confirme qu'une majorité peut être qualifiée de coopérateurs conditionnels comme l'ont montré Fischbacher et al. (2001). Cependant, il convient de noter que le pourcentage de sujets qui déclarent qu'ils contribueront pleinement si d'autres le font est également affecté par le framing. Les free riders inconditionnels sont légèrement plus nombreux lorsque les externalités négatives potentielles de l'interaction sociale sont mises en évidence (Fosgaard et al., 2014 ; Gachter et al., 2017 ; Gachter et al., (Forthcoming)). Nous confirmons ce résultat dans notre expérience.

Un autre résultat intéressant, qui a été initialement trouvé par Park (2000), est que le framing semble affecter plus fortement les sujets qui ont une orientation sociale individualiste. Dans la première séquence du Baseline, les sujets individualistes ont un niveau de contribution différent selon le framing, alors que nous n'observons pas une telle différence pour les sujets pro-sociaux. En outre, leur coopération conditionnelle déclarée est plus fortement affectée par le framing, car ils sont nettement moins disposés à contribuer pleinement dans le framing négatif. Enfin, ce sont eux qui réagissent différemment à l'introduction de sanctions dans le framing négatif car ils sont moins enclins à imiter le meilleur comportement affiché. En résumé, la manière dont la question de l'action collective est présentée et perçue affecte fortement la dynamique de groupe. Lorsque des sanctions monétaires sont introduites, le framing négatif restreint fortement la capacité des groupes à converger vers une contribution totale. Alors que le nombre de sujets à orientation pro-sociale est équivalent dans les deux framings. Par conséquent, le nombre de sujets disposés à supporter le coût de la coopération devrait être identique.

En ce qui concerne les limites et les extensions possibles, nous aurions pu mieux déterminer les effets du framing, si notre base de données avait été vidée des groupes qui coopèrent pleinement sans aucun mécanisme, même s'ils sont principalement composés de sujets individualistes. Ces résultats sont particulièrement curieux et questionnants. De plus, pour mieux comprendre comment le framing affecte la dynamique de groupe, il serait intéressant de montrer les actions individuelles dans le Baseline. Cela permettrait également d'augmenter la comparaison avec les traitements dans lesquels des mécanismes de désapprobation sont introduits et pour lesquels des actions individuelles sont affichées. En outre, pour améliorer notre compréhension des effets du framing, il serait nécessaire d'éliciter les croyances des sujets sur les actions des autres. Il a été démontré que les croyances sont des effets conséquents du framing (Dufwenberg et al., 2011 ; Fosgaard et al., 2014 ; Gachter et al., 2017). De plus, si l'on considère, comme notre analyse de l'apprentissage tend à le confirmer, que les sujets se conforment à l'action des autres et, dans une moindre mesure, y effectuent la meilleure réponse ; alors leur croyance dans les actions des autres doit fortement influencer leurs comportements. Des enquêtes supplémentaires sont nécessaires pour mieux comprendre comment le framing peut affecter le comportement attendu ou répréhensible (Kahneman, 1992). L'intégration du test de jugement tel que défini par Cubitt et al. (2011) dans l'expérience d'Andreoni pourrait être une piste. Pour finir, il serait intéressant d'étudier plus en détail comment le framing affecte le comportement en fonction des types de sujets. Plus précisément, cela nous permettra d'avoir plus d'indications pour confirmer que les sujets individualistes sont particulièrement sensibles au changement de perception créé par le framing. Ceci nous amène aux questions communes qui découlent des axes de recherche développés dans cette thèse.

Questions communes et propositions d'extension

Dans cette dernière partie, nous discuterons des conclusions communes résultant des trois chapitres de cette thèse. A savoir, l'effet des préférences sociales dans l'action collective, et comment elles influencent la manière dont les sujets réagissent à l'information affichée. Pour chacun d'eux, nous les confronterons à la littérature et enfin nous proposerons des pistes d'investigation complémentaires.

La coopération conditionnelle, le conformisme et les préférences sociales comme moteurs de la dynamique de groupe

Un résultat commun qui ressort de ces trois chapitres est que le comportement de la majorité des sujets dépend fortement du comportement de leurs pairs. C'est pourquoi, ils peuvent être qualifiés de coopérateurs conditionnels (Fischbacher et al., 2001). Une étude comparative récente montre que ce modèle de comportement est reproductible et constitue donc un résultat cohérent (Thöni & Volk, 2018). Ce comportement peut être qualifié de goût du conformisme, car les sujets se conforment aux actions des autres. Notre analyse de l'apprentissage montre également que dans les deux cas, les ressources communes et les questions de bien public, le goût de la conformité (i.e. l'imitation de l'action moyenne), est un moteur fiable de la dynamique de groupe.

En outre, nos résultats mettent en évidence le fait que les préférences sociales sont un moteur important des questions d'action collective. Les sujets ayant des préférences pro-sociales sont plus susceptibles de coopérer à la fois sur des questions de pool commun et de bien public. Ces résultats sont conformes aux résultats expérimentaux et théoriques, qui promettent de considérer les préférences sociales comme un moteur important de la dynamique de groupe. Fischbacher et Gächter (2010), dans une expérience publique en "Stranger conditions", démontrent que (i) le type de sujets, défini par leur volonté de contribuer en fonction des contributions des autres (Fischbacher et al., 2001) ; et (ii) le fait que les sujets actualisent leurs croyances sur les actions des autres de manière non naïve, expliquent la diminution observée des contributions. En d'autres termes, la prise en compte de la manière dont les différents sujets déclarent qu'ils vont réagir aux actions des autres et de la manière dont ils actualisent leurs croyances, contribue à expliquer la dynamique de groupe lorsqu'il n'existe pas de mécanisme pour favoriser la coopération. Ambrus et Pathak (2011) proposent d'expliquer la contribution initiale et leur diminution progressive par l'hétérogénéité des préférences sociales des sujets.

Ces résultats soulèvent la question du lien potentiel entre les préférences sociales et le goût du conformisme. Plus précisément : La volonté de se conformer à la norme sociale est-elle le résultat de préférences sociales ou l'inverse ? Ce point appelle beaucoup plus de preuves avant de pouvoir donner une explication. Au vu de nos résultats, nous serons tentés de donner du crédit aux arguments développés par Fehr et Williams (2018). Ils affirment que la volonté de se conformer, la norme de la coopération conditionnelle, ne peut expliquer : i) la volonté de punir les resquilleurs ii) les préférences pour un contexte qui permet la punition par les pairs. C'est pourquoi, ils considèrent que "la volonté de se conformer à la norme survient si les individus ont un désir intrinsèque d'équité ou de justice". Notre analyse de l'apprentissage montre que lorsque les extractions d'un individu sont affichées, les individus pro-sociaux ont plus tendance à continuer à se conformer à l'extraction moyenne affichée et, dans une moindre mesure, à y répondre au mieux. Ce comportement est cohérent avec le comportement de coopération conditionnelle imparfaite. À l'inverse, les sujets individualistes ont plus tendance à imiter la pire extraction affichée, et ils semblent plus sensibles aux biais de perception dans la manière dont ils réagissent à la pression de leurs pairs.

Sur la base de ces résultats, nous considérons qu'il convient d'accorder plus d'attention à la manière dont les préférences sociales peuvent expliquer la dynamique de groupe. Plus particulièrement, si l'on considère qu'un pourcentage conséquent de sujets est animé par un désir ou par l'équité et la conformité, la question suivante se pose : "Comment pouvons-nous construire des institutions qui régulent les actions des individus moins pro-sociaux ? Outre les actions qui modifient les incitations monétaires, il serait intéressant d'aller plus loin dans l'étude de l'effet des incitations non monétaires et plus particulièrement des effets d'information tels que l'information complète ou la norme injonctive.

Niveau de détails des informations, heuristique et type de sujets

Comme votre capacité de calcul est limitée, nous pouvons faire l'hypothèse que donner plus d'informations sur la structure du jeu peut changer le comportement. Certains diront qu'Apesteguia (2006), semble contredire cette règle, car il considère que donner ou ne pas donner d'informations sur les gains conduit les sujets à atteindre l'équilibre de Nash dans tous les cas. Néanmoins, les informations qu'il fournit dans ses deux traitements sont limitées. Dans un cas, il n'y a aucune information et, dans l'autre, il y a une description de base de la fonction de gain et quelques illustrations. Il ne fournit pas la structure des gains, i.e. les détails sur l'évolution de leurs revenus en fonction de leurs actions mais aussi des actions des autres. Cette sensibilité à la comparaison sociale est corroborée par l'expérience d'Andreoni (1995a), qui montre que l'ajout d'informations sur le classement du sujet dans une VCM réduit la contribution des sujets. En d'autres termes, lorsqu'ils disposent d'informations qui font explicitement une comparaison sociale, ils sont moins enclins à coopérer.

Toutefois, Saijo et Nakamura (1995) montrent que lorsque les sujets disposent d'informations relativement peu nombreuses sur la structure des gains, ils sont plus susceptibles d'être "spitefull" (méchants). Cela signifie qu'ils sont moins disposés à contribuer même lorsqu'il s'agit d'une stratégie dominante. Au contraire, ils sont plus sensibles à la comparaison sociale (le classement entre eux). En outre, Ramalingam et al. (2018) ont récemment démontré que dans un "Voluntary contribution mechanism", des instructions plus courtes conduisent à un niveau de contribution plus faible et à un niveau de sanction relativement plus élevé. Ce sont là des résultats importants, car dans la vie réelle, les cas où les sujets sont capables d'avoir à l'esprit la matrice complète des gains sont rares. Nous devons donc prendre en considération le fait que, dans la plupart des situations, les gens sont susceptibles d'être plus méchants et de prêter plus d'attention à la comparaison sociale que ce que la théorie prévoit.

Dans une autre expérience, Huck et al. (2017) montrent qu'en situation d'information complète, le fait de permettre aux sujets de calculer ce qu'auraient été leurs gains au cours de la période précédente pour des choix alternatifs, conduit à des comportements moins coopératifs. De part ces résultats, nous considérons qu'il faut accorder plus d'attention au format dans lequel l'information est fournie (ajouter ou non la matrice des gains, permettre ou non aux sujets de calculer leurs gains). Cela nous permettra de mieux comprendre quel type d'information peut réduire le'"spite effect" ou, au contraire, rendre les sujets moins coopératifs.

De plus, nous considérons que ces résultats renforcent l'intuition que fournir des informations sociales peut avoir un impact significatif sur le comportement ; et qu'il est utile d'approfondir notre compréhension en essayant de démêler ses effets. Il serait intéressant de mieux comprendre comment les différents types d'informations : agrégées, actions individuelles, informations complètes et ajout d'une dimension injonctive ; influencent la volonté de coopérer des sujets en les distinguant par leur orientation sociale. Une expérience de terrain montre que la manipulation des informations agrégées pourrait principalement affecter le comportement des sujets qui pourraient être qualifiés de coopérateurs conditionnels (Frey & Meier, 2004). Des enquêtes supplémentaires doivent être menées pour comprendre comment différents types de sujets réagissent à divers types d'informations susceptibles de modifier leur perception de l'action des autres. À cette fin, la poursuite de l'analyse de l'apprentissage pour mieux étudier l'heuristique des sujets peut constituer une ligne de recherche intéressante.

Des pistes d'investigation complémentaires pour caractériser un contexte donné

Il a été démontré que les préférences sociales sont fortement influencées par les contextes culturels. Dans le cadre d'une étude interculturelle, Henrich et al. (2004) ont démontré que les préférences sociales (mesurées par les jeux de dictateurs et les jeux ultimes) reflètent les liens entre les gens par le biais d'un marché et leur dépendance sociale. Les baleiniers, dont la survie dépend des autres, avaient les préférences sociales les plus élevées, tandis que les chasseurs-cueilleurs isolés avaient les préférences les plus faibles. En outre, Andersen et al. (2008) montrent que le contexte culturel pourrait avoir une forte influence sur le comportement de contribution dans un VCM. Ils observent un pourcentage significativement plus faible de "free riders" dans la société matrilinéaire. Cette différence est principalement due aux hommes, qui sont plus coopératifs dans la société matrilinéaire. Un autre résultat intéressant est que le contexte a une influence sur la sensibilité des sujets au framing de l'action collective. Dans les sociétés non matrilinéaires, la contribution des sujets est plus faible dans le cadre négatif tel que défini par Andreoni (1995b). Outre ces cas extrêmes, cette étude appelle à une meilleure compréhension de la manière dont le contexte culturel façonne les préférences sociales et donc la volonté des sujets de rendre la pareille (leur réciprocité). Comme nous l'avons montré, les préférences sociales pourraient être des éléments importants à prendre en considération car elles peuvent influencer la façon dont les sujets réagissent et utilisent les informations sociales.

De plus, il semble important de mieux comprendre quelle est la perception que les gens ont du problème d'action collective auquel ils sont confrontés et de l'effet de l'action des autres. Ces perceptions pourraient avoir un impact sur leur volonté de coopérer et sur les mécanismes de régulation auxquels ils sont favorables (Alesina et al., 2018). En outre, les perceptions peuvent également avoir un impact sur la manière dont ils réagissent à la pression des pairs ou à la punition des pairs. Nous démontrons que la perception créée par le framing peut avoir un impact sur la façon dont les sujets réagissent à la punition par les pairs. Plus largement, Nikiforakis (2010) a démontré que le type d'informations fournies concernant les actions des autres ont également une influence importante sur l'efficacité de la punition par les pairs. Il est intéressant de noter que ces différents effets dus à une perception différente ou aux informations sociales affichées n'apparaissent pas toujours lorsqu'il n'y a pas de mécanismes susceptibles de favoriser la coopération ; mais ils apparaissent clairement lorsqu'ils sont introduits. En conséquence, des enquêtes sont nécessaires pour mieux comprendre comment, dans un contexte donné, les sujets perçoivent le fonctionnement de l'action collective à laquelle ils sont confrontés, les effets des actions des autres et ce qu'ils considèrent comme un comportement durable et acceptable.

En outre, dans la plupart des situations concrètes de pool commun ou de bien public, les gens sont hétérogènes en ce qui concerne leur dotation et leurs fonctions de production. Il faut mieux comprendre comment cette hétérogénéité peut affecter les questions d'action collective, à travers : leur perception de l'effet des actions des autres, leur volonté de coopérer, la façon dont ils définissent le comportement acceptable et leur réaction aux informations sociales. En effet, il y a de fortes raisons de penser que cette hétérogénéité pourrait rendre la définition d'un comportement durable et acceptable plus complexe. Enfin, dans la plupart des actions concrètes concernant la gestion des ressources naturelles, les sujets sont confrontés à des risques et à des incertitudes qui ont un impact sur leurs gains. Des études supplémentaires sont nécessaires pour mieux comprendre comment ces aspects peuvent avoir un impact sur la dynamique de groupe, et plus particulièrement comment celle-ci peut interagir avec les informations sociales fournies. La diffusion d'informations sociales pourrait modifier la perception qu'ont les sujets des actions des autres et de ce qu'ils perçoivent comme étant le comportement souhaitable, la pensée renforçant la norme sociale. Cialdini et al. (1990) ont défini la norme comme suit " *ensemble de croyances sur ce que les autres font ou ce qu'ils approuvent ou désapprouvent de faire*". En outre, certaines expériences montrent que plus les sujets font confiance en leurs pairs, plus ils sont susceptibles d'adapter leur comportement en cas de variation des ressources et d'incertitude concernant ces dernières (Brann & Foddy, 1987 ; Baggio et al., 2015). Ces résultats appellent à plus d'investigations sur la manière dont différents systèmes d'information pourraient aider à gérer les ressources naturelles, dans un contexte mondial où le risque et l'incertitude augmenteront en raison du changement climatique.

Pour conclure, cette thèse apporte de nouvelles preuves que la diffusion d'informations sociales et la façon dont le collectif est présenté, et donc perçu, ont un impact sur la capacité des groupes à coopérer. En outre, elle met en lumière le fait que les préférences sociales sont des moteurs importants de la dynamique de groupe, en apportant des explications sur les raisons pour lesquelles la diffusion d'informations détaillées sur les actions des sujets peut aggraver la tragédie de la communauté. Elle nous invite à développer des recherches plus approfondies sur la manière dont différents types d'informations sociales, telles qu'une information complète, l'ajout de normes d'injonction, de classement ou d'information plus détaillée sur la structure des gains, peuvent promouvoir des comportements vertueux ou au contraire accroître les comportements compétitifs. Étant donné que la plupart des sujets sont des coopérateurs conditionnels, cela permettra de mieux identifier quel type d'information (dans les coups de coude) permet d'obtenir des comportements coopératifs. Enfin, cela pourrait nous permettre d'identifier quel type d'information sociale pourrait être fourni pour renforcer la confiance et donc le capital social des groupes dépendant des ressources.

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