Cooperative Initiative through Pre-Play Communication in Simple Games

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Abstract

I consider two games, a stag hunt and a prisoners' dilemma. Each game either features non-binding, costless and free-form pre-play communication or not. I study experimentally the differential effect of communication across games and whether the frequency of verbal initiative-taking suggesting cooperation varies across games. I find that communication has a larger effect on group cooperation in the stag hunt than in the prisoners' dilemma. I also find that in the stag hunt initiative-taking is ubiquitous and initiators cooperate more often than non-initiators. In the prisoners' dilemma, initiative-taking is less frequent relative to the stag hunt and initiators cooperate remarkably more often than non-initiators. In this case, initiators who cooperate are also more altruistic, averse to lying, and believe others are likely to cooperate compared to initiators who defect. I also find that participants often respond to initiative with agreement. Initiators who observe the other person agreeing to their proposal cooperate more often than those who do not observe agreement, in both games.

JEL: C9, D8, C7.

Keywords: Cooperation, Communication, Leadership.

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1 Introduction

The literature on the effect of communication on cooperation is vast. Most papers, however, treat communication as an indivisible event, despite the richness of form, timing and sequence of messages people usually exchange. We know little, for example, about the role of context on the messages individuals decide to send, in particular initiating a suggestion to cooperate, and on actual cooperation. This paper studies the effect of the underlying game on the decision to take the initiative and on subsequent actions.

The experimental design consists of a baseline condition in which individuals play a stag hunt (a variant of two-players, two-actions coordination games) simultaneously, but have the chance to communicate through a message window ("chat box") for a fixed period of time before doing so. I focus on this type of free-form, non-binding and costless communication because it is perhaps the most direct channel through which individuals seek to exert influence. The stag hunt serves as a baseline because there is little tension between first suggesting *cooperation* and following through. I use the word cooperation instead of coordination to simplify exposition when referring to the payoff-dominant outcome in this game and the other game I consider: a prisoners' dilemma with pre-play communication. This prisoners' dilemma differs from the stag hunt only in the payoffs for unilateral defection. The tension between the efficient outcome and individual incentives in the prisoners' dilemma undermines the effectiveness of communication. My design allows game partners 30 seconds preceding the start of the game to send non-binding, costless, and free-form on-line messages through a chat box, and initiators are identified by any such messages that first suggest cooperation. Communication ends when actual play begins.

The first question this paper answers is whether communication has a differential effect on cooperation across games. To answer this question, I run two additional conditions, a stag hunt without pre-play communication and a prisoners' dilemma without pre-play communication. That is, my design relies on two sources of exogenous variation: whether the payoff-relevant game is stag hunt or prisoners' dilemma and whether the interaction features pre-play communication or not. This two-by-two design allows me to assess the effect of communication on cooperation when keeping constant the payoff-relevant game, and more importantly, whether communication leads to cooperation more frequently in the stag hunt than in the prisoners' dilemma. To my knowledge, this is the first paper to study the differential effect of communication across strategic contexts.

The second question is whether the messages people decide to exchange, in particular verbal initiative suggesting cooperation, depend on the underlying game. Verbal initiative is a pervasive phenomenon that has largely escaped scrutiny in economics, at least to my knowledge. The main challenge to study initiative is that it emerges endogenously. In this paper, I record verbal

initiative and compare the frequency of initiative-taking between the stage hunt with pre-play communication and prisoners' dilemma with pre-play communication.

Regarding the differential effect of communication on cooperation, the data reveal that communication leads to more group cooperation in each game, but its impact is larger in the stag hunt. Regarding the role of context on initiative-taking, I find that the proportion of groups featuring at least one initiator is high and similar across games on average. However, with repeated play (each time with an unknown and different partner) initiative is slightly more frequent in the prisoners' dilemma than in the stag hunt (89% vs. 78% of the groups, respectively), but reverses dramatically after several repetitions (61% vs. 94% of the groups, respectively).

The data from the two games with pre-play communication offer other qualitative results on the relationship between verbal initiative and cooperation. Despite I cannot make causal claims about the effect of initiative on cooperation (because initiative is not exogenously imposed, but emerges endogenously in the conversation), it is instructive to report whether initiators follow through their suggestions to cooperate and whether initiators behave differently compared to non-initiators across games. I find that 90% of the initiators actually cooperate in the stag hunt, but only half of them do so in the prisoners' dilemma. Most of the initiators who cooperate in the prisoners' dilemma seem to respond to the other player verbally agreeing to their proposal to cooperate. Yet, some initiators suggest cooperation deceitfully, defecting even when the other player agrees to cooperate. In any case, those who decide to take the initiative cooperate significantly more often than those who do not, with the greatest differential in the prisoners' dilemma. In the stag hunt, initiators cooperate roughly 30% more often than non-initiators. In the prisoners' dilemma, initiators cooperate 60% more often. Moreover, with repeated play the rate of cooperation conditional on initiative rises in the stag hunt and declines, but remains positive, in the prisoners' dilemma.

Conditional on initiative, cooperation is correlated with individual characteristics in the prisoners' dilemma. Even though I find no differences in individual characteristics of initiators across games, I do find that those who first suggest cooperation and actually cooperate are different from those who initiate and defect only in the prisoners' dilemma; initiators who cooperate are more altruistic, averse to lying and optimistic about others' cooperation than are initiators who defect. Altruism is the idea that initiators value other people's payoffs and lying aversion reflects a cost associated with breaking one's word. This paper considers initiators' non-pecuniary motivations for two reasons. First, under standard preferences, pre-play communication is fruitless in a prisoners' dilemma. Initiative-taking in a conversation, therefore, should be of no use. However, experimental evidence suggest that communication fosters cooperation even in these situations. Second, altruism provides incentives to cooperate when payoffs favor defection. As a result, altruism coupled with lying aversion, may render verbal initiative credible. Thus, the heart of the study

is to place subjects in pairs where they have an opportunity to take the initiative through a chat box, perhaps advocating for cooperation, and decide whether to cooperate in the simultaneous play.

The rest of the paper is divided as follows. Section 2 provides a literature review on leadership and communication relevant to this study. In Section 3, I describe the experimental design, in Section 4 the hypotheses, and in Section 5 the results. Section 6 shows a discussion and Section 7 concludes.

2 Background and hypotheses

Scholars have shown an increasing interest in initiative-taking, especially the variety known as leading by example. Hermalin (1998) shows that exogenously imposed leaders can alleviate the free-rider problem in a public-good game through leading by example, that is, by signaling private information about the value of the good. Hermalin's theory has been tested experimentally in several papers with mixed results.[1] Other papers compare contributions to a public good arising from exogenously imposed versus endogenously emerging leaders (initiative by individuals without pre-imposed leadership role) and have found higher contributions when leaders emerge endogenously.[2] These results highlight the importance of endogenous leading by example for coping with the free-rider problem, even in the absence of private information.[3]

Scholars have also investigated the traits of emerging leaders. Bruttel and Fischbacher (2010) find that they are characterized by generosity, strong preferences for efficiency, above-average cognitive skills, internal locus of control and patience. Arbak and Villeval (2013), using a two stage public goods experiment with endogenous timing, find leaders are more altruistic and concerned about their social image.[4] Similarly, Préget, Nguyen-Van and Willinger (2012) find that leadership emergence is pervasive and conditional cooperators are more likely to emerge as leaders. In short,

[1] Meidinger and Villeval (2002), Güth, Levati, Sutter and van der Heijden (2006), Potters, Sefton and Vesterlund (2007), Moxnes and van der Heijden (2007) and Gätcher and Renner (2006, 2018).

[2] For example, Potters, Sefton and Vesterlund (2005), Haigner and Wakolbinger (2010) and Rivas and Sutter (2011). A related literature on negotiation with pre-play interaction suggests that the type of pre-play interaction affects the outcome of negotiations (see for example, van Dolder et al. 2015; Brañas-Garza et al. 2018).

[3] Van Vugt (2006) points out that taking the initiative is one of the most salient aspects of leadership, which he defines as "a process of influence to attain mutual goals" (p. 355). There is a large literature on leadership in political science (see, e.g. Ahlquist and Levi 2011 for a cross-disciplinary survey). Our stylized experiment lies within the experimental analysis of endogenous leadership emergence. Prominent related studies on exogenous leadership, both experimental and theoretical, are: Fiorina and Shepsle (1989), Dewan and Myatt (2007), Dickson (2006, 2011), Siegel (2009), and Grossman and Baldassarri (2012).

[4] The authors elicited generosity by asking individuals to give a portion of their show-up fee to a charity, and personality traits through the Big 5 personality test (John, Naumann and Soto 2008).

leaders often have preferences for giving and efficiency. Apart from public-good settings and other situations that pose a dilemma to individuals, leadership is also important in situations that require coordination, see for example Calvert (1992) and Van Vugt (2006). In economics, Kreps (1990) posits leaders as coordinators in the presence of multiple equilibria (see Hermalin, 2012a). Foss (2001), however, argues that more needs to be done in economics to understand leadership in coordination games. The empirical literature focuses on leading by example in the context of public good (dilemma) games but has not paid special attention to the role of context in conditioning leadership.[5]

This paper examines initiative-taking and cooperation in different strategic contexts—a prisoners' dilemma and a stag hunt. It also explores the characteristics of those who initiate and cooperate. It focuses on free-form, non-binding and costless communication rather than leading by example. The main contribution of this paper is that it studies a suspected but seldom explored determinant of mutual cooperation: Leadership by initiative-taking through free-form pre-play communication.

2.1 Hypotheses

The extant theory addresses the effect of pre-play communication as a whole, rather than the endogenous sequence of messages. Pre-play communication offers the opportunity for players to jointly condition their actions on the messages exchanged rather than choosing their actions independently (Forges 1986). In other words, communication may make the set of correlated equilibria accessible to players. In a correlated equilibrium an external mediator or "correlation device" selects a profile of actions according to an equilibrium distribution, and informs each player only its corresponding equilibrium action. In two person games, however, the scope of communication is limited (Urbano and Vila, 2003). Barany (1992) shows that only a subset of correlated equilibrium outcomes of the normal form game coincides with the Nash equilibrium of an extended game with costless pre-play communication. In the games presented in this paper, these coincide with the convex combination of the pure strategy Nash equilibria in the one-shot game under purely pecuniary payoffs. That is, in the stag hunt (SH, Table 1 panel 1) with pre-play communication both mutual defection and mutual cooperation can occur; in the prisoners' dilemma (PD, Table 1 panel 2) with pre-play communication only mutual defection is predicted to happen.[6] This leads to the first hypothesis.

[5] Context has been considered to be crucial in effective leadership in social psychology, e.g., Fiedler (1994) and Rotemberg and Saloner (1993).

[6] In the appendix D, I characterize these equilibria.

1\2	**D**efect	**C**ooperate
Defect	$4,4$	$\mathbf{8},0$
Cooperate	$0,\mathbf{8}$	$9,9$

1. SH

1\2	**D**efect	**C**ooperate
Defect	$4,4$	$\mathbf{14},0$
Cooperate	$0,\mathbf{14}$	$9,9$

2. PD

Table 1: Games in the Stag Hunt and Prisoners' Dilemma

Hypothesis 1. ***a.*** *In the stag hunt, mutual cooperation is more frequent when communication is possible than when communication is not possible.* ***b.*** *In the prisoners' dilemma, mutual cooperation is not affected by the possibility to communicate.*

In theory, the sequence of messages, the identity of the communicator, and the particular arguments used are of no particular consequence. Communication merely serves to partially replace a public randomizing device. The experimental literature, however, shows that individuals often choose the payoff-dominant outcome when communication is possible even in social dilemmas.[7] In light of these results, I am interested in the endogenous sequence of messages, rather than considering communication merely as a public randomizing device. In particular, I study whether the frequency of initiative differs across strategic contexts. SH provides a meaningful baseline to study the effect of context on initiative because any individual can state her intention to cooperate to incite her partner to cooperate, and such statements may help make this equilibrium focal.[8] Following this reasoning, we should expect that an initiator exists in every group, that anyone who initiates also cooperates, and that every non-initiator who faces a leader cooperates in SH.

Hypothesis 2a. *Every group features someone taking the initiative suggesting cooperation in SH.*

This behavior responds to purely monetary concerns, but behavior consistent with non-monetary concerns is commonly observed in social dilemmas. Scholars have proposed behavioral explanations in line with altruism and lying aversion to rationalize the success of pre-play communication. Altruism, understood as the idea that people value other people's payoffs, may lead to cooperation even in the absence of communication (see, e.g. Kreps et al. 1982; Andreoni and Miller 1993).[9] In

[7]For social dilemmas, see, for example, Ledyard (1994); Sally (1995); Cooper, DeJong, Forsythe and Ross (1996); Crawford (1998); and Bochet, Page and Putterman (2006); Dale and Morgan (2010), and Dal Bó and Dal Bó (2014). For coordination games, see Cooper, DeJong, Forsythe and Ross (1992); Charness (2000) test of Aumann's conjecture (Aumann 1990) and Brandts, Cooper and Weber (2011).

[8]Evidence that participants in laboratory experiments behave this way come from Charness (2000), Charness and Dufwenberg (2006) and Blume and Ortmann (2007).

[9]Bolton and Ockenfels (2000) provide a model based on other regarding preferences (that embeds a taste for reciprocity and for fairness) to explain the positive correlation between wage offers and subsequent effort found in the literature (among other non-standard economic behavior). Moreover, Fischbacher, Gächter and Fehr (2001) find evidence that 50% of their subjects are conditional cooperators in a public goods game. In sum, cooperation in social dilemmas has been found experimentally even without communication (Andreoni and Miller 1993; Cooper

terms of lying aversion, the literature documents that individuals may also experience an intrinsic cost of lying (e.g., Ellingsen and Johannesson 2004; Gneezy 2005).[10]

In SH, altruism does not change the fact that cooperation is a best response to cooperation. To see this, consider the payoffs in panel 1 in Table 1. Let us also consider the simple version of the Charness and Rabin (2002) model of social preferences to illustrate the argument. In that model, the utility of player 2 is given by $u_2(\pi_1, \pi_2) = w_1\pi_1 + (1 - w_1)\pi_2$, where π_i, $i = 1, 2$, represents monetary payoffs and w_1 the weight player 2 assigns to player 1's payoffs. Using this model in SH payoff matrix, if player 1 cooperates, player 2's utility is 9, if player 1 defects, player 2's utility is $(1-w_1)\times 8 < 9$ (provided $w_1 \geq -1/8$).[11] Everyone should take the initiative (to make cooperation focal) and follow through, so lying aversion should not change individual behavior relative to purely monetary concerns in SH either. Altruism and lying aversion, however, should play a role in PD. Consider now the payoffs in PD from panel 2 in Table 1. In PD, defection is the best response to cooperation under purely monetary concerns. Under Charness and Rabin's utility specification, however, cooperation is a best response to cooperation for a sufficiently altruistic player i, i.e. $w_j \geq 5/14$. If player i is altruistic enough, then we expect that she cooperates no matter what the other player does. If, in addition, we assume that altruist participants also care (at least a bit) about own payoffs, in particular that $w_j < 9/14$, then they prefer that the other player cooperates as well.

From this discussion, one can conjecture that initiative may be used by altruist and selfish participants to incite their partner to cooperate. As we should expect that altruistic initiators follow through their verbal initiative, we should also expect that selfish initiators try to exhort others deceitfully. The difference between a truthful and a deceitful initiator is that lying for the former is never a problem, because she plans to adhere to her word anyway. For the latter, however, lying might be a problem if lying is costly. If we assume that altruism and lying aversion are not perfectly correlated in the population, then there are some selfish individuals who do not like to lie.

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et al. 1996).

[10] In this paper, I elicit individuals' cost of lying as in Gneezy (2005), see experimental procedure below. The literature has explored the nature of that cost. Charness and Dufwenberg (2006), for example, provide a mechanism through which guilt aversion leads individuals to reciprocate in a trust game: individuals face a cost if they believe they are letting others down. Similarly, Miettinen and Suetens (2008) measure guilt (through self-reported emotional reaction) when individuals do not honor their word in social dilemma games with pre-play communication. The authors find that their measure of guilt is positively correlated with cooperation in a prisoners' dilemma game. Guilt in particular and honesty in general is likely to be determined by the co-evolution of culture and values (see Gächter and Schulz 2016). Gneezy et al. (2018) posit that the cost of lying is related to social identity, as honesty is modeled as a value for the individuals sharing her social identity. Abeler et al. (2018) find, in a provocative and convincing paper, that people are likely to have preferences for honesty and for being perceived as honest.

[11] Charness and Rabin (2002) model also allows for $w_1 < -1/8$ (individuals have a preference for hurting their partners). However, $w_1 \geq -1/8$ seems to be a plausible assumption given our experiment ensures full anonymity and consists of interactions among strangers.

We should observe that those selfish individuals abstain from initiating. Initiative reveals that the initiator is more likely to be altruistic—making the message more credible—because all altruists would use initiative to exhort others to cooperate, but only some selfish individuals (those who do not care about lying) would do so. In other words, a player who observes initiative deduces that although initiative may still come from a selfish person (selfish who is not lying averse), the distribution of those who take the initiative should feature more altruist individuals than the (prior) population distribution. This reasoning on individual decision making allows me to state three additional hypotheses:

Hypothesis 2b. *Some groups feature someone taking the initiative suggesting cooperation in PD (every group except those in which both members are selfish and lying averse).*

Hypothesis 3. ***a.*** *Every initiator cooperates in SH.* ***b.*** *Only some initiators cooperate in PD.*

Hypothesis 4. *A higher proportion of altruists take the initiative in PD than in SH.*

As we describe below, the design features repeated play, each time with a stranger. I elicit beliefs about cooperation (which I label "optimism") each round, so as to capture learning from previous rounds. An interesting empirical question is whether optimism is associated with initiative taking. In particular, we should expect that pessimistic participants refrain from taking the initiative if they are also lying averse; there is no point in suggesting cooperation because it is in the best interest of any participant to defect when expecting defection. This holds for both games, SH and PD.

Hypothesis 5a. *Pessimistic participants who are lying averse refrain from taking the initiative in both games.*

Assuming that altruism and optimism are independently distributed, we should also expect that optimism is associated with cooperation in both games. Moreover, optimistic, altruistic and lying averse initiators should be more likely to cooperate only in the PD (as every initiator should cooperate in the SH, see Hypothesis 3a). This is the final hypothesis.

Hypothesis 5b. *Optimism is correlated with cooperation in both games. Conditional on initiative, however, optimism, altruism and lying aversion are positively correlated with cooperation only in PD.*

3 Experimental Procedure

The heart of the design consists of varying the underlying context for potential initiative-taking. The experimental design features two chat treatments of three sessions each and two no-chat treatments of two sessions each. The difference between the chat and no-chat treatments is that

pre-play communication in the form of on-line messaging is allowed in the former but not in the latter. The written instructions for the experiment (appendix A) were given to the participants and read aloud before the session began. Participants were not allowed to interact with the experimenter, except to ask questions immediately after the instructions were read and before the experimental tasks began. The experimental currency is the Berkeley Buck ($) and the rate of exchange with the U.S. dollar is 12 Berkeley Bucks per dollar. The procedure elicits initiative-taking defined as first suggesting cooperation, and actual cooperation. It also measures proxies for altruism and lying aversion, as well as beliefs about overall cooperation (which I label "optimism"). All treatments were programmed and conducted using z-Tree (Fischbacher 2007).

3.1 Initiative and cooperation

The two chat treatment conditions (144 subjects in total, 72 in each treatment) elicit initiative and cooperation. In the first chat treatment subjects play a stag hunt ("SH") with pre-play communication; in the second chat treatment they play a prisoners' dilemma ("PD") with pre-play communication. The no-chat treatments (96 subjects in total, 48 in each treatment) are the same as the chat treatments except that they are conducted with no pre-play communication. In what follows, I focus the description of the experimental procedure on the chat treatments because the no-chat treatments follow the exact same procedure, except that participants cannot communicate.

At the beginning of each chat treatment, participants see a display of the game's payoff matrix, see Table 1 panel 1, for SH; and Table 1 panel 2, for PD. I label A the Defect option and B the Cooperate option to minimize framing subjects into cooperating. On the left side of each display is the chat box, which is an on-line messaging window through which subjects may communicate for 30 seconds prior to making choices. Once the 30 seconds elapse, both subjects are again directed to a display containing the corresponding payoff matrix in Table 1, but now they have to simultaneously choose whether to defect or cooperate without the opportunity to exchange messages.[12]

The messaging portion of the design records any verbal initiatives, and the results of the subsequent play portion indicate the verbal initiatives' effectiveness (or lack thereof). The proxy for initiative comes from the first message that suggests mutual cooperation. For instance, messages such as "We both should choose B," "B and B," or "Shall we both go B" (in which B is cooperation) are all coded as taking the initiative. If the participant's first message is irrelevant (such as "Hi"),

[12] I do not randomize the order of option A and B as presented to subjects to make sure they are familiarized with the meaning of each option in case they want to communicate intentions to play to the other individual. Figure 2 in appendix C shows the screen shots corresponding to this section.

he or she is not coded as taking the initiative unless he or she is the first to suggest B later on. A participant who suggests defection is not coded as taking the initiative. An initial message suggesting defection occurs in 1% of the interactions in SH treatment and in 6% of the interactions in PD treatment. Finally, when both players suggest cooperation and their messages occur within 3 seconds of one another, both are coded as taking the initiative. 15% of the interactions exhibit simultaneous initiative.[13] The instances in which an individual agrees to the initiator's suggestion are also recorded. After an individual takes the initiative, the matched partner can either reply by agreeing to the suggestion to cooperate, or not (say nothing, say something unrelated to cooperation or suggest defection). 79% of the initiatives suggesting cooperation are met with agreement in SH, and 72% in PD. All the coding was done by a team of research assistants who were unfamiliar with the experiment. Appendix E shows the instructions given to the research assistants to code the messages. Cooperation by each individual is directly recorded from the z-Tree program: Cooperation is equal to one if the participant decides to play B and zero if the participant decides to play A.

A few words must be said about why I chose to compare initiative and cooperation between a stag hunt and a prisoners' dilemma. With a stag hunt, I am able to both turn off monetary incentives against initiative and keep the payoff-relevant games symmetric to facilitate communication. When considering only monetary payoffs, players prefer the other player to cooperate in both games. The key distinction for the purpose of eliciting initiative is that initiators in the stag hunt have incentives to follow through, whereas initiators in the prisoners' dilemma have incentives to defect. The incentive to follow through in the stag hunt should encourage initiative by *everybody*, whereas the incentive to defect in the prisoners' dilemma should deter *some people* from taking the initiative. In the prisoners' dilemma, selfish lying averse individuals should refrain from taking the initiative because they would be lying otherwise. Even initiators willing to cooperate may refrain from taking the initiative because the other person has no incentive to believe them. The stag hunt, on the other hand, provides a unique baseline in which I can turn off these incentives against initiative and, at the same time, keep a similar, symmetric payoff structure. In sum, I chose the games in Table 1 for two important reasons. First, these games offer larger expected differences in initiative-taking than, say, two prisoners' dilemma with different deviation payoffs, because two prisoners' dilemma still feature incentives against initiative. Power comes at the cost of making cooperation (coordination) an equilibrium in one game, the stag hunt, but not in the other. This is a cost I was willing to face in order to maximize differences in initiative-taking across games. The

[13] Considering a more stringent definition of simultaneous initiative, namely messages suggesting cooperation within 2 seconds or 1 second, does not change the results. 14%, of the interactions exhibit simultaneous initiative within 2 seconds, and 10% within 1 second.

second reason I chose these games is that their simplicity allows for clear pre-play communication. By keeping the games symmetric, I sought to avoid misunderstanding and awkward explanations about intentions of a message. One alternative could have been to break symmetry and manipulate the payoff for deviation for only one player. This would have turned off either initiators' incentive to deviate or the worry that the other person defects, but would have made communication much more difficult.

Subjects' interactions have immediate payoff consequences and feedback. This process is repeated 12 times, each time with a different participant selected with a rotation matching protocol (see e.g. Cooper et al. 1996). The rotation matching protocol consists of dividing participants in each session into two groups and then matching each subject in one group with one subject in the other group without repetition. This ensures that any pair of subjects are matched at most once and that one subject is not matched with a participant in her own group. It is worth noting that the rotation matching protocol does not guarantee independence of observations across rounds, because outcomes are revealed after each round. I decided to reveal outcomes because even if I had not done so, the chat conversation already undermines independence. The message exchange in the first round would likely affect participants' beliefs about cooperation, which might affect behavior in subsequent rounds. This is the reason why I report treatment effects only for outcomes in the first round.

The advantage of making subjects play multiple rounds is that I can study the evolution of behavior. Precisely, the message exchange and the outcome of the game each round provide participants with new information to update their beliefs about cooperation after each round. I elicit such beliefs, as I describe below, to track participants' learning as the experiment progresses. My experiment is not designed to make observations independent across rounds, but uses participants' experience to create variation in beliefs, which I can correlate with initiative and cooperation.

In each session, participants play either SH or PD, never both. In the no-chat treatments, the procedure is exactly the same, except that individuals do not have the opportunity to chat in any of the 12 interactions. All the following experimental procedures are the same for all treatments.

3.2 Characteristics

I elicit unconditional social preferences ("altruism") once at the beginning of the experiment, before the main treatments are conducted. In an individual decision task, I ask subjects to allocate 10 tokens between him/her and a partner, who is randomly matched to the subject at the end of the experiment (see the instructions for Block 1, appendix A). I run this exercise four times, with the value of each unit kept remaining at 1 Berkeley Buck, and the value of each unit passed varying

equals 1.25, 1.00, 0.67 and 2.00. I classify subjects that keep all the tokens in each iteration as "selfish"; otherwise the subject is "altruist."[14] I use this dichotomous classification for three reasons. First, this is the simplest indicator that uses the information from the four dictator games. An alternative could have been a weighted average of the value of keeping, but it seems less intuitive. Second, I use this proxy to check whether is in line with previous results. I find that about 20% of the subjects are selfish, which is similar to Andreoni and Miller (2002, 23%) and Fisman et al. (2007, 26%). The third reason is that a dichotomous measure facilitates reporting and interpretation of the results (see, e. g., Figure 4 panel a).

I elicit participants' lying aversion once, immediately after altruism, but before the main treatments are conducted. I use two individual decision tasks similar to those in Gneezy (2005). In the first task (see the instructions for Block 2, appendix A; and Figure 6, top panel, appendix B), subjects face two options featuring different divisions of 20 Berkeley Bucks: Keep 15 and give 5 to the other participant, or keep 5 and give 15 to the other participant. Subjects then choose one of two designated advice messages—one untruthful and one truthful—to send to the other participant. The untruthful message reads "Option 1 will earn you more money than Option 2"; the truthful message reads "Option 2 will earn you more money than Option 1." The other participant does not know which option corresponds to which set of payoffs and must simply decide whether to believe the message received, choosing option 1 or 2 accordingly.[15] I also ask the subjects in this task to guess the probability that their matched partner will follow their advice. This allows me to distinguish between untruthful messages intended to deceive and those that are untruthful messages intended to counteract the partner's belief that the advice is deceitful. However, this procedure potentially confounds lying aversion with altruism. A sufficiently altruistic subject who is not lying averse may still send a truthful message purely out of a desire to be generous. Therefore, following Gneezy (2005), I implement a non-strategic (dictator) version of the first game to untangle lying aversion and altruism (see instructions for Block 3; and Figure 6, bottom panel, appendix B). Here, every subject (who previously sent a message) selects one of the two options, which gets executed by the computer with the same probability that the subject predicted for the other participant in the first game. Subjects do not know that the probability in the second version is going to be the same as the probability guessed by the subject in the first version; they

[14]This revealed preference elicitation procedure was introduced by Andreoni and Miller (2002) and subsequently extended by Fisman, Kariv and Markovits (2007).

[15]I randomize the order of Option 1) and Option 2) and use colors (Blue and Red) instead of numbers (Option Blue instead of Option 1), etc.) to avoid mechanical decisions. Participants are anonymously matched in pairs at the end of the experiment. Subjects are told the message will be delivered to another randomly matched participant at that time, and the amount of money they both will get depends on this other subject's decision. As a result, each subject receives the payout from her decision after observing the matched participant's message and the payout from the matched participant's decision after reading her message.

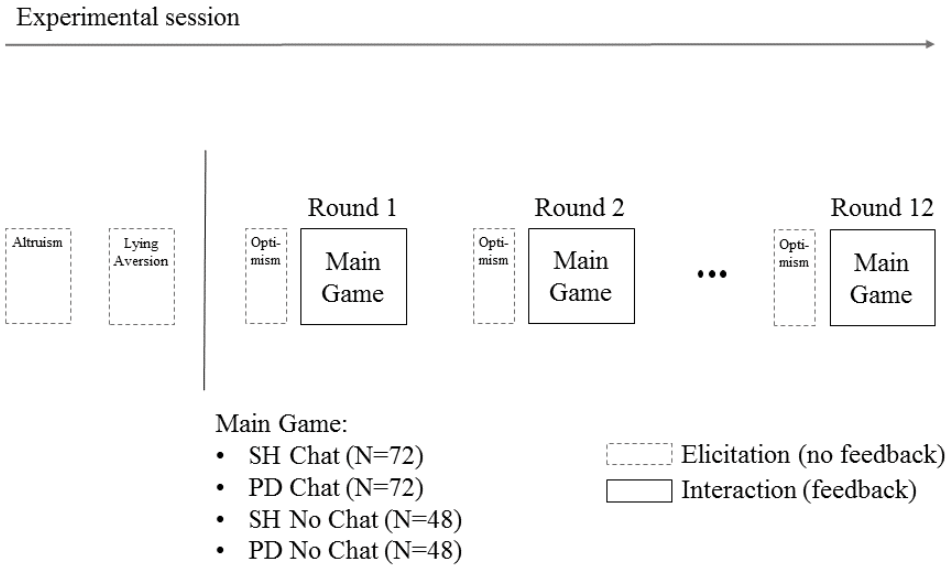


Figure 1: Experimental procedure.

are told only that the computer will execute their decision with some probability. Since lying to a computer does not carry the same moral stigma as lying to another person, choices in this round should purely reflect the extent to which altruism is present.

I label individuals as lying averse if (1) in the first version of the game, they send a truthful message and declare that the other participant would follow it with at least a 50% chance, and (2) in the second version, they choose the selfish option. This follows the exact same classification procedure as in Gneezy (2005). On the other hand, subjects who, in the first version of the game send either the truthful message or a false message that they expect few will believe, and in the second version choose the altruistic outcome are categorized as not lying averse. I also observe participants who send an untruthful message with the expectation that it would be implemented with a less than 50% chance, and, in the second version, choose the selfish option. Note that this second classification is not present in Gneezy (2005) because his paper assumes that a majority believes the receiver will follow the message. These subjects represent a small portion of the sample, only 23 out of 240 participants: 8 in SH, 7 in PD, 4 in SH No Chat, and 4 in PD No Chat; I code these participants are unclassified. In sum, in SH treatment 20 out of 64 (31%) participants are lying averse. In PD treatment 15 out of 65 (23%) are lying averse.[16] I elicit altruism and lying aversion (appendix A, Blocks 1 through 3) before the main treatments take place, as Figure 1 illustrates.

[16] I also use a battery of tests to elicit other individual characteristics. See the appendix "Further Results."

3.3 Optimism

I elicit each individual's beliefs about cooperation, which I label as "optimism". Beliefs can vary from round to round, so I elicit optimism twelve times, once before each of the twelve interactions in the main games (SH and PD), see Figure 1. I ask subjects to report the number of participants that they expect will cooperate in a one-shot two-player prisoners' dilemma ("OSPD"), played before each interaction. (See instructions for Block 2, appendix A). I do this to keep track of the evolution of beliefs, as participants experience communication and payoff-relevant outcomes. Note this elicitation procedure is different from the way I measure altruism and lying aversion, which are elicited only once at the beginning of the experiment. To elicit optimism, I reward accuracy in the report of the number of other participants who cooperate in the OSPD, using the following formula

$$\max\{0, 8 - |y - n|\},$$

where y is the reported number and n is the actual number of other participants cooperating. If a participant guesses correctly, $y = n$, he or she gets \$8. One Berkeley Buck is discounted for each report above or below the correct number of participants who cooperate. If the report is inaccurate by 8 persons or more, the participant gets zero. This is an individual decision task. Participants receive no feedback about their performance in the OSPD until the end of the experiment (so participants cannot condition their actions in the main games on the outcomes in the OSPD). I define optimism as $p = y/23$, where 23 is the number of other participants in the session.

Note that belief elicitation is an alternative to keeping track of the game path after each possible message exchange and each possible outcome of the payoff-relevant game, which is impractical. Beliefs about cooperation capture what participants infer about future cooperation based on these outcomes. Such beliefs are instrumental when weighing benefits against costs of initiating and cooperating. Whether there is a correlation between beliefs and behavior is an interesting question that this design allows to address at least qualitatively.

Table 2 provides a summary of the variables just described. Overall, treatment assignment does not seem to correlate with participants' characteristics. Optimism and behavior, on the other hand, seem to be very different: they vary across participants and rounds, so I only report averages over non-independent observations.

	Chat SH N	Chat SH mean	Chat PD N	Chat PD mean	t-test p	NoChat SH N	NoChat SH mean	NoChat PD N	NoChat PD mean	t-test p
CHARACTERISTICS										
Lying Aversion $\in\{0,1\}$*	64	0.31	65	0.23	0.30	44	0.36	44	0.34	0.82
Selfish $\in \{0,1\}$	72	0.17	72	0.24	0.30	48	0.19	48	0.27	0.34
BELIEFS & BEHAVIOR										
Optimism$\in [0,1]$	864	0.44	864	0.41	-	576	0.34	576	0.32	-
Initiate $\in\{0,1\}$	864	0.57	864	0.42	-	-	-	-	-	-
Cooperate $\in\{0,1\}$	864	0.82	864	0.38	-	576	0.23	576	0.10	-

Table 2: Summary statistics. Note: *Not all subjects can be classified in terms of lying aversion (see section on Characteristics above).

I ran 10 sessions in total (six sessions with communication and four sessions without communication) from April 2012 to April 2013 at the Xlab of the University of California, Berkeley. The participants consisted of 240 UC Berkeley students from the Xlab subject pool. Sessions lasted approximately one hour, and payoffs averaged 16 US dollars. Each participant took part in only one session. I sought to ensure anonymity throughout the experiment. Participants worked in separated workstations, and no communication took place except through the pre-play on-line messaging that was allowed for 30 seconds in each round of the chat treatments.

4 Experimental results

4.1 Communication

Communication increases the frequency of mutual cooperation in both games. The first columns in Table 3 panel a. and b. present the number of groups in which both players cooperate, one player cooperates and no one cooperates for the no chat treatments, pooling observations across groups and across rounds. The second columns show the same results for the chat treatments. In the stag hunt, mutual cooperation (both individuals cooperate) increases from 5% without chat to 70% with chat; while in the prisoners' dilemma, mutual cooperation goes from 1% to 20%. In the first round, when group observations are independent of each other, the frequencies of mutual cooperation, at least one cooperates and no cooperation are respectively 4%, 83% and 13% in the stag hunt without chat, and 58%, 33% and 8% in SH (with chat) (the Pearson's chi-squared statistic for the null that distributions are independent across treatments, chi-squared hereafter, p-value is less than 0.01). Similarly, communication increases cooperation significantly in the prisoners' dilemma, where the corresponding frequencies of outcomes are 4%, 42% and 54% without chat, and 36%, 42% and 22%

Cooperate	SH-NoChat	SH-Chat
No one	172 (60%)	30 (7%)
One	101 (35%)	99 (23%)
Both	15 (5%)	303 (70%)

a.

Cooperate	PD-NoChat	PD-Chat
No one	237 (82.3%)	190 (44%)
One	47 (16.3%)	155 (36%)
Both	4 (1.4%)	87 (20%)

b.

Table 3: Cooperation with and without communication, by treatment

with chat (chi-squared p-value less than 0.01). These results lend support to Hypothesis 1a in that communication increases cooperation in the stag hunt, but does not give support to Hypothesis 1b because communication also increases the frequency of mutual cooperation in the prisoners' dilemma.

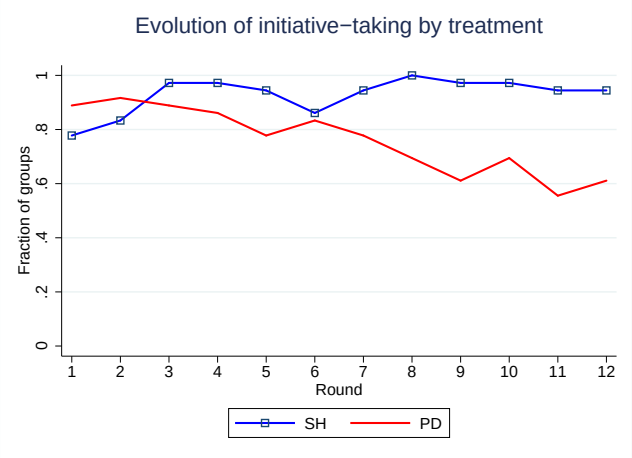
Result 1. *Consistent with Hypothesis 1a, communication increases the frequency of mutual cooperation in the stag hunt. Communication also increases the frequency of mutual cooperation in the prisoners' dilemma, which is not consistent with Hypothesis 1b.*

A weaker version of Hypotheses 1a and 1b is that pre-play communication matters more in SH than in PD. In other words, we should observe a higher increase in mutual cooperation from no-chat to chat in the stag hunt than in the prisoners' dilemma. Looking at the last row in both panels in Table 3, mutual cooperation increases by 65% (70% - 5%) in SH and by 18.6% (20% - 1.4%) in PD. The difference between these two differences is positive and equals 46%, suggesting that communication matters more in SH. If I look only at the first round, this difference-in-differences estimator is high, 22%, but not significant at conventional levels (t-test p-value = 0.14). I interpret this result as suggesting that communication matters in both cases, but slightly more in SH.

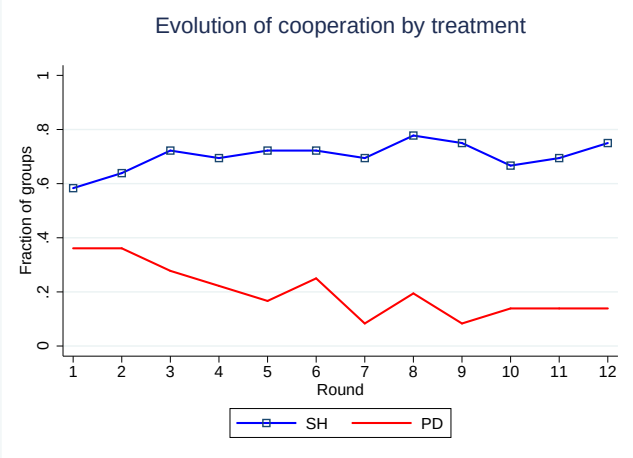
Additional Result 1. *Communication has a much larger impact on the frequency of mutual cooperation in the stag hunt than in the prisoners' dilemma, but the positive difference in impact is not statistically significant in the first round.*

4.2 Initiative and cooperation in SH and PD

When looking at the chat treatments data, participants frequently take the initiative in both games, and the frequency is overall higher in SH. Figure 2 panel a) shows the difference between initiative across rounds. In the first round, counting the groups in which at least one participant takes the initiative, PD features slightly higher initiative rates (SH: 78% vs. PD: 89%), but this difference is not significant at conventional levels (chi-squared test p-value = 0.2). Across rounds, the frequency of initiative is 93% SH and 76% PD and by the last round, initiative reaches 94% in SH but goes down to 61% in PD. The frequency of initiative in PD goes down, but a sizable



a) Initiative



b) Cooperation

Figure 2: Fraction of groups in which: a) at least one subject initiates, b) both cooperate.

proportion of participants still encourage others to cooperate as rounds go by. This arguably lends support to Hypotheses 2a and 2b; even though initiative is not complete in SH, it persists at a very high level, while it declines in later rounds in PD.

Result 2. *Almost every group features someone taking the initiative suggesting cooperation in SH, while about 3/4 of the groups do so in the PD, on average. These results are consistent with Hypotheses 2a and 2b.*

Is the frequency of initiative similar to the frequency of cooperation across treatments? Figure 2 panel b) counts the number of groups in which both players cooperate by round and by treatment. The difference in cooperation rates in the first round is significant (SH 58% vs PD 36% chi-squared p-value = 0.06). When pooling observations across groups and across rounds, cooperation rates are: SH 70% vs. PD 20%. In the last round, cooperation rates diverge: SH 75% vs. PD 14%. This evidence suggests that cooperation is prevalent in SH and infrequent in PD. However, despite that the theory on pre-play communication offers the clear prediction that cooperation should not occur in PD, Figure 2 panel b) shows that at least one group cooperates each round. Moreover, despite that the theory on pre-play communication also predicts that mutual defection is also an equilibrium in SH, it seldom occurs. At least 60% of the groups achieve mutual cooperation every round. This last result does not contradict the extant theory on the role of pre-play communication on cooperation, but it indicates that communication promotes selection of the cooperative action in SH by both players.

I also explore how initiative and agreement mediate the effect of communication on cooperation. Table 4 shows the results of a linear regression model, where the unit of observation is the group

and the dependent variable is mutual cooperation. In each regression, I fix the payoff-relevant game (either stag hunt or prisoners' dilemma) and use as explanatory variable an indicator of whether the treatment allows for communication. I also interact communication and the presence of an initiator, as well as communication, initiator and agreement. Columns (1) - (4) show the results for the stag hunt and columns (5) - (8) the results for the prisoners' dilemma. Looking first at the stag hunt, column (1) corroborates the importance of communication. Mutual cooperation goes from 5% to 70% as in Table 3 panel a. However, mutual cooperation is more prevalent when at least one person takes the initiative, as opposed to when message exchanges do not feature a clear initiative, as shown in column (2). Column (3) documents the importance of agreement. When at least one person takes the initiative and the other person agrees, mutual cooperation is even higher, as shown in column (3). Importantly, the significance of communication, outside explicit messages suggesting cooperation and agreement, does not vanish with the inclusion of the interactions. One interpretation of this result is that messages that do not suggest cooperation directly may still be useful making cooperation focal, which is somewhat consistent with the theoretical work on communication. Column (4) replicates column (3) but only reports the results from the first round. The data show that initiative and agreement together correlate with cooperation when players do not have experience playing the game.

Table 4 column (5) shows that mutual cooperation goes from almost zero without communication to 20% when communication is allowed in the prisoners' dilemma, the same result as in Table 3 panel b. However, when I separate communication featuring a first message suggesting cooperation from any other message exchange in column (6), initiative seems to explain all the variation in cooperation produced by the opportunity to communicate. In other words, initiative seems to be essential to attain mutual cooperation, relative to any other messages. This result differs from the result in column (2) for the stag hunt, in which, even messages that do not feature a clear suggestion to cooperate are still associated with cooperation. When looking at column (7), agreement is associated with mutual cooperation, but it does not make initiative-taking by itself irrelevant. Yet, communication outside initiative and agreement, does not seem to be associated with mutual cooperation. When I look at the first round, only initiative matched with agreement is significantly associated with mutual cooperation at 5% level of significance.

Additional Result 2. *Messages of initiative and agreement are significantly correlated with cooperation in both games. Messages other than initiative and agreement are (weakly) correlated with cooperation in SH, but not in PD.*

The results in the preceding paragraphs show that, at the group level, initiative and agreement positively correlate with cooperation in both the SH and PD. When looking only at the chat treatments data, initiators seem to behave differently across games and also when compared to

Dependent variable:	Mutual Cooperation							
	SH				PD			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Chat	0.65***	0.14**	0.14**	0.08	0.19***	-0.00	-0.00	-0.04
	(0.03)	(0.07)	(0.07)	(0.13)	(0.02)	(0.04)	(0.03)	(0.20)
Chat x Initiative		0.55***	0.27***	0.21		0.25***	0.12***	0.18
		(0.07)	(0.07)	(0.15)		(0.03)	(0.04)	(0.22)
Chat x Initiative x Agree			0.35***	0.56***			0.19***	0.34**
			(0.04)	(0.13)			(0.04)	(0.14)
_cons	0.05**	0.05**	0.05**	0.04	0.01	0.01	0.01	0.04
	(0.02)	(0.02)	(0.02)	(0.06)	(0.02)	(0.02)	(0.02)	(0.08)
N	720	720	720	60	720	720	720	60
R^2	0.410	0.459	0.505	0.596	0.076	0.140	0.168	0.270

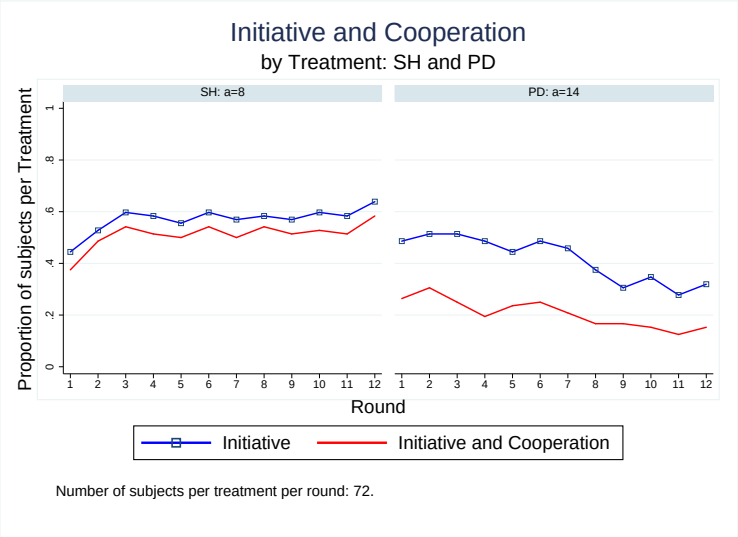
Table 4: Mutual cooperation. The table shows the results of a linear regression model in which the outcome variable is mutual cooperation and the explanatory variables are the possibility of communication (Chat), whether Chat interacts with an indicator variable that the group features at least one initiator (Chat x Initiative), and the interaction between these two variables and whether the person agrees to initiative (Chat x Initiative x Agree). Standard errors in parentheses. $*p < 0.10$, $**p < 0.05$, and $***p < 0.01$.

non-initiators in the same game. Figure 3 panel a) counts individuals who cooperate among those who initiate across rounds by game. In SH, a majority of the initiators cooperate in the first round, 84%, while in PD 54% of the initiators do so. In the last round, almost all initiators cooperate in SH (90%) and still roughly half of the initiators do so in PD, 48%. Note that cooperation at the individual level does not only depend on the exogenous variation in the payoffs (type of game), but also on the messages exchanged. In this sense, it is a post-treatment variable at the individual level. Since I am interested in initiative *and* cooperation as the group outcome, I can only use the group as the unit of observation and assume that observations (groups) are independent in the first round. Under this assumption, I count the groups that feature an initiator who cooperates in each game and test for the significance of the difference across games. 24 out of 36 groups feature an initiator who also cooperates in SH, and 19 out of 36 do so in PD. A chi-squared test rejects a significant difference at conventional levels (p-value = 0.2). However, this difference increases in the last round: 31 out of 36 in SH, and 10 out of 36 in PD. Even though I formally reject differences in the behavior of initiators in the first round across games, the time-series evidence suggests that almost all initiators end up cooperating in SH, but some (about half) of them do in PD.

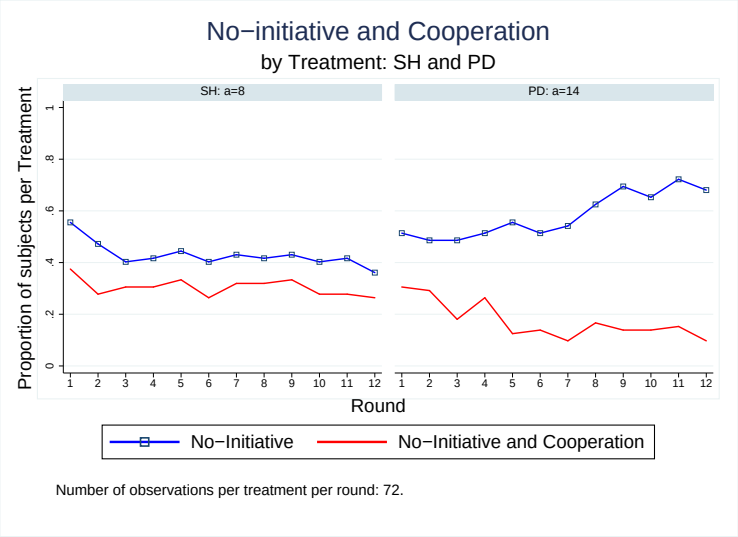
Result 3. *Some initiators do not cooperate in SH, which is not consistent with Hypothesis 3a. However, some initiators do cooperate in the PD, which is consistent with Hypothesis 3b.*

Although not part of the hypotheses, it is instructive to analyze the behavior of non-initiators. Pooling the data across rounds and across subjects, Figure 3 panel b) shows a greater proportion of non-initiators who cooperate in SH relative to PD: 71% in SH versus 30% in PD on average. This difference evolves from SH: 68% vs. PD: 60% in the first round to SH: 73% vs. PD: 14% in the last round. It is worth noting that in PD, the proportion of initiators who cooperate in the first round is very similar to the proportion of non-initiators who cooperate (54% and 59% respectively), yet by the end of the experiment only 14% on non-initiators do so (compared to 48% of initiators, see Figure 3 panel a). The same concerns about independence and post-treatment variables laid out in the previous paragraph apply in this case. As before, when counting all the groups that feature a non-initiator who cooperates and comparing the distribution across treatments in the first round, I find that 26 out of 36 groups feature at least one non-initiator who cooperates in SH, and 22 out of 36 groups do so in PD. A chi-squared test fails to reject a significant difference in distribution (p-value = 0.3). However, in the last round, the difference becomes more pronounced: 19 out of 36 groups feature a non-initiator who cooperates, while only 7 out of 36 do so in PD. In sum, Figure 3 panels a) and b) together suggest that initiators cooperate more often than non-initiators in PD, on average.

Before moving on to the relation between altruism, lying aversion and initiative, I use the



a) Initiators and cooperation



b) Non-initiators and cooperation

Figure 3: Initiative and cooperation across rounds by treatment.

data on agreement to explore drivers of individual cooperation. For example, it may be the case that initiators who cooperate do not act solely based on their initial intentions, but respond to whether the partner agrees to their proposal. Initiators who observe a partner agreeing to their proposal cooperate more often than those who do not observe a partner agreeing in both SH and PD. Average cooperation rates across rounds are 94% and 79% in SH, and 55% and 37% with and without observing agreement, respectively. This pattern holds even if I look only at the first round decisions, with a starker difference in PD. 68% (15 out of 32) of initiators cooperate when they observe agreement, while only 31% (4 out of 13) of initiators who do not observe agreement cooperate. Note that agreement is a post-treatment behavior (not exogenous) from the perspective of the initiator. A person who waits for the partner to take the initiative mechanically affects the likelihood that the partner actually takes the initiative, and the partners' initiative is likely to correlate with him or her cooperating. Nevertheless, the data show a rather strong qualitative relation between partner's agreement and initiator's cooperation.

Additional Result 3. *Initiators who observe the partner agreeing cooperate more often than initiators who do not observe the partner agreeing.*

Overall, these results roughly support the extant theory of communication in the stag hunt. They do not support, however, the theory of communication with money maximizers rational individuals in the prisoners' dilemma. The pattern of communication, understood as whether at least one person first suggests cooperation and whether the other person agrees, is correlated with cooperation in PD. Moreover, although messages are truthful about half of the time in PD, we observe that initiators cooperate more frequently than non-initiators. Next, I provide descriptive results as to whether initiators who cooperate are more altruistic and lying averse than those initiators who do not.

4.3 Altruism and lying aversion

In this subsection, I use only data from the chat treatments. The data reveal no significant difference between the number of altruistic individuals who take the initiative in SH and in PD. Pooling subjects and rounds, 57% of the altruists take the initiative in SH and 41% in PD. When looking at the first round only, the proportions are 47% SH and 47% PD (one-sided two-sample test of proportions p-value = 0.5). This evidence does not support Hypothesis 4.

Result 4. *There is no difference in the proportion of altruists who take the initiative in PD and in SH, which is not consistent with Hypothesis 4.*

There is no difference in terms of initiators' lying aversion across games either. 59% of lying averse individuals take the initiative in SH, while 38% do so in PD, pooling subjects and rounds.

In the first round, the respective proportions are different, but insignificant at conventional levels: 60% SH and 40% PD (one-sided two-sample test of proportions p-value = 0.12).

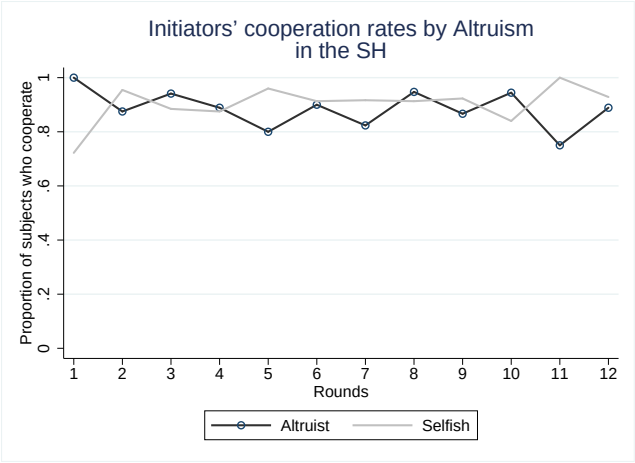
Are there any differences in cooperation? I compare the fraction of altruists who cooperate across treatments. Over all subjects and rounds, 84% of those who cooperate are altruists, while in PD that fraction is 87%. Interestingly, in the first round the proportions are 87% SH and 94% PD, suggesting that altruists cooperate slightly more often. These proportions, however, are non-significant conventional levels (one-sided two-sample test of proportions p-value = 0.14).

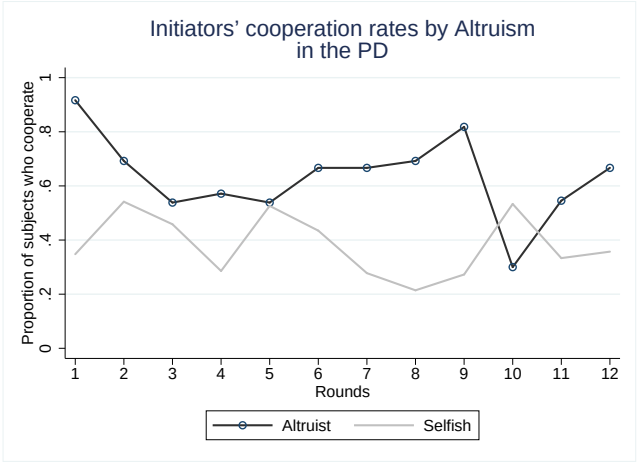
In my data, everything that happens after initiative is endogenous at the individual level. However, reporting correlations can illustrate whether altruism and lying aversion correlate with initiative and cooperation, especially in PD. When looking at the data from this perspective, I do not find significant differences in altruism and lying aversion between initiators and non-initiators in neither of the games. Initiators who end up cooperating, however, are more frequently altruistic than those who end up defecting only in PD. Figure 4 panel a) right-hand side shows that for all the rounds, except one (round 10), a higher proportion of altruist initiators than selfish initiators ends up cooperating. In the first round, the proportions are 92% of altruists vs. 35% of selfish in PD.

Initiators who end up cooperating are also more lying averse than those who end up defecting only in PD. Figure 4 panel b) shows the fraction of lying averse subjects who cooperate after taking the initiative. The pattern is similar to altruism in PD: In every round, a higher proportion of lying averse initiators than not lying averse initiators ends up cooperating. In the first round the proportions are 81% of lying averse vs. 42% of non-lying averse.

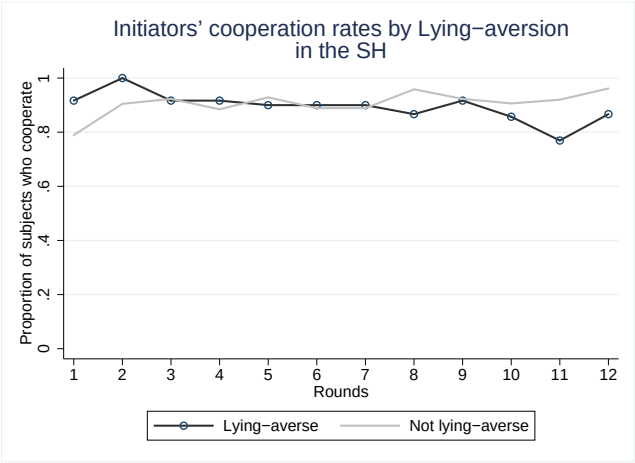
4.4 Optimism

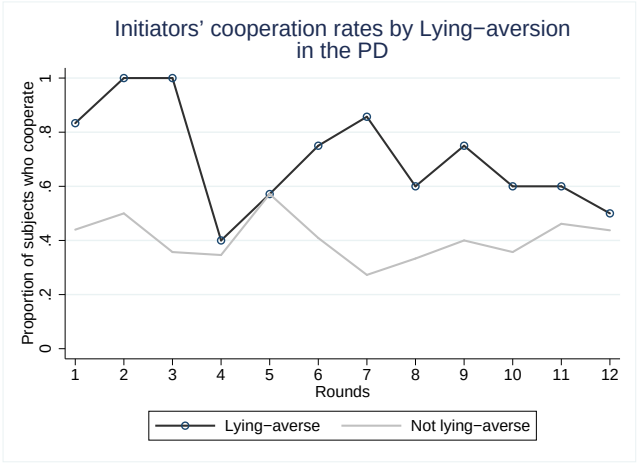
The last set of results present correlations between optimism and initiative and between optimism and cooperation. Regarding optimism and initiative, Table 5 shows the estimates of a panel data (i: participants, t: rounds) random-effects model of initiative on optimism for each game, SH and PD, clustering standard errors at the subject level. For each game, I add a specification that includes lying aversion and another one that includes an interaction between optimism and lying aversion as regressors. From these specifications, I check whether pessimistic individuals who are also lying averse refrain from initiating by looking at the magnitude of the coefficient on lying aversion—which represents the correlation between lying aversion and initiative for extremely pessimistic individuals. Table 5 columns (1) and (2) show the results for SH, and columns (3) and (4) for PD. In SH, there is no association between initiative and beliefs, nor between initiative and lying aversion. In the PD, however, I do find a mild positive correlation between initiative





a. Altruism





b. Lying aversion

Figure 4: Rates of initiative taking and cooperation by treatment for altruistic initiators (panel a.) and for lying averse initiators (panel b.).

	(1) SH Initiate	(2) SH Initiate	(3) PD Initiate	(4) PD Initiate
Optimism	0.04	0.06	0.14*	0.07
	(0.07)	(0.08)	(0.08)	(0.09)
Lying aversion		0.07		-0.12
		(0.10)		(0.11)
Optimism x Lying aversion		-0.13		0.22
		(0.15)		(0.22)
_cons	0.55***	0.55***	0.36***	0.38***
	(0.04)	(0.05)	(0.05)	(0.05)
N	864	768	864	780
R^2 overall	0.00	0.00	0.02	0.01
Ho:b[optimism]+b[optxLA]=0, p-value		0.61		0.15

Table 5: Initiative and optimism. Standard errors in parentheses: $*p < 0.10$, $**p < 0.05$, and $***p < 0.01$.

and optimism (column 3), but such relationship disappears when adding lying aversion and the interaction (see bottom row, p-value = 0.15 for the null hypothesis that the sum of coefficients on optimism and the interaction is equal to zero). In column (4) the coefficient on lying aversion is negative (-0.12, s.e. 0.11), but not significant at conventional levels, suggesting that even though lying averse individuals may refrain from taking the initiative in PD, the association is weak at best.

Result 5a. *There is little correlation between optimism and initiative in both games. Moreover, pessimistic participants who are also lying averse are no less likely to take the initiative compared to pessimistic individuals who are not lying averse. This lends no support for Hypothesis 5a.*

Regarding optimism and cooperation, I estimate a panel data random effects model of cooperation on optimism, clustering standard errors at the subject level for each game separately. Now, however, I run the model over two different samples: on every participant and on every initiator. Running the model on every participant allows me to study the correlation between optimism and cooperation unconditionally, and running the model on initiators allows me to check whether optimism (as well as lying aversion and altruism) correlate with cooperation, conditional on taking the initiative. Note in the first case I am just correlating two endogenous variables and in the second case, I condition on an endogenous variable (initiative). Although purely descriptive,

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	SH	SH	SH	SH	PD	PD	PD	PD
Dep. variable:	Coop.	Coop.	Coop.	Coop.	Coop.	Coop.	Coop.	Coop.
Optimism	0.12***	0.06	0.06	0.01	0.26***	0.19***	0.18***	0.24***
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.07)	(0.07)	(0.06)
Altruism			0.00	-0.00			0.18*	0.16*
			(0.06)	(0.06)			(0.09)	(0.09)
Lying-ave.				0.01				0.22**
				(0.07)				(0.11)
_cons	0.76***	0.86***	0.86***	0.88***	0.27***	0.41***	0.34***	0.25***
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.06)	(0.07)	(0.07)
N	864	493	493	448	864	361	361	314
R^2overall	0.02	0.004	0.004	0.001	0.08	0.08	0.11	0.18

Table 6: Cooperation for those who take the initiative as a function of optimism, altruism and lying aversion. Standard errors in parentheses: $*p < 0.10$, $**p < 0.05$, and $***p < 0.01$.

this exercise can shed light on whether beliefs are associated with cooperation. Table 6 shows the results for both treatments. The first four columns feature the regression of cooperation on optimism in SH. Column (1) shows the result for the unconditional sample, and columns (2)-(4) for the sample of initiators. I find a significant correlation between optimism and cooperation only in the unconditional sample. In the PD, however, (columns (5)-(8)) optimism positively correlates with cooperation among initiators in PD in the unconditional (column (5)) and conditional models (columns (6)-(8)). Thus, when including lying aversion and altruism as well as optimism, all the coefficients are positive and significant at conventional levels, suggesting that initiators' optimism, lying aversion and altruism may be associated with them cooperating. These results support Hypothesis 5b.

Result 5b. *Optimism is positively correlated with cooperation in both games. Among initiators, however, optimism is positively correlated with cooperation only in PD. In SH, there is no correlation between optimism and cooperation among initiators. The same holds for lying aversion and altruism among initiators, but the correlation is weaker than for optimism. These results lend support to Hypothesis 5b.*

5 Conclusion

The results in this paper highlight the importance of considering non-binding, costless and free-form communication in context rather than an abstract phenomenon that can help achieve desirable outcomes in all situations. Rewards for unilateral defection, what I refer to as "context," make an important difference in the efficacy of communication. When it is in the best interest of the parties to cooperate in response to cooperation, communication is effective even when it does not feature clear messages suggesting cooperation. When incentives motivate people to defect when others cooperate, the possibility to communicate increases the likelihood of mutual cooperation, but the magnitude of the increase is not as significant as when cooperation is in the best interest of both parties.

Communication, however, is not a black box. It consists of a rich sequence of messages that emerge endogenously, without pre-imposed order. Our focus on the first message suggesting cooperation is motivated by the fact that it triggers a conversation that may or may not lead to mutual cooperation. I find that the frequency of initiative suggesting cooperation is rather similar across contexts. However, whether initiative is associated with cooperation depends on the incentives to deviate when others cooperate. An overture to cooperate is almost always genuine when monetary incentives favor mutual cooperation; and when it comes from intrinsically motivated individuals under conditions that favor defection.

One implication of these results is that the benefits of communication depend on the context. In some cases, it may not be cost effective to promote communication as it will have a limited effect on cooperation. In other cases, the effect of communication on cooperation is so large that justifies almost any cost. This paper exposes an important aspect of the strategic context that should be considered when assessing the costs and benefits of communication: the rewards to unilaterally defect from cooperation. Another implication is that the sequence and the content of a conversation matter. In particular, the first message is not irrelevant. It can be associated with cooperation, especially in situations in which monetary payoffs favor opportunistic behavior. One could think of situations in which encouraging initiative may help overcome some of the reluctance to cooperate, especially if we expect that individuals (e.g., workers, colleagues or citizens) in the population are intrinsically motivated.

This analysis contributes to our understanding of communication in economics by providing evidence on (1) the differential effect of communication depending on context, (2) how the types of messages sent, in particular verbal initiative initiative, depend on the context and (3) context and individual characteristics can help explain the association between initiative-taking and cooperation.

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