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Watch your Words: An Experimental Study on Communication and the Opportunity Cost of Delegation*

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Abstract

Communication has been shown to play a positive role in promoting trust, yet there is no evidence on how sensitive this result is to the size of the gains from cooperation. To investigate this issue, we adopt an experimental design in which an agent can send a free-form message to a principal, before the latter makes a delegation choice, by selecting whether or not to allow the agent to decide how to share a given sum between the two of them. We allow the opportunity cost of delegation to vary, and find that communication increases the principal's beliefs on the amount that the agent will choose to transfer, only when this cost is high to start with, therefore attenuating the effect of the size of the opportunity cost of delegation on the principal's choice. We find evidence of deception, but in some circumstances the agent is overoptimistic about her ability to deceive. Indeed, in the presence of lower opportunity costs of delegation, we document an illusion effect: the agent uses non-precise promises and incorrectly expects these to exert positive effects on the principal's beliefs and propensity to delegate.

Keywords: Communication, Promises, Delegation, Deception, Language Precision

JEL classification: C7, C9, D9

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1 Introduction

Consider a pharmaceutical firm wishing to invest in a research unit to develop and launch a new drug. The firm may have limited control over the researcher's incentives to pursue a private agenda, for instance, by publishing academic papers that require disclosure of information, or building a reputation for research orientation.[1] While these secondary activities can generate value for society as a whole, they may nevertheless reduce the financed project's profitability. The pharmaceutical firm's decision will naturally be influenced by the value of its alternative safer option, which represents the opportunity cost of investing (or of delegating). Prior to making the final decision, the firm can consult researcher to try to figure out her true intentions, even if what the researcher actually says does not have a binding effect in contractual terms. Given this scenario, for higher values of the firm's safe option, will a researcher be more prone to promise greater returns, and will more generous statements of intent have a different impact on the investment decision? Also, will a researcher be more or less willing to live up to his promises in order to reward the firm for investing?

The setting described above can be classified under the general category of problems that involve principals choosing to delegate decision making power to agents in the presence of contractual incompleteness. In such situations, trust is an important determinant of the delegation decision, and it is a well-known result in the social science literature that non-binding communication has the potential to enhance trust and facilitate cooperation (see the references cited in the literature review section). However, the unexplored issue that we examine is whether the interplay between communication and the principal's opportunity cost of delegation affects the choices and beliefs of both players. Indeed, in many settings that share the features of the example described above, the opportunity cost of delegation may vary significantly and potentially have an impact on the role, as well as on the content of communication.

Considering the pharmaceutical firm-research unit example, the former's reluctance to invest may stem from the fact that the firm has a number of safer alternative projects to choose from, and faces a relatively high opportunity cost of engaging with a new research unit of uncertain trustworthiness. On the other hand, a previous investment in a specific R&D alliance automatically implies that breaking away from an existing business relationship is a more costly option, leading to a lower opportunity cost of continuing to delegate. A similar pattern typically characterizes different relations within organizations. The value of a manager's option to refrain from delegating to a collaborator is lower, when the manager's remuneration depends on the performance of the team. On the contrary, when the reward is prevalently based on individual performance, we should expect self-interested managers with competitive bonuses to have a higher opportunity cost of trusting their peers. In a looser sense, this setting may capture some features of electoral communication

[1] Lerner and Malmendier (2010) show that, when research is non-contractable, although it is possible to write option contracts (i.e., the financing firm is given the unconditional right to terminate the collaboration, in which case it obtains broad property rights to the terminated project), these are second-best optimal and it is never possible to acheive full efficiency with contractual solutions.

in which a voter in the role of a principal faces a lower opportunity cost of voting for a politician that shares her same ideology, with respect to one that is ideologically distant but may nevertheless turn out to be more honest.

In this paper, we explore the role of communication in mediating (attenuating or amplifying) the effects of the opportunity cost of delegation on the principal's choice to delegate, and the agent's attitude to prove worthy of trust. In relation to the firm-research unit example, we compare situations in which the firm has a relatively larger versus smaller riskless alternative, in order to assess in which of these cases communication is more effective in determining investment decisions. Moreover, we analyze how the nature of communication, in terms of both the propensity to make more generous promises as well as the precision of the amount promised, varies based on the opportunity cost of delegation.

Our analysis is based on the lost-wallet game as originally introduced by Dufwenberg and Gneezy (2000). In this game, the trustor (that corresponds to the firm in our example) decides whether to keep or pass an endowment to the trustee (that corresponds to the research unit in our example).[2] If she keeps the endowment, then the game ends with final payoffs being null for the trustee and equal to the endowment for the trustor. If instead she passes, the endowment is increased by some proportion and transferred to the trustee, who then decides how to split the overall amount between himself and the trustor. We enrich the original design by adding one-sided communication, allowing the trustee to send a free form message to the trustor before she makes her choice. We compare results from the original game with those observed in the enriched version involving communication. To depict how communication and choices interact with either low or high opportunity costs of delegation, we also manipulate the size of the initial endowment in the hands of the trustor setting it either above or below the amount representing the equal split between the two players.

In line with the literature on the positive role of non-binding communication on cooperation, we rely on a baseline theoretical framework of costly talk. The model assumes that individuals tend to live up to their promises because they suffer a cost of lying, but are willing to pay this price since messages can influence the principal's beliefs and therefore also the delegation decision. The main feature of our framework is that both the message space and the choice set of the trustee are non-binary. The role played by the cost of lying in this context is that the action of the trustee involves choosing how much to reciprocate by returning any amount ranging from 0 to 20 euro, and is therefore not a simple choice of whether to reciprocate or not. This introduces a possible avenue for communication to be used in a different manner based on the opportunity cost of delegation. If the cost of lying induces the trustee to live up to his promises, we should expect him to optimally choose how much to promise, by internalizing the costs and benefits of making certain promises based on the context. Indeed, the trustee faces a trade-off between the benefit of promising greater amounts and therefore increasing the principal's beliefs on the amount he will receive (and consequently the

[2]Throughout the paper, we use female pronouns for the trustor and male pronouns for the trustee and interchangeably refer to principal and agent respectively as either trustor and trustee, or Player A and Player B.

chances of delegation) and the cost of having to return a greater amount to the trustor in order to live up to his promise.

The baseline model delivers the following predictions. First, when communication is allowed, the trustee will choose to make promises. Second, the face value of these promises is positively related to the amount the trustee chooses to redistribute to the trustor conditional on delegation, the trustor's beliefs on this amount (first order beliefs), as well as to the trustee's beliefs on the amount the trustor expects to receive (second order beliefs). Third, when the opportunity cost of delegation is high and therefore the trustor is less likely to delegate, the trustee should make higher promises to increase the chances of delegation at the cost of having to return a larger amount. Thus, communication will attenuate the role of the opportunity cost of delegation on the principal's choice to delegate, by reducing the positive difference that exists, between the share of trustors that pass when the opportunity cost is low versus when it is high in the absence of communication.

The experimental results are partially consistent with the implications of the model. In particular, we observe that: (1) promises contain a higher (lower) reference value when the opportunity cost of delegation is high (low); (2) when the cost of delegation is high, promises increase the trustor's beliefs on the amount she will receive contingent on passing (first order beliefs), as well as the trustee's beliefs on this amount (second order beliefs); (3) communication has no effect on the amount that the trustee actually chooses to return; and (4) non-precise promises (meaning those that contain a non-unitary set of values delimited by a lower bound) are often used when the cost of delegation is low and significantly affect second order beliefs, but not first order beliefs.

Results (1) and (2) seem to provide evidence that costly promises are used only when they are strictly necessary, in other words when the trustor's chances of delegating are slim to start with. Moreover, consistently with the theoretical predictions, the size of the opportunity cost of delegation exerts a negative effect on the probability that the trustor will delegate, but results (1) and (2) jointly imply that communication attenuates this effect.

Result (3) is rather surprising: even if communication affects second order beliefs, the amount the trustee chooses to redistribute does not depend on communication, and is generally below what promised. This finding provides evidence of deception, and casts doubt on the suitability of the costly talk hypothesis to provide an exhaustive explanation of the results in this context. In order to further probe the results, we introduce a model of cheap talk in the spirit of Crawford and Sobel (1982) and assess how well it fits our data relative to the baseline model of costly talk. The main feature of the cheap talk model is that the utility of the trustee is not affected by communication. Therefore, assuming that the trustee is characterized by a desired amount that he intends to redistribute, and that these preferences are unknown to the trustor, communication can be effective in influencing beliefs and choices only if it is informative about the true intentions of the trustee in equilibrium. In our setup, we show that this is possible only if the trustee believes that the trustor deems him worthy of little trust prior to communication. However, the experimental results do not provide supporting evidence in favor of this prediction, implying that, like the costly talk model, the cheap talk framework does not offer a complete rationalization of our results.

Nonetheless, while both families of models fall short of providing an exhaustive explanation of our experimental findings, each seems to capture some essential features. In particular, the costly talk model is valid in explaining why promises tend to be more inflated when there is a bias against delegation. On the other hand, the cheap talk model well matches the fact that agents tend to give back an amount that depends on their preferences. This suggests that a framework incorporating some aspects of both models is possibly more appropriate. Hence, we introduce a hybrid model in which the trustee has preferences for fairness that are unaffected by communication, the trustor is naive and can be influenced by messages, and talk is costly in the sense that the trustee suffers from lying even if this does not lead him to change his actions.

Finally, in the discussion section, we propose a possible behavioral explanation for result (4), which we attribute to an "illusion effect" leading trustees who use non-precise promises to erroneously believe they will have a positive effect on trustor's expectations. This is based on the idea that when the opportunity cost of delegation is high, even if the principal believes the agent will give back a fair amount, she is very unlikely to delegate when the opportunity cost of doing so is greater than this fair amount. In order to convince the trustor to delegate, the trustee must promise to give back an amount that is greater than the fair amount. If he were to do so by using a non-precise promise, it would be as if the agent were setting a reference point that is strictly above an amount that he considers fair, therefore declaring that he may even return more than this if the principal chooses to delegate. It is however extremely implausible that the principal will believe that the agent may actually return an amount that is greater than this high reference point, because this would mean that the agent is moving farther away from an amount that he considers fair. Therefore, the trustee will never consider non-precise promises to be effective when the opportunity cost of delegating is high, and this is consistent with the fact that we almost exclusively observe precise promises in this case. On the other hand, when the opportunity cost of delegation is low there is less need to promise an amount that is above the fair amount, because there is already a positive bias in favor of delegation. Thus, as long as the reference point established by promises is reasonably low (i.e., less than or equal to the fair amount), a trustor may actually be induced to believe that the trustee will return an amount that is above the reference point, as long as she is sufficiently predisposed towards trusting the agent. Naturally, in this second case, the agent is uncertain about the principal's predisposition, and may therefore erroneously believe that the principal is receptive to non-precise promises, thus developing an over-optimistic view regarding the effect that non-precise promises will have on the amount that the principal expects to receive if she passes. As long as the agent is sufficiently over-optimistic on the receptiveness of the principal, the behavior prescribed by the model is consistent with the illusion effect that we observe in the data.

The rest of the paper is organized as follows. Section 2 reviews the related literature. Section 3 presents the experimental design and theoretical predictions. Section 4 reports the experimental results. Section 5 discusses the experimental results and provides some additional theoretical arguments to organize the empirical findings. Finally, Section 6 provides further insight on the use of precise versus non-precise promises and introduces the "illusion effect".

2 Literature review

The fact that communication triggers cooperation between counterparts with conflicting interests stems from the empirically validated observation that people make promises they do not want to break. In this regard, two possible explanations for why this occurs have been proposed. A first reason is rooted in guilt aversion (e.g., Charness and Dufwenberg, 2006; Battigalli and Dufwenberg, 2007; Battigalli et al., 2013; Khalmetski, 2016; Ederer and Stremitzer, 2017) and a second is related to preferences for keeping promises or costs of lying (e.g., Ellingsen and Johannesson, 2004; Gneezy, 2005; Vanberg, 2008; Kartik et al., 2007; Corazzini et al., 2014, Casella et al., 2018). The guilt aversion explanation is based on the idea that individuals are averse to disappointing others, and live up to their promises since they expect these to affect the beliefs of the trustors. The second explanation instead relies on the assumption that individuals act according to their promises, because they are concerned about the consistency of their behavior with respect to their statements of intent. Both stories of promise-keeping are well relevant and heavily depend on the context (Charness and Dufwenberg, 2010).

Within this literature, our paper is closely related to Charness and Dufwenberg (2006) and Casella et al. (2018).[3] Charness and Dufwenberg (2006) study the impact of non-binding, one-sided, freeform, pre-play communication in a one-shot modified trust game with hidden action. In their framework, after allowing the trustee to send a free form message to the trustor, the latter decides whether to pass (i.e., to allow the former to decide how to split a fixed sum between the two of them or not). Upon being trusted, the trustee faces a binary choice of whether to reciprocate or not (i.e., either to roll a die or not to role). The authors show that free form communication has a positive impact on the trustee's decision to role the die, thus inducing greater trust and cooperation between subjects. Casella et al. (2018) study the effects of competition on promised amounts and trustworthiness, by relying on a lost wallet game in which the trustee sends a fixed form message specifying a non-binding amount to return to the trustor who chooses to pass. The authors compare the results between a setting in which the principal faces one agent only, with those in which there are two agents sending their promises simultaneously. Their main finding is that competition between agents inflates promises, although messages do not substantially affect beliefs and final choices.

The novel feature of our research question with respect to the literature discussed above is that we study the interplay of communication and the opportunity cost of delegation. Guided by our

[3]Indeed, the research that investigates the positive impact of communication is much broader and there are equally important contributions that we do not discuss in the main body of the text for the sake of brevity of the literature review. For instance, Ben-Ner and Putterman (2009) study communication in a standard trust game and illustrate that it can increase trust as well as trustworthiness. Cadsby et al. (2015) find evidence of the positive role of relational closeness in inducing promise keeping behavior. Servatka et al. (2011) show that communication can do a better job than other incentives, such as (financial) gifts. Brandts et al. (2015) experimentally show that free-form communication, mainly involving the use of promises and discussion of compensations in case of ex-post shocks, increases the relevance and profitability of flexible contracts relative to rigid ones. Dufwenberg et al. (2017) instead investigate the impact of two-sided pre-play communication in the lost wallet game, in order to examine the role of informal agreements in inducing cooperation between agents.

research question, a key aspect of the experimental design that we share with Casella et al. (2018) is that neither the choice space nor the message space of the trustee are constrained to be binary. For example, while in Charness and Dufwenberg (2006) the trustee can only choose whether to return a greater expected amount to the trustor by choosing whether to role a die or not, and in Gneezy (2005) and Battigalli et al. (2013) the message space is constrained to be binary, in our case no such limitations apply. The richer choice space therefore allows the choice of messages to potentially be more heterogeneous. More specifically, since the amount that the trustee distributes in case delegation occurs can be any amount between 0 and 20 euro, this implies that the reference value contained in a promise is a relevant choice variable. In this respect, our work is closely related to Casella et al. (2018). A major departure of our approach with respect to Casella et al. (2018) is that while they focus on the effects of competition on communication, our central research question concerns the role of the opportunity cost of delegation. Moreover, while they assume fixed form messages, we do not impose any constraint on the message space by allowing for free form messages, which allows us to also investigate how the opportunity cost of delegation affects communication content (i.e., empty messages versus promises as well as the precision of the latter).

Another strand of literature that is related to our work investigates the impact of communication content, in terms of precise versus non-precise promises, on coordination. There seems to be consensus that, if given the opportunity, individuals may strategically opt for imprecise communication in order to conceal information about the true state of the world, and reach either socially or personally beneficial outcomes by increasing contributions to public goods or improving coordination (Serra-Garcia et al., 2011; Agranov and Schotter, 2012; Agranov and Schotter, 2013). Our analysis instead provides some insight on the motivations behind the choice of precise versus non-precise communication, in the attempt to induce trust. More specifically, we explore the impact of the opportunity cost of delegation in determining promise precision. In this respect our paper is related to Frenkel (2014) that provides a theoretical explanation for the fact that imprecise communication may have a reduced commitment value, as it may signal lower willingness to act in line with the specific action promised.

Regarding the choice of precise versus non-precise promises, our paper is also related to the recent literature on the role of narratives in shaping economic behavior (Falk and Tirole, 2016; Shiller, 2017). This literature mainly focuses on understanding how different narratives may emerge based on the context. In this respect, we show that the size of the opportunity cost of delegation is associated with the emergence of some faulty form of communication (non-precise promises) that may not be effective in producing the desired results. Indeed, our experiment suggests that non-precise promises may give a trustee the false illusion of being able to positively influence a trustor's beliefs on his trustworthiness.

3 Experimental design and testable predictions

3.1 The basic game

Our experimental design builds on the "lost wallet game" (Dufwenberg and Gneezy, 2000), by introducing one-sided communication. The basic framework consists of a sequential game involving two players, A and B, which we respectively denote as the trustor and the trustee. Player A is endowed with an amount $x > 0$ and chooses whether to keep the endowment or pass it to B. If A keeps the endowment, then the game ends with final payoffs being equal to x for A and 0 for B. On the other hand, if A passes the endowment to B, then B receives an amount y, with $y > x$. Given y, B chooses how to split it between himself and A. In order to analyze the role of communication, we consider both the baseline game without communication and compare it with one in which we allow B to send a free form text message to A at the beginning of the game, before A decides whether to keep the endowment or pass it.

Our representation of the game includes both the settings with and without communication. In order to simplify exposition, with a slight abuse of notation, we denote communication with $m \in \{\varnothing, e, p\}$, where $\varnothing$ represents the game without communication, and e and p respectively represent the two possible categories of messages that B can send to A in the communication game, where e is an empty message, and p is a promise or statement of intent. In the next section we provide further details on this classification of messages. In what follows we interchangeably use the terms delegate and pass as synonyms.

The timing of the game depicted in the left panel of Figure 1 can be summarized as follows:

1) B communicates by sending a message (m) to A

2) A decides either to pass (or delegate) to B, allowing him to dispose of an amount of money y, or to keep the amount x (not to delegate to B), where c_A^m denotes A's choice conditional on message m, with $c_A^m \in \{pass; keep\}$.

3) If A chooses not to pass to B, she gets the outside option x, B gets 0 and the game ends.

4) If A passes to B, then B is called on to play again and chooses the amount to redistribute to A, where c_B^m denotes B's choice conditional on message m, with $c_B^m \in [0, y]$. Therefore, $y - c_B^m$ denotes the amount B keeps for himself.

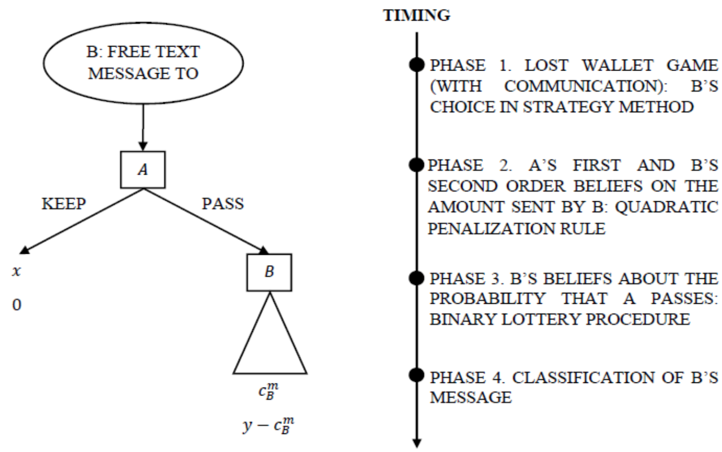

Figure 1. The lost wallet game and the timing in LC and HC

The amount x represents the outside option of A, namely the amount she receives if she does not pass to B. Thus, it is a measure of A's opportunity cost of delegating to B because when she passes she relies on B's willingness to return a sufficiently high amount to her, and foregoes the sure amount x.

3.2 Theoretical predictions

Building on the recent literature on the role of non-binding communication in affecting coordination and cooperation (see Section 2), we model the "lost wallet game" described in the previous section as a game in which the agent suffers a cost from not behaving fairly towards a principal that delegates. In the absence of communication, the reference point for this cost is determined by the agent's personal feelings about what he considers fair (implicit reference), while when communication is allowed, making promises provides an explicit reference point that the agent feels an obligation to live up to, that can be interpreted as a cost of lying. The agent makes these promises because he is ultimately concerned about how they affect beliefs, since beliefs influence the chances that the principal will delegate.[4] Agents may differ in terms of how sensitive they are to returning less than their implicit or explicit reference point, and A does not have complete information on the level of sensitivity of the specific trustee she confronts.[5] In what follow we highlight the main features of the model and relegate a more detailed analysis to the appendix.

More formally, $\alpha_B^m \in [0, y]$ denotes the reference point for the amount the agent considers fair conditional on having sent message m, and B is characterized by a type $\gamma_B \in [0, +\infty)$, where higher types denote greater sensitivity to not living up to the reference point. The trustee's subjective

[4]This explains why the agent may be concerned about the principal's beliefs when maximizing his expected utility, even if these do not directly enter the agent's utility function as occurs with guilt aversion.

[5]In this respect, our model is consistent with the framework introduced by Attanasi et al. (2015), in that we relax the assumption that utility functions representing preferences are common knowledge, which is particularly unrealistic in experimental settings.

utility, evaluated based on this reference point and on the amount that he chooses to redistribute c_B^m, is the following:

$$U_B\left(\alpha_B^m, c_B^m, \gamma_B\right) = y - c_B^m - \max[0, l_B(\gamma_B, \alpha_B^m - c_B^m)], \quad (1)$$

where $l_B(\cdot)$ is increasing in γ_B and $(\alpha_B^m - c_B^m)$, and represents B's loss from giving to A less than the reference point α_B^m . To simplify the analysis we assume that the loss function is quadratic so that $l_B(\gamma_B, \alpha_B^m - c_B^m) = \gamma_B(\alpha_B^m - c_B^m)^2$.

3.2.1 The role of beliefs

Although B is not explicitly concerned about A's beliefs on the amount that he will return in case delegation occurs, these beliefs indirectly affect B's expected utility since they have an impact on the probability that A passes. In particular, B's expected utility can be written as follows:

$$E_B[U_B(\cdot)] = \pi_B^m U_B\left(\alpha_B^m, c_B^m, \gamma_B\right),$$

where π_B^m represents B's beliefs on the probability that A passes conditional on the opportunity cost of delegation, x and on communication, m.

In order to see how π_B^m depends on B's beliefs on A's expectations, we introduce some notation on the relevant first and second order beliefs considering the fact that these beliefs may be affected by communication. We denote with μ_A^m, the amount that A expects to receive from B (conditional on delegation) after observing message type m. Although A's behavior is not explicitly modelled, we assume that she will choose to delegate if μ_A^m is greater than a subjective threshold value that we denote with $z_A(x)$. We assume that $z_A(x)$ is not influenced by the type of message received, but depends on the opportunity cost of delegation x, implying that if this opportunity cost varies also the threshold for delegating may be different. The underlying assumption is that μ_A^m depends on A's beliefs on the sensitivity type (γ_B) of the agent that she faces. However, B does not know A's belief type, but has beliefs on the distribution of the principal's beliefs on the type of the agent that she faces.[6] These beliefs determine π_B^m, as well as $B's$ second order beliefs on the amount that A expects to receive (μ_B^m). Therefore, in attempting to increase the chances that A passes, B will also be inflating $A's$ beliefs on the amount she expects to receive.

Based on these considerations, the expressions for B's relevant set of beliefs follow immediately:

$$z_B(x) \equiv E_B[z_A(x)],$$

$$\mu_B^m \equiv E_B[\mu_A^m],$$

$$\pi_B^m \equiv \Pr_B[\mu_A^m > z_B(x)].$$

[6]More formally, we represent these with a probability distribution function $F(\gamma_B)$. To simplify the analysis, we assume that these second order beliefs are independent of B's true type γ_B. This implies that B is characterized by two dimensional belief types (or epistemic types).

Notice that $z_B(x)$ depends only on x and is not influenced by messages, while μ_B^m and π_B^m may depend on both x and m. We make the following natural assumption on the relation between the opportunity cost of delegation and $\pi_B^{\varnothing}(x)$:

Assumption 1 $\pi_B^{\varnothing}$ is decreasing in x.

This implies that, in the absence of communication, an increase in the opportunity cost of delegation always reduces B's beliefs on the probability of A passing.

3.2.2 Communication versus no communication

In the absence of communication, we assume that the reference point (α_B^m) is determined by B's beliefs on the amount that A considers fair, so that $\alpha_B^{\varnothing} \geq 0$. In the game without communication, type γ_B represents unfairness aversion, while in the communication game, B can affect this reference point and therefore γ_B represents the agent's aversion to lying.[7]

The different types of messages can be classified in the following way based on the impact that they have on this reference point.

Promises or statements of intent. A promise, which we denote with p is a message stating that B will reward A with an amount ranging from p to $p_{\max}$ where $p_{\max} \geq p$.[8] Note that this classification includes both precise and ambiguous statements of intent, where we define the latter as promises that contain a non unitary set of values delimited by a lower bound.[9] For instance a precise promise such as "I will give you 10", implies that $p = 10$ and $p_{\max} = 10$ and a non-precise promise such as "I will give you at least 10" implies that $p = 10$ and $p_{\max} = y$. We introduce costly talk by assuming that $\alpha_B^p = p$. In other words, the lower bound of a statement of intent determines the reference point for the amount that B believes A will use to compute the amount she expects to receive if she passes.

Empty Messages. An empty message, which we denote with e does not contain any specific statement of intent or reference (either direct or indirect) to an amount that B promises to redistribute if A chooses to pass. Therefore, e does not contain an intrinsic cost and its impact on the reference point is determined in equilibrium.

[7]In principle we could assume that each agent has different unfairness and lying aversion types, but to keep notation parsimonious we simply assume that these parameters are the same for a given agent.

[8]We omit the upper bound in the representation of non-precise promises to simplify notation, since this dimension does not play a role in our model. Moreover, none of the non-precise promises that we observe contain an upper bound that is less than y.

[9]Notice that based on the prevalent classification of communication in the literature (Fine, 1975; Sainsbury, 1990; Agranov and Schotter, 2012), our definition of promises includes ambiguous promises (i.e., statements of intent that have multiple meanings), and does not include those promises that do not contain an explicit reference amount such as "I will give you something fair", which are normally classified as vague (i.e., statements of intent that may be deficient in meaning unless one knows exactly where the bounds between words lie). Indeed, in our framework these vague messages can be assimilated to empty messages, in that like empty messages, they do not effect prior beliefs on the reference amount.

3.2.3 Predictions

Intuitively, the mechanics of the model can be described as follows: whenever the sender promises to return an amount that is strictly greater than what he believes the receiver considers the reference point in the absence of communication, this leads to an increase in this reference point ($\alpha_B^{m\neq\varnothing} > \alpha_B^{\varnothing}$), and therefore has a positive effect on the sender's beliefs on what the receiver expects to receive ($\mu_B^{m\neq\varnothing} > \mu_B^{\varnothing}$) as well as on the amount that he actually chooses to return ($c_B^{m\neq\varnothing} > c_B^{\varnothing}$), and consequently also on the chances that delegation will occur ($\pi_B^{m\neq\varnothing} \geq \pi_B^{\varnothing}$). Naturally, the impact of m on π_B^m is only weakly increasing, since even if a message has a strictly positive impact on μ_B^m this does not necessarily translate into an increase in B's beliefs on the probability of A passing.[10]

We now consider B's optimal choice of messages when communication is allowed (i.e., e, p). The expected utility of an agent of using a certain message of type m when the opportunity cost of delegating is x is:

$$\pi_B^m \left(y - \alpha_B^m + \frac{1}{4\gamma_B} \right), \tag{2}$$

where since in equilibrium $c_B^m = \alpha_B^m - \frac{1}{4\gamma_B}$, the term in parenthesis represents $B's$ utility conditional on delegation.[11] Notice that this term is always decreasing in α_B^m, implying that conditional on A passing more generous promises reduce B's utility.

Whenever communication is allowed, the trustee will choose the type of message that maximizes his expected utility. We now show that equilibria in which empty messages are sent are very unlikely to arise. To see this, note that for any beliefs α_B^e there always exists a corresponding promise such that $\alpha_B^p = \alpha_B^e$. Leaving aside the knife edge case in which B is indifferent between making a promise or sending an empty message, it is therefore very unlikely that empty messages will be observed since promises allow for a greater degree of freedom. This implies that in both treatments we should expect B to use promises to increase his expected utility with respect to situations in which communication is absent. Therefore promises will prevail over empty messages whenever communication is allowed:

P.1 *Communication and statements of intent.* Communication implies the prevalence of promises with respect to empty messages.

From this prediction it follows immediately that since promises prevail, communication will affect beliefs and possibly also choices. Here B faces a trade-off because, while promising more increases the probability that A will delegate, it also reduces his utility conditional on A having

[10]Notice that the model does not have any empirical implications with respect to the relation between between the reference value of promises (p) and $B's$ beliefs and actions. This is because we allow for heterogeneous beliefs on the distribution of $B's$ beliefs relative to $A's$ beliefs on the agent's sensitivity to returning less than the reference value (i.e., $F(\gamma_B)$ may differ for each B). For example, notice that a given B that makes a higher promise with respect to another trustee, may have lower (higher) values of μ_B^m and π_B^m relative to the other, if he has more pessimistic (optimistic) beliefs on $A's$ propensity to trust him.

[11]In Appendix A we include a more detailed description of the equilibrium.

passed, because promises inflate α_B^m implying that B feels obliged to give back a larger amount in order to live up to his promise.[12]

We now highlight the model's implications in relation to the impact that communication may have on the role of the opportunity cost of delegation in determining choices and beliefs, by stating the following predictions:

P.**2** *With communication, the opportunity cost of delegation exerts a strictly positive effect on the reference amount contained in B's promise ($\partial p/\partial x > 0$).*

P.**3** *Communication, beliefs, and the opportunity cost of delegation.* Without communication, there is no effect of the opportunity cost of delegation on A's (first order) and B's (second order) beliefs on the amount distributed by B ($\partial \mu_A^{\varnothing}/\partial x = 0$ and $\partial \mu_B^{\varnothing}/\partial x = 0$ respectively). With communication instead, the opportunity cost of delegation exerts a strictly positive effect on these first and second order beliefs. ($\partial \mu_A^{m\neq\varnothing}/\partial x > 0$ and $\partial \mu_B^{m\neq\varnothing}/\partial x > 0$ respectively).

P.4 *Communication, B's choice, and the opportunity cost of delegation.* Without communication there is no effect of the opportunity cost of delegation on the amount distributed by B ($\partial c_B^{\varnothing}/\partial x = 0$). With communication instead, the opportunity cost of delegation exerts a strictly positive effect on this amount ($\partial c_B^{m\neq\varnothing}/\partial x > 0$).

As a basic intuition for these results, notice that when A has a greater opportunity cost of delegating, B's chances of being trusted are fairly slim to start with. This induces the agent to reduce the amount he keeps for himself, by making more ambitious promises in order to try to enhance the chances that the principal will pass. Regarding the part of $P.4$ that concerns A's beliefs, this prediction relies on the fact that second order beliefs move in the correct direction.

Finally we can also make predictions regarding A's behavior. First of all, it is straightforward to observe that based on assumption 1 we know that in the absence of communication, the higher is the opportunity cost of delegation, the less likely it is that A will pass. Considering that $P.3$ states that with communication a higher opportunity cost of delegation will lead to greater values of μ_A^m, as long as there is a positive monotonic relationship between μ_A^m and A's decision to pass, this implies that communication will have a greater impact on A's decision to pass in HC with respect to LC. This allows us to state the following prediction on the attenuation effect:

P.**5** *Communication, A's choice, and the cost of delegation: the attenuation effect.* Communication attenuates the effect of the opportunity cost of delegation on the choice of A to pass (c_A^m).

[12]Notice that the model is sufficiently general to allow for B to use promises to either increase or reduce A's (first order) and B's (second order) beliefs on the amount distributed by B. For example, when the opportunity cost of delegation is zero (i.e., $x = 0$) it may be the case that B finds it optimal to reduce second order beliefs on the amount that the trustor expects to receive. Indeed, if he believes that the trustor will pass regardless of the promised amount (although this is not necessarily the case even if $x = 0$), by reducing his beliefs on $A's$ expectations, B can increase his expected utility by raising the amount he can keep for himself without feeling guilty (i.e., $y - \alpha_B^m + \frac{1}{4\gamma_B}$).

3.3 Treatments

Our experiment includes four treatments in a $2x2$ design that manipulates two dimensions of the original "lost wallet" game: communication and the size of x. The following table summarizes the main experimental features in the four treatments.

Table 1. The four experimental treatments

	$Communication$	$No\ communication$
$x = 7$	LC	LNC
$x = 13$	HC	HNC

In all treatments, we set $y = 20$. The first manipulation is the level of x, being set to the (low) amount of 7 euro in LC and LNC, and to the (high) amount of 13 euro in HC and HNC. There are two good reasons that have driven our choice to use these two values of x. First, they are aligned with the parameters used by Dufwenberg and Gneezy (2000) in two of their treatments, providing a natural reference to compare the results of our baseline treatments with. Second, they both differ by 3 euro from the (natural reference of) 10 euro, namely the amount obtained by both A and B when B decides to split y equally. The second dimension that we manipulate concerns the possibility given to B to unilaterally send a text message to A prior of A's choice.

3.4 Procedures

Upon their arrival, subjects were randomly assigned to a computer terminal. At the beginning of the experiment, subjects were randomly and anonymously assigned to a pair and a role, either A or B. During the experiment, subjects participated in a number of consecutive phases, each involving a different task. Subjects were not informed about the number of phases of the experiment and instructions for each phase were handled at the end of the previous phase. At the beginning of each phase, instructions were read aloud to guarantee common knowledge (instructions used in HC are included in the appendix) and questions were answered privately. Feedback on the partner's decisions and information about payoffs in each phase was given at the end of the experiment. The right panel of Figure 1 shows the 4 phases of HC and LC.

Phase 1: the Lost wallet game. In the first phase, subjects participated in the lost wallet game with one-sided communication. In particular, at the beginning of the phase, B had the possibility to send a text message to A. We imposed only two restrictions on B's message. First, B could not provide any information about his identity, such as name, student id, and number of the computer terminal. Second, the length of the message could not exceed 300 digits. After reading the message, A had to choose whether to pass or keep the endowment x. B made his choice in strategy method. In particular, before being informed about A's decision, B chose the share of y to give if A chose to pass. B knew that his choice would have been implemented only if A had effectively chosen to pass. Our choice of using the strategy method for B's choice is motivated by two main considerations. First, thanks to the strategy method, our analysis is based on a balanced and rich dataset, as we collected choices from all A and B subjects in the experiment. Second, the strategy method allowed us to elicit B's first and second order beliefs in subsequent phases as subjects were only informed about final results at the end of the experiment.

Phase 2: A's first and B's second order beliefs on the amount sent by B to A. We elicited A's first and B's second order beliefs about the amount assigned by B to A. Subjects were paid according to the precision of their estimates by using a rule that gave 3 euro for correct guesses and, in case of errors, assigned a penalization as a quadratic function of the discrepancy between the stated belief and the true value.

Phase 3: B's first order beliefs on the probability that A chose to pass. In the third phase of the experiment, we elicited the probability subjectively attached by B to the two possible actions of A, either passing or keeping x. We rely on the Binary Lottery Procedure (McKelvey and Page, 1990; Schlag and van der Weele, 2013; Hossain and Okui, 2013; Harrison et al., 2014) as a proper incentive compatible mechanism to elicit B's subjective probabilities. More precisely, B was asked to indicate both the probabilities (in integers from 0 to 100) that A passed and kept x. Both probabilities were converted into tickets for a lottery by using a quadratic rule. Then, B participated in the lottery with the number of tickets assigned to the stated probability for the actual choice of A. In case of victory, the lottery gave 3 euro.

Phase 4: a coordination game to classify B's message sent to A in the first experiment. In the last phase, both A and B participated in the incentivized task introduced by Houser and Xiao (2011) and aimed at classifying the messages sent by B to A in phase 1 according to one of two possible categories: a promise - that contained a statement of intent - or an empty message - that did not contain any statement of intent. A and B received 1 euro to add to their overall payments if they matched their classifications, and nothing otherwise.

The only difference between the treatments with communication (HC and LC) and the treatments with no communication (HNC and LNC) is that in the latter, B was not allowed to send text messages to A and the design did not include phase 4 explained above.

It might be argued that rewarding accuracy of stated beliefs in addition to payments for decisions in the lost wallet game might induce risk-averse subjects to hedge with their stated beliefs against adverse outcomes in the main decisional task. However, there are at least four reasons to believe that the (potential) hedging problem plays a marginal role in our setting. First, there is experimental evidence suggesting that hedging is not a major problem in strategic interaction settings, unless hedging opportunities are very prominent (Blanco et al., 2010). Second, the maximum amount subjects could get from each of the belief elicitation phases was relatively small when compared to the money at stake in the lost wallet game. Third, subjects received instructions only at the beginning of each phase, thus being unable to formulate sophisticated hedging strategies since the beginning of the experiment. Fourth, in order to avoid confusion-driven pseudo-hedging, we explicitly explained to subjects in the instructions of each phase that by stating their beliefs truthfully, they could have minimized the penalization due to errors and maximized the corresponding gains.

At the end of the experiment, subjects were privately paid the sum of the payoffs obtained in the consecutive phases. On average, they earned 12.87 euro (3 euro for showing up) for sessions lasting about 45 minutes, including the time for instructions and payments. The experiment took place between March 2015 and June 2016 in the Behavioral and Experimental Laboratory in Social Sciences ($BELSS$) of Bocconi University, Milan. Participants were mainly students from Economics, Management and Law. The experiment was computerized using the z — Tree software (Fischbacher, 2007).

4 Experimental results

We are mainly interested in assessing how the opportunity cost of delegation affects choices and beliefs of A and B, and to what extent this relationship depends on communication. Differences between LNC and HNC represent the natural benchmarks in our analysis, as they partly replicate the "lost wallet" experiment with no communication run by Dufwenberg and Gneezy (2000).

The analysis mainly relies on parametric techniques that allow us to isolate the effects of the determinants (including treatment effects and types of message) of choices and beliefs in a multivariate setting. Nevertheless, in order to confirm our main results, we will also amply refer to results of non-parametric tests based on independent observations at the subject level.

In phase 3 of the experiment, we elicited B's beliefs on the probability that A passes. In the following parametric analysis, we will use a dichotomic transformation of the stated measure, taking a value of one if the probability reported by B is higher than 51 (out of 100). This empirical strategy is motivated by two important considerations. First, this neutralizes potential measurement errors that are due to subjective (mis-)interpretation of the concept of probability. Second, compared to an absolute number, the dichotomic measure provides clearer and more straightforward information about whether B actually expects A to pass or keep the endowment. Results remain qualitatively the same (although less precise) if we replicate the analysis by replacing the dichotomic measure with the stated probability.

4.1 Communication, message types and promised amounts in LC and HC

The following table shows the distribution of message categories in LC and HC according to the classification made by A and B in the last phase of the experiment. We restrict our attention to pairs of subjects that successfully coordinated their message classification. Results remain qualitatively the same when using the specific classifications made by either A or B.

Table 2. Distribution of messages in HC and LC

	A's Classification			B's Classification			Match		
	e	p	N	e	p	N	e	p	N
LC	4	48	52	3	49	52	3	48	51
HC	7	44	51	3	48	51	2	43	45

Note. This table reports the distribution of messages categories in the two treatments with communication (LC and HC) according to A's classification and B's classification. The table also reports the distribution when A and B coordinated their responses on the same classification. The message categories are: (e)mpty and (p)romise.

We find that 88.24% and 98.08% of the pairs in HC and LC respectively, successfully coordinated their message classifications in phase 4 of the experiment. In line with prediction $P.1$ delivered by the model, in both treatments B makes intense use of promises: the share of messages categorized as promises is 94.12% in LC and 95.56% in HC. We do not detect significant difference in the number of promises between LC and HC (according to a two-sided proportion test, $z = 0.316$, $prob. = 0.752$). This suggests that the level of the outside option does not influence B's attitude to send a promise to A. We summarize the first result with the following statement.

$R.1$ Communication is mainly used by B to make promises to A. The level of the opportunity cost of delegation (x) does not influence B's attitude to make promises.

Most of the promises in LC and HC contain a statement of intent that is related to a reference amount. We look at whether the reference amounts in the statements of intent differs across HC and LC. The next table reports descriptive statistics about the reference amounts contained in promises. Again, we restrict our attention to pairs of subjects that successfully coordinated in classifying messages, as results remain qualitatively the same under the alternative classifications.

Table 3. Reference amounts in promises in HC and LC

	A's Classification		B's Classification		Match	
		N		N		N
LC	9.542	48	9.551	49	9.542	48
	(1.624)		(1.608)		(1.624)	
HC	13.429	42	13.477	44	13.415	41
	(2.154)		(2.118)		(2.179)	

Note. By focusing only on the promises containing a reference amount, this table reports the (mean) amount promised by B to A in phase 1 of LC and HC (standard deviations in parentheses). All the other remarks of Table 2 apply.

Due to the higher cost of delegation and in line with prediction $P.2$, the reference amount for B's promise is higher in HC than in LC (according to a two-sided Mann–Whitney rank-sum test, $z = -6.698$, $prob. < 0.001$). Moreover, while we do not detect any significant difference between the reference amount and the outside option of 13 euro in HC (according to a two-sided Wilcoxon signed-rank test: $z = 1.068$, $prob. = 0.285$), in LC it is significantly higher than the outside option of 7 euro ($z = 5.959$, $prob. < 0.001$) and tends to be set around the equal split of the endowment (10 euro for both A and B; $z = -1.929$, $prob. = 0.054$).

$R.2$ The reference amount contained in B's promise is strongly and positively associated with the cost of delegation: its level is close to the opportunity cost of delegation (x) in HC, while it tends to the equal split of the amount y in LC.

4.2 A's and B's choices

Columns (1) and (2) of Table 4 report summary statistics on A's and B's choices (c_A^m and c_B^m, respectively) in the four treatments of our experiment.

Table 4. Choices and beliefs of A and B

	$f(c_A^m = pass)$	c_B^m	π_B^m	$d\pi_B^m$	μ_A^m	μ_B^m	N (per role)
LNC	0.615	5.577	46.718	0.410	5.646	6.583	39
	(0.493)	(3.894)	(32.067)	(0.498)	(3.669)	(3.217)	
HNC	0.216	5.081	21.297	0.054	4.081	6.149	37
	(0.417)	(4.970)	(21.104)	(0.229)	(3.902)	(5.049)	
LC	0.500	6.856	54.615	0.538	6.569	7.163	52
	(0.505)	(4.092)	(32.761)	(0.503)	(4.276)	(3.952)	
HC	0.353	5.886	30.745	0.196	9.154	9.431	51
	(0.483)	(5.168)	(29.216)	(0.401)	(5.912)	(5.517)	

Note. This table reports the proportion of As choosing to pass, $f(c_A^m = pass)$, and the (mean) amount sent by B, c_B^m, (standard deviations in parentheses) in the four treatments. The table also reports mean and standard deviation (in parentheses) of B's beliefs about the probability that A passes, π_B^m, and the proportion of Bs expecting A to pass, $d\pi_B^m$. Finally, the table reports A's first and B's second order beliefs on the amount sent by B, μ_A^m and μ_B^m.

We observe a substantial variability in A's choices across treatments, with LNC and HNC registering the highest (61.5%) and the lowest (around 21.6%) proportion of the choices to pass, respectively. Communication reduces the impact of the opportunity cost of delegation on A's choice: without communication, increasing the opportunity cost reduces the proportion of As that pass by 39.9%, with this effect being much smaller in size (14.7%) when communication is allowed. On the contrary, the amount sent by B is relatively stable in the four treatments, with its average ranging from 5.081 euro in HNC to 6.856 euro in LC.

Table 5 parametrically investigates the interplay between the opportunity cost of delegation and communication in affecting A's and B's choices. We also look at the magnitude of the differences in A's and B's choices across treatments, with LNC serving as the reference category.

Table 5. Choices of A and B

	c_A^m		c_B^m			
	(1)	(2)	(3)	(4)	(5)	(6)
HC	-0.248^{***}	-0.480^{***}	0.017	-1.177	0.796	-0.436
	(0.093)	(0.076)	(1.212)	(1.213)	(1.172)	(1.216)
HNC	-0.363^{***}	-0.328^{***}	-1.017	-0.825	0.285	0.049
	(0.082)	(0.083)	(1.345)	(1.211)	(1.347)	(1.243)
LC	-0.113	-0.187^{*}	1.400	1.130	0.966	0.874
	(0.101)	(0.101)	(1.049)	(0.956)	(0.993)	(0.933)
μ_A^m		0.068^{***}				
		(0.011)				
μ_B^m				0.423^{***}		0.353^{***}
				(0.110)		(0.117)
$d\pi_B^m$					3.501^{***}	2.422^{***}
					(0.842)	(0.872)
$Constant$			5.023^{***}	2.252^{**}	3.576^{***}	1.711
			(0.804)	(1.056)	(0.883)	(1.058)
$log\ (pseudo)\ L$	-114.457	-89.097	-476.984	-466.999	-470.632	-463.918
$Wald-\chi^2,\ F-stat$	14.45	56.05	1.41	5.51	5.66	6.68
$prob.$	0.002	0.000	0.242	0.000	0.000	0.000
N	179	179	179	179	179	179

Note. Columns (1) and (2) report probit marginal effect estimates (robust standard errors in parentheses). The dependent variable is a dummy that takes a value of 1 if A passes and 0 o/w. Columns (3), (4), (5) and (6) report tobit estimates (robust standard errors in parentheses). The dependent variable is the amount sent by B to A in case A passes. HC, HNC and LC are treatment dummies. μ_A^m and μ_B^m, respectively, are A's first order beliefs about the amount sent by B and B's second order beliefs about the amount expected by A as elicited in the second phase of the experiment. $d\pi_B^m$ is a dummy that takes a value of 1 if B expects A to pass with a probability that is higher or equal than 51 out of 100. Significance levels are denoted as follows: $^{***}p-value < 0.01$,$^{**}p-value < 0.05$,$^{*}p-value < 0.1$.

The opportunity cost of delegation reduces the probability that A passes when B is not allowed to communicate while the effect becomes negligible when communication is introduced. Indeed, column (1) suggests that while the probability that A passes is significantly lower in HNC than in LNC (the coefficient of HNC is negative and highly significant, $prob. < 0.001$), we do not detect any significant difference between HC and LC ($\chi^2(1) = 2.26$, $prob. = 0.133$). The previous evidence is confirmed by non-parametric tests. According to a two-sided proportion test, the percentage of As choosing to pass is significantly lower in HNC than in LNC ($z = 3.523$, $prob. < 0.001$), while no significant difference is detected between HC and LC ($z = 1.509$, $prob. = 0.131$).

$R.3$ Communication attenuates the effects of the opportunity cost of delegation on A's choice to pass. With no communication, the higher the level of the opportunity cost of delegation, the more likely is A to choose to keep. With communication, the level of the opportunity cost of delegation exerts no effect on the probability that A chooses to keep.

Moving to the analysis of B's choice, neither the opportunity cost of delegation, nor communication influence the amount sent by B. Indeed, in column (3), we detect no significant difference in B's choice between HNC and LNC (for the coefficient of HNC, $prob. = 0.451$) as well as between HC and LC ($F(1, 176) = 1.45$, $prob. = 0.230$). Again, these results are supported by non-parametric tests. According to a two-sided Mann–Whitney rank-sum test, the difference in the amount sent by B is neither significant between HNC and LNC ($z = 0.478$, $prob. = 0.632$), nor between HC and LC ($z = 0.671$, $prob. = 0.502$).

$R.4$ Neither communication, nor the level of the outside option affect the amount sent by B.

While $R.3$ provides supporting evidence in favor of prediction $P.5$, $R.4$ is clearly not consistent with prediction $P.4$ and highlights the main shortcoming of the costly talk model: regardless of the content of the message, communication seems to play no role in shaping B's decision about the amount to return to A in the lost wallet game.

Columns (2), (4), (5), and (6) of Table 5 add A's and B's beliefs as elicited in phases 2 and 3 of the experiment to the original regressions.

Two main observations follow from this empirical exercise. First, based on the evidence in column (2) and after controlling for A's first order beliefs, also the difference between LC and HC in the probability that A passes becomes significant ($\chi^2(1) = 12.61$, $prob. < 0.001$), suggesting that in line with the theoretical motive behind $P.5$, $R.3$ is mainly driven by the impact of communication on A's beliefs. Second, both A's and B's choices are strongly associated with beliefs. A's choice to pass is positively and significantly correlated with A's first order beliefs about the amount sent by B, as captured by the highly significant coefficient of μ_A^m ($prob. < 0.001$). Similarly, as indicated by the significant coefficient of μ_B^m in column (6), the amount sent by B is positively and significantly associated with B's second order beliefs about the amount A expects him to send ($prob. = 0.006$). Likewise, the significant coefficient of $d\pi_B^m$ (in column 6, $prob. = 0.006$) indicates that the amount sent by B is also positively and significantly related to his beliefs that A passes. It is worth noting that, after controlling for B's beliefs, treatment effects do not substantially change and differences across treatments remain not significant, in line with what observed in column (3). Thus, the positive relationship between B's choices and beliefs is not mediated by communication but is mainly due to pure heterogeneity of beliefs in the population.

We also run a set of additional regressions to investigate differences across treatments in the effects of beliefs on A's and B's choices. In particular, we replicated the same parametric strategy employed in columns (3) and (6) of Table 5 by adding a set of interaction terms between belief measures and treatment dummies (results are available upon request). All the interaction terms in the augmented regressions are not significant. Similarly, pairwise comparisons between interaction terms are generally not significant. Only in the augmented version of column (6), three pairwise comparisons (when comparing the effect of μ_B^m between HC and HNC, and between HC and LC, as well as when comparing the effect of $d\pi_B^m$ between HC and LC, respectively) reach marginal significance. Thus, while both A's and B's choices are strongly associated with stated beliefs, we detect no difference in such relationships across treatments.

Apart from the observations on the interplay between communication and the opportunity cost of delegation, the previous results are in line with those reported in Dufwenberg and Gneezy (2000). In their original study, the authors find that the higher the outside option, the more likely is A to take it. Moreover, they find that the amount transferred by B to A is not correlated with the outside option while it is positively associated with B's second order beliefs about what A expects from him.[13]

4.3 A's and B's beliefs

Table 4 also presents summary statistics on B's beliefs about the probability that A passes (π_B^m and $d\pi_B^m$) as well as on A's first order and B's second order beliefs about the amount sent by B (μ_A^m and μ_B^m, respectively). As clearly shown by the table, the opportunity cost of delegation substantially increases μ_A^m and μ_B^m only with communication. The effect is much smaller (and even negative) when communication is not allowed. Finally, the opportunity cost of delegation exerts a negative effect on both π_B^m and $d\pi_B^m$ and communication seems to increase the proportion of Bs expecting A to pass both with a high and a low opportunity cost of delegation.

The parametric analysis reported in the following table confirms this preliminary observation and adds further insight on differences in beliefs across treatments.

[13]Other studies further explore the result that the amount transfered by B to A is not correlated with the outside option, such as Servátka and Vadovič (2009), Cox et al. (2010) and Woods and Servátka (2018). All of these confirm the robustness of this result to variations in the context.

Table 6. A's and B's beliefs

	(1)	(2)	(3)	(4)
	μ_A^m	μ_B^m	$d\pi_B^m$	$d\pi_B^m$
			$m \in \{p, e, \varnothing\}$	$m \in \{p, \varnothing\}$
HC	3.614^{***}	2.613^{**}	-0.190^{**}	-0.182^{**}
	(1.247)	(1.088)	(0.077)	(0.081)
HNC	-1.683	-1.079	-0.332^{***}	-0.343^{***}
	(1.144)	(1.226)	(0.059)	(0.061)
LC	0.944	0.336	0.112	0.144
	(1.089)	(0.910)	(0.096)	(0.099)
$Constant$	5.016^{***}	6.380^{***}		
	(0.802)	(0.598)		
$log\ (pseudo)\ L$	-485.082	-492.069	-95.312	-92.208
$Wald - \chi^2,\ F - stat$	5.99	2.82	26.53	27.66
$prob.$	0.000	0.040	0.000	0.000
N	179	179	179	173

This table reports Tobit estimates (robust standard errors in parentheses). Columns (1) and (2) analyze difference across treatments in A's first and B's second order beliefs about the amount sent by B, μ_A^m and μ_B^m. Columns (3) analyzes difference across treatments in B's beliefs that A passes with a probability higher than 51 out of 100, $d\pi_B^m$, when pooling data. Column (4) replicates the analysis in column (3) by excluding those trustees who, in LC and HC, sent an empty message. All the other remarks of Table 5 apply.

Both when considering μ_A^m and μ_B^m, we document a robust correlation between the belief measures and the opportunity cost of delegation only when communication is allowed. Indeed, A's first order beliefs in HC are significantly higher than those in LC ($F(1, 176) = 4.71$, $prob. = 0.031$), while the difference between HNC and LNC is not significant ($prob. = 0.143$). Similarly, when looking at B's second order beliefs, the difference between HC and LC is highly significant ($F(1, 176) = 4.06$, $prob. = 0.046$), while no difference is detected when comparing HNC with LNC ($prob. = 0.380$). Interestingly, for both μ_A^m and μ_B^m, we detect no significant difference between LC and LNC (for the coefficient of LC, $prob. = 0.388$ in the regression based on μ_A^m and $prob. = 0.713$ in the regression based on μ_B^m). Thus, although communication plays no role in shaping beliefs when the opportunity cost of delegation is low, it amplifies the effects on μ_A^m and μ_B^m of passing from a low to a high opportunity cost of delegation.

These results are also supported by two-sided Mann–Whitney rank-sum test: we detect a highly significant difference in A's first order beliefs between HC and LC ($z = -3.005$, $prob. < 0.01$), while the difference between HNC and LNC only reaches marginal significance ($z = 1.667$,

$prob. = 0.096$). Similarly, when looking at B's second order beliefs, the difference between HC and LC is highly significant ($z = -3.266$, $prob. < 0.01$), while it does not reach statistical significance when comparing HNC with LNC ($z = 0.194$, $prob. = 0.846$). No relevant difference between LC and LNC is documented, neither for μ_A^m ($z = 1.661$, $prob. = 0.097$), nor for μ_B^m ($z = 1.568$, $prob. = 0.117$).

Finally, as shown in the last two columns of table 6, the opportunity cost of delegation substantially decreases the proportion of Bs expecting A to pass both with and without communication. When pooling data in column 3, we detect highly significant differences in $d\pi_B^m$ both between HC and LC ($\chi^2(1) = 12.75$, $prob. < 0.001$), and between HNC versus LNC ($prob. < 0.001$). The same results are documented in column 4 when excluding those Bs who, in LC and HC, sent an empty message: both the differences between HC and LC ($\chi^2(1) = 13.19$, $prob. < 0.001$), and between HNC versus LNC ($prob. < 0.001$) are highly significant. The last two columns of table 6 also provide evidence in favor of the idea that B strategically uses communication (mainly in the form of promises) to affect A's choice to pass. Indeed, when the opportunity cost of delegation is high, we find that communication increases the proportion of Bs expecting A to pass, with this effect being stronger in case the trustee has sent a promise: the difference between HC and HNC is marginally significant in column (3) ($\chi^2(1) = 3.61$, $prob. = 0.057$) and significant at the 5% level in column (4) ($\chi^2(1) = 4.01$, $prob. = 0.045$). Instead, communication seems to play no role with a low opportunity cost of delegation, neither when considering all messages (in column 3, $prob. = 0.242$), nor when excluding trustees who sent an empty message (in column 3, $prob. = 0.148$).

$R.5$ The opportunity cost of delegation exerts a positive effect on A's first and B's second order beliefs on the amount sent by B when communication is allowed. Without communication, the opportunity cost of delegation has no relevant effect on these belief measures. The effect of the opportunity cost of delegation on B's beliefs about the probability that A passes is negative and strong. Moreover, when the opportunity cost of delegation is high, communication (in the form of promises) increases the proportion of Bs expecting A to pass.

In line with prediction $P.3$ delivered by the costly talk model, $R.5$ shows that communication is effective and enforces the relationship between the opportunity cost of delegation and A's first and B's second order beliefs on the amount sent by B.

Given results $R.4$ and $R.5$, it is natural to ask whether first and second order beliefs on the amount sent by B are consistent, and how beliefs relate to B's actual choice. We refer to consistency and correctness of beliefs, whereby the former characteristic refers to the alignment of A's first order and B's second order beliefs, while the latter concerns their difference with respect to the amount effectively sent by B. Both these issues are explored in Table 7, which reports evidence on the difference between μ_A^m and μ_B^m as well as between belief measures and the actual choice of B, c_B^m.

Table 7. Differences between belief measures and B's choice

	$\mu_A^m - \mu_B^m$	$\mu_A^m - c_B^m$	$\mu_B^m - c_B^m$	N (*per role*)
LNC	-0.937	0.069	1.006	39
	(5.143)	(5.848)	(3.901)	
HNC	-2.068^{*}	-1.000	1.068	37
	(6.057)	(6.266)	(4.941)	
LC	-0.594	-0.287	0.308	52
	(5.995)	(5.491)	(4.059)	
HC	-0.276	3.269^{***}	3.545^{***}	51
	(8.417)	(7.926)	(7.161)	

This table reports differences and significance levels (from two-sided Wilcoxon signed-rank tests) between μ_A^m and μ_B^m, between C_B^m and μ_A^m and between C_B^m and μ_B^m. Significance levels are denoted as follows: $^{***}p - value < 0.01$,$^{**}p - value < 0.05$,$^{*}p - value < 0.1$.

The difference between A's first and B's second order beliefs is not significant in LNC, LC, and HNC, while it reaches marginal significance only in HNC. Thus, in all treatments, B consistently formulates beliefs on what A expects to receive from him. Moreover, in LNC, HNC, and LC, A's (first order) and B's (second order) beliefs are correct in that they do not significantly differ from the amount sent by B. In HC instead, while belief consistency is confirmed, we find that B consciously chooses to send less than what expected by A.

$R.6$ A's first and B's second order beliefs on the amount sent by B are aligned in all treatments. Belief measures are generally correct, in that they coincide with the effective amount sent by B. Only in the treatment with communication and a high opportunity cost of delegation (HC), the amount distributed by B is significantly lower than A's first and B's second order beliefs.

Result $R.6$ qualifies the previous conclusion about the discrepancy between our experimental results and what predicted by the costly talk model, as it provides evidence of deception: while consistently anticipating the positive effect of his message on the counterpart's willingness to pass, B consciously chooses to send less than what expected by A.[14]

As a final step of our analysis, in Table 8, we explore how promises - the most frequent message type - affect subjects' beliefs in HC and LC, relative to the corresponding treatments with no communication. We will exclusively focus on A's (first order) or B's (second order) beliefs on the amount sent by B.

[14]The evidence in favor of deception is further confirmed by the observation that, in both treatments with communication, the amount sent by B is significantly smaller than the reference amount contained in his promise (according to a two-sided Wilcoxon signed-rank test: $z = 5.388$, $p - value < 0.001$ in HC; $z = 2.391$, $p - value = 0.017$ in LC.

Table 8. Beliefs and message types

	μ_A^m	μ_B^m
H	-1.680	-1.071
	(1.132)	(1.223)
e	-5.870^{**}	-4.611^{*}
	(2.666)	(2.567)
p	1.450	0.627
	(1.075)	(0.912)
$H * e$	6.745^{*}	9.134^{***}
	(3.954)	(3.280)
$H * p$	4.508^{***}	3.007^{*}
	(1.682)	(1.685)
$Constant$	5.043^{***}	6.382^{***}
	(0.793)	(0.597)
$log\ (pseudo)\ L$	-479.926	-490.794
$F - stat$	6.11	2.99
$prob.$	0.000	0.013
N	179	179

This table reports Tobit estimates (robust standard errors in parentheses) to analyze the interplay between message types (as classified in phase 4 by A and B) and the opportunity cost of delegation in determining μ_A^m and μ_B^m. In all regressions, we pool data from LC, HC, LNC and HNC. H is a dummy that takes a value of 1 in HC and HNC and 0 o/w. e (p) is a dummy that takes a value of 1 if the message is classified as Empty (Promise) by the subject whose belief measure is elicited and 0 o/w. The same remarks of Table 6 apply.

When the level of the opportunity cost of delegation is low and relative to the treatment with no communication, promises - the most used message type - do not exert any significant effect on A's first (for the coefficient of P in the regression based on μ_A^m, $prob. = 0.179$) and B's second order beliefs about the amount sent by B (in the regression based on μ_B^m, $prob. = 0.493$). Opposite results emerge when the opportunity cost of delegation is high. Relative to the treatments with no communication, promises positively and significantly affect A's first (for the linear combination of P and $H * P$ in the regression based on μ_A^m, $F(1, 174) = 21.34$, $prob. < 0.001$) and B's second (in the regression based on μ_B^m, $F(1, 174) = 6.57$, $prob. = 0.011$) order beliefs on the amount sent by B. The effect of empty messages is more volatile, being negative and significant on both measures of beliefs in LC and positive and significant on B's second order beliefs in HC, although the number of empty messages is too small (see Table 2) to assure robustness and precision of the estimates.

$R.7$ Promises, beliefs and the opportunity cost of delegation. When the cost of delegation is high, promises increase both A's first and B's second order beliefs about the amount sent by B. Instead, when the cost of delegation is low, promises do not affect belief measures.

5 Discussion: cheap talk, naïve receivers and costly talk

Considering that the theoretical predictions of the baseline costly talk model do not appear to be consistent with two of our experimental results ($R.4$ and $R.6$), in order to provide a more complete explanation of our findings we proceed in two steps. We first introduce a cheap talk model and illustrate how this may be consistent with ($R.4$), but continues to fall short of describing some of the salient features of our experimental evidence unless receivers are somewhat naïve. As a second step, we therefore introduce a modified version of the costly talk model to incorporate this feature, and show that it provides a more exhaustive explanation of the experimental evidence.

5.1 The cheap talk model

Starting from the baseline framework we modify it to include cheap talk, implying that communication is costless in the spirit of Crawford and Sobel (1982). In particular, player B suffers a loss from acting in a manner that is believed to be unfair, and A does not have complete information on B's characteristics, that determine the amount that the specific trustee she confronts is willing to return to her. B may communicate with A in the attempt to signal his intentions, but talk is cheap in the sense that B's message is not costly for him both in direct and indirect terms.[15]

We continue to use the structure and notation of the baseline model where the only relevant difference is that B's beliefs on the fair amount α_B are not affected by communication.[16] The trustee continues to be characterized by $\gamma_B \in [0, +\infty)$, where a higher level of unfairness aversion denotes a greater sensitivity to behaving in a manner that is considered unfair. The fact that talk is cheap implies that promises no longer have an impact on the amount the agent returns to the principal, which is therefore entirely determined by B's preferences represented by α_B and γ_B (i.e., $c_B^m = \alpha_B - \frac{1}{2\gamma_B}$)

Notice that a trustee that believes the fair amount is higher (i.e., higher α_B) will also have higher values of c_B^m, μ_B^m and π_B^m. Thus, there is a positive relation between beliefs (μ_B^m and π_B^m) and choices (c_B^m) but this is not mediated by communication.[17] Prediction $P.4$ can therefore be

[15] Note that this cheap talk feature implies that guilt aversion does not play a role. With guilt aversion communication carries an indirect cost, because when communication increases A's expectations, B suffers a utility loss from not satisfying these expectations, implying that communication is indirectly costly if it affects beliefs.

[16] With respect to the costly talk model, we drop the superscript m from α_A^m and α_B^m to indicate that they no longer depend on communication.

[17] This resembles the "false consensus" effect described by Ellingsen et al. (2010) driven by the fact that higher expectations on the fair amount have an impact on all these variables, but there is no direct causality between second order beliefs (μ_B^m) and the amount distributed (c_B^m) as guilt aversion would suggest.

replaced by the following which is consistent with ($R.4$):

P.**4b** *Communication, B's choice, and the opportunity cost of delegation.* There is no effect of the opportunity cost of delegation on the amount distributed by B, both with and without communication ($\partial c_B^m / \partial x = 0$ for every m).

As in any cheap talk framework there always exist babbling equilibria in which communication is meaningless. However, there may exist informative equilibria in which communication is credible.[18] These equilibria can exist if and only if B's second order beliefs on the amount that will be distributed, are sufficiently low to start with. Intuitively, these informative equilibria exist when B has low expectations on the amount that A believes she will receive in the absence of communication, meaning that these must be lower than the preferred amount that B actually intends to return. If this is the case, then communication can lead to a rational increase in the second order beliefs of the agent, given by μ_B^m.

When B's beliefs on how much A deems him worthy of trust are not sufficiently low to start with, in the cheap talk game introduced in this section, communication cannot be effective unless the principal is considered naive (by B), in the sense that her beliefs can be irrationally swayed by the agent's messages. Indeed, this appears to be the relevant case when considering our experimental results. As stated by result ($R.6$), and shown in Table 7, in the absence of communication the following distance ($\mu_B^{\varnothing} - c_B^{\varnothing}$) is never significantly different from zero, suggesting that beliefs on trustworthiness are not particularly low in the absence of communication. In the following section we therefore introduce a modified version of the costly talk model that provides a more complete description of our results.

5.2 Naïve principals and costly messages

While both models of costly talk and cheap talk fall short of providing an exhaustive explanation of our experimental results, each one seems to capture some essential features of our findings. We therefore introduce a hybrid model in which senders have beliefs on fairness that are not affected by communication, receivers are somewhat naive and can be influenced by messages, but talk is costly in the sense that receivers suffer from lying even if this does not lead them to change their actions.

These ingredients allow us to provide a rationalization for $R.4$ and $R.6$, respectively the invariance effect that shows that c_B^m does not vary significantly across treatments, and the deception effect that illustrates that B tends to inflate A's beliefs in HC without significantly increasing the amount returned if A delegates. Furthermore, the hybrid model is also consistent with all the other experimental results ($R, 1$, $R.2$, $R.3$, $R.5$, and $R.7$).

We introduce the above mentioned assumptions of this hybrid model by rewriting the utility

[18] We provide a formal proof of this result in Appendix A.

function of the agent in the following way:

$$U_B\left(m, c_B, \alpha_B, \gamma_B\right) = y - c_B^m - \gamma_B(\alpha_B - c_B^m)^2 - \phi \max[(\alpha_B^m - \alpha_B), 0], \tag{3}$$

where ϕ is a positive parameter that denotes B's cost of sending messages above the fair amount, and γ_B represents unfairness aversion as in the cheap talk model. Therefore, it is straightforward to observe that the amount that B returns to A if he is trusted continues to depend on preferences and is not affected by communication. However, now B may choose to inflate his language if the returns from influencing naive receivers exceed the costs of lying about the fair amount.

In order to derive our results we first specify the channel through which messages may affect naive principals. We assume that A's beliefs on the amount B will return, may be positively affected by messages in which the agent states his intention to return an amount above what is considered fair. More specifically, we assume that there is a positive share of naive principals that believe the agent will return an amount equal to the lower bound of the reference point contained his statement of intent, and ε represents B's subjective probability of being matched with a naive A (and $(1-\varepsilon)$ is the complementary probability of encountering a rational principal). To illustrate the impact of this assumption on beliefs, consider the expression for B's second order beliefs on what A expects to receive:

$$\mu_B^m = \varepsilon \alpha_B^m + (1-\varepsilon) \int_0^\infty \left(\alpha_B - \frac{1}{2\gamma_B}\right) f(\gamma_B) d\gamma_B. \tag{4}$$

First of all, this expression implies that the trustee strictly prefers sending $m = p = \alpha_B$ rather than $m = e$, since when $\varepsilon > 0$ there is a strictly positive share of naive trustors that take the message at face value. If an empty message is sent these naive trustors do not play a role, from which it follows that like in the baseline costly talk model, empty messages should not be observed, thus delivering the same prediction $P.1$. Moreover, (3) implies that B suffers a cost of lying only if $\alpha_B^m > \alpha_B$ and it is therefore never optimal for him to set $\alpha_B^m < \alpha_B$, since as in the cheap talk model the amount he returns ($c_B^m = \alpha_B - \frac{1}{2\gamma_B}$) depends only on his preferences, α_B and γ_B.[19]

Besides $P.1$, the hybrid model also maintains the main features of the baseline costly talk model by delivering the same predictions $P.2$, $P.3$, and $P.5$.[20] As shown previously, prediction $P.4$ no longer holds and can be replaced by $P.4b$ which is therefore consistent with $R.4$. Finally, predictions $P.3$ and $P.4b$ jointly imply the deception result of $R.6$. Intuitively, this is driven by the assumption that the nature of the cost of lying differs from that suggested by the initial theoretical predictions. Namely, while the sender bears a psychological cost from misrepresenting the fair amount and inducing the receiver to erroneously believe he will get more than he initially expected, nevertheless this does not lead him to modify his actions after having inflated beliefs. In other words, the hybrid

[19] In this respect, the baseline costly talk model differs since if the principal is very likely to pass even in the absence of communication (i.e., when the opportunity cost of delegating is very low), B may have an incentive to reduce the trustor's expectations on what she will get back if she passes.

[20] In Appendix A we show that the sufficient conditions for $P.2$, $P.3$, and $P.5$ to be true is that both assumption 1 and assumption 2 continue to hold.

model is characterized by separability between actions and messages. These considerations allow us to state that the hybrid model better rationalizes our findings with respect to both costly talk and cheap talk models, because the model's predictions ($P.1$, $P.2$, $P.3$, $P.4b$, and $P.5$) are consistent with all the experimental results ($R.1$, $R.2$, $R.3$, $R.4$, $R.5$, $R.6$ and $R.7$).

6 Further insight: precise versus non-precise promises and the "illusion effect"

The free form nature of the message that the trustee can send to the trustor in the treatments with communication represents a distinctive feature of our experimental design and allows us to study how the communication strategy changes in relation to variations in the opportunity cost of delegation. We focus on messages containing statements of intent and we distinguish between precise and non precise promises. A precise promise contains a clear and unitary reference amount (such as "*If you pass, I will send* 10 *euro to you*"). On the contrary, a non precise promise either involves a vague statement of intent containing no reference amount (such as "*If you pass, I will send a fair amount to you*") or is ambiguous meaning that it involves a non unitary set of possible values (such as "*If you pass, I will send you an amount that is higher than* 7 *euro*").[21]

First, in Table 9, we look at differences in the proportion of precise versus non precise promises between LC and HC.

Table 9. Promise precision in LC and HC

	A's Classification				B's Classification				Match			
	e	pp	np	N	e	pp	np	N	e	pp	np	N
LC	4	38	10	52	3	39	10	52	3	38	10	51
HC	7	42	2	51	3	44	4	51	2	41	2	45

Note. This table extends information in Table 2 by categorizing promises as precise (pp) or non precise (np). All other remarks of Table 2 apply.

We detect relevant differences in the distribution of promise types, precise and non precise, between the two treatments. Indeed, while the proportion of non precise promises in HC is below 5%, it jumps to 20.83% in LC. The difference in the frequency of non precise promises between LC and HC is highly significant according to a proportion test ($z = -2.278$, $prob. = 0.023$). Overall, these results suggest that the level of the outside option, while not affecting B's attitude to make promises, positively influences the precision of B's statement of intent.

$R.8$ While the size of the opportunity cost of delegation does not influence B's attitude to make promises, it strongly affects its precision: the proportion of non precise promises in LC is 4 times larger than in HC.

[21] In Appendix C, we report all the messages collected in LC and HC together with their classification.

Second, we investigate the effects of precise and non-precise promises on A's first and B's second order beliefs on the amount sent by B. Since we mainly observe non precise promises in LC, we restrict our attention to this treatment only. Moreover, we employ the same empirical strategy presented in Table 8 and isolate the effects of the two types of promises on beliefs in LC, relative to the corresponding treatment with no communication. Results are reported in Table 10.

Table 10. Promise precision and beliefs in LC

	μ_A^m	μ_B^m
e	-5.614^{**}	-4.292^{*}
	(2.430)	(2.195)
pp	1.598	0.404
	(1.106)	(0.990)
np	0.805	1.846^{***}
	(1.595)	(0.689)
$Constant$	5.160^{***}	6.454^{***}
	(0.774)	(0.572)
$log\ (pseudo)\ L$	−234.565	−236.822
$F-stat$	3.12	4.67
$prob.$	0.030	0.005
N	91	91

This table reports Tobit estimates (robust standard errors in parentheses) to isolate the effects of precise and non precise promises on μ_A^m and μ_B^m in LC, relative to LNC. e, pp, and np are dummies that take a value of 1 if the message in LC is empty, a precise promise, or a non precise promise, respectively, and 0 o/w. The same remarks of Table 8 apply.

When accounting for the effects of both precise and non precise promises in LC, we find that neither promise type exerts a significant effect on A's first order beliefs (by focusing on the regression based on μ_A^m: $prob. = 0.152$ for the coefficient of pp; $prob. = 0.615$ for the coefficient of np). On the contrary, we find heterogeneous effects of precise and non precise promises on B's second order beliefs. Indeed, while sending a non precise promise significantly increases B's second order beliefs relative to the treatment with no communication (for the coefficient of NP in the regression based on μ_B^m, $prob. < 0.01$), the effect of sending a precise promise is not significant (for the coefficient of pp, $prob. = 0.684$). Together, these observations suggest that, in sending his message, B incorrectly expects non precise promises to increase A's beliefs.

$R.9$ *Promise precision and beliefs: the illusion effect*. When the opportunity cost of delegation is low, relative to the treatment with no communication, precise promises affect neither A's first, nor B's second order beliefs on the amount sent by B. On the contrary, non precise promises significantly increase B's second order beliefs but do not exert any significant effect on A's first order beliefs.

We provide a behavioral explanation for both the greater presence of non-precise promises in LC ($R.8$) and for the "illusion effect" ($R.9$), whereby B over-weights the effect of non precise promises on A's first order beliefs relative to the amount she expects to receive. Our explanation focuses on the ambiguous promises, (i.e., those that involve a non unitary set of possible values included between a lower bound and the overall endowment), and is justified by the fact that none of the promises we observe in LC can be distinctly classified as vague.[22]

So far we have considered the optimal choice of the lower bound of the reference point contained in promises. We now analyze the sender's optimal choice of precision of the promise associated with this reference point. Starting from the hybrid model introduced in the last section we add a few simple assumptions that illustrate how the model is consistent with what we observe in the data.

We begin by introducing some notation, and denote a precise promise pp as a message stating that the sender will reward the receiver with an exact amount $pp,$ while we denote a non-precise promise np as one in which the sender states he will reward the receiver with an amount ranging from np to $np_{\max}$, where $np_{\max} > np$. So that, for example a non-precise promise such as "I will give you at least 10" implies that $np = 10$ and $np_{\max} = y$, and a precise promise such as "I will give you 10", implies that $pp = 10$.[23] Therefore, messages are now defined over the following domain: $m \in \{\varnothing, np, pp, e\}$

We now introduce the parameter $\eta \in (-np, (np_{\max} - np))$ which represents the effect that trustees expect to induce on naive trustors with non-precise promises. We assume that when the message is above the beliefs on the fair amount, non-precise promises are never believed to be effective by B. On the other hand, when messages are (weakly) below beliefs on the fair amount, the effectiveness of non-precise promises depends on whether the trustor is receptive to non-precise promises which we denote with R, or not receptive (NR). In the first case, non-precise promises can positively affect the trustor's beliefs, while in the second case they are not effective. Intuitively, as long as the reference point provided by promises is reasonably low compared to the fair amount, a non-precise promise may induce the trustor to believe that the trustee will actually return something above the reference point, if the trustor is a receptive type. The underlying idea behind this assumption is that, if A is naturally predisposed toward trusting B, she may be more receptive towards believing that the he will give back more than the lower bound established by a non-precise promise. In other words, trustful language (non-precise promises) may have a positive effect if the

[22]The only non-precise promises in the LC treatment that could be considered vague (rather than ambiguous) are the following: "If you pass seven euro to me you could earn more" and "Both of us could earn more than what we did if you kept the money. I have no interest in snatching everything from you when both of us could obtain a higher gain." In these cases however, vagueness appears to be more related to the intentions rather than to the amount, since B specifies that more "could" be earned without explictly mentioning an intention to give, while both statements implicitly set $np = 7$.

[23]As in the baseline model, we omit the upper bound in the representation of non-precise promises to simplify notation, since this dimension does not play a role in our model, and none of the non-precise promises that we observe contain an upper bound that is less than y.

principal is of a trusting nature.[24]

On the contrary, when the reference point set by promises is equal to or greater than the fair amount, regardless of the principal's willingness to trust the agent, it is impossible for her to believe that the agent will actually return an amount that is greater than the reference point α_B, because this would mean that the agent is moving further away from an amount that he considers fair. Since this will appear as a non credible (or even deceitful) statement for the trustor, it may even backfire and result in $\eta < 0$. These assumptions are summarized in the following expression:

$$\eta \begin{cases} \leq 0 \text{ if } m = np \geq \alpha_B, \\ = 0 \text{ if } m = pp \text{ or } m = np < \alpha_B \text{ and } NR, \\ > 0 \text{ if } m = np < \alpha_B \text{ and } R. \end{cases}$$

The agent however does not have perfect information on the principal's receptiveness but faces some uncertainty and has expectations on η conditional on the message sent, which we denote with $E_B(\eta \mid m)$. Therefore, the expression for μ_B^m now becomes:

$$\mu_B^m = \varepsilon(m + E_B(\eta \mid m)) + (1 - \varepsilon) \int_0^\infty \left(\alpha_B - \frac{1}{2\gamma_B} \right) f(\gamma_B) d\gamma_B.$$

When the opportunity cost of delegation is sufficiently low, an agent will choose whether to make precise versus non-precise promises based on his beliefs on the principal's receptiveness. It follows that an agent for which $np + E_B(\eta \mid np) > (<) \alpha_B$ will strictly prefer to make a non-precise (precise) promise. Thus, agents will make non-precise promises only if the expected benefit of receptiveness on μ_B^m given by $E_B(\eta \mid np)$, offsets the reduction in μ_B^m that comes from setting $np < \alpha_B$ in order for the non-precise promise to be effective. This may contribute to explain why we continue to observe a prevalence of precise promises also in LC (i.e., 38/51 in the matched classification). Furthermore, we assume that $\delta \equiv E_B(\eta \mid np) - E_A(\eta \mid np)$ denotes the discrepancy between B's and A's beliefs on the expected value of η when sending message np. Whenever δ is positive this indicates that B is overestimating the effectiveness of a non precise message on the principal's beliefs.

Given these additional assumptions, the hybrid model introduced delivers results that are consistent with the patterns we observed on the relative precision of promises in HC and LC. First of all, when the opportunity cost of delegation is high (HC), raising the chances that A will pass is more important for B, and the only credible way of doing so is to adopt a precise promise such that $pp > \alpha_B$, because non-precise promises are never effective when the reference point is set above the fair amount α_B. On the other hand, in LC, the principal may be receptive to non-precise promises but the agent is not sure of this. An agent that overestimates the principal's receptiveness will therefore be induced to make non-precise promises. As long as δ is sufficiently high, behavior prescribed by the model is consistent with the illusion effect that we observe in the data, whereby

[24]In some respect this concept is related to the idea of deception introduced by Akerlof and Shiller (2015), in that an agent may try to signal himself as a trustworthy person, in the attempt to "phish" for principals that are more inclined to trust others.

on average non-precise promises have a significant effect on the second order beliefs, μ_B^m, but not on the corresponding first order beliefs, μ_A^m.

7 Conclusion

Communication is beneficial in many strategic interactions as it generally facilitates cooperation, trust, and the emergence of proficuous norms of conduct. Nevertheless, understanding how communication mediates institutional and pre-existing conditions still represents an important open question for social scientists. In this paper, we consider a principal-agent setting, and experimentally study whether communication is comparatively more effective in influencing trust, based on the size of the opportunity cost of delegation. Our analysis relies on the lost wallet game, while introducing a pre-stage involving one-sided, free form, non binding communication from the agent to the principal. Two aspects of the lost wallet game make it an ideal framework to investigate our research question. First, the trustee chooses an action on a richer (non-dichotomous) choice space. On the one hand, this increases message heterogeneity in the communication stage, as promises are naturally anchored to the action space. On the other hand, this allows us to better investigate the extent to which the trustee lives up to his promises. Second, the choice of the trustor depends on the (exogenously set) outside option representing her payoff in case she does not delegate. This allows us to manipulate the size of the outside option to capture situations in which the trustor faces either a high or a low opportunity cost of delegation.

We find that communication is relatively more effective when the trustor faces a high cost of delegation. Indeed, in this situation, communication increases trustor's (first order) and trustee's (second order) beliefs on trustee's intentions as well as it attenuates the effects of the opportunity cost of delegation on the trustor's choice to delegate. Surprisingly, we detect no effect of communication on trustee's choice to pay back the trustor. With a low opportunity cost of delegation, instead, we find that communication plays no role in shaping beliefs and affecting choices.

To rationalize these results, we propose a model that incorporates aspects of both costly talk and cheap talk models. In this setting, trustees have beliefs on fairness that are not affected by communication (a cheap talk feature), some trustors are naïve and can be influenced by messages, but talk is costly in the sense that trustees suffer from lying even if this does not lead them to modify their choices on how much to reciprocate.

A novel result of our study concerns the effects of the opportunity cost of delegation on the communication strategy adopted by the trustee to induce the trustor to delegate. Indeed, when this cost is low, communication becomes less precise, with the trustee's messages containing more ambiguous statements of intent. The reduction in message precision is associated with an illusion effect, whereby the trustee wrongly expects non-precise communication to exert positive effects on trustor's beliefs and her propensity to delegate.

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A Appendix A.

A.1 Baseline model: Details

Assumption 1 follows directly from the underlying assumption we make on the relation between $B's$ beliefs of on the distribution of A's beliefs and the opportunity cost of delegation and $z_B(x)$. While both may be increasing in x, the increase in $z_B(x)$ is predominant. In other words, even if A believes that for higher values of x, B will be more generous in compensating her if she passes, this effect is not sufficient to offset the fact that for higher values of the outside option, A will require a greater amount to in order to pass. Notice also that the assumption that $z_B(x)$ is increasing in x does not exclude that B may believe that A will delegate, even if she receives less then the outside option x, and is therefore consistent with the experimental evidence of Dufwenberg and Gneezy (2000).

A.2 Baseline model: equilibrium behavior (choices and beliefs)

To describe equilibrium behavior we start from the final period and work backwards.

Period 3: *B's choice of how much to return to A if A passes*

In the final period, if the receiver passed in the second period, the sender is called on to choose his level of contributions. If this occurs, he chooses c_B^m by maximizing (1). We therefore have:

$$c_B^m = \begin{cases} \max[0, \alpha_B^m - \frac{1}{2\gamma_B}] & m \in \{\varnothing, e, p\} \end{cases}, \tag{A1}$$

where it follows that c_B^m depends on communication and is strictly increasing in the reference point α_B^m. Also, notice that plugging (A1) into $U_B(\cdot)$ we obtain the following expression:

$$U_B(\alpha_B^m, \gamma_B) = y - \alpha_B^m + \frac{1}{4\gamma_B}.$$

Period 2: *Beliefs*

In considering belief formation it is important to notice that for a given m, second order beliefs depend on the reference point determined by communication, and on B's beliefs on A's beliefs on the distribution of types in the population of senders:

$$\mu_B^m = \int_0^\infty \left(\alpha_B^m - \frac{1}{2\gamma_B}\right) f(\gamma_B) d\gamma_B. \tag{A2}$$

Notice that $\mu_B^m \leq \alpha_B^m$, since the agent believes that the principal will expect to get less than the reference point, as long as he believes that the principal believes that some agent types in the population are not infinitely averse to lying and unfairness (i.e., $f(\gamma_B) > 0$ for some $\gamma_B < +\infty$). This expression models the thought process that B goes through to come up with second order beliefs on μ_B^m. First of all, both players know that B tends to suffer a loss from giving less than the promised amount. Therefore, B's beliefs on the amount that A expects to get depend both on his beliefs on what A considers the reference amount (α_B^m), and on his beliefs on the distribution of A's beliefs on types ($F(\gamma_B)$).

We denote γ_x^m as the minimum value of γ_B for which B believes A will pass (i.e., $\mu_A^m = z_B(x)$). It follows that $\gamma_x^m = 1/[\min[0, 2(\alpha_B^m - z_B(x))]$ which represents the type γ_B that will contribute exactly $z_B(x)$, given the opportunity cost of delegating x. Therefore, the agent's subjective probability that the principal will pass when sending message m in treatment x is:

$$\pi_B^m \equiv \Pr_B[\mu_A^m > z_B(x)] = \int_{\gamma_x^m}^{\infty} f(\gamma_B) d\gamma_B. \tag{A3}$$

This last expression highlights how the subjective probability depends on the opportunity cost of delegation (x), and may actually be affected by communication because promises affect B's beliefs on the amount that A expects to receive. Therefore, higher promises reduce γ_x and have a positive effect on B's beliefs relative to the chances that A will delegate.

A.3 Baseline model: derivation of $P.2$, $P.3$, and $P.4$

In order derive these results, we first introduce a basic assumption that describes the impact of second order beliefs on probabilities:

Assumption 2: $\frac{\partial \pi_B^m / \partial \alpha_B^m}{\pi_B^m}$ is increasing x for every value of α_B^m.

This is quite a natural assumption because the probability of passing is bounded above since it can never be greater than one and, by assumption 1, $\pi_B^{\varnothing}$ is decreasing in x.[25] It states that the percentage variation in B's beliefs on the probability of A passing produced by an increase in the reference point α_B^m is always greater when the opportunity cost of delegation is higher.

To provide further insight for these predictions consider the first order conditions of expression (2) with respect to p, after having substituted the optimal level of c_B^p determined by (A1):

$$\frac{\partial \pi_B^p / \partial \alpha_B^p}{\pi_B^p} \leq \frac{1}{\left(y - \alpha_B^p + \frac{1}{4\gamma_B}\right)}. \tag{A4}$$

Notice that the right hand side (RHS) of the above expression does not depend on x, while by assumption 2 the left hand side (LHS) is increasing in x. Now considering any two values of x and p for which (A4) is satisfied with equality, if we increase x, it follows that the LHS is now greater than the RHS. In order to restore equality, since $\partial \alpha_B^p / \partial p > 0$, the trustee must increase p, therefore leading the RHS to rise by decreasing the denominator. This implies prediction $P.2$.[26]

[25] Notice that assumption 1 implies that Assumption 2 is satisfied even if $\partial \pi_B^m / \partial \alpha_B^m$ is decreasing in x as long as it decreases at a slower rate than π_B^m.

[26] It is important to observe that nothing guarantees that the sender will not find it optimal to reduce the chances that A passes by setting $m^* = p < \alpha_B^{\varnothing}$. As long as x is high enough to guarantee that there is an internal solution and the

Concerning $P.3$ and $P.4$, notice that by (A1) and (A2), in the absence of communication, everything is determined by the reference point $\alpha_B^{\varnothing}$ and therefore beliefs and choices do not vary for different values of the opportunity cost of delegation. On the other hand, if communication takes place, the trustee makes greater promises when the opportunity cost of delegation is high with respect to when it is low, and the mechanics of the model imply that communication will have a greater effect on B's beliefs and therefore also on the amount he returns if A passes. Regarding the part of $P.4$ that concerns A's beliefs, this prediction relies on the fact that second order beliefs move in the correct direction.

A.4 Informative equilibria of the cheap talk game

The following proposition states the condition for the existence of informative equilibria in the cheap talk game described in section 5.1:

Proposition 1 *In the cheap talk game described in section 5.1, informative equilibria characterized by messages rationally increasing B's beliefs on the amount that A expects to receive (second order beliefs), exist if and only if these beliefs are sufficiently low to start with in relation to B's true intentions.*

We first establish that separating equilibria, meaning those in which different messages convey information on different intentions c_B^m, cannot exist.

Lemma 1 *Separating Equilibria in which messages reveal information on intentions cannot exist.*

Proof. We prove this by contradiction. Suppose a separating equilibrium exists, then it must be that there exist at least two message partitions $m^{'}$ and m'' such that $m^{'} \neq m''$, for which $\mu_B^{m'} > \mu_B^{m''}$. However, this cannot be an equilibrium since a sender that is sending m'' will always prefer to deviate to m'. ∎

We know that in cheap talk games babbling equilibria, in which all messages are used but communication has no impact on beliefs and actions always exist. In line with Farrell (1993), that introduces the neologism-proof refinement in cheap-talk games, the fact that all messages are used in equilibrium is implausible. We therefore focus on pooling equilibria in which a sender uses a message partition that does not include all the available messages. This putative equilibrium is supported by out of equilibrium beliefs such that all messages that are not in this partition reduce the sender's expected subjective utility. In this setting, in which each sender is uncertain about the beliefs of the receiver, considering whether first and second order belief are consistent is of little relevance in analyzing the informativeness of cheap talk. Indeed, equilibrium behavior is defined by the sender's subjective rationality, in other words the fact that he best replies to his beliefs. The question is therefore whether there may exist subjectively rational communication strategies that can rationally increase the sender's second order beliefs on the amount that A will receive if

FOC is satisfied with equality for $m^* = p \geq 0$, an increase in x always leads B to make a promise with a strictly higher value of p.

she passes. More formally, we ask whether there exists an equilibrium characterized by a message partition m such that $\mu_B^{m\neq\varnothing} > \mu_B^{\varnothing}$.

To prove that this putative equilibrium can exist we therefore focus on B's beliefs, disregarding whether these are consistent with A's beliefs. We proceed by defining the true amount that B will return (defined by B's true unfairness aversion type), $c_B^m = \alpha_B - \frac{1}{2\gamma_B}$. Thus, μ_B^m is given by the following expression:

$$\mu_B^m \equiv \int_0^\infty (\alpha_B - \frac{1}{2\gamma_B}) f(\gamma_B \mid m) d\gamma_B,$$

which clearly depends on the trustee's beliefs on A's beliefs on the distribution of types conditional on the message received, $f(\gamma_B \mid m)$. Now in order for messages in partition m to rationally increase μ_B^m, it must be that the following two properties are jointly satisfied:

Property 1 (Effectiveness): messages must have a positive effect on second order beliefs μ_B^m.

Property 2: (Informativeness): communication must attenuate the distance between μ_B^m and c_B^m so that $\left|\mu_B^{\varnothing} - c_B^{\varnothing}\right| > \left|\mu_B^{m\neq\varnothing} - c_B^{m\neq\varnothing}\right|$.

It is straightforward to observe that these two properties can be jointly satisfied if and only if $\mu_B^{\varnothing} - c_B^{\varnothing} < 0$. Thus, when in expectations the sender believes there is little trust in him to start with. Considering a population of senders such as that which we obtain from our experimental data, since we observe that $0 \approx (\mu_B^{\varnothing} - c_B^{\varnothing}) < (\mu_B^{m\neq\varnothing} - c_B^{m\neq\varnothing})$, this is consistent with effectiveness but not with informativeness.

A.5 Hybrid Model: derivation of $P.2$, $P.3$, and $P.5$

To show that also the hybrid model delivers predictions $P.2$, $P.3$ and $P.5$, we continue to make use of assumption 2. The agent's expected utility after having substituted the optimal level of $c_B^m = \alpha_B - \frac{1}{2\gamma_B}$, which as mentioned previously is determined only by preferences as in the cheap talk model, is given by the following expression: $\pi_B^m(y - \alpha_B - 1/4\gamma_B - \phi \max[(\alpha_B^p - \alpha_B), 0])$. To determine the optimal promise we can compute the first order conditions of this expression with respect to p:

$$\frac{\partial \pi_B^p / \alpha_B^p}{\pi_B^p} \leq \frac{\phi}{A}, \tag{A5}$$

where $A = [y - \alpha_B - 1/4\gamma_B - \phi \max[(\alpha_B^p - \alpha_B), 0]]$ and therefore does not depend on x. Notice that by assumption 2 for every value of α_B^p the left hand side (LHS) of the above expression is increasing in x. Now considering the right hand side (RHS), since in equilibrium $\alpha_B^p \geq \alpha_B$ and recalling that in the hybrid model (as in costly talk) $\frac{\partial \alpha_B^p}{\partial p} = 1$, it follows that the numerator (given by the marginal cost of higher promises) is a positive constant and equal to $\partial \phi \max[(\alpha_B^p - \alpha_B), 0]/\partial p = \phi$

Now considering any two values of x and p for which (A5) is satisfied with equality, if we increase x, it follows that the LHS is now greater than the RHS. In order to restore equality, the cost of promises must increase leading to a decrease in A, and therefore allowing the RHS to increase.[27] This proves that the hybrid model implies $P.2$, while for $P.3$ as for the baseline costly talk model, it is sufficient to observe that μ_B^p is increasing in α_B^p for the part that concerns B's beliefs, and for the part that concerns A's first order beliefs (μ_A^p), this follows from the fact that second order beliefs move in the correct direction. $P.5$ follows from the same argument of the baseline costly talk model.

Probability of Delegating in the Hybrid Model

The probability of delegating continues to be represented by expression (A3) introduced in the baseline costly talk model:

$$\pi_B^m = \int_{\gamma_x^m}^{\infty} f(\gamma_B) d\gamma_B. \tag{A6}$$

Now considering that γ_x^m is defined as the value of γ_B such that $\mu_A^m = z_B(x)$ (i.e., $\varepsilon\alpha_B^m + (1-\varepsilon)\left(\alpha_B - \frac{1}{2\gamma_B}\right) = z_B(x)$), and since this equation implies a positive relation between α_B^m and γ_x^m, it follows that π_B^m is non-decreasing in α_B^m.

[27]As long as there is an internal solution (i.e., that for $m^* = p \geq \alpha_B$ the FOC is satisfied with equality), an increase in x always leads to a strict increase in the the optimal value of p.

Appendix B. Instructions of HC

[Instructions were originally written in Italian. The following instructions refer to HC.]

[Phase 1]

Welcome and thank you for taking part in this experiment!

During the experiment talking to other participants is not allowed.

- If you have any questions during the experiment, raise your hand and an assistant will come to help you.
- By carefully following the instructions you can gain an amount depending on your choices and on the other participants' choices.
- At the end of the experiment the amount you gained will be paid in cash.
- The following rules apply to all participants.

General rules

- At the beginning of the experiment, the computer will randomly and anonymously form groups of two participants.
- During the experiment, each participant will interact exclusively with the other person in his/her group.
- At the beginning of the experiment, participants will be randomly assigned to one of two different roles, called A and B, in such a way that, in each group, one person will have role A and the other person will have role B.

The choices of A and B

- In each group, A will be endowed an amount of 13 euro.
- A chooses whether to KEEP or to PASS the amount of 13 euro.
- If A chooses KEEP, then A gains 13 euro and B gains 0 euro.
- If A chooses PASS, then B receives 20 euro and chooses how much to TRANSFER to A. In this case A gains the amount that B transfers, whereas B gains 20 euro minus the amount transferred to A.

- The following table shows how the gains of A and B are calculated according to their choices:

	A gains	B gains
If A chooses to KEEP 13 euro	13 euro	0 euro
If A chooses to PASS 13 euro to B and B chooses to TANSFER X euro	X euro	(20-X) euro

- B chooses how much to TRANSFER to A before knowing A's choice. At the end of the experiment B's choice will be used to calculate the gains of A and B only if A has in fact chosen to PASS 13 euro.

- Before A makes his choice, B can send him a MESSAGE. The message can contain up to 300 alphanumeric characters. The only restriction on the message content is that B cannot include personal information to reveal her identity (name, computer id, etc.).

[Phase 2]

Before knowing the results of the interaction, each participant has the opportunity to gain an extra amount if he/she will predict his/her partner's choice within the group.

What will A predict? How much does A gain?

- A has to predict the amount that B has chosen to TRANSFER assuming that A has chosen to PASS 13 euro.

- A can gain up to 3 extra euro depending on how accurate his prediction is. Precisely, A's gains will be calculated according to the following rule:

$$gains\ of\ A = 3euro - 0.75 * (prediction\ of\ A - amount\ transfered\ by\ B)^2$$

- According to the rule above, if A's gains are negative, then A will not gain any extra euro.

- Please, pay attention to the following three features about this rule: i) if A exactly predicts the amount transferred by B, then he will gain 3 euro; ii) the penalization due to errors in A's prediction increases in the difference between A's prediction and the amount transferred by B; iii) if the difference between A's prediction and the amount transferred by B is at least 2 euro, A does not gain any extra euro.

- Notice that A has an incentive to state her/his prediction truthfully. Indeed, if the prediction is correct, by truthfully reporting it, A minimizes the penalization that is due to errors and maximizes her/his gains.

What will B predict? How much does B gain?

- B has to predict A's prediction made according the rule above. That is, B has to predict how much A expects that B transfers assuming that A has chosen to PASS 13 euro.
- As before, B can gain up to 3 extra euro depending on how accurate her prediction is. Precisely, B's gains will be calculated according to the following rule:

$$gains\ of\ B = 3euro - 0.75 * (prediction\ of\ B - prediction\ of\ A)^2$$

- According to the rule above, if B's gains are negative, then B will not gain any extra euro.
- Again, please, pay attention to the following three features about this rule: i) if B exactly predicts A's prediction, then she will gain 3 euro; ii) the penalization due to errors in B's prediction increases in the difference between B's prediction and A's prediction; iii) if the difference between B's prediction and A's prediction is more than 2 euro, B does not gain any extra euro.
- As much as for A, B has an incentive to state her/his prediction truthfully. Indeed, if the prediction is correct, by truthfully reporting it, B minimizes the penalization that is due to errors and maximizes her/his gains.

[Phase 3]

Before being informed of the experiment results, participants who play the role of B will have the choice to gain an extra amount according to the following rules.

What will B do? How much does B gain?

- B will be asked to reveal her guess of the likelihood that A has chosen to KEEP 13 euro, and of the likelihood that A has chosen to PASS 13 euro. To do this, the computer will show two frames to B, one positioned on the left and the other on the right. In the left side frame B shall include how likely she guesses that A has chosen to KEEP 13 euro, whereas in the right side frame B shall include how likely she guesses that A has chosen to PASS 13 euro. Each prediction must be a number between 0 and 100, where 0 means that B guesses that A has not made the correspondent choice and 100 means that B is sure that A has made the correspondent choice. Finally, the sum of the two predictions made by B must be equal to 100.
- Given B's predictions, at the end of the experiment B will take part in a lottery and, if lucky, she will gain 3 extra euro.
- The procedure used to determine the result of the lottery is such to make B more willing to make her predictions as accurate as possible. The more likely B guesses a given A's choice, the higher the correspondent prediction must be.

- The computer will assign a score (from 0 to 10,000) to each of the two B's predictions according to the following expressions:

$$Score\ for\ prediction\ of\ B\ on\ A\ choosing\ to\ KEEP\ 13\ euro =$$
$$= 10000 * \left[1 - \left(1 - \frac{prediction\ of\ B\ on\ A\ choosing\ to\ KEEP\ 13\ euro}{100}\right)^2\right]$$

$$Score\ for\ prediction\ of\ B\ on\ A\ choosing\ to\ PASS\ 13\ euro =$$
$$= 10000 * \left[1 - \left(1 - \frac{prediction\ of\ B\ on\ A\ choosing\ to\ PASS\ 13\ euro}{100}\right)^2\right]$$

where:

$$prediction\ of\ B\ on\ A\ choosing\ to\ KEEP\ 13\ euro +$$
$$+ prediction\ of\ B\ on\ A\ choosing\ to\ PASS\ 13\ euro = 100$$

- Note that the higher B's prediction in a given frame, the higher the assigned score.
- The lottery result and the eventual assignment of the 3 euro depend on the number of points assigned to B's prediction about the actual choice made by A.
- In particular, at the end of the experiment the computer will randomly draw an integer number between 1 and 10,000 with uniform probability. This random number will be compared to the number of points assigned to B's prediction about the choice in fact made by A. If the random number is not greater than the number of points assigned to B's prediction, B will gain 3 euro; otherwise B gains nothing.
- Example. B guesses that A has chosen to KEEP 13 euro with probability 70 over 100 and, therefore, that A has chosen to PASS 13 euro with probability 30 over 100. In this case, according to the above rules, the computer assigns 9100 points to the former prediction and 5100 points to the latter prediction. Note that expressing a higher prediction for the event considered more likely to occur is always profitable to B because, if she is right, B will have more probability to win the lottery. Suppose that A has chosen to PASS 13 euro so that B will take part in the lottery with 5100 points. Suppose that the random number drawn by the computer is 4812. Since the random number is lower that the score assigned to B's prediction about the choice made by A, B gains 3 euro.
- If B attaches probability 100 over 100 to a given A's choice, then regardless of the random number drawn by the computer, B will gain 3 euro if and only if A has in fact made that choice and will gain nothing if A has made the opposite choice.
- Before confirming her predictions, B will have the opportunity to know how many points have been assigned to her predictions using the "Calculate points" button. B can modify her

predictions every time she likes. To confirm predictions, B has simply to click on the "confirm your choice" button.

[Phase 4]

Before being informed of the results of the experiment, you will have the choice to gain an extra amount by classifying the message that B has sent to A at the beginning of the experiment

What shall A and B do? How much do A and B gain?

- During the experiment B has sent a message to A. A will be asked to classify B's message using one of the following categories:
  - PROMISE: a message containing "a promise or a declaration of intent";
  - EMPTY MESSAGE: a message not containing "any promise or declaration of intent"
- B will be asked to predict the category chosen by A in order to classify the message.
- Both A and B gain 1 euro if B predicts the category chosen by A; otherwise both A and B gain nothing.

B Appendix C. Message classification in LC and HC

Table A1. Message classification in LC and HC

Message	A's category	B's category	Precision
LC			
Hi, as you have noticed, this is the famous prisoner dilemma that we study in microeconomics 101. If you choose to pass and I type in 10, WE BOTH WIN! It's the smartest thing to do! In this way, we share the gains.	e	p	p
Hi, if you choose to pass 7 euro, I will transfer 10 to you, in such a way, at the end, both of us will earn 10 euro each. Let us trust each other, so that we can both go home happy!!!!	p	p	p
If I was A, I would probably keep 7€... however it seems to me that it is fair to split 20€, so if you pass you will receive 10€ :) I know that you don't trust me, but trust me! You will get 3€ more and we create wealth: from 7€ to 20€	p	p	p
This is my proposal for you: 10 and 10. I imagine that there will be a second round where we will switch roles, so that if I give you 10 now then you'll do the same later. It seems fair to me!	p	p	p
Hi, it is convenient for both of us if you do not keep 7 euro because I can transfer a higher amount such as 10	p	p	np
Hi A, we both know that you will decide the final outcome of this game. You can either trust me or not, in the latter case you would get your 7 euro for sure. If you choose to transfer 7 euro to me, I will give 13 back to you	p	p	p
If you decide to PASS, I will assign an amount of 8 euro to you in order for both of us to earn more than what implied by your possible choice to KEEP.	p	p	p
I can transfer more than 7 euro to you, in this way we can both gain.	p	p	np
I will give 10 euro back to you if you choose to pass your 7.	p	p	p
what are you going to do?	e	e	np
Hi player A, I do not really know how to convince you to pass, I can only tell you that my intention is to give you more than what you would earn by keeping the 7 euro. Hi	p	p	np
Hi A I was thinking that both of us could earn today! For example if you decide to pass the 7 euro to me I will be fair and divide the 20 euro fairly: I get 10 and you get 20. You have my word! In this way you will increase your gains and so will I.	p	p	p
If you pass the 7 euro to me I will give 10 back to you so that both of us will gain!	p	p	p

Table A1. Message classification in LC and HC (con't)

Message	A's category	B's category	Precision
LC			
Hi, I propose that you pass the 7 euro, and I promise that I will give you 9 euro back. In this way you will earn 2 euro more (7 +2), with no trouble.	p	p	p
Hi A. It is better for both of us if you transfer the 7 euro to me; in this way both of us will earn a higher amount because I would transfer more than 7 euro to you.	p	p	np
If you PASS, my intention is to transfer 10 EURO. It is a win win for both :)	p	p	p
You could choose not to pass the 7 euro to me, and in this way you would earn only 7. Instead, if you pass, I would pass 10 to you and you would earn more	p	p	p
If you pass the 7 euro, I will give 12 back to you and keep 8 in order to have gains that are more or less fair.	p	p	p
Hi, it is a pleasure to collaborate with you. I know that you have the possibility to earn only 7 euro, but in such a situation with my endowment of 20 euro we could have a win-win solution by splitting 50-50, namely 10 to you and 10 to me, we could both earn more, isn't it true?	p	p	p
If you pass the 7 euro to me, I'll transfer them back to you, I'll transfer 7 euro, so that you don't lose anything and both of us gain!	p	p	p
[BLANK]	e	e	np
Hi, if you transfer the 7 euro we share 10 fifty-fifty, 10 euro each and we make a good impression. You have the choice.	p	p	p
Listen, both of us can earn 10 euro per game: if you do not keep the 7 euro I'll reward you with 10 euro, so that we both earn 10 euro for each stage instead of 7 for you and 0 for me, or 0 for you and 20 for me	p	p	p
Hi I don't know who you are but I am sure of one point! We both have the opportunity to earn more than 7 Euro, I am not saying that I will pass all of the 20 euro, but we will share fifty-fifty as it is fair, so that we get back a bit of the tuition fees! Hi beauty:)	p	p	p
If you decide not to pass 7 euro you earn only 7 whereas I earn 0; instead, if you decide to pass them to me I can make you earn even more than 7. In my opinion it is the suitable choice because I will make you earn more than 7. Even if I made you earn only 8 you would have a gain of 1 anyway	p	p	np

Table A1. Message classification in LC and HC (con't)

Message	A's category	B's category	Precision
LC			
Hi! From what I understand, both of us can earn a given amount in case you pass. In particular, you can earn more than your 7 euro if I choose a minimum amount of 13 for X. If you decide to pass, I will type in X so that you can have at least 10	p	p	np
Hi! I could choose to transfer 10€ so that both of us will earn 10€.	p	p	p
If you pass seven euro to me you could earn more	p	p	np
The best solution for both of us is certainly to maximize our gains, ten euro each looks like more than fair to me, I believe that also for you it's surely better to pass	p	p	p
Hi! I'll certainly transfer an amount greater than 7 euro; otherwise you wouldn't have an incentive to transfer money to me. I believe that the fairest thing is to give 12 to you and 8 to me :) 10 would be too little in my opinion	p	p	p
Pass 7 euro, I'll transfer 8 to you and both of us gain	p	p	p
If you choose to pass 7 euro, you'll receive 10	p	p	p
Have you got more than 15 euro?	e	e	np
Why am I saying this to you? If you pass, I'll split it evenly: in my opinion in this way we'll reach more or less the expected payment, which is about 12 euro (10+3). Let's try to cooperate in order to remove the pleasure for microeconomists who see only selfish behavior in their models. I'll do it	p	p	p
Hi A! I'll propose an agreement to you, considering that if you decide not to pass you gain 7 euro, I propose you pass me the money, so that it becomes 20 and I commit to give 10 back to you. In this way, we get the same amount and you gain more than 7 euro. I trust you! Bye.	p	p	p
Hi, I'll transfer 10 euro, this is profitable for both of us	p	p	p
Hi, I'm B. If you transfer the amount we both have the chance to earn more by splitting the reward (10€ each) and maximizing our gains. I promise maximum reliability :)	p	p	p
Hi A! If you pass your 7€ to me you'll earn more because I'll give 10 back to you. With this choice both of us will earn something	p	p	p
Let's do it. Hi, I know that the rational choice in this game would be not to pass in the first step. However, the rational choice is not always the most efficient: it is profitable for us to cooperate to take home these 10 euro each. I trust in your sign of faith.	p	p	p
Hi A, if you choose to pass 7 euro, you will earn more	p	p	np

Table A1. Message classification in LC and HC (con't)

Message	A's category	B's category	Precision
LC			
This is my proposal for this game, you transfer 7 euro to me, and I'll equally split the 20 I'll receive. 10 euro each	p	p	p
I don't know whether the actual gains are based on how money is passed in this stage of the experiment but in any case I believe it is appropriate that you pass 7 euro to me and I transfer 13 of my twenty in order to get fair gains	p	p	p
Hi, let us not be intimidated by moral hazard. We have the chance to split either 7 or 20 euro. If you decide to pass, you will earn more than now. Maximize your gain and don't be scared of risking	p	p	np
Both of us could earn more than what we did if you kept the money. I have no interest in snatching everything from you when both of us could obtain a higher gain.	p	p	np
Trust me ! You get three small euro more and we split the twenty. 10 and 10 each	p	p	p
Hi I am B, I'll assign 10€ to you if you decide to pass. So both of us can get half of the total!	p	p	p
If you pass the money to me I'll transfer 10 euro, in this way we both gain and you gain more than 7 euro. I swear	p	p	p
Hi, I know that if I said that I would split it 10 and 10 you wouldn't probably risk, therefore I'll divide the 20 euro in 13 for you and 7 for me, so that both of us earn somethingl. I hope to persuade you to trust me :)	p	p	p
To be quick: 10 (that is more than 7) and 10?	p	p	p
Hi :) I would like to persuade you that the choice to pass 7 euro is more profitable for you because I would give you half of my gains, more than what you would get if you decided to keep it!	p	p	p
If you pass the 7 euro to me, I'll transfer 7 euro to you, so that your earnings will remain 7 euro.	p	p	p
To both make profits, X should be more than 7 and less than 20. Moreover, to persuade you to give me 7 euro, X=10 would warranty a fair reward, so that both of us earn the same amount	p	p	p

Table A1. Message classification in LC and HC (con't)

Message	A's category	B's category	Precision
HC			
If you pass 13€, I will pass 15€ back to you and I will keep 5 for me. This is the only incentive that I can offer to you. Moreover it will be more convenient to earn 20 together than 13 alone.	p	p	p
IF YOU PASS 13 EURO, I WILL GIVE 15 EURO BACK TO YOU IN SUCH A WAY YOU EARN MORE AND I DO NOT GET 0 EURO. I THINK THAT THIS IS CONVENIENT FOR BOTH OF US. THANKS!	p	p	p
I will give 14 euro to you!:) pass the money thankssss	e	p	p
HI I AM B. LET US DO AN HONEST THING. YOU KEEP 15, I KEEP 5. IN THIS WAY WE BOTH EARN, AND YOU GET MORE THAN WHAT YOU WOULD GET BY KEEPING 13.	p	p	p
I will split sum equally if you allow me to decide.	p	p	p
If you decide to transfer the money to me I will leave 15 euro to you. In such a way you earn 2 euro more and I obtain a profit too.	p	p	p
Hi! I propose you to transfer 13 euro to me in such a way that we will both earn. If you pass 13 euro to me I will transfer 13 to you: in this way you earn as much as you could get by keeping it and I take the remaining 7! :)	p	p	p
Ciao! It is 2:20pm, the max payout of the experiment is 30€, here is 20€. This makes me suppose that there will be a second trial. I think it is convenient to build a relationship based on trust. Transfer 13€ to me, I will split it so that we each get 10€.	p	p	p
MAKE A SMART CHOICE	e	e	np
Taking the risk can imply an advantage.	p	p	np
Hi, by making a simple calculation, if you pass the amount to me, I will transfer 14 because for me it's better to have 6 instead of 0 and in this way you would earn a euro more.	p	p	p
Hi A, this is B. If you choose to pass the loot, I will pass 16 euro to you. You gain, I gain.	p	p	p
I will assign 16€ to you, keeping 4 for myself. At least, let me have a coffee.	p	p	p
If you pass 13 euro to me, I will give 14 back to you	p	p	p
14 euro if you pass ;)	p	p	p
Hi! I believe in the dominance of management on economics, and therefore on the higher importance of altruism and cooperation than egoism (yes, reading such a statement would make me bored). I believe in the importance of trust: for this reason I will type in 10, trusting you.	p	p	p

Table A1. Message classification in LC and HC (con't)

Message	A's category	B's category	Precision
HC			
If you decide to pass the 13 euro to me, I will transfer an amount X to you, with X equal to 13 euro, so that you do not lose anything and I get a profit of 7€	p	p	p
Hi A! You have an incentive not to pass, but if we cooperate all of us can be happier: I assure you that if you pass the 20 euro to me I will send 15 back to you so that you earn 2 euro more, I get 5 for a pizza tonight, which is better than nothing :) Pareto improvement, come on! :)	p	p	p
Hi, I think it is a game of interaction therefore if we divide gains equally both of us can win. I hope you will collaborate, see you soon.	p	p	p
[BLANK]	e	e	np
So, given the fact that if you do not decide to transfer the 13 euro, you earn 13. I ask you to transfer it and I will return 15 to you, so that we can both gain. At the end I think that the experiment will be more successful if you earn more than 13	e	p	p
Hi it is better if we transfer the money, because we generate more! if you do not transfer, only 13€ will remain, in THE OPPOSITE CASE WE CAN GENERATE 20....	e	p	np
Dear A, the aim of this experiment is clearly to maximize the gains for both of us. The only thing that is better than 13euro for you is 14 euro. I will be happy to keep 6. In my opinion, they expect this. The payment depends on our behavior, so I am persuaded that this is the best choice.	p	p	p
I will transfer 14 euro to you if you pass the 13 euro	p	p	p
Dear A, I invite you to send the 13 euro to me. You're surely worried that I will give back less to you, but I swear on my honor that this will not happen. I promise that if you renounce to the 13 euro, I will give 15 back to you, so that you can earn 2 euro more (that never hurts) and I will keep 5.	p	p	p
Hi, I have an idea that can make both of us earn. You can choose to pass, while I choose to set x = 13. In this way you do not lose anything, and I earn something too. Perhaps you can think that I am lying, but it is up to you to decide whether or not to trust me.	p	p	p
Hi A, if you transfer the 13 euro to me I guarantee that I will transfer 10 euro to you, so that both of us will be satisfied. 10 euro each. I hope you will accept. thanks ! HI A!! :)	p	p	p
Hi :) I have decided to set x=13 in order to divide gains! at the end for me it would be 7+3(show up fee) anyway, surely better than 0! ahahaha :)	p	p	p

Table A1. Message classification in LC and HC (con't)

Message	A's category	B's category	Precision
HC			
Hi, so: if you choose to pass, I will receive 20 euro. Since your maximum gains are 13 euro, I will pass 15 euro back to you so that I will have at least 5 euro and you will have earned 15. As soon as roles are switched we'll do the same!	p	p	p
Hi. Unfortunately it is not a repeated game and so I have no chance to convince you to trust me, and you have no incentive at all. In any case, I tell you that I will transfer 14 euro to you and I will keep 6 for me. I give you my word, for whatever it is worth!	p	p	p
If you decide to pass, I will transfer 14 euro, so that you will obtain a euro more than what you could get by choosing to keep, while I will earn more than what I would obtain if you keep. Both of us will earn more!	p	p	p
Hi! In order to have an incentive to pass the 13 euro to me, I propose this agreement: if you pass 13, I will give 14 back to you. In this way you could earn something more and I will earn 6 instead of 0. You can trust me! If you pass, I could never dishonor your brave choice!	p	p	p
Unfortunately I have been assigned the role of B that is less dominant than A. However, the same could happen to you. For this reason I ask you to be generous and bet on generosity, in this way both of us can benefit from a safe gain (10, 10) thanks :)	p	p	p
Today's experiment is simple, you must decide between two opportunities. Either you live I die, or we share and get 10 each. You choose. ciaooo	p	p	p
Given the fact that I have been assigned to B, little is better than nothing. If you allow me to have 20 euro I will give 13 back to you.	p	p	p
If you pass 13 euro to me, I will transfer 15 back to you.	p	p	p
Hi A, if you agree to pass the 13 euro, I will transfer half of the money that I will receive, namely 10. Trusting in your collaboration, I send you my warmest greetings.	p	p	p
Let us agree that A always passes the 13 and B passes 10 so that we get 10 and 10 with no risk at each stage. However, this needs trust and honesty, I pass 10 to you as I am B, you pass the 13 to me so that we end up with a good result for both.	p	p	p
Hi, the amount I will select to transfer is equal to 14 euro. It is the only amount that makes it profitable for you to decide to transfer. It also represents the only way for me to earn something. I trust in your trust! :)	p	p	p

Table A1. Message classification in LC and HC (con't)

Message	A's category	B's category	Precision
HC			
If you pass 13 euro you will earn more. I need 5 euro so you will get 15 back, more than the initial 13 and both of us will gain	p	p	p
Hi! I propose an exchange, if you pass 13 euros to me I commit to give 16 back to you in such a way you gain too	p	p	p
Hi, if you pass the money we will split the amount! I woke up early as well xD	p	p	np
Hi, if you choose to pass I will transfer 15 euro to you (that is better than 13 euro) and I will keep 5 euro for me (that is better than 0). In this way, we both gain.	p	p	p
Hi, if you decide to pass 13 euro, you can be certain that the amount you will receive from me is 17 euro. so you will be compensated for taking this risk.	p	p	p
Hi, I propose to transfer your amount of 13 euro to me. I will assign 15 to you later so that you can earn more. I will have the opportunity to keep 5 euro. Optimal solution for both of us	p	p	p
Pass	e	p	np
Since there is only one interaction, if you decide to pass 13 euro to me, that become twenty I will return 13 euro to you, and I will keep 7 for me. this is because otherwise I would earn 0 and you keep 13 in any case. I think this is mutually advantageous.	p	p	p
I know that the most profitable choice for you is to keep 13€, but if you pass I will give 13 euro back to you and both of us will earn something.	p	p	p
Hi A. If you decide to pass your 13 euro then from my 20 euro I will pass 15 to you. It is profitable for both of us, for you because you will earn 2 euro more, for me because I will earn 5 euro instead of 0.	p	p	p
Given the fact that the maximum amount to be earned is 30€, it is obvious that the experiment will be repeated. Therefore, the best way to maximize our payoffs is to split 20€ each time. Indeed, it is very likely that it will be repeated with reversed roles. In this way 10€ x 3 stages gives 30. While 13 x 2 stages gives 26	p	p	p
Let's make sure that the experiment will have a win win outcome. If you decide to pass 13 euro, I'll transfer to 16€ to you so that both of us will gain.	p	p	p