

Information Asymmetry and Deception

Irma Clots-Figueras
Universidad Carlos III de Madrid

Roberto Hernan-Gonzalez
University of Nottingham

Praveen Kujal
Middlesex University

Abstract: Situations such as an entrepreneur overstating a project's value, or a superior choosing to under or overstate the gains from a project to a subordinate are common and may result in acts of deception. In this paper we modify the standard investment game in the economics literature to study the nature of deception. In this game a trustor (investor) can send a given amount of money to a trustee (or investee). The amount received is multiplied by a certain amount, k , and the investee then decides on how to divide the total amount received. In our modified game the information on the multiplier, k , is known only to the investee and she can send a nonbinding message to the investor regarding its value. We find that 66% of the investees send false messages with both under and over, statement being observed. Investors are naive and almost half of them believe the message received. We find greater lying when the distribution of the multiplier is unknown by the investors than when they know the distribution. Further, messages make beliefs about the multiplier more pessimistic when the investors know the distribution of the multiplier, while the opposite is true when they do not know the distribution.

I. Introduction:

Lying (or deception) in Economics is a rational act if it leads to an increase in one's payoffs. Recent research has shown there may be several motives to lying ranging from pure selfish to altruistic (Gneezy, 2005). Meanwhile, there is a vast literature on the neuro-biological basis of lying and manipulative behavior. Zhu et al. (2014) state that substantial correlational evidence suggests that prefrontal regions are critical to honest and dishonest behavior. For example, Yang et al. (2005) studied prefrontal gray and white matter volumes for 12 individuals who pathologically lied, cheated and deceived. They found that liars showed a 22-26% increase in prefrontal white matter and a 36-42% reduction in prefrontal grey/white ratios relative to their controls. It has been shown that the dorsolateral prefrontal cortex affects tradeoffs between honesty and self interest (Zhu et al., 2014) and that there may also be gender differences in neural basis of deception (Marchweka et al., 2012).

Lying is a prevalent daily phenomenon and is a part of daily social interaction. Importantly, lying behavior has important economic consequences. It is also for this reason that the study of lying is important. While the neuro-biological literature has studied the neurological underpinnings of deception, experiments in the economics literature have studied how and when individuals lie in incentivized settings. Starting with Gneezy (2005), the recent literature in experimental economics has studied specifically the nature of lies for a randomly drawn sample of University students. Using incentivized experiments this literature has found that lying is prevalent, may not always be selfish, and may have many motivations.

This experimental literature has classified the nature of lies based upon the gains and losses they impose on a third party. For example, Gneezy (2005) defines four categories of lies. The first category is composed by lies that help both sides, or at least do not harm anyone (white lies). The second are lies that may benefit the other person even though they may harm the liar. The motivation for such lies may be altruism or efficiency motives. Thirdly, a lie may not help the liar but may harm at least one person (if not both). These would be classified as spiteful lies. Finally, Gneezy studies lies that decrease the payoff to the other party and increase the payoff to the liar; these are classified as black lies. He finds that people are sensitive to the harm their actions may cause when deciding to lie. In addition, he finds that this unselfish motive diminishes with the size of the gain to the decision maker. Sanchez-Pages and Vorstaz (2007) investigate why a majority of subjects tell the truth when incentives would suggest otherwise. They find a group of subjects with preferences for truth-

telling and one that only cares about material incentives. Hurkens and Kartik (2009) modify the game in Gneezy (2005) and find that there is lying aversion but that results are also consistent with the fact that some people never lie and others lie only in their own benefit. Erat and Gneezy (2013) study white lies (altruistic or Pareto improving) and find that there is reluctance to tell Pareto improving lies indicating pure lying aversion.

There are other lies that do not rely on the gains and losses from the outcomes. In this case the perception that one transmits may be more important. For example, Fishbacher and Heusi (2013) find that people may lie to not appear dishonest and lies may even be disadvantageous to oneself.¹ Utikal and Fischbacher (2013) study disadvantageous lies where individuals may lie to maintain a positive self-perception. They argue that if the utility gained from maintaining the perception outweighs the monetary cost then people will tell disadvantageous lies. Sutter (2009), meanwhile, studies how truth telling can be a strategic form of lying when the truthful message may not be believed. In addition, Hao and Houser (2013) show that people may also have preferences on lies and may prefer incomplete lies over bigger ones. Finally, Kriss et al. (2013) study deception in an ultimatum bargaining game under asymmetric information. They find that deception is greater when informed parties make an explicit statement than when information is communicated implicitly. This is especially true for larger stakes. However, allowing the explicit statement to be accompanied by a promise of truthfulness reverses this effect. Finally, as in our paper they also observe very high levels of dishonesty.

Besides the taxonomy of lies mentioned above, there are many real life situations that involve over, and under, statement of the truth. Think of a typical situation in a firm where a superior proposes her subordinate to work on a project. Clearly, the superior has additional knowledge about it and knows the potential gains it entails for himself and the subordinate, and may choose to over (or under) sell it. Another example is venture capital where the investee may oversell a project to make it look attractive². In these examples the information transmitted regarding the return on an investment may not be verified easily and can have

¹ Fishbacher and Heusi (2013) study what they define as lies in disguise. In their design subjects face no threat of being caught and no material incentives to honesty exist in their experiments. They can only observe the distribution of lying behaviour and find that individuals either lie fully, partially, or are honest. They explain both full cheating and honesty through the model of lying aversion. However, this model is not able to explain partial lying.

² For example, Bloom Energy an energy startup sold their project as an “industry creator” that would eventually substitute the domestic grid.

adverse economic (efficiency) consequences.³ Situations with asymmetric information are pervasive and may result in deception due to conflict of interests.

We introduce information asymmetry and communication in a modification of the standard investment game (Berg, Dickhaut and McCabe, 1995). In this game, two players, an investor and an investee, are endowed with an initial amount of money. The investor must decide how much of his initial endowment to invest. The amount invested is multiplied by a parameter (the multiplier) greater than one. Then, the investee can decide how much of this amount, if any, is returned to the investor, keeping the remaining amount for herself. We introduce information asymmetry in this setting by informing the investee about the true value of the multiplier, whereas the investor only has information about the distribution of the multiplier. We introduce communication by allowing the investee to send a numerical message to the investor regarding the value of the multiplier. The investee can decide whether to inform the investor truthfully, or not. The possibility of communication between the investee and the investor is what allows us to study the nature of messages and deception.

We find that under-, and over-, statement of messages is common with a large proportion of subjects sending false messages. We find that almost half the investors believe the message they receive. Further, we find that messages understating the true value are more likely to be believed.

We also explore why investees may decide to deceive investors by understating or overstating the true value of the multiplier. We analyze some possible explanations from the literature that may explain lying through under, or over, statement. Investees may want to overstate (the true value of k) if investors are naive, or believed to be so, and their investment is expected to increase with the value of k . In this regard, our structure has the flavour of the cheap-talk scenario in Ottaviani and Squintani (2006) and Kartik, Ottaviani and Squintani (2006)⁴ where message inflation will be observed if those who send the message believe that the receivers of the message are naive. We find evidence of this behaviour as those investees who overstate the true value of k expect to receive greater investments than those who tell the truth or understate it.

³ Evidence suggests that the economic loss to society can be quite large. For example, Mazar and Ariely (2006) state that the loss from returning used clothes to the fashion industry is estimated at \$16 billion. The cost to the US economy from the Enron and WorldCom crisis was approximated at \$37-42 billion.

⁴ Kartik (2009) introduces the cost of lying in a model of strategic information transmission.

While overstatement may occur if investors are considered naive, there are several competing explanations for message deflation. It may be that investees have beliefs regarding what types of messages are believable (Fischbacher and Heusi, 2013; Sutter, 2009). Another possible explanation is guilt aversion (Charness and Dufwenberg, 2006, and 2010). Investees may understate the true value of k if they expect to return a low amount and therefore feel less guilty. Finally, individuals may have preferences over the degree and the direction of the lies. In this scenario individuals may view small (i.e. partial) lies as more acceptable than big ones (see Hao and Houser, 2013)⁵, and understatement could be perceived as more acceptable than overstatement. We find evidence for all of these possible explanations.

In our paper the investees can lie to obtain the maximum benefit for themselves (a black lie), but they can also lie to maximize the total surplus, by increasing the amount sent by the investor, and benefit later both parties (a white lie). Therefore, lies can have positive or negative consequences to both parties depending on the posterior investee's decision. In this regard, we can consider them as grey lies and fit them between white and black lies in Gneezy's classification. Further, in our structure lies are endogenous and may lead to under, and over, statement.

Though the game they study is different, the two papers closest to ours are Gneezy (2005) and Fishbacher and Heusi (2013). In Gneezy (2005) subjects have 2 options: lie or tell the truth, in our case they report a numeric message so lying is endogenous and there can be different degrees of lying. This is more similar to real-life situations in which the information given is, for example, the returns on an investment, or the probability that a project succeeds. As in our paper, lying in Fishbacher and Heusi (2013) is endogenous. Subjects can over or under state the true values taken by the roll of a dice. In their design the direction of the lie determines the payoffs. The difference between Fishbacher and Heusi (2013) and this paper is that in our scenario the consequences of the lies are also endogenous, given that the investor can react in different ways to the message and send a larger or smaller fraction to the investee, who can then decide how much to return.

We contribute to this literature by studying a message that is open to interpretation by the receivers of the message. The lies have a strategic element to it as they seek to exploit knowledge regarding the beliefs. We also analyse the effect of ambiguity on the distribution

⁵ Note that this explanation is similar to an understatement being more believable.

of the true state, i.e. the value of the multiplier which, to the best of our knowledge, has not been analysed before. Ambiguity is all pervasive in our daily interactions. In our everyday interactions we frequently encounter situations where risk is not quantifiable (i.e. ambiguous), while situations with defined probabilistic outcomes are few. For example, future stock prices are ambiguous⁶, as is the quality of education, or the outcome of a business venture (as we state in the venture capital example earlier). We find that introducing ambiguity may exacerbate the effect of information asymmetry as we observe higher levels of deception.

II. Methods.

Anonymity was always preserved (in agreement with Spanish Law 15/1999 on Personal Data Protection). No association was ever made between participants' names and the results. As is standard in socio-economic experiments, no ethic concerns are involved other than preserving the anonymity of participants. This procedure was checked and approved by the Deans at the University Carlos III of Madrid; the institution hosting the experiments. At that time no official IRB was established at the university.

Participants and general protocol

A total of 694 undergraduate students from the university were recruited for an hour and the average payoff was approximately €20. Including the instructions, the experiment lasted approximately 45 minutes. Prior to their recruitment, all subjects were given a questionnaire (see supplementary SI1). Responding to the questionnaire was a pre-requisite to participating in the experiments. The questionnaire contained personal information about age, studies, grades, family origin etc.

All instructions were computer based (see supplementary SI2). This protocol was implemented to ensure strict anonymity across subjects and to minimize the interaction with the experimenter. After making their decisions subjects responded to a set of questions (see supplementary SI3). The experiment ended after all subjects had responded to this second set of questions. They were then called out individually and paid their earnings privately.

The investment game

⁶ There is a substantial literature on ambiguity in the Finance literature.

Subjects played the investment game introduced by Berg et al. (1995). In this game, two individuals, investee and investor, receive an initial endowment of 100 dex (experimental money; approx. \$12). The investor can send any amount (M) between 0 and 100 dex to the investee. The amount sent by the investor is then multiplied by k (the multiplier). Finally, the investee decides how much of the amount received ($k \times M$) is returned to the investor, keeping the remaining amount for herself.

Individuals were randomly selected into sessions and roles were randomly assigned. Investees and investors were assigned to separate rooms in the same building before they arrived for the experiment and were referred to as player A and player B, respectively. Both were told they would be paired with another person (A/B) in a different location.

Treatments

We compare variations of the standard investment game (Berg et al., 1995) where we introduce uncertainty (for the investor) regarding the value of k . We introduce information asymmetry by giving the information on the value k takes only to the investee. From the beginning, the investee gets to know the actual value of k , and knows that the investor does not know this value. All this is common knowledge for both players. Further, in these treatments we also allow for communication between the subjects. The investee can decide whether to send a numerical message informing the investor about the value of k .⁷ The investee is free to state any value of k and may choose to deceive the investor or not.

Below we describe the main treatments in detail and then provide justification for the treatment selection. The treatments are also summarized in Table 1.

TABLE 1. Treatments

		Timing of the messages		
		No messages	Message before investor's decision	Message after investor's decision
Information known by the investor about k	$k \in \{2, 3, 4\}$	234_No	234_ExAnte	234_ExPost
	$k > 1$	k>1_No	k>1_ExAnte	

⁷ In Sanchez-Pages and Vorsatz (2009), senders can choose whether to tell the truth, lie or remain silent.

Treatment 234_No: k ($=2, 3$ or 4). The investor is told that k can now take any value between $\{2, 3, 4\}$ with equal probability.

Treatment 234_ExAnte: Ex-ante message about k ($=2, 3$ or 4). The only difference from treatment 234_No is that now the investee can decide whether to send a message or not regarding the value of k prior to the decision of the investor. The message is numerical and the investee can input any value. Upon receiving the message the investor decides how much to send to the investee. In case of no message the investor is informed that there is no message.

In order to further analyse the reasons why individuals over, or under, state the value of k we conducted another treatment in which the investees send a message ex-post:

Treatment 234_ExPost: Ex-post message about k ($=2, 3$ or 4). The only difference from treatment 234_ExAnte is that the investee informs (or not) the investor of the value of the k after the investor has decided how much to send.

Finally, we study how the degree of information asymmetry affects false messages. In order to do this, we conducted two additional treatments where the investor was not informed about the distribution of k .

Treatment $k>1$ _No. *Ambiguity* treatment. The only difference from the 234_No treatment is that the investor is told that k can now take any value greater than one. From the beginning, the investee gets to know that the value of k is equal to 3, and is told about the information the investor has. All this is common information.

Treatment $k>1$ _ExAnte: Ex-ante message about k (>1). The only difference between treatment $k>1$ _No and this treatment is that now the investee can send a (numerical) message indicating the value of k prior to the investor's decision.

The nature of pre-play communication we have is minimal. Given the value of the return on the investment (k), the investee can send any numeric announcement to the investor regarding the value k takes⁸. While compromising on the richness of language,⁹ using only

⁸ Note that we didn't want to impose any constraint in the message sent by investees in treatment $k>1$ _ExAnte. In order to keep treatments comparable, we didn't impose any constraints in treatments 234_ExAnte and 234_ExPost either.

⁹ See Charness and Dufwenberg (2006, 2010).

numeric values has an advantage as it enables us to clearly measure the direction and the size of the false message, i.e. above or below the actual value. This also enables us to measure clearly when subjects over-, and under-, state in their messages. We further avoid the difficulties associated with the subjective classification of language. The use of language may be an important factor in reciprocity if agents have preferences on “language.” That is, agents may interpret language differently and respond accordingly to it. Note, however, that the study of reciprocity is not the focus of this paper.

III Results

In this section we first study the nature of false messages, i.e. how subjects inflate, or deflate, messages. We then study whether investors believe the messages they receive. Finally, we analyze subjects’ behavior in the game and their responses to the questionnaire.

III.1 False messages

In principle any message sent should be interpreted as cheap talk. However, if investees believe that investors are naive, i.e. believe the messages they receive, they may be interested in sending a message to influence their investment decision. In this case, if investees believe that the amount sent by the investors may increase with the return on the investment, k , they may then overstate their messages in order to receive a higher amount from the investor (Ottaviani and Squintani, 2006). Contrarily, the investees may decide to understate the value of k if they anticipate that they will return a very small amount to the investor. In other words, understating k and subsequently returning less can be explained by guilt aversion (Charness and Dufwenberg, 2006), where decision makers feel guilty if they disappoint others. If this is the case then messages can influence what the investor will expect to receive, and to avoid disappointment, investees might report a lower value of k if they expect that they will return little.¹⁰ Note that investees could believe that lower values of k are more believable, and they could then decide to understate k .

We will now look at results from the treatment (234_ExAnte) where k can take any value from the distribution $\{2, 3, 4\}$ with equal probability. Investees can choose to send a message, or none, regarding the value of k . We have data from 134 students, organized in 67 pairs. First we identify those who sent false messages and those who told the truth (see Figure

¹⁰ Note that this assumes that a player’s utility depends on others’ beliefs.

1). Of all investees in this treatment, 14.93% decided not to send any message while, 11.94% sent a message outside of the known distribution. We consider these two groups as sending an uninformative message. Investees may choose not to send a message due to two reasons. One may be that they think that any message they send may be considered as “cheap talk”. On the other hand a message may not be sent to not transmit any information to the investor.¹¹

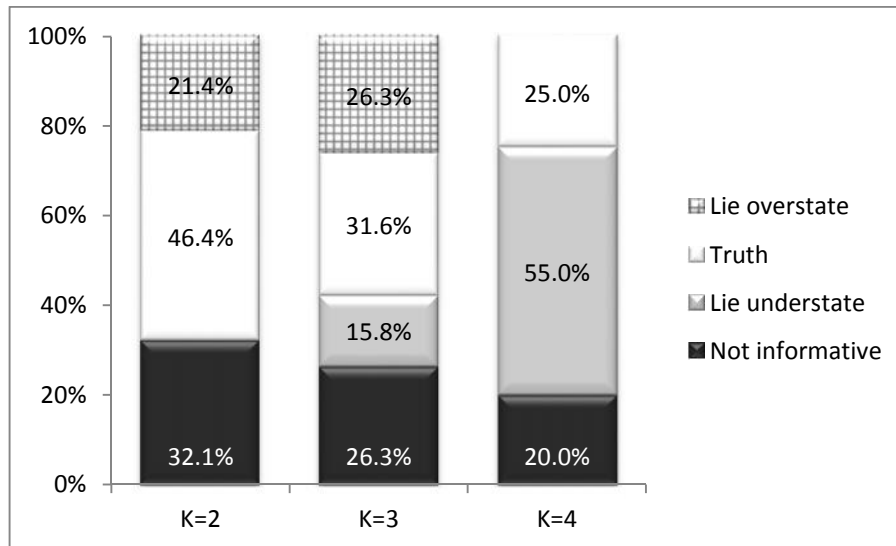


Figure 1. Distribution of messages by return.

Excluding the subjects who sent an uninformative message, almost the same proportion of individuals sent false messages, 51.02%, and told the truth about the value of k , 48.98%. Meanwhile, 28.57% understated k , while 22.45% overstated it.

We classify false messages according to the difference between the real and the reported values of k for each value of k (Figure 1). The proportion of individuals who told the truth is higher for low values of k : 46% (32%) [25%] when k took value of 2 (3) [4]. However, pairwise tests of proportions (Table 2) indicate that the differences in proportions are not statistically significant. The proportion of individuals acting strategically and overstating the true value of k is the same when k took the value of 2 or 3. Understatement of k is significantly higher for $k=4$ than when $k=3$.

We may get understatement due to two reasons. First, and consistent with the guilt aversion hypothesis, investees may believe that the larger the reported value of k the more

¹¹ Alternatively, those who send a message outside the distribution may have done it because they thought that any message sent may not be believable, or because they did not understand the game properly.

investors are going to be likely to believe that they will be returned a large amount. As a result, if they plan on returning a small amount, they will be more likely to understate the value of k when k is high. The second reason could be strategic. If investors are not naive and have prior beliefs on subject responses, investees may strategically best respond. In this case investees may strategically understate to make their messages believable, and to induce investors to send a larger amount. In the following section we will see that investors find smaller values more believable than large ones.

TABLE 2. False Messages.

	Tests of proportions (p-value)		
	k=2 vs. k=3	k=2 vs. k=4	k=3 vs. k=4
Told the truth about k (k =message)	0.3086	0.1305	0.6481
Overstated the value of k (k <message)	0.6976	-	-
Understated the value of k (k >message)	-	-	0.0402

We now study whether our results are robust to the introduction of ambiguity regarding the value that k can take. Most situations in real life involve a certain degree of ambiguity, for example, situations with defined probabilistic outcomes are very few. We want to analyse whether lying behaviour is similar under ambiguity. Similarly, Rode (2008) varies the level of information asymmetry to study the effect on lying and trust. He finds that advisors tell the truth more frequently when decision makers' uncertainty is low, as advisors feel less morally bound to send accurate information. Decision makers followed the recommendations independently of the level of uncertainty. However, Rode (2008) finds that inducing a competitive environment, previous to the communication game, reduced the proportion of recommendations that are followed by the decision makers when the level of uncertainty is low or medium.

We compare the results of the uncertainty treatment (234_ExAnte) with those of the ambiguity treatment ($k > 1$ _ExAnte). Contrary to Rode (2008), we find that the proportion of subjects who tell the truth in the ambiguity treatment is significantly smaller while, the proportion of the subjects who overstate the value of k is higher (see Table 3 and Figure 2). This can be partially due to the fact that k is always equal to 3 in the ambiguity treatment. When comparing the subset of subjects in treatment 234_ExAnte for which $k=3$ to those in the ambiguity treatment ($k=3$), the proportion of subjects who tell the truth is much smaller in the latter, but the proportion of subjects overstating returns are not significantly different. This shows that the introduction of ambiguity encourages false messages.

TABLE 3. False messages in the ambiguity treatment.

	Tests of proportions (p-value)	
	234_ExAnte vs. k>1_ExAnte	234_ExAnte vs. k>1_ExAnte (k=3 in both cases)
Told the truth (k=message)	0.0041	0.0872
Overstated the value of k (k<message)	0.0018	0.2556
Understated the value of k (k>message)	0.6032	0.4150

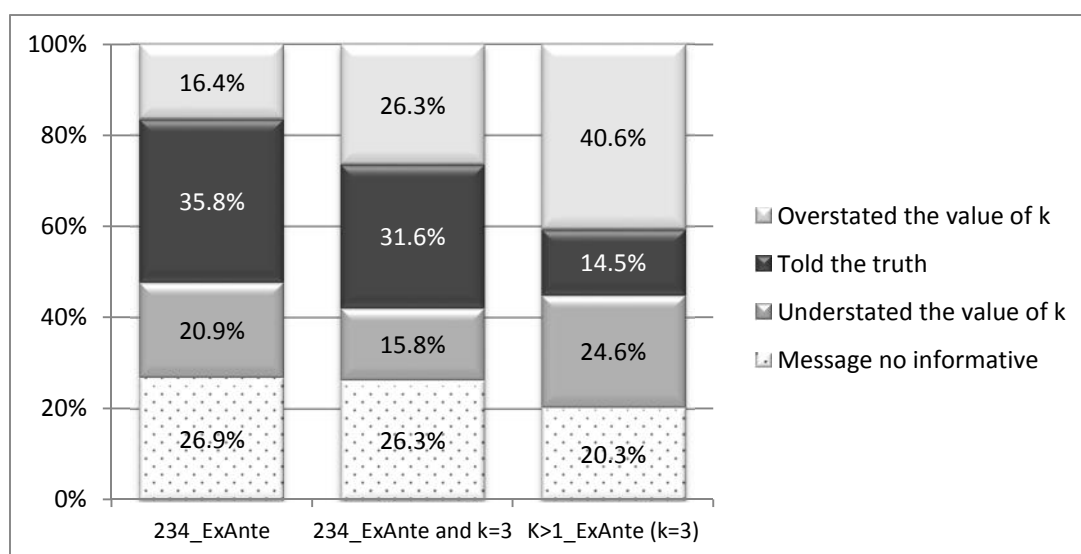


Figure 2. Distribution of messages by return in the ambiguity treatment.

III.2 Are messages believable?

We obtain information on subject beliefs from the questionnaires we conducted after the players made their decisions. This allows us to see whether messages are believed. This information is useful as it also tells us whether investors are naive.

In the questionnaire we asked investors about the value they thought k took.¹² Considering only those pairs in which the investee sent an informative message, a sizeable proportion of investors (45.16%) believed the message, while 48.39% of the investors believed that the investees were overstating the value of k . In contrast, only 6.45% believed

¹² Unfortunately, and due to software problems, we could only collect 50% of the answers to this question in the questionnaire.

that investees understated the value of k .¹³ This means that most investors expected the investees to act strategically and to overstate k .

Overstating k did indeed induce subjects to send a larger amount. We check whether those investors who believed that k took larger values sent a larger amount. In order to do this, we compare investors with different beliefs. In the treatment 234_ExAnte, those investors who believed (as reported in the questionnaire) that $k=2$ sent on average (median) 33.5 (25.0), while those who believed $k=3$ sent 59.0 (55.0). This difference is significant (Mann-Whitney p -value=0.0055, t -test p -value=0.0145, and the median test p -value=0.016). If we consider all treatments with $k=\{2,3,4\}$ (234_No, 234_ExAnte, 234_ExPost), investors who believed $k=2$ sent on average (median) 36.0 (30.0), while those who believed $k=3$ sent 53.6 (60.0), with Mann-Whitney p -value=0.0023, t -test p -value=0.0028 and Median test p -value<0.001. We do not have enough data to do the same analysis for those who believed $k=4$ (only 9 observations for the three treatments)¹⁴.

Interestingly investors were more likely to believe the message when the reported value of k was low, i.e. 89% (36%) [25%] of the investors believed a message stating that k was equal to 2 (3) [4]. This suggests that if investors are not naive then investees may also have incentives to understate k . That is, there is also a strategic motive to understate k to make messages more credible.

Figure 3 shows the distribution of beliefs by treatment.¹⁵ When no message was sent (234_No), investors were more likely to believe that k would take low values, only 11% thought that it took the value of 4, while 50% thought it was 3 (the expected value). In those treatments where a message was sent (234_ExAnte and 234_ExPost), beliefs were even more pessimistic, as a larger fraction of individuals thought that k took the values 2 or 3. The effect of the message was then to induce investors to believe that returns were lower. In fact, in the treatment “234_ExAnte”, 63%, 29%, and 9% of investors thought that the value of k was 2, 3 and 4, respectively. This distribution is significantly different from the one corresponding to

¹³ Three individuals reported a message outside of the distribution.

¹⁴ In Figure S1 we plot our measure of trust (the investment), by the message received. We do this separately for the treatments 234_ExAnte and K>1_ExAnte. When the message receiver knows the distribution of k , pairwise tests show that investment is the same for the three types of messages. When the message receiver does not know the distribution, pairwise test show that investment when k is larger than 4 is greater than investment when it is exactly 4, however, it is not different from investment when k is 3. The other pairwise comparisons are not significantly different from zero.

¹⁵ Restricting the sample to subjects who received informative messages and believed that k would take the values 2, 3, or 4.

the treatment 234_No (Kruskal-Wallis test p-value=0.0547). In the treatment “234_ExPost”, 53%, 44%, and 3% of investors believed that the value of k was 2, 3, and 4, respectively. In this case the difference with 234_No is not significant (Kruskal-Wallis test p-value=0.1394), but the number of observations is lower.

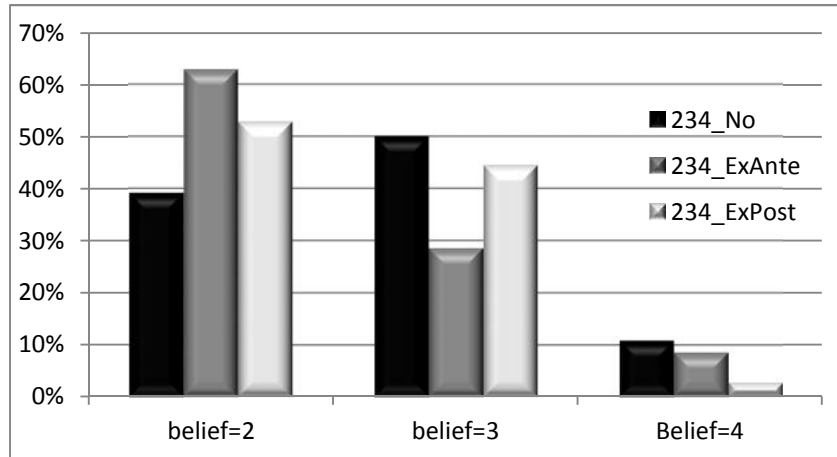


Figure 3. Distribution of Beliefs by Treatment.

Note: Proportion of subjects by treatment who believed that the value of k was 2, 3 or 4.

The questionnaire responses suggest that investors expected false messages; in fact, they expected that the value of k would be overstated and upon receiving low values, found them believable. It is clear that the messages were not cheap talk for a sizeable proportion of subjects. This is important as it raises the possibility of strategic behaviour both on the part of investees and investors. In addition, the introduction of messages made the investors more pessimistic about the value of k .

We now analyse whether messages are considered cheap talk by subjects in the treatment $k>1_ExAnte$. Results in this case are very similar to those found above. When we analyse whether investors actually believed the messages, we find that under ambiguity the proportion of investors who believe the message is still sizable (38%). Interestingly, 15% of the investors thought that the investees were under-reporting the value of k . This is larger than the proportion that believed that the message was understated by the investees in the 234_ExAnte treatment, 6.45%.

As shown in Figure 4, in treatment $k>1_No$, 51% of individuals thought that the value of k was 2, meanwhile 29%, 3%, 9% and 9% thought that it was 3, 4, 5, and >5 , respectively. The effect of the message seems to be very different in this case as it moves the distribution of beliefs to the right. When a message was sent only 29% of the subjects thought that the value of k was 2, while 38%, 6%, 15%, and 12% thought that it was 3, 4, 5 and >5 ,

respectively. According to a Kruskal-Wallis test, the difference is significant at the 10% level (p -value=0.0903). This also shows that individuals have pessimistic beliefs under ambiguity, and contrary to what we found before, the message reverses this pessimism¹⁶.

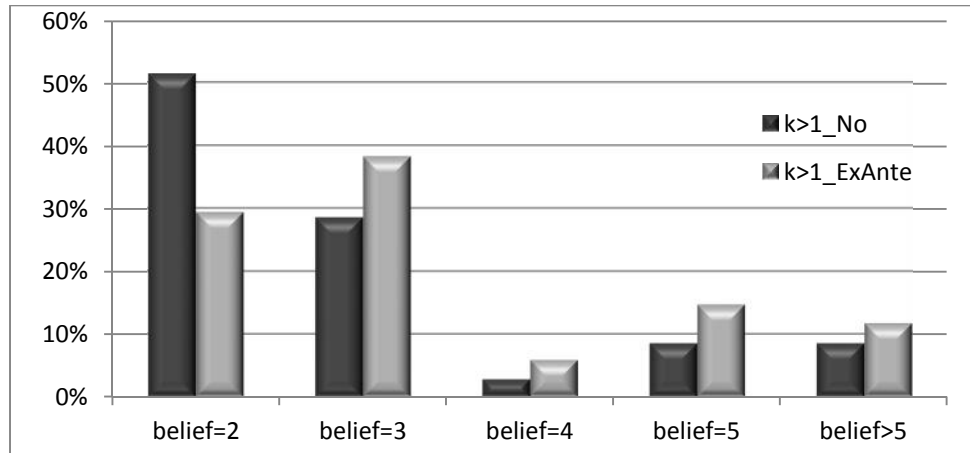


Figure 4. Distribution of beliefs by treatment. Ambiguity treatments.

Comparing those who believed the message with those who did not believe it, those who believed had an average payoff of 82.43 DEX, while this was 80.63 DEX for those who did not believe the message. These two numbers are not statistically different, whether we use a two-sample t test ($p = 0.8154$) or the Wilkison-Mann-Whitney test ($p = 0.8759$). An equality of medians test also reaches the same conclusion ($p = 0.89$). In contrast, those who lied obtained higher returns in the experiment; they received on average 106.52 DEX, while those who told the truth received 75.125 DEX. The absolute difference is now larger, and a one-sided t-test would give a p -value of 0.0599, even if the other tests do not report a difference that is statistically significant ($p > 0.1$).

III.3 Why are false messages sent?

In this section we explore the motives behind under, and over, statement of messages. Earlier (Figure 1) we saw that 20.8% of the investees understated the value of k , while 16.42% overstated it. Those who overstated k could have done it for strategic reasons, while those who understated it could have done it due to both guilt aversion and strategic reasons if they believed that exaggeration is not credible. In what follows we will investigate this further.

¹⁶ In Figures S2 and S3 we plot the distribution of beliefs by message received for both treatments in which a message is sent ex ante.

Strategic reasons: In the survey we asked the investees *how much they expected to receive from the investors* (given the message they had sent). We can use this question to understand whether investees who overstated the value of k did it to get the investor to send them a larger amount. The amount they expected to receive should be larger for those who overstated k than for those who told the truth and those who understated it.

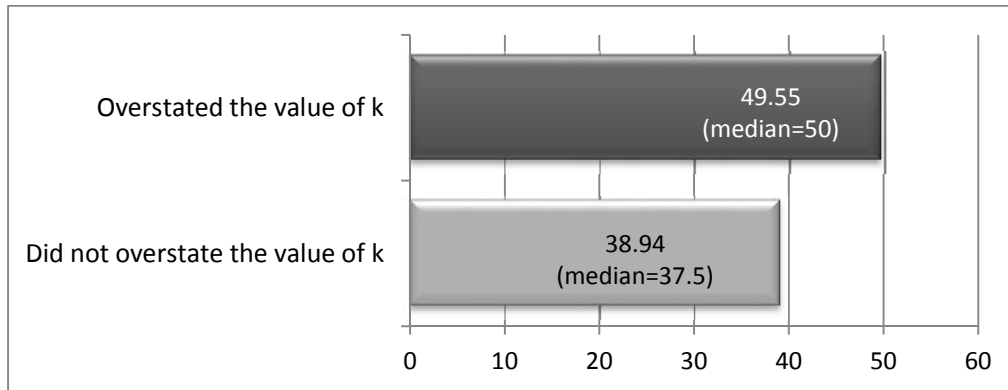


Figure 5. Amount investees expected to receive from investors.

Results using the treatment 234_ExAnte are shown in Figure 5. We find that subjects who overstated returns expected to receive on average 49.55 (median=50), while the amount was 38.94 (median=37.5) for subjects who told the truth or, understated the returns. A Wilcoxon-Mann-Whitney test shows that these two numbers are statistically different ($p=0.0997$), in addition, a non-parametric test for differences in medians reaches the same conclusion ($p=0.033$).¹⁷

Understatement can be due to strategic reasons as well. As we have seen above, messages with lower values of k were more believable, which is consistent with understating the value of k for strategic reasons, that is, to make the message more believable and induce the investor to send a larger amount. Also, we found a large percentage of investees that understated its value when k was 4.

Guilt aversion: Another reason for understating the value of k is to avoid anticipated guilt aversion. Some investees may feel guilty if they return a small amount knowing that the investor gets to know that k is large. If investees plan to return a small amount, then they may report a smaller k to avoid investor disappointment. If the investors could know the exact

¹⁷ A standard t test would give a larger p value, but the number of observations is too low to derive reliable conclusions.

value of k , the message would stop being useful. To avoid investor disappointment, investees would then be more likely to return a larger amount than the amount they actually sent.

In the questionnaire we asked investees *how much they would have returned if the investor had known the exact value of k* . Figure 6 shows that out of those who understated k , 54% replied that they would have returned a larger amount if the investor had known the exact value of k . In contrast, out of those who did not understate the returns, just 28% replied that they would have returned more to the investor if the investor had known the exact value of k . The first proportion is significantly larger than the second one ($p=0.0512$ in a one tail difference in proportions test).¹⁸

In the treatment 234_ExPost investees sent the message about the value of k ex post. The advantage of running the ex-post message treatment is that it removes the strategic motive to send a false message as ex-post messages have no impact on the amount sent.

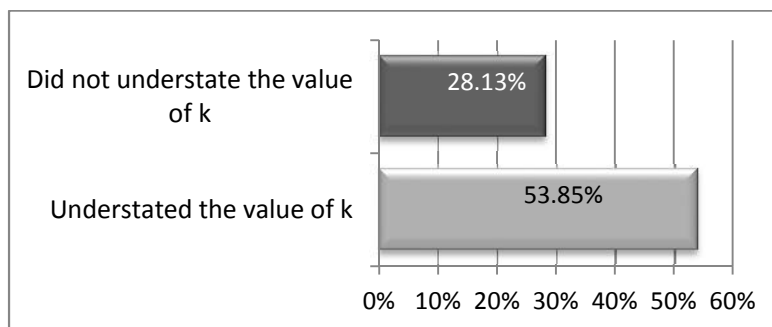


Figure 6. Guilt aversion. Proportion of investees that would have returned more if k was known.

One can see from Figure 7 that 42% told the truth about the value of k , while the rest either overstated or understated its value. Out of those who overstated k , the majority (83%) expected to receive more from the investor than what they received. In contrast, the percentage is only 56% among those who did not overstate returns. We can think of these messages as inflicting some kind of non-monetary “punishment” on the investors. That is, the investee expected to receive more from the investor and when sending the message about the value of k reported a larger number than the true value. However, when comparing those who understated the value of the returns to the rest, approximately half the subjects of each group

¹⁸ The two tails difference in proportions test gives $p=0.1025$, however, the hypothesis we test in this case is whether the proportion who would return more is larger within those who understated k than within those who did not understate the value of k .

reported that they would have returned more if the investor had known the exact value of the returns.

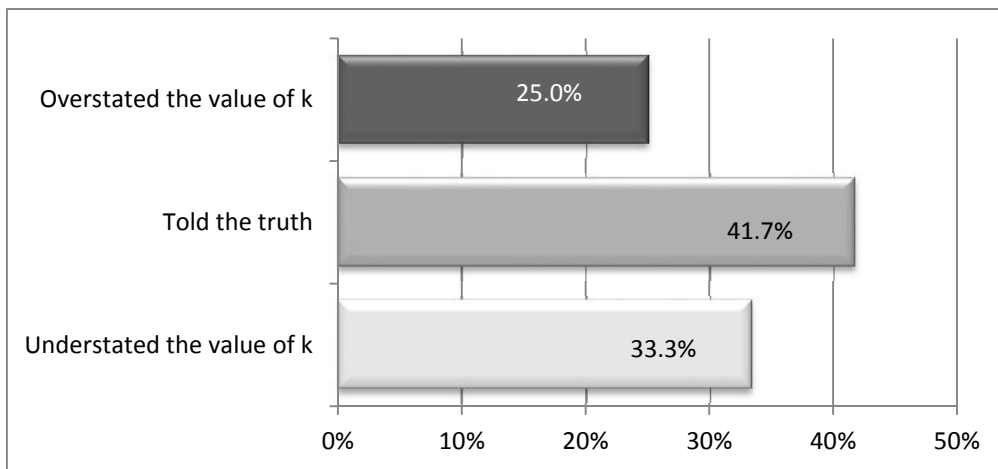


Figure 7. Proportion of subjects who overstated the value of k , understated it or told the truth.

III.4. Questionnaire responses and false messages.

We asked our subjects to respond to a questionnaire after the experiment and before the subjects knew their earnings. Through the questionnaire we can relate social and/or behavioural characteristics to subject choices in the experiment. Information was obtained on subject characteristics such as how frequently they lie to their parents, friends, acquaintances and partners. Other questions asked them whether they lie to avoid harming other people or in their own benefit. They could answer using a Likert scale from 1 (very frequently) to 5 (never). We create dummy variables equal to one if the individual admits lying very frequently, frequently or sometimes, and zero otherwise. Below we elaborate on whether there is a significant relationship between these variables and subject behaviour by running multinomial logit models in which we estimate the correlation between the answers to these survey questions and behaviour in the experiment. Obviously, these variables are self-reported, but at least we can analyse whether those who sent false messages in the experiment about the value of k also admit lying in real life. Our dependent variable has 4 categories: uninformative message, lie understating, tell the truth, and lie overstating.

We first run a specification in which we analyse whether lying in the experiment is correlated to the subjects answering that they lie to their parents, friends, partner or acquaintances (results are reported in columns 1-4 of Table 4). Results in Panel A (without controls) and Panel B (with controls) show that those individuals who admit lying to their

friends or partners are not more likely to send false messages in the experiment. Those who admit lying to their parents are more likely to send uninformative messages or to lie understating the value of k , however, these results become non-significant in the specifications in which we add control variables. Those who admit lying to acquaintances are more likely to tell the truth in the experiment, both in the specifications with and without controls. Control variables include a gender dummy, year of birth, a dummy for whether they are currently working, whether they are in a technical degree or in Sociology, Law or Journalism (the reference category are Economics related degrees), and their average grade. We then analyse whether lying in the experiment is correlated to lying to avoid harming others or in their own benefit. Results are shown in columns 5-8 of both panels, with and without controls, respectively. Those subjects who claimed lying in their own benefit are more likely to tell the truth in the experiment, however the coefficient becomes non-significant when we add the controls. As before, individuals in the ambiguity treatment are both less likely to tell the truth and more likely to lie overstating the value of k .

Table 4: False Messages and questionnaire responses.

VARIABLES	1 Uninformative message	2 Lie understating	3 Tell the truth	4 Lie overstating	5 Uninformative message	6 Lie understating	7 Tell the truth	8 Lie overstating
PANEL A: Without controls								
Lies to parents	-0.135* (0.0742)	0.194** (0.0952)	-0.0212 (0.0825)	-0.0386 (0.0932)				
Lies to friends	0.103 (0.142)	0.0108 (0.132)	-0.109 (0.103)	-0.0054 (0.135)				
Lies to partner	0.0645 (0.165)	0.229 (0.205)	-0.135 (0.124)	-0.158 (0.142)				
Lies to acquaintances	-0.0678 (0.0814)	-0.0481 (0.0869)	0.175* (0.093)	-0.059 (0.0914)				
Lies to avoid harming others					-0.0351 (0.0811)	0.0109 (0.0796)	-0.0385 (0.0869)	0.0628 (0.0845)
Lies in own benefit					-0.122 (0.0861)	-0.0547 (0.0918)	0.211* (0.116)	-0.0341 (0.0993)
PANEL B: With Controls								
Lies to parents	-0.113 (0.0831)	0.137 (0.107)	0.0101 (0.092)	-0.0341 (0.104)				
Lies to friends	0.0795 (0.143)	0.108 (0.167)	-0.127 (0.0974)	-0.0611 (0.124)				
Lies to partner	0.0148 (0.162)	0.329 (0.232)	-0.153 (0.110)	-0.19 (0.131)				
Lies to acquaintances	-0.0637 (0.0912)	-0.0712 (0.0936)	0.175* (0.106)	-0.0401 (0.101)				
Lies to avoid harming others					-0.0268 (0.0848)	0.0353 (0.0857)	-0.104 (0.089)	0.0957 (0.0919)
Lies in own benefit					-0.125 (0.0855)	0.000692 (0.124)	0.193 (0.142)	-0.0696 (0.0996)
Treatment: k unknown	-0.0599 (0.081)	0.0233 (0.0883)	-0.192** (0.0828)	0.229*** (0.0846)	-0.0523 (0.0791)	0.0299 (0.0859)	-0.209** (0.0844)	0.232*** (0.0842)

Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. All regressions have 121 observations. The results reported are marginal effects. The dependent variable has 4 categories: uninformative message, lie understating, tell the truth and lie overstating. Results are for treatments "234_AM" and "Kunknown_AM". Control variables are described in the text.

V. Discussion

Our experiments show that lying is prevalent and involves a complex cognitive process. Individuals may have beliefs about which form of lying may be credible (i.e. understatement) or may elicit a certain response (i.e. overstatement). We further find that understatement is more believable than overstatement. Further, more than half the individuals believe the messages they receive, though, a priori they have no reason to believe them. The different types of lying we observe can be observed by guilt aversion and strategic lying. We observe a combination of both indicating that individuals have preferences over lying that are conditioned by their beliefs. We further find that beliefs of investors are conditioned by the degree of asymmetric information.

As found by others earlier (Gneezy, (2005), Kriss et al (2013)) we find a few truthful people in our experiments. Restricting the sample to those who sent an informative message 66% of the subjects sent false messages. The value of the multiplier (k) did not affect the probability of lying, but understatement of the multiplier was more likely when the multiplier was 4 than when it was 3. Interestingly, the incidence of false messages is much larger in the ambiguity treatment than in the uncertainty treatment.

We elicit beliefs regarding the message investors received. This allows us to see whether subjects are naive. Almost half the investors believe the message they receive. Further, messages stating a lower value of k are more believable while messages stating a higher value of k are less likely to be believed. We find that subjects have more pessimistic beliefs regarding k under ambiguity, and while the message makes beliefs about the multiplier more pessimistic when investors know the distribution of k , the opposite is true in the ambiguity treatment.

Subjects both over, and under, -state the returns on the investment. We find this to be consistent both with strategic lying (Ottaviani M. and F. Squintani, 2006) and with guilt aversion (Charness and Dufwenberg, 2006). Understatement can also be explained by the fact that investees may know that lower values of the returns are more believable.

Finally, results from the questionnaire conducted at the end of the experiment show that those who tell the truth in the experiment are also more likely to report lying to acquaintances in real life. We did not include questions that we could use in order to measure different

personality traits in the questionnaire. These personality traits could also affect the propensity to deceive or to be prone to deception.

Our results have some consequences for the design of organizations. They suggest that a less information opens the door for deceptive acts. More research is needed, however, on what are the institutional arrangements that minimize deception and encourage trust facilitating exchanges.

Acknowledgements

The authors acknowledge financial support from the International Foundation for Research in Experimental Economics, the Argyros School of Business and Economics at Chapman University, the Spanish Ministry of Education [Grant 2012/00103/001, SEJ2004-07861 and SEJ2007-67436], Spanish Plan Nacional I+D MCI [ECO2013-44879-R], 2014-17, and Proyectos de Excelencia de la Junta Andalucía [P12.SEJ.1436], 2014-18. This research was developed while the second author was working at the Universidad Europea de Madrid and at the Universidad de Granada, and the third author was working at the University Carlos III of Madrid We gratefully acknowledge comments from Antonio Cabrales and Brice Corgnet.

References:

- Berg, J., J. Dickhaut and K. McCabe, 1995, "Trust, Reciprocity and Social History," *Games and Economic Behavior*, 10, 122-142.
- Charness, G. and M. Dufwenberg, 2006, "Promises and Partnership," *Econometrica*, 74, 1579-1601.
- Charness, G. and M. Dufwenberg, 2010, "Bare Promises: An Experiment," *Economics Letters*, 107, 281-283.
- Erat, S. and U. Gneezy, 2013, "White lies," *Management Science*, 58, 723-733.
- Fischbacher, U. and F. Föllmi-Heusi 2013, "Lies in Disguise. An Experimental Study on Cheating," *Journal of the European Economic Association*, 11, 525-547.
- Gneezy, U., 2005, "Deception: The Role of Consequences," *American Economic Review*, 95, 384-393.
- Hao, L. and D. Houser, 2013, "Perceptions, Intentions, and Cheating," George Mason University, Interdisciplinary Center for Economic Science. Working Paper 1039.

- Hurkens, S. and N. Kartik, 2009, "Would I Lie to You? On Social Preferences and Lying Aversion," *Experimental Economics*, 12, 180-192.
- Kartik, N., M. Ottaviani and F. Squintani, 2006, "Credulity, Lies, and Costly Talk," *Journal of Economic Theory*, 134, 93-116.
- Kartik, N., 2009, "Strategic Communication with Lying Costs," *Review of Economic Studies*, 76, 1359-1395.
- Mazar, N. and D. Ariely, 2006, "Dishonesty in Everyday Life and Its Policy Implications," *Journal of Public Policy & Marketing*, 25, 117-126.
- Marchewka, A., K Jednorog, M. Falkiewicz, W. Szeszkowski, A. Grabowska, and I. Szatkowska, 2012, "Sex, Lies and fMRI-Gender Differences in Neural Basis of Deception," *PLoS One*, 7(8): e43076.
- Ottaviani M. and F. Squintani, 2006, "Naive Audience and Communication Bias," *International Journal of Game Theory*, 35, 129–150.
- Kriss, P. H., R. Nagel and R. A. Weber, 2013, "Implicit vs Explicit Deception in Ultimatum Games with Deception," (*special issue*) *Journal of Economic Behavior & Organization*, Volume 93, 2013, Pages 337–346.
- Luan Phan, K., A. Magalhaes, T. J. Ziemlewicz, D. A. Fitzgerald, C. Green, and W. Smith, "Neural Correlates of Telling Lies: A Functional Magnetic Resonance Imaging Study at 4 Tesla," *Academic Radiology*, Vol 12, No 2, February 2005
- Rode, J., 2010, "Truth and Trust in Communication-Experiments on the Effect of a Competitive Context," *Games and Economic Behavior*, 68, 325-338.
- Sanchez-Pages, S. and M. Vorstaz, 2007, "An Experimental Study of Truth-Telling in a Sender-Receiver Game," *Games and Economic Behavior*, 61, 86-112.
- Sanchez-Pages, S. and M. Vorsatz, 2009, "Enjoy the Silence: An Experiment on Truth-telling," *Experimental Economics*, 12, 220-241.
- Sutter, M., 2009, "Deception Through Telling The Truth? Experimental Evidence from Individuals and Teams," *The Economic Journal*, 119, 47–60.
- Utikal, V. and U. Fischbacher, 2013, "Disadvantageous Lies in Individual Decisions," *Journal of Economic Behavior and Organization*, 85, 108–111.
- Zhu L., A. C Jenkins, E. Set, D. Scabini, R. T. Knight, P. H. Chiu, B. King-Casas and M. Hsu, 2014, "Damage to dorsolateral prefrontal cortex affects tradeoffs between honesty and self-interest," *Nature Neuroscience*, 17, 1319–1321, doi:10.1038/nn.3798.

Supplementary Information

SII – Recruitment questionnaire.

This questionnaire was given to all subjects prior to their participation in the experiment.

1. In what year were you born?
2. Country of birth (or State in case of Spain).
3. Place of residence.
 - i. Country or State
 - ii. City
4. If you were born outside of Spain (or outside your present State of residence) when did you arrive in your current residence (State)?
5. Country (or State for Spain) of birth of father.
6. Country (or State for Spain) of residence of father.
7. If your father was not born in Spain (or in the State where he currently resides) when did he arrive at his present residence?
8. Country (or State for Spain) of birth of mother.
9. Country (or State for Spain) of residence of mother.
10. If your mother was not born in Spain (or in the State where she currently resides) when did she arrive at his present residence?
11. Gender.
12. What is your major?
13. Year of study.
14. Average grade (0-10).
15. Religion.
16. Father's studies (did not study/primary school/secondary school/university).
17. Mother's studies (did not study/primary school/secondary school/university).
18. Total number of siblings (including you).
19. Do you have a partner (yes/no)?
20. Do you work? If yes, how many hours a week?
21. Do you do voluntary work? If yes, how many hours a week?
22. How many hours did you study (alone) last week?
23. How many hours of TV did you watch last week?
24. Are you a member of any political organization (yes/no)?

SI2 – Instructions

Sender instructions-Part in italics vary according to treatments

No-Message (234_No):

Thanks for coming. These instructions explain how the experiment works.

You have been selected at random as individual A. Another participant, in another place (outside of this room), has been selected at random to play with you. This person will be individual B. You and your partner will each receive 100 dex (experimental money).

After the experiment you will be able to convert the experimental money into real money that will be paid in cash at the end of the experiment. The exchange rate is 1 €= 12.5 dex.

This is how the experiment works:

First, you will have the opportunity to transfer all, none, or part of the 100 dex to individual B. The amount sent to individual B will be multiplied by X , where X can take the values 2, 3 or 4 with equal probability, and is determined at random. The different values that X can take are also known for the individual B. Thus, if you send 50 dex and, for example, $X = 3$, individual B will receive $3 \times 50 = 150$ dex.

The amount you send will appear on the display of individual B, with the value that X has finally taken. Individual B will then have the possibility to send you back some of the amount received. Individual B may send any amount between zero and the amount you sent multiplied by X .

For example, if you send 50 dex to individual B and $X = 3$, then individual B receives $3 \times 50 = 150$ dex. Given this, individual B can send you any number between 0 and 150 dex. The amount individual B will send back will not be further multiplied.

The experiment ends after the decision of individual B. Your earnings will be calculated on the following basis. You will be earning the initial 100 dex, minus the amount transferred to individual B, plus the amount individual B sends back to you.

Thus, if you send 50 dex to individual B and individual B sends back 70 dex, then your earnings will be $100 \text{ dex} - 50 \text{ dex} + 70 \text{ dex} = 120 \text{ dex}$. Applying the exchange rate this will be 9.60€ This will be your profit in this example.

The game will be played only once. Once the game ends, we will ask you to answer a few questions. Your answers will not have any influence on your earnings and will be treated as strictly confidential. The results of the experiment and the questionnaire will be used only in our research.

In the experiment today you will not interact with your partner again. You will not be able to know the identity of your partner. Similarly, your partner, nor any other participant, will know any details about you. Please do not talk to anyone during the experiment and raise your hand if you have any questions.

You are participating in a science experiment funded by the Ministry of Science and Technology. The information you give will not be associated with you and will be treated as confidential.

Ex-ante message (234_ExAnte):

First, you will have the opportunity to transfer all, none or part of the 100 dex to individual B. The amount sent to individual B will be multiplied by X , where X can take the values 2, 3 or 4 with equal probability, and is determined at random. The different values that X can take are also known for the individual B.

Before you make the transfer to individual B, individual B knows the true value of X and may decide to send a message with information about the value of X . Note that individual B may choose to send you a true, or false, message, or not send a message at all.

Thus, if you send 50 dex and, for example, $X = 3$ (which does not have to match the value reported by the individual B), individual B will receive $3 \times 50 = 150$ dex.

The amount you send will appear on the display of individual B, with the value that X has finally taken. Individual B will then have the possibility to send you back some of the amount received. Individual B may send any amount between zero and the amount you sent multiplied by X .

For example, if you send 50 dex to individual B and $X = 3$, then individual B receives $3 \times 50 = 150$ dex. Given this, individual B can send you any number between 0 and 150 dex. The amount individual B will send back will not be further multiplied.

Ex-post message (234_ExPost):

First, you will have the opportunity to transfer all, none or part of the 100 dex to individual B. The amount sent to individual B will be multiplied by X , where X can take the values 2, 3 or 4 with equal probability, and is determined at random. The different values that X can take are also known for the individual B. Thus, if you send 50 dex and, for example, $X = 3$, individual B will receive $3 \times 50 = 150$ dex.

The amount you send will appear on the display of individual B, with the value that X has finally taken. Individual B will then have the possibility to send you back some of the amount received. Individual B may send any amount between zero and the amount you sent multiplied by X .

Once individual B decides the amount he will send to you, individual B may decide to send a message with information about the value of X . Note that individual B may decide to send a true, or false message, or not send a message at all. This message will be shown to you at the end of the experiment along with your earnings.

For example, if you send 50 dex to individual B and $X = 3$, then individual B receives $3 \times 50 = 150$ dex. Given this, individual B can send you any number between 0 and 150 dex. The amount individual B will send back will not be further multiplied.

k Unknown No Message (k>1_No):

First, you will have the opportunity to transfer all, none or part of the 100 dex to individual B. The amount sent to individual B will be multiplied by X ($X > 1$). Individual B knows that $X > 1$. Thus, if you send 50 dex and, for example, $X = 3$, individual B will receive $3 \times 50 = 150$ dex.

The amount you send will appear on the display of individual B, with the value that X has finally taken. Individual B will then have the possibility to send you back some of the amount

received. Individual B may send any amount between zero and the amount you sent multiplied by X.

For example, if you send 50 dex to individual B and $X = 3$, then individual B receives $3 \times 50 = 150$ dex. Given this, individual B can send you any number between 0 and 150 dex. The amount individual B will send back will not be further multiplied.

k Unknown Ex-ante Message ($k > 1$ _ExAnte):

First, you will have the opportunity to transfer all, none or part of the 100 dex to individual B. The amount sent to individual B will be multiplied by X ($X > 1$). Individual B knows that $X > 1$.

Before you make the transfer to individual B, individual B knows the true value of X and may decide to send a message with information about the value of X. Note that individual B may choose to send you a true, or false, message, or not send a message at all.

Thus, if you send 50 dex and, for example, $X = 3$ (which does not have to match the value reported by the individual B), individual B will receive $3 \times 50 = 150$ dex.

The amount you send will appear on the display of individual B, with the value that X has finally taken. Individual B will then have the possibility to send you back some of the amount received. Individual B may send any amount between zero and the amount you sent multiplied by X.

For example, if you send 50 dex to individual B and $X = 3$, then individual B receives $3 \times 50 = 150$ dex. Given this, individual B can send you any number between 0 and 150 dex. The amount individual B will send back will not be further multiplied.

Receiver instructions- Part in italics vary according to treatments

No-Message (234_No):

Thanks for coming. These instructions explain how the experiment works.

You have been selected at random as individual B. Another participant, in another place (outside of this room), has been selected at random to play with you. This person will be individual A. You and your partner will each receive 100 dex (experimental money).

After the experiment you will be able to convert the experimental money into real money that will be paid in cash at the end of the experiment. The exchange rate is 1 € = 12.5 dex.

The experiment works like this:

First, individual A will have the opportunity to transfer, all, none, or part of their 100 dex to you. The amount sent by individual A will be multiplied by X, where X can take the values 2, 3, or 4 with equal probability, and it is determined at random. Thus, if individual A sends 50 dex and, for example, $X=3$, you will receive $3 \times 50 = 150$ dex.

The amount sent by individual A will appear on your screen. You will also get to know the value taken by X. This value is not known to individual A, but he or she knows that X can take the values 2, 3, or 4 with equal probability and is determined at random.

You will then have the possibility to send back some of the amount received. You may send any amount between zero, and the amount sent by individual A to you multiplied by X.

For example, if individual A sends 50 dex to you and $X=3$, then you will receive $3 \times 50 = 150$ dex. Given this, you can send to individual A any number between 0 and 150 dex. The amount you send back will not be further multiplied.

The experiment ends after your decision. Your earnings will be calculated on the following basis. You will be earning the initial 100 dex plus the difference between the amount received from individual A and the amount you send back (to individual A).

Thus, if individual A sends 50 dex to you and you send back 70 dex, then your earnings will be $100 \text{ dex} + 150 \text{ dex} - 70 \text{ dex} = 180 \text{ dex}$. Applying the exchange rate this will be 14.40€ This will be your earnings in this example.

The game will be played only once. Once the game ends, we will ask you to answer a few questions. Your answers will not have any influence on your earnings and will be treated as

strictly confidential. The results of the experiment and the questionnaire will be used only in our research.

In the experiment today you will not interact with your partner again. You will not be able to know the identity of your partner. Similarly, your partner, nor any other participant, will know any details about you. Please do not talk to anyone during the experiment and raise your hand if you have any questions.

You are participating in a science experiment funded by the Ministry of Science and Technology. The information you give will not be associated with you and will be treated as confidential.

Ex-ante message (234_ExAnte):

First, individual A will have the opportunity to transfer, all, none, or part of their 100 dex to you. The amount sent by individual A will be multiplied by X, where X can take the values 2, 3, or 4 with equal probability, and it is determined at random. Thus, if individual A sends 50 dex and, for example, $X=3$, you will receive $3 \times 50 = 150$ dex.

Before individual A makes the transfer to you, you will know the true value of X and may decide to send a message with information about the value of X. Note that you may choose to send a true, or false, message, or not send a message at all to individual A. Individual A will get to see the message you send, or a message stating that you choose not to send a message.

The amount sent by individual A will appear on your screen, with the value that X has finally taken. This value is not known to individual A, but he or she knows that X can take the values 2, 3, or 4 with equal probability and is determined at random.

You will then have the possibility to send back some of the amount received. You may send any amount between zero, and the amount sent by individual A to you multiplied by X.

For example, if individual A sends 50 dex to you and $X=3$, then you will receive $3 \times 50 = 150$ dex. Given this, you can send to individual A any number between 0 and 150 dex. The amount you send back will not be further multiplied.

Ex-post message (234_ExPost):

First, individual A will have the opportunity to transfer, all, none, or part of their 100 dex to you. The amount sent by individual A will be multiplied by X, where X can take the values 2, 3, or 4 with equal probability, and it is determined at random. Thus, if individual A sends 50 dex and, for example, $X=3$, you will receive $3 \times 50 = 150$ dex.

The amount sent by individual A will appear on your screen, with the value that X has finally taken. This value is not known to individual A, but he or she knows that X can take the values 2, 3, or 4 with equal probability and is determined at random.

You will then have the possibility to send back some of the amount received. You may send any amount between zero, and the amount sent by individual A to you multiplied by X.

Once you decide the amount you will send to individual A, you may decide to send a message with information about the value of X. Note that you may decide to send a true, or false message, or not send a message at all. This message will be shown to individual A at the end of the experiment along with his or her earnings.

For example, if individual A sends 50 dex to you and $X=3$, then you will receive $3 \times 50 = 150$ dex. Given this, you can send to individual A any number between 0 and 150 dex. The amount you send back will not be further multiplied.

k Unknown No Message (k>1_No):

First, individual A will have the opportunity to transfer, all, none, or part of their 100 dex to you. The amount sent by individual A will be multiplied by X ($X>1$). Thus, if individual A sends 50 dex and, for example, $X=3$, you will receive $3 \times 50 = 150$ dex.

The amount sent by individual A will appear on your screen. You will also get to know the value taken by X. This value is not known to individual A, but he or she knows that $X>1$.

You will then have the possibility to send back some of the amount received. You may send any amount between zero, and the amount sent by individual A to you multiplied by X.

For example, if individual A sends 50 dex to you and $X=3$, then you will receive $3 \times 50 = 150$ dex. Given this, you can send to individual A any number between 0 and 150 dex. The amount you send back will not be further multiplied.

k Unknown Ex-ante Message ($k > 1$ _ExAnte):

First, individual A will have the opportunity to transfer, all, none, or part of their 100 dex to you. The amount sent by individual A will be multiplied by X ($X > 1$). Thus, if individual A sends 50 dex and, for example, $X=3$, you will receive $3 \times 50 = 150$ dex.

Before individual A makes the transfer to you, you will know the true value of X and may decide to send a message with information about the value of X . Note that you may choose to send a true, or false, message, or not send a message at all to individual A. Individual A will get to see the message you send, or a message stating that you choose not to send a message.

The amount sent by individual A will appear on your screen, with the value that X has finally taken. This value is not known to individual A, but he or she knows that $X > 1$.

You will then have the possibility to send back some of the amount received. You may send any amount between zero, and the amount sent by individual A to you multiplied by X .

For example, if individual A sends 50 dex to you and $X=3$, then you will receive $3 \times 50 = 150$ dex. Given this, you can send to individual A any number between 0 and 150 dex. The amount you send back will not be further multiplied.

SI3 – Post questionnaire

The following questionnaire was completed by the subjects at the end of the experiment (senders didn't know their earnings). Questions were common for senders and receivers, except those indicated in square brackets.

Do you think that you responded with care to the questionnaire?

1. Yes; 2. Yes, but I could have been more careful; 3. I am not sure; 4. No

With what frequency do you lend money to your friends?

1. More than once a week; 2. Once a week; 3. Once a month; 4. Once a year (or less than that); 5. Never

With what frequency do you do you leave personal objects (CDs, clothes, videos, etc.) with friends?

1. More than once a week; 2. Once a week; 3. Once a month; 4. Once a year (or less than that); 5. Never

How many close friends do you have?

Would you leave your belongings in the university locker without locking it?

1. Yes; 2. No

Overall, can one trust people?

1. Yes; 2. No

Do you think a large majority of people will take advantage of you if they had the opportunity?

1. Yes; 2. No

With what frequency do you lie to your parents?

1. Very frequently; 2. Frequently; 3. Some times; 4. Few times; 5. Never

With what frequency do you lie to your friends?

1. Very frequently; 2. Frequently; 3. Some times; 4. Few times; 5. Never

With what frequency do you lie to the people you know?

1. Very frequently; 2. Frequently; 3. Some times; 4. Few times; 5. Never

With what frequency do you lie to your partner?

1. Very frequently; 2. Frequently; 3. Some times; 4. Few times; 5. Never

Have you ever benefitted from someone's (unknown to you) generosity?

1. Yes; 2. No

With what frequency do you lie to someone not to hurt their feelings?

1. Very frequently; 2. Frequently; 3. Some times; 4. Few times; 5. Never

With what frequency do you lie to someone for your own benefit?

1. Very frequently; 2. Frequently; 3. Some times; 4. Few times; 5. Never

A person's wealth should not depend upon the effort which they make. Do you agree with this statement?

1. Very much agree; 2. Agree; 3. Agree somehow; 4. Do not agree; 5. Very much disagree

These days one cannot trust unknown people. Do you agree with this statement?

1. Very much agree; 2. Agree; 3. Agree somehow; 4. Do not agree; 5. Very much disagree

You consider yourself to be a trustworthy individual. Do you agree with this statement?

1. Very much agree; 2. Agree; 3. Agree somehow; 4. Do not agree; 5. Very much disagree

When dealing with strangers one should always be careful (before you trust them). Do you agree with this statement?

1. Very much agree; 2. Agree; 3. Agree somehow; 4. Do not agree; 5. Very much disagree

The majority of students do not copy during the exam? Do you agree with this statement?

1. Very much agree; 2. Agree; 3. Agree somehow; 4. Do not agree; 5. Very much disagree

Do you trust other people when you do something of little importance with them?

1. A lot; 2. Sufficiently; 3. A little; 4. Never

Do you trust other people when you do something of great importance with them?

1. A lot; 2. Sufficiently; 3. A little; 4. Never

Do you trust your family?

1. A lot; 2. Sufficiently; 3. A little; 4. Never

Do you trust your friends?

1. A lot; 2. Sufficiently; 3. A little; 4. Never

Do you trust your neighbors?

1. A lot; 2. Sufficiently; 3. A little; 4. Never

Do you trust your colleagues in the University?

1. A lot; 2. Sufficiently; 3. A little; 4. Never

Can you trust the school system?

1. A lot; 2. Sufficiently; 3. A little; 4. Never

Do you trust the police?

1. A lot; 2. Sufficiently; 3. A little; 4. Never

Do you trust the judicial system?

1. A lot; 2. Sufficiently; 3. A little; 4. Never

Do you trust the big corporations?

1. A lot; 2. Sufficiently; 3. A little; 4. Never

Mr. Martinez is about to sell his car for 1,200 euros. The oil pump on his engine does not work well, and Mr. Martinez knows that if the buyer knew it he would have to reduce the price by 250 euros (the price of repair). If Mr. Martinez does not tell the buyer, the engine will overheat the first day of heat, causing damage worth 250 euros. Winter has just started and the buyer will not notice unless Mr. Martinez tells him. Mr. Martinez has decided not to mention this problem with the oil pump to the buyer. In your opinion, the behavior of Mr. Martinez is:

1. Completely acceptable; 2. Acceptable; 3. Little acceptable; 4. Inacceptable

What would have been your answer regarding Mr. Martinez's behavior if the cost of repairing the oil pump had been 1,000 euros (instead of 250 euros)?

1. Completely acceptable; 2. Acceptable; 3. Little acceptable; 4. Inacceptable

[Senders] Considering the amount you sent, how much do you think that individual B will return to you?

[Receivers] How much did you expect individual A to send?

Think about some of your college friends who have more or less the same economic position as you. Imagine that your colleague has found 20 euros on the street. It is impossible to identify the owner and, therefore, it is completely acceptable and unquestionable from the moral point of view to keep it. Could you say that if you had found the money, this money would have been _____ beneficial to you than to your colleague?

1. much more; 2. more; 3. as much as; 4. less; 5. much less

[Senders - Baseline] If the amount sent would have been multiplied by an amount twice as much (than the actual amount), what amount would you have sent?

[Senders, all treatments except Baseline] With what value do you think the amount you have

sent to individual B has been multiplied with?

[Senders, all treatments except Baseline] If you would have known that the exact value by which the amount sent was multiplied, 3 for example, how much would have sent of the 100 dex?

[Receivers, all treatments except Baseline] If individual A would have known the true value by which the amount is multiplied, what quantity would you have sent (as individual B) to individual A?

[Receivers, treatments 234_ExAnte, 234_ExPost and k>1_ExAnte] Did you find sending a message to individual A useful?

1. Yes; 2. No

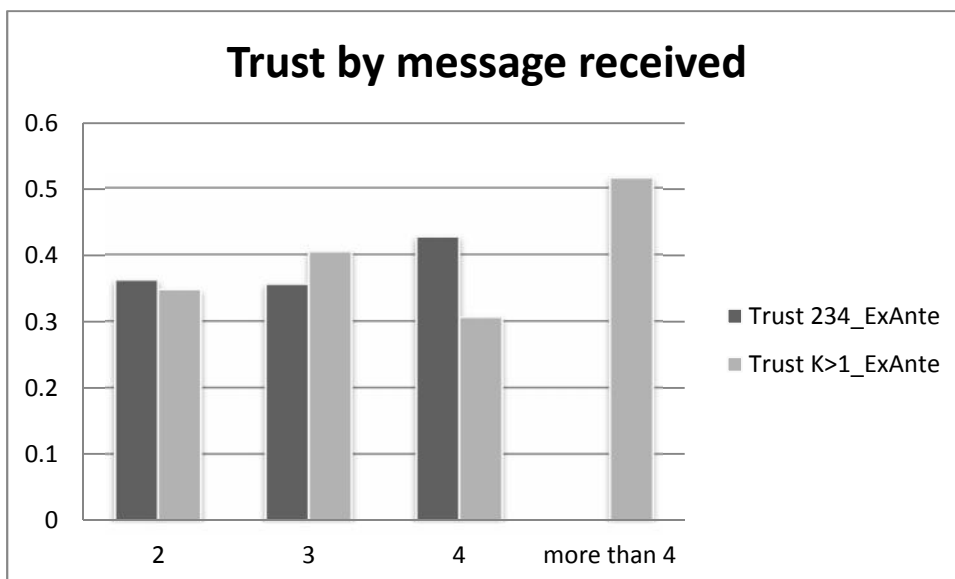


Figure S1. Average trust by message received in treatments 234_ExAnte and k>1_ExAnte.

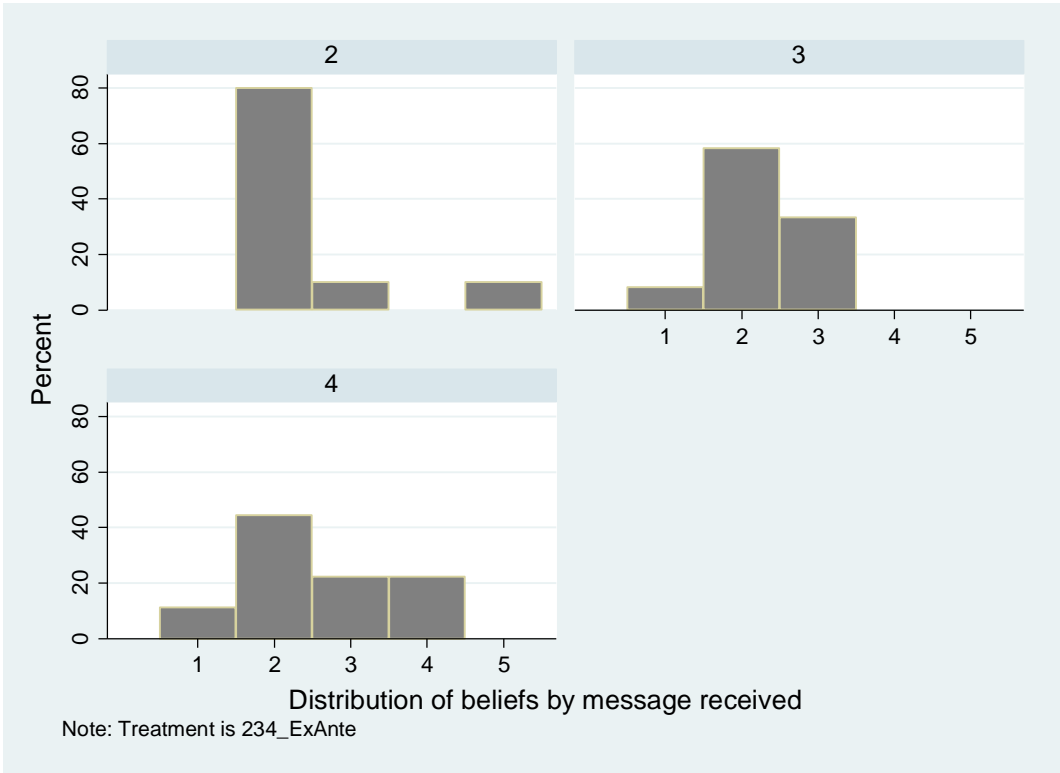


Figure S2. Distribution of beliefs by message received in treatment 234_ExAnte.

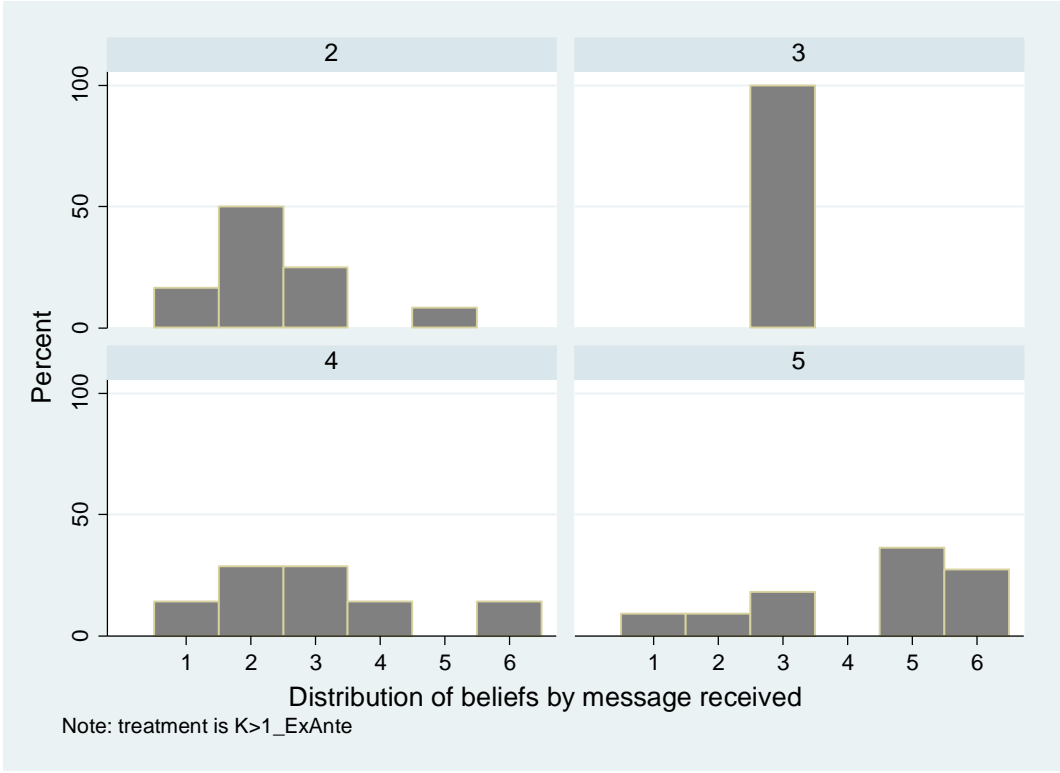


Figure S3. Distribution of beliefs by message received in treatment k>1_ExAnte.