Gossip and the efficiency of interactions*

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September, 15, 2018

Abstract

Human communication often involves a large amount of gossiping about others. Here we study in an experiment whether gossip affects the efficiency of human interactions in an experimental trust game. Third parties can send unverifiable messages about a trustee's behavior to a trustor. We find that this form of gossip increases trust and trustworthiness compared to a situation without a third party. However, a large part of this increase is due to the mere observation of trustees through third parties. In further control treatments we check the robustness of our findings by examining the effects of the information structure, costs or informational value of gossip.

Keywords: *gossip, communication, trust game, efficiency, experiment.*

JEL Classification: *C72, C92.*

* We would like to thank the Associate Editor and three anonymous referees as well as seminar participants at the ESA-meeting in Santa Cruz, UIBK-MPI-Workshop in Innsbruck, HeiKaMax Workshop in Mannheim and IfW Kiel for helpful comments and discussions. We are grateful to Lorenz Kurrek for programming and assistance in running the sessions as well as discussions at an early stage of this project. Dietmar Fehr acknowledges financial support from the Deutsche Forschungsgemeinschaft (DFG) through CRC 649 "Economic Risk".

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1. Introduction

Communication is pervasive in human interactions. While communication naturally serves a plethora of purposes, an important function is the exchange of information. Information about other individuals can, for example, be valuable in situations that involve collective action or trust because it helps to make judgements about others' willingness to cooperate or to repay trust. Indeed, the more complex the social environment is, the more information is needed about potential interaction partners to ensure efficient interaction (Dunbar, 1994).

One way to obtain this information is through gossip. Gossip is the exchange of information (positive or negative) about absent third parties (Foster, 2004).[1] It is often second-hand information as it is not based on own experience with the gossip target and it may reveal information which would otherwise be hard to obtain. In fact, it is a widespread phenomenon in everyday life that serves various social functions. While gossip for entertainment (including gossip about celebrities) is one of these functions, we will focus here on the functions of gossip that are more socially valuable, such as exchanging and gathering valuable information, sharing social norms, and sanctioning possible norm violations. Note that gossip does not only refer to persons with whom addressees of gossip may never interact, but it is also frequently about other members of the gossiper's organization which may then bear informational value for the addressee of gossip in case he or she interacts in the future with the target of the gossip (Dunbar, 1994, 2004; Foster, 2004). For example, exchanging (personal) information about third parties may help to create bonds between individuals and may be used to communicate experiences, norms as well as formal and informal rules. Gossip may also influence the reputation of individuals (Coleman, 1990). First of all, knowing that potential norm violations are likely to be discussed by observers or communicated to alert others may actually induce norm compliance if individuals care about their reputation (negative gossip).[2] Moreover, in the same way as gossip is used to point out norm violations, it can be utilized to praise behavior to reinforce norm compliance (positive gossip). This dual purpose of gossip for the sharing of reputational information raises the question how it affects cooperation and efficiency within social groups.

[1] Foster (2004) provides an extensive discussion about the definition of gossip and its social functions. Note that gossip is different from a rumor, which is characterized by unsupported information or opinions with no discernible source that is spread through a network (see e.g., Bloch et al., 2015).

[2] Knez and Simester (2001) conjecture, for example, that the success of firm-wide team bonuses to mitigate freeriding at Continental Airlines was in part due to mutual monitoring and the possibility that norm violations were discussed within work teams (see also Hamilton et al., 2004). Gossip may also contribute to maintaining and fostering an organization's culture and to the coordination of activities within organizations (Noon and Delbridge 1993, Burt and Knez 1995).

In this paper, we examine this particular aspect of gossip – the spreading of reputational information – and how it affects the efficiency of interactions between individuals. In the field, it is typically difficult to observe gossip and its implications on behavior because outside observers often lack the context of conversations and it is costly to track and observe subsequent behavior. Therefore, we turn to evidence from a controlled laboratory experiment to study the emergence of gossip and whether and how it affects behavior in situations that involve trust.

We study a standard trust game (Berg et al., 1995) in an environment where players are randomly matched in every round and modify this game by introducing a third party. In our main experimental treatment (labeled *Gossip*) this third party can gossip by observing a trustee's behavior and writing a free-form message to the trustor with whom the trustee will be paired in the next round. Importantly, the third party has no material interest in the trust game, which allows us to focus on the emergence of gossip in the absence of strategic motives. We do not restrict the content of gossip and thus explicitly allow positive and negative reputational information that may even be incorrect. In addition, gossiping is costly in our case. That is, trustors only receive gossip if a third party's willingness to pay for gossip is sufficiently high. Therefore, gossip is second-hand information, evaluative and unverifiable for the trustor, and it is uncertain whether it reaches the trustor at all.

Even with these (realistic) limitations of gossip, we find that gossip increases efficiency significantly compared to a baseline treatment without a third party that can engage in gossip. Trustors send higher amounts as first movers, and trustees return more money as second movers in the trust game with gossip, resulting in an efficiency increase of 13 percent (accounting for costs of gossiping). This is despite that gossip is unverifiable, possibly noisy information, and often not transmitted to trustors because third parties typically display a too low willingness to pay to transmit gossip.

A significant part of the observed efficiency increase is due to the observability of trustees' behavior through third parties, which is a necessary condition for gossip. Comparing our baseline treatment with our second main treatment (called *Observation*) in which the third party remains passive and can only observe the trustee's behavior, reveals that the observability of trustees' behavior accounts for about half of the efficiency increase in treatment Gossip. Importantly, however, the possibility of third parties to share their observations with other people increases efficiency on top of the observability-effect. Together, these findings suggest that trust and, in particular, cooperation increase because misbehavior, but also norm compliance, can be observed and *may* be discussed among individuals. It thus seems sufficient that people can potentially talk about observed behavior in order to reduce norm violations and it possibly explains why costly punishment of norm violations is rarely observed outside the laboratory.

Given that gossip matters and contributes to efficiency gains, we then present a series of additional treatments that are intended to investigate various aspects of gossip. First, we review the effects of the cost of gossip in a treatment where gossiping is costless. Second, we investigate the impact of the available information to gossipers by enriching the gossiper's information about trustor's and trustee's behavior. Third, we implement a treatment where gossip is noisy (i.e., messages are mixed up in 20% of cases) to check the importance of the informational value of gossip. Finally, we present a control treatment in which trustors get full and certainly correct information about a trustee's past behavior, but where no third parties can gossip about it. Through our control treatments, we can show that the costs and details of observed information do not matter for the effectiveness of gossip. However, we document that the effect of gossip is comparable to the observability-effect if it is noisy, i.e., when its informational value is presumably lower. Interestingly, giving trustors full information about a trustee, but not having a third party, is not as useful as gossip.

In the following, we relate our paper to previous literature in section 2. Section 3 presents the experimental design and our predictions. Section 4 shows our results, and section 5 concludes the paper.

2. Related Literature

Our study complements a growing literature on reputation, communication in social interactions, or third-party interventions, such as punishments and rewards.[3] A key difference of our study is that gossip is second-hand information and arises endogenously.

The literature on feedback systems and reputation, for example, is concerned with how feedback about the previous transaction history affects prices and trading volume. In these types of experiments the transaction history of trustees (i.e., sellers) is typically publicly available (see, e.g., Duffy and Feltovich, 2002, 2006, Bolton et al., 2004, Bohnet and Huck, 2004, Bohnet et al., 2005, Brown and Zehnder, 2007, Bracht and Feltovich, 2009, Charness et al., 2011, Huck et al., 2010, 2012, Duffy et al., 2013). In contrast to our study, these experiments exogenously

[3] There is also a more remote relationship to the literature on advice giving, pioneered by Schotter (see Schotter, 2003, Ballinger et al., 2003, or Celen et al., 2010). In experiments with advice, players who have already played a particular game can give advice to successive players playing the same game. Importantly, advisors have a material stake in the subsequent game as they typically receive a portion of what their successors earn. Our approach to study gossiping differs substantially as gossipers are not affected by the behavior in the trust game and have no experience in playing the trust game themselves.

provide information of actual behavior that is based on the buyer's own experience ("first-hand information"). Such unambiguous feedback increases efficiency in trust games.[4] A small and more recent strand of this literature indicates that this is to some extent also the case when the provision of first-hand information is endogenous (e.g., Masclet and Pénard, 2012, and Abraham et al., 2016).[5] We find that second-hand information has a positive impact on trust and trustworthiness, despite that gossip is rarely transmitted to trustors in our setup. Thus, the mere possibility of unverifiable gossip is sufficient to produce similar effects as the institutionalized reputation mechanisms in the previous literature.

Another related literature discusses the effects of indirect reciprocity, which captures the idea that human subjects treat others nicer when those others have been nicer to yet another person (see, e.g., Seinen and Schram, 2006, Sommerfeld et al., 2007, Engelmann and Fischbacher, 2009). Similar to the previously mentioned studies on feedback systems, subjects in these studies usually carry an image score on which interaction partners can base their helping decision. As such, information about a partner's reputation is always available and, importantly, this information is based on previous behavior and thus always correct. In contrast, information about previous behavior of an interaction partner in our study is only available if a third party gossips. Moreover, gossip is cheap talk and may convey vague or even incorrect information.

Our experiment also contributes to the literature on third-party interventions, which are essential for the enforcement of social norms. Most of these studies focus on punishment (and rewards) of third parties in the context of dictator or trust games (e.g., Fehr and Fischbacher, 2004, Charness et al., 2008, Almenberg et al., 2011, Lergetporer et al., 2014, Nikiforakis and Mitchell, 2014). Third-party interventions in these papers have immediate and direct material consequences, for example, when third parties inflict punishment on norm violators and thereby reduce their payoffs. In contrast, a third-party intervention in our experiment has no immediate material consequences for the target of this gossip. It only provides a (positive, neutral, or negative) signal about a trustee's past behavior for the receiver of gossip, which may or may not induce this person to withdraw trust in future interactions. Thus, the third-party intervention we study is weaker than in the previous literature and we particularly consider the consequences of both positive and negative gossip.

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[4] Related, Stahl (2013) and Greiff and Paetzel (2016) study the case where subjects receive noisy signals about past actual play in each round. They show that subjects learn to correctly interpret these signals over time, leading to more cooperation compared to situations without noisy signals.

[5] In Abraham et al. (2016), for instance, first movers in a trust game had the possibility to pass on information to other first movers, which was either objective (truthful revelation of actual play) or subjective (rating on a 5-point scale), and costly or free. The results provide a mixed picture suggesting that privately exchanged information does often worse than publicly available first-hand information.

From a more general perspective, our paper is related to the broad literature on the effects of communication on cooperative behavior (see, e.g., Isaac and Walker, 1988, Crawford, 1998, Bochet et al., 2006, Ben-Ner and Putterman, 2009, Oprea et al., 2014). Typically, communication has been found to increase cooperation levels, also in trust games (Charness and Dufwenberg, 2006, 2010).[6] In most of this literature, communication takes place between the interacting parties, though, while in our approach we let (unaffected) third parties communicate with the trustor only, and we are then particularly interested in how this communication affects a trustee's behavior who is *not* involved in communication. Our results highlight that actual communication is not essential to increase trust and cooperation as it is often sufficient that the possibility to share information exists. Importantly, however, if gossip takes place trustors seem to believe the received messages, as they significantly reduce trust in light of negative messages, but increase trust in response to positive messages. This is remarkable, as gossip may have been cheap talk or even false.

Finally, we would like to mention independent and simultaneous work by Fonseca and Peters (2017) that also studies the effects of gossip. They are mainly interested in the effects of large degrees of inaccurate gossip (where the content of gossip is wrong), which is most closely related to our treatment where gossip is noisy. Remarkably, they find that inaccurate gossip is less effective than accurate gossip, but more effective than no gossip. This consistency of results in spite of non-trivial methodological differences between both papers, such as the level of inaccuracy of gossip, gossiper's material interest, and message forms (numerical or free-form) – points to the likely robustness of the findings in both papers.

3. Experimental Design and Behavioral Predictions

General setup: The design of our experiment is based on a standard trust game (Berg et al., 1995) where two players, a trustor and a trustee, interact with each other. Both players receive an endowment of 8 Experimental Currency Units (ECU). First, the trustor decides about an amount $x \in [0, 8]$ to send to the trustee. The invested amount x is tripled by the experimenter and after observing the transferred amount the trustee has to decide about a back-transfer of $y \in [0, 8 + 3x]$. Given standard selfish preferences, the subgame-perfect Nash equilibrium in this game is for the trustor to send nothing and for the trustee to return nothing. Of course, this equilibrium outcome is inefficient, and total payoffs would be maximized if trustors sent the

[6] An important insight of this literature is that the communication protocol is crucial for enhancing cooperative outcomes. While free-form (chat) or face-to-face communication greatly improves cooperation, other forms of communication such as signaling actions through numerical values lead to mixed effects (see e.g., Wilson and Sell, 1997, Duffy and Feltovich, 2002, Bochet et al., 2006, or Bochet and Putterman, 2009).

full amount of 8 ECU to the trustee. Notice that investing $x = 8$ and sending back twice the invested amount results in a Pareto efficient outcome that shares the total pie equally.

We implement three main treatments, explained in detail below, the following, and four additional treatments that examine the importance of various aspects of gossip. In each treatment, subjects play the trust game 10 times with feedback after each round. Subjects keep their randomly assigned roles throughout the experiment and in each round, they are anonymously and randomly matched with another subject. We also ask for trustors' beliefs about the trustees' back-transfers in each round.[7] Belief elicitation is not incentivized to keep the decision environment as simple as possible and because our main focus is on the economic effects of gossip on the efficiency of interactions. In the following we describe our three main treatments in more detail.

Baseline**:** Our baseline condition is a replication of the standard trust game with two players (trustor and trustee) that is repeated for 10 rounds with random matching.

Observation**:** In this treatment we add a third party to the standard trust game. This third party can observe a trustee's behavior – more precisely the return ratio (of *y/3x*) – but is otherwise passive.[8] The third party receives 16 ECU per round, and is not affected in any material way from the actions of the trustor and trustee. The third party cannot communicate with any of the players in the trust game.

Gossip**:** As in treatment *Observation*, we add a third party (called gossiper in the following) who can become active this time. In each round *t*, the gossiper observes the return ratio $(y/3x)$ of a trustee and can then write a message to the trustor who will be paired with the observed trustee in the next round $t+1$. While this piece of information (which is identical to what the third party observes in treatment *Observation*) is revealing about a trustee's behavior, it represents only minimal information about the behavior of a trustee. That is, gossipers are neither informed about the absolute transfer that the respective trustee has received nor about the absolute back-transfer. Therefore, it remains unclear to the gossiper how much money both the trustor and the trustee earned, which minimizes the influence of relative payoff comparisons on the decision to gossip.

[7] In the treatments with third parties, we elicit trustors' beliefs on the same computer screen in which they see the third party's gossip (if any) and make their investment decision.

[8] Note that the return ratio can be zero either because a trustee returned zero in response to positive investment of the trustor or per definition when a trustor decides to send nothing. In the latter case, third parties received a note indicating that the trustor sent nothing. Accordingly, this is the only situation where gossipers can infer the payoffs of both the trustor and trustee, i.e., where relative payoff comparisons are in principle possible.

There are several noteworthy features of gossip. First, messages from gossipers to trustors are limited to 300 characters and free-form.[9] We explicitly allow messages to contain positive and negative information about a trustee's behavior to emphasize its evaluative aspect. Second, it is not possible for the trustor to verify the content of messages, which may even be incorrect. Finally, the setup also captures the fact that gossip is often second-hand information and that it is uncertain whether it even reaches the intended recipient (in our case the trustor). To mimic the latter fact, we make gossip costly. That is, whether a message of a gossiper is transmitted to the trustor depends on the gossiper's willingness to pay (WTP). Using the Becker-DeGroot-Marschak (1964; hereafter BDM) mechanism, the gossiper has to state a price $P \in [0, 8]$ which he would be willing to pay for transmitting the message to the trustor. If this price P is smaller than a randomly drawn variable $r \in [0, 8]$, the message is not transmitted and the gossiper does not have to pay anything. If P is larger or equal to r, the message is transmitted and the gossiper pays a price r (not the willingness to pay P) that is subtracted from the gossiper's endowment of 16 ECU per round. Correspondingly, we speak of transmitted gossip if messages are actually transmitted to a trustor. The gossiper can infer from the feedback after each round whether or not the message has been transmitted and at what cost. The trustor observes a box on his decision screen that displays the gossiper's message before he has to make his decision about the investment x.

Behavioral predictions: Our main interest is in the overall effect of gossip, which we measure by comparing *Baseline* to *Gossip*. Moreover, because the observability of a trustee's action is a precondition for gossiping about a trustee, we break down the overall effect into two components. First, we compare behavior in *Baseline* to *Observation* that allows us to identify the importance of mere observability. Second, we compare *Observation* to *Gossip* to gauge the additional value of communicating observed behavior. We do not derive formal predictions, but use previous work to come up with a behavioral hypothesis.

Haley and Fessler (2005) were among the first to show that being observed by others makes subjects more prosocial and less selfish. We expect that this will also be the case for the trustees in our trust game, for which reason their return ratios should be higher in *Observation* than in *Baseline*. It is less clear whether trustors' investments (x) should be higher as well, because trustors get no information from third parties in treatment *Observation*. For treatment *Gossip*, we expect the same effects on trustees as in *Observation*, because trustees' behavior (i.e., their return rate) is also observable by a third party in *Gossip*, but there might be an additional effect on trustors in case gossipers will bear the costs of gossip and send useful information to them.

[9] Gossipers are instructed to not identify themselves or use offensive language.

Like in other experiments on third party punishment (Fehr and Fischbacher, 2004; Leibbrandt and Lopez-Perez, 2012; Mussweiler and Ockenfels, 2013) where third parties incur costs to punish norm-deviant behavior, we can expect that (many) gossipers have a willingness to pay to transmit their message to trustors in order to inform them about the matched trustee's behavior. This should lead to higher investments in cases where trustors receive "good" news about their matched trustee, which in turn should increase their investment levels, compared to both *Baseline* and *Observation*. Overall, we therefore expect the highest level of investments and return ratios in *Gossip* and the lowest in *Baseline.* This implies that we should observe the highest level of efficiency in *Gossip*, followed by *Observation*, and followed by *Baseline*.

Control treatments: In addition to our three main treatments, we run four further treatments to assess the boundaries of gossip in more detail.[10] In treatment *Noisy Gossip*, gossipers are in exactly the same situation as in *Gossip*, i.e., they observe a trustee's behavior and can write a message. However, if their message is transmitted, there is a 20 percent likelihood that the message is misdelivered, i.e., the trustor receives a message that refers to the behavior of a trustee with whom he is *not* matched in the current round. That this can happen is public knowledge among gossipers, trustors and trustees. Consequently, this treatment makes the uncertainty of gossip more salient. While trustees are still observed and possibly evaluated, the likelihood that their behavior is revealed to a trustor is lower than in *Gossip*. Given that the informational value of gossip is lower in *Noisy Gossip* than in *Gossip* (where messages are not confused) we expect weaker effects of gossip in *Noisy Gossip* than in *Gossip*.

In treatment *Full Gossip*, third parties receive richer information about the trustee's behavior in the previous round than in *Gossip*. More specifically, they learn the absolute transfer x and back-transfer y along with the corresponding return ratio ($y/3x$) of the previous interaction of the observed trustee. All other details are the same as in *Gossip*, in particular, that third parties have to pay for the transmission of gossip. Here we expect to see at least as much trust and trustworthiness as in *Gossip* because gossipers' access to more information should not harm efficiency.

In treatment *Costless Gossip*, gossipers can write a costless message. If gossipers write a message, it is automatically transmitted to the trustor. It is, *a priori*, ambiguous what to expect from this treatment in comparison to *Gossip*. Since gossipers have to pay for their messages in *Gossip*, their willingness to pay for transmitting their message may be only sufficiently large for informative messages. We should then observe a stronger effect of gossip on trustors'

[10] We thank the referees and the associate editor for suggesting three of those additional treatments (all except *Noisy Gossip* that was already included in the first version of this paper).

behavior *in Gossip*, because in *Costless Gossip* the quality of messages might be less informative and less influential on trustors as even messages without any substantive content will be transmitted for sure. On the other hand, *Costless Gossip* might do better exactly because all messages are transmitted. It remains an empirical question which effect dominates in this case, for which reason *Costless Gossip* is considered an exploratory treatment.

Finally, in treatment *Reputation* we use the same setup as in *Baseline* but we give trustors information on trustees' past behavior, i.e., verifiable "first-hand" information about their matched trustee. Specifically, trustors learn a trustee's return ratio in the previous round, which is transmitted directly and truthfully through the experimental software. This treatment can first be compared to *Baseline*, but then also serves as a kind of benchmark for *Gossip* to see whether giving the same information to trustors for sure – without any gossiper, though – has the same effects as gossip. We note, however, that *Reputation* and *Gossip* differ in more than one dimension (for instance, having a third party or not, receiving gossip if the willingness to pay is large enough vs. getting the information about the return rate for sure) for which reason this is also an exploratory treatment to compare the effects of verifiable "first-hand" information with the influence of gossip.

-- *Table 1 about here* --

Table 1 summarizes the details of the treatments and provides a breakdown of the number of participants per treatment. We ran the experiment in the experimental laboratory of a large public university using z-Tree (Fischbacher, 2007). In total, we recruited 852 students from various fields from a database (ORSEE, Greiner, 2015) where students can register for participation in economic experiments. For treatments with a third party (*Observation*, *Costless Gossip*, *Full Gossip*, *Noisy Gossip* and *Gossip*) we ran eight sessions (six sessions for *Costless Gossip*) with 18 subjects each. For *Baseline* and *Reputation*, we ran sessions with either 12 subjects or 24 subjects (the latter involving two matching groups of 12). Because of the random matching of subjects, each session with 12 or 18 subjects constitutes an independent observation for each of these treatments, whereas in sessions with 24 subjects we have two independent observations due to the matching groups. Sessions lasted about one hour and average earnings were 14.1 Euro.[11]

[11] In determining payoffs, we rounded to the nearest 50 Euro-cents.

4. Experimental results

We start presenting our main results from treatments *Baseline, Observation* and *Gossip* in Section 4.1, followed by robustness checks in Section 4.2. All our stated results are based on non-parametric comparisons of treatments using session-level data as independent observations, if not specified otherwise. To account for multiple testing issues, we back all stated results by parametric regressions where we correct p-values by controlling for the false discovery rate (FDR; see Benjamini et al. 2006; Anderson 2008).

4.1 The effects of observation and gossip

4.1.1 Trustors' and trustees' behavior

Figure 1 shows the evolution of trustors' investments in the top panel and trustees' return ratios in the bottom panel in each of the ten rounds in *Baseline*, *Observation* and *Gossip*. In both panels, the ordering is as expected. The level of investments is, on average, lowest in *Baseline* (4.6). It is evident that average investments are higher in *Observation* (5.6) and highest in *Gossip* (6.4) in each round. A Jonckheere-Terpstra test for ordered alternatives confirms this ordering ($p < 0.001$).

At a first glance the large difference in investments between *Baseline* and *Gossip* (Mann-Whitney-U (MWU) test: $p < 0.01$) suggests a very large effect of gossip. Yet, it is noteworthy that the mere fact of having an observer (in *Observation*) accounts for slightly more than half of the increase in investments between *Baseline* and *Gossip*. Nevertheless, there is still a significant difference between *Observation* and *Gossip* (MWU test: $p < 0.04$), which shows that the possibility to communicate the observed behavior does have an effect in itself.

-- *Figure 1 about here* --

Turning to trustees' behavior shown in the bottom panel of Figure 1, we observe a similar patterns as for investments. Averaging over all 10 rounds, the return ratio is 0.31 in *Baseline*, 0.35 in *Observation*, and 0.51 in *Gossip*. Again, using a Jonckheere-Terpstra test for ordered alternatives, we can reject the null hypothesis of equality of the three treatments ($p < 0.001$). Note, however, that pairwise MWU tests reveal that differences in return ratios are only statistically significant in comparisons involving treatment *Gossip*, whereas there is no significant difference between *Baseline* and *Observation* (contrary to our expectation).

Turning to payoffs, we find that, on average, trustors earn 8.5 in *Baseline*, 9.3 in *Observation*, and 11.8 in *Gossip*.[12] This ordering is again significant (Jonckheere-Terpstra test, $p < 0.001$). Trustees benefit from the investments by trustors, and earn considerably more, with averages of 16.6 in *Baseline*, 17.9 in *Observation* and 17.1 in *Gossip*.

We next turn to the question whether gossip increases efficiency of interactions. For this purpose, we calculate the sum of payoffs of trustors and trustees, deduct the costs of gossip (if any), and take the total earnings resulting from that as our measure of efficiency. More precisely, we calculate total earnings in a round as $(8 - investment) + investment * 3 + 8 - c$, where c is the cost of gossiping. Notice that c is equal to the random draw r in the BDM procedure and zero if no gossip is available (in *Baseline* and *Observation*) or if no messages are transmitted in *Gossip* (i.e., r > WTP for gossip). The average total earnings are 28.3 in *Gossip*, which is larger than the total earnings of 27.2 in *Observation*, and 25.1 in *Baseline*. That is, gossip increases efficiency by 13 (5) percent in comparison to *Baseline (Observation).* Again, a Jonckheere-Terpstra test for ordered alternatives reveals a significant *p*-value for the ordering of these three treatments ($p < 0.001$).

Our results indicate that observability of behavior itself increases overall efficiency, but the opportunity of gossiping about trustees – even if only transmitted in relatively few cases (see below) – has an additional effect on top of observability. This illustrates that observability is an important precondition for gossip as it captures a bit more than 50% of the difference between *Baseline* and *Gossip*.

-- *Table 2 about here* –

-- *Table 3 about here* –

To support our non-parametric statistics, we present Tobit regressions in Table 3 where we also control for multiple testing issues using the FDR (Benjamini et al. 2006; Anderson 2008). In column (1), we regress a trustor's investment on a set of dummy variables for our treatments (*Baseline* is the reference category). The coefficients for *Observation* and *Gossip* are highly significant, indicating higher investments in these treatments relative to *Baseline*. This finding is robust to including a subject's expected return ratio of their trustee, a linear time trend (round) and a dummy to capture possible endgame effects (see column 2). Notably, the expected return

[12] Note that trustors' payoffs in our *Baseline* treatment are slightly better than in an average trust game experiment (compare the meta-study of Johnson and Mislin, 2011), so the effects of observation and gossip are contrasted against a challenging baseline.

ratio is correlated with investment, meaning that trustors send more money when they expect higher back-transfers relative to their amount sent.

In columns (3) and (4) we focus on trustees' behavior, i.e., their return ratio. Again, we first regress the return ratio on our treatment dummies, indicating a substantially higher return ratio in *Gossip* than in *Baseline* and in *Observation*, while there is no difference between the latter two treatments. Including the same controls for time effects as before and the investments of trustors confirms our results. Controlling for the trustor's investment shows that the return ratio in *Gossip* is not only higher than in the other two treatments because trustors send the highest investments to trustees in this treatment (which gives trustees more money to transfer back), but that they are even higher for the same levels of investment, which is an indication for stronger reciprocity on the trustees' side in *Gossip*. We summarize our results so far as follows:

Result 1: *Gossip leads to higher relative back-transfers of trustees and higher investments of trustors than in a Baseline-treatment. About half of the effect of gossip is due to the observability of a trustee's actions. Yet, gossip adds to the effects of observability, which is reflected in the highest overall efficiency in Gossip, an intermediate value in Observation, and the lowest in Baseline.*

4.1.2 Details of gossip and its effects on trustors

The previous analysis has highlighted that the possibility to gossip has a substantial effect on top of just observing behavior. In this section we provide a more in-depth analysis of messages. The left panel of Figure 2 reveals that gossipers write a message in 367 out of 432 cases (85 percent) in the *Gossip* treatment. Moreover, gossipers have on average a strictly positive willingness to pay (*P = 2.23*) for sharing a message (gossip), as evidenced in the right panel of Figure 2. More detailed, the willingness to pay for a message *with* content is on average *P = 2.53*. A minor fraction of gossipers have a positive willingness to pay for transferring an empty message (*P = 0.57*). Overall, the willingness to pay for transmitting a message is significantly higher in the first half than in the second half of the experiment. This indicates that gossipers consider the opportunity to transmit a message as more important earlier on in the experiment when the return ratios are lower than in the second half.[13]

[13] Regressing the willingness to pay for sending a message on round reveals a significant negative coefficient estimate (*-0.113, std. err. 0.037*).

We observe a considerable degree of heterogeneity in the gossipers' willingness to pay. About 26 percent of price statements are $P = 0$, whereas 21 percent of prices are in the range $0 < P \leq 1$. The remaining 53 percent of prices satisfy $1 < P \leq 8$. That is, the intention to transmit gossip is widespread as subjects have a positive willingness to pay to share information about trustees in about 74 percent of cases. The share of subjects who always state $P = 0$ is ten percent, while 29 percent have an average willingness to pay of less than 1 over all ten rounds. The remaining 61 percent of subjects state on average $P > 1$.

A positive willingness to pay for sharing information is a precondition that trustors do receive gossip. In fact, messages are transmitted in only 26 percent of cases (in the other cases, the BDM-mechanism did not lead to the transmission of the message). Conditional on transmission, gossipers pay, on average, 2.5 and their average (unconditional) profit is 15.4, implying an average cost of gossiping of 0.6.

Next, we turn to a more detailed analysis of the content of messages. For that purpose, we recruited 20 additional students (coders), who were not familiar with the purpose of the study, to rate and code all 717 messages in *Gossip* and *Noisy Gossip*. We formed four groups of 5 coders and assigned to each group about 180 randomly selected messages. That is, each message was evaluated by five independent coders who had to indicate (i) whether a message was positive, neutral or negative (with respect to the description of the trustee's behavior), (ii) whether a message was detailed (i.e., a message indicated the return ratio), vague (i.e., a message did not explicitly state the return ratio) or wrong, and (iii) whether a message evaluated a trustee's behavior or not.[14] In the analysis, we use the median of the answers to these three questions provided by the five coders.

First, a large majority of written messages report actual observed behavior in a detailed way (75 percent). That is, these messages include the observed return ratio and almost every third of these messages contains some kind of judgment about the observed behavior. More specifically, such judgments are used to warn trustors about malicious behavior of trustees (in 40 percent of messages with judgements; e.g., "no repayment, don't send anything") or to encourage investments in case of observing positive behavior (54 percent; e.g., "totally fair, he repaid 2/3!"). Second, a fraction of written messages is vague (18 percent), which means that there is some leeway in how they can be interpreted by the trustor (e.g., "he paid back reasonably" or "perfect gameplay").[15] Third, there is a small fraction of written messages (7

[14] In addition, the coders had to indicate one or more pre-specified categories describing the content of a message (see the appendix for the list of categories and the coder instructions).

[15] There is some heterogeneity in fairness views of gossipers, which makes the interpretation of messages possibly harder, in particular if gossipers do not state the observed return ratio. For example, while some gossipers find a return ratio of 0.5 fair, others find return ratios below 0.66 unacceptable.

percent) that either contains wrong information (e.g., "he repaid half", when in fact the observed return ratio was zero) or pointless information (e.g., "Participant A"), which we both label as wrong messages.

A closer look at the relationship of gossip content and WTP reveals that gossipers have a significantly higher WTP for detailed messages (2.73) and vague messages (2.50) than for wrong messages (0.55).[16] The relationship between message content and WTP reveals no difference in the WTP for sending positive (3.1) and negative messages (3.0), but in both cases the WTP is significantly higher than the WTP for neutral messages (2.2). Looking at the observed return ratio, which is arguably a more objective measure than the ratings of the coders, shows that the WTP is significantly higher for observed return ratios that are smaller than or equal to one third (2.7) than for larger return ratios (2.2).[17]

How do trustors react to gossip? If a message is transmitted and negative (i.e., negative gossip), trustors typically react with low investments. In such cases, they invest on average only 3.2. In strong contrast, investments are clearly higher after neutral (6.0) or positive gossip (7.2). This implies that trustors actually seem to believe good messages and act upon them, although they cannot verify the truth of a gossiper's message. Trustors interpret even receiving no gossip as good news, which is the case in 74 percent of cases. That is, investments average to 6.7 when no gossip occurs. While investments are not significantly different after receiving neutral, positive or no gossip (all $p > 0.6$, MWU-tests), the difference between investments after negative gossip and after positive, neutral or no gossip, respectively, is always significant (all $p < 0.03$, MWU-tests). Moreover, investments in cases of positive, neutral or no gossip are significantly higher than investments in *Baseline* (all $p < 0.02$, MWU-tests). Thus, gossip can affect behavior and efficiency in two ways. Gossip about negative behavior clearly hurts efficiency, whereas positive, neutral or no gossip leads to higher efficiency compared to a situation where there is no gossiper (as in *Baseline*). However, it is also interesting to note that trustors' behavior differs between *Observation* and *Gossip* in the following sense. When trustors receive no message in treatment *Gossip*, they are de facto in the same situation as trustors in treatment *Observation*, because in both cases there is a third party, but the trustor does not receive any message. The only difference is that in treatment *Gossip* the trustor *could*

[16] See Table A1 in the appendix for the regression results of the analysis in this paragraph.
[17] Note that the correlation between WTP and observed return ratio is low and insignificant (Spearman's $\rho = 0.05$, $p > 0.32$). However, we may lack power to detect a significant relationship as only a comparatively small fraction (0.24) of observed return ratios is below 0.33. Conditional on transmitted messages, the correlation between WTP and observed return ratio is negative and significant (Spearman's $\rho = -0.19$, $p < 0.046$) as expected. This means that gossipers are particularly interested in revealing cheaters, while they are less willing to pay money to gossip about trustworthy trustees. This asymmetry is reminiscent of the stronger motivation to punish non-cooperators than to reward cooperators in public good games (e.g., Sefton et al., 2007).

have received a message, while this is by design ruled out in *Observation*. In such a situation, trustors invest on average 6.7 in *Gossip*, but only 5.6 in *Observation*, and this difference is significant ($p < 0.012$). This indicates that the mere option of third parties to send a message can affect trustors' behavior.

Result 2: *Third parties display a positive willingness to pay for the transmission of gossip, and 26 percent of all messages are transmitted to the trustors. Trustors react sharply to negative gossip, but also positively by increasing investments when they receive positive, neutral or even no messages. The option to write a message, even if none is transmitted, generates higher investments in Gossip than in Observation.*

4.2 Control Treatments

4.2.1 Robustness of gossip

Noisy Gossip: Recall that in this treatment we introduce the possibility that information is misdelivered, i.e., that a transmitted message is about some other trustee with whom the trustor is *not* currently matched, and that this happens in 20 percent of cases.[18] This means that trustees face a reduced probability that their behavior is revealed and this may reduce trustworthiness and, in turn, the investment of trustors.

This is what we find. The average investments over all rounds are significantly lower in *Noisy Gossip* (5.5) than in *Gossip* (6.4; MWU test, $p = 0.024$). Similarly, the return ratio of 0.36 is significantly lower than the return ratio (0.51) in *Gossip* (MWU test, $p < 0.01$). These observations suggest that gossip loses (at least parts of) its potential for increasing efficiency when transmitted information is less valuable, for which reason trustees might care less about their reputation.

Even though noisy gossip is less effective than gossip without transmission errors, it increases investment levels compared to *Baseline* (as can also be seen in Figure A.1 in the appendix). The average investment level in *Noisy Gossip* is 5.5, i.e., investments are 20 percent higher compared to *Baseline* (4.6; MWU test, $p = 0.046$).

Full Gossip: In this treatment, we provide gossipers with more information than in *Gossip*. They do not only receive information about the return ratio ($y/3x$), but also about the full

[18] It is noteworthy that the 20 percent-likelihood of confusing messages does not lead to less written messages in *Noisy Gossip*, compared to *Gossip*. We observe that gossipers write only slightly less messages (81 vs. 85 percent of all possible cases) and have the same WTP for sharing this information in *Noisy Gossip* (2.53) and in *Gossip* (2.53). Moreover, the transmission rate is similar across the two treatments (25 vs. 26 percent). Neither transmission rates nor WTP are significantly different across treatments.

realization of play in the previous round, i.e., the transferred amount (x) and the returned amount (y). This allows inferring the payoffs of the trustor and the trustee. Otherwise, the treatment is identical to *Gossip*.[19]

We do not find evidence that more detailed information about a trustee's behavior has a major impact on the effectiveness of gossip. In fact, we observe that investments (6.0) and return ratio (0.45) are slightly lower in *Full Gossip* than in *Gossip*. However, none of these differences is statistically significant (MWU tests, all p-values > 0.17). Consequently, the effects of gossip do not seem to depend on the amount of information available to the gossiper.

***Costless Gossip*:** To address the question whether gossip only takes full effect (i.e., that trustees care about their reputation and trustors believe in the received gossip) when it is costly, we run a treatment that entails no gossiping cost for the third party (*Costless Gossip*). In this treatment, any message is automatically transmitted to the trustor at no cost and trustees can be certain that trustors get the third party's message (if there is any). Otherwise, the treatment is identical to *Gossip*.

Not surprisingly, in about 96 percent of cases gossipers decide to write a message (compared to 85 percent in *Gossip*). Although trustors in *Costless Gossip* receive significantly more messages than in *Gossip* (MWU test, $p = 0.051$, one-sided), they do not achieve the same level of investments as in *Gossip*. This may be due to the inflation of messages that may reduce the average quality (i.e., the informative content) of messages or may fatigue the trustors' attention to the content of the messages.

On average, the investment level in *Costless Gossip* is 5.74 compared to 6.41 in *Gossip*, which is marginally significantly different (two-sided MWU test, $p < 0.095$). Despite this difference in investments, the average return ratio is roughly the same in both treatments (0.50 vs. 0.51). Thus, while it does not matter for trustees whether third parties have to pay for transmitting gossip or not, the result on investments suggest that messages unfold a higher impact when they are costly because trustors might assume that gossipers pay only for more informative messages, and hence react to occasionally transmitted gossip in a stronger way (with higher investments).

Result 3: *The effects of gossip do not depend on the extent of information available to gossipers, and the costs of gossiping have little effects also. Yet, when the informational value of gossip is*

[19] Similar to *Gossip*, we observe that gossipers write a message in 352 out of 432 cases (81 percent) in the *Full Gossip* treatment and have a strictly positive willingness to pay of $P = 2.21$. Accordingly, about 30 percent of messages are transmitted to trustors and on average gossipers receive a payoff of 15.4 (meaning that average costs for gossip are 0.6).

lower due to possible transmission errors, it loses some of its effect, leaving basically the observational effect of gossip.

4.2.2 Gossip vs. first-hand information

We have seen that second-hand information in the form of gossip greatly improved efficiency (even when accounting for the costs of gossiping). Our *Reputation* treatment is intended to examine whether the same effects can be generated by simply giving the trustor first-hand information about the matched trustee's past round behavior, but having not third party that may potentially gossip. To make the informational content comparable to the situation in *Gossip,* we provide only information about the trustee's return ratio to the trustor.

Our results show return ratios are practically the same in Reputation and Gossip (0.46 vs. 0.51; not significant), but that investments are not (5.0 vs. 6.4; MWU: $p < 0.05$). This suggests that trustees react in the same way in *Reputation* and *Gossip* to being observed – either directly by the trustor to whom the trustee is matched next in *Reputation* or by the third party who may send some gossip to the trustee's next trustor in *Gossip*. Yet, trustors react differently. They investment much more in *Gossip* when a third party can send them a message. So it seems that first-hand information itself (in *Reputation*) is less suitable to improve efficiency than gossiping.[20]

Result 4: *Giving information about a trustee's return ratio in the previous round automatically is a less powerful tool to increase a trustor's investment than having a third party with an option to gossip about the trustee. Hence, the effects of gossip are not only due to the information about a trustee's past behavior.*

5. Conclusion

Gossiping about others occurs frequently. However, gossip is typically associated with idle chat or negative behavior. Often, it is second-hand information because it is not based on the gossiper's own experience with the gossip target. Despite these limitations of gossip, and despite its often negative connotation, gossip may have positive effects on the efficiency of interactions. According to Dunbar (1994, 2004), language has evolved to facilitate social bonding in large social groups through the exchange of social information within groups. In

[20] As already indicated in section 3 on the design, both treatments – Gossip and Reputation – differ in more than one dimension for which reason this comparison is of an exploratory nature, as it addresses the question whether another mechanism can achieve similar effects as gossip in total.

this sense, gossiping allows people to keep track of behavior or changes in the social network and to maintain efficient relationships. This view suggests that gossip may prevent free riding or malicious behavior of individuals whose behavior may become the substance of gossip.

In this paper, we have investigated how gossip may affect the efficiency of interactions in a trust game when a trustor and a trustee interact with each other. We find that if a third party can gossip about the behavior of the trustee, (absolute and relative) back-transfers are much higher, and, concomitant with that the investments of the trustor increase significantly, compared to a baseline condition without any third party that may gossip.

Of course, gossip requires the observability of a trustee's past actions, and it may be this observability that increases efficiency through gossip, rather than the exchange of messages itself. To shed light on this issue, we have conducted a second treatment, in which third parties can simply observe a trustee's actions, but cannot transmit any messages to the matched trustor. This treatment demonstrates that observability increases investments of trustors in the trust game, compared to the baseline condition. Yet, the increase accounts only for a bit more than half of the increase in investments when gossip is possible. This indicates that our *Gossip*-treatment results in higher investments and higher efficiency than *Baseline* because of two effects, namely that trustees are observed, and – to a smaller extent – that third parties can gossip about trustees. In fact, because it is sufficient that someone may gossip about trustees' behavior to deter norm violations, it turns out that the threat of gossip is a cheap and efficient instrument of social sanctioning and, at the same time, circumvents the second-order public good problem of punishment (Coleman 1990).

Looking at the frequency and content of gossip in more detail, we find that there is more gossiping going on in the earlier part of the experiment than in the later part, which may indicate that gossip is particularly useful to help establishing an efficient level of interaction early on. Trustors react in particular to negative gossip about the trustee with whom they are paired. As expected, negative gossip leads to a withdrawal of trust and thus lower investments of trustors. This indicates that trustors seem to believe the messages that they receive from the gossipers, which is an important finding, given that gossip is completely unverifiable for trustors. Investment levels of trustors react positively to positive, neutral or even no gossip, as investments are higher than in a baseline condition without a gossiper. Accordingly, the possibility of gossip fosters trust by selectively trusting interaction partners, which reflects findings that the ability to choose partners can greatly enhance cooperation in social dilemma situations (e.g., Coricelli et al., 2004, Page et al., 2005, Charness and Yang, 2014, Feinberg, Willer, Schultz, 2014, Kamei and Putterman, 2015).

In a series of control treatments, we have investigated specific aspects of gossip that may be important for fostering trust and trustworthiness. While we have found that the costs of gossip or the level of information available to gossipers are negligible factors, we demonstrate that gossip has to be reliable (if it takes place) to unfold its full effects. When it is possible that trustors receive gossip about trustees with whom they are *not* paired, then efficiency is reduced significantly (*Noisy Gossip*), compared to our findings from a situation where gossip always refers to the trustee with whom an interaction takes place. This is not due to less frequent gossiping (compared to *Gossip*), but rather because trustees reduce their back-transfers in response to the lower likelihood that their actual behavior is revealed to others, and consequently trustors lower their investments as well.

Our results emphasize the potential of gossip to increase the efficiency of interactions (beyond what mere observability achieves). We have focused on a simple setting in which we abstracted from strategic motives for gossip to investigate whether gossip will emerge even in situations where gossipers do not directly profit from sharing information and to examine how it affects behavior of trustees and trustors. The findings suggest that gossip can, in particular, serve as cost-effective instrument to enhance trust and trustworthiness in settings where it is difficult to keep direct track of behavior of potential interaction partners. In such cases, gathering information about others through intermediaries is useful to assess the trustworthiness or willingness of others to cooperate. A natural extension is to ask whether these positive effects of gossip are robust to situations in which gossipers have material interests in the game. While, for example, in social dilemma situations or coordination games we may observe a similar impact of gossip on behavior as in the present setup, it might well be the case that in competitive settings gossipers have an incentive to misreport behavior or spread bad reputational information to get an advantage over competitors. The potential interplay of strategic incentives and the specific context opens interesting question, which we leave for future research.

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Tables and Figures

Table 1. Summary of Treatments

Treatment	# of sessions (# of indep. obs.)	# of subjects	Third party's possible actions
Baseline	5 (8)	96	No 3rd party present
Gossip	8 (8)	144	Gossip
Reputation	3 (6)	72	No 3rd party, trustee behavior observable
Observation	8 (8)	144	Only observation, no gossip
Costless Gossip	6 (6)	108	Gossip, costless
Full Gossip	8 (8)	144	Gossip, full info about trustee behavior
Noisy Gossip	8 (8)	144	Gossip, noisy transmission

Table 2. Summary of Results for all Treatments

	Trustor			Trustee		Gossiper		
	Amount sent	Expected back-transfer	Expected return ratio	Amount sent back	Return ratio	WTP	Fraction oftransmitted messages	N
Baseline	4.55 (2.90)	7.34 (5.82)	0.46	5.03 (5.38)	0.31	--	--	480
Gossip	6.41 (2.17)	10.61 (4.90)	0.52	10.17 (5.24)	0.51	2.23 (2.30)	0.26 (0.44)	480
Reputation	4.96 (2.93)	8.19 (5.75)	0.46	7.84 (5.86)	0.46			360
Observation	5.60 (2.86)	8.62 (5.89)	0.43	6.95 (6.09)	0.35	--	--	480
Costless Gossip	5.74 (2.55)	9.10 (5.60)	0.48	9.42 (5.89)	0.50	--	1.0	360
Full Gossip	5.97 (2.67)	9.96 (5.42)	0.50	9.01 (5.97)	0.45	2.21 (2.28)	0.30 (0.46)	480
Noisy Gossip	5.47 (2.94)	9.03 (5.70)	0.49	6.65 (5.97)	0.36	2.06 (2.29)	0.25 (0.43)	480

Notes: Standard deviations in parentheses. WTP: Gossiper's average willingness to pay for transmitting their message.

Table 3. Trustor and trustee behavior (Tobit regressions)

	Dependent variable			
	Investment		Return Ratio	
Gossip (d)	3.669*** #	3.185*** #	0.259*** #	0.166*** #
	(0.892)	(0.721)	(0.065)	(0.057)
Reputation (d)	0.730	0.815	0.188** #	0.165*** #
	(0.907)	(0.698)	(0.076)	(0.064)
Observation (d)	2.073*** #	2.450*** #	0.054	-0.001
	(0.727)	(0.548)	(0.077)	(0.064)
Costless Gossip (d)	2.115*** #	1.989*** #	0.248*** #	0.187*** #
	(0.650)	(0.617)	(0.070)	(0.063)
Full Gossip (d)	2.925*** #	2.688*** #	0.186** #	0.114* #
	(0.939)	(0.696)	(0.074)	(0.062)
Noisy Gossip (d)	1.891*** #	1.673** #	0.068	0.021
	(0.715)	(0.654)	(0.072)	(0.060)
Round		0.040		-0.016***
		(0.045)		(0.002)
Round 10 (d)		-0.879***		-0.156***
		(0.277)		(0.025)
Expected Return Ratio		7.550***		
		(2.122)		
Investment				0.051***
				(0.003)
Tests (*p-values*):				
Reputation vs. Gossip	0.0049 #	0.0068 #	0.115	0.97
Observation vs. Gossip	0.074 #	0.31	0.000 #	0.000 #
Costless Gossip vs. Gossip	0.059 #	0.11	0.746	0.55
Full Gossip vs. Gossip	0.48	0.53	0.0835 #	0.12
Noisy Gossip vs. Gossip	0.0435 #	0.052 #	0.000 #	0.000 #
N	3120	3120	3120	3120
Pseudo R^2	0.02	0.11	0.06	0.26

Notes: Tobit regressions with standard errors clustered at the session level. (d) denotes dummy variable.
*** (**) [*] indicates conventional significance at the 1% (5%) [10%] level. # indicates significance after controlling for False Discovery Rate using the two-step procedure proposed by Benjamini et al. (2006).

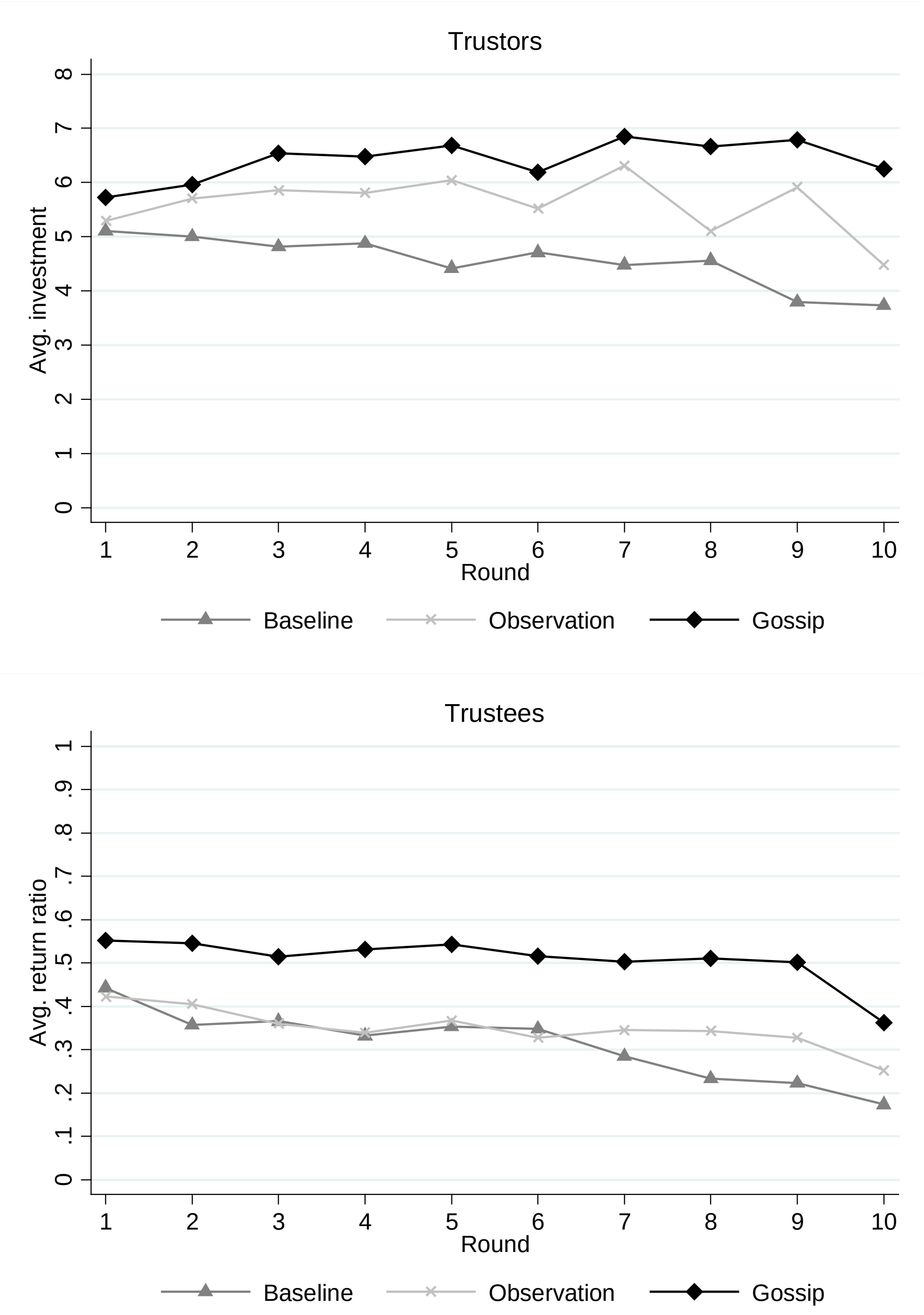

Figure 1: Evolution of trustor and trustee behavior in *Baseline*, *Observation*and *Gossip*.

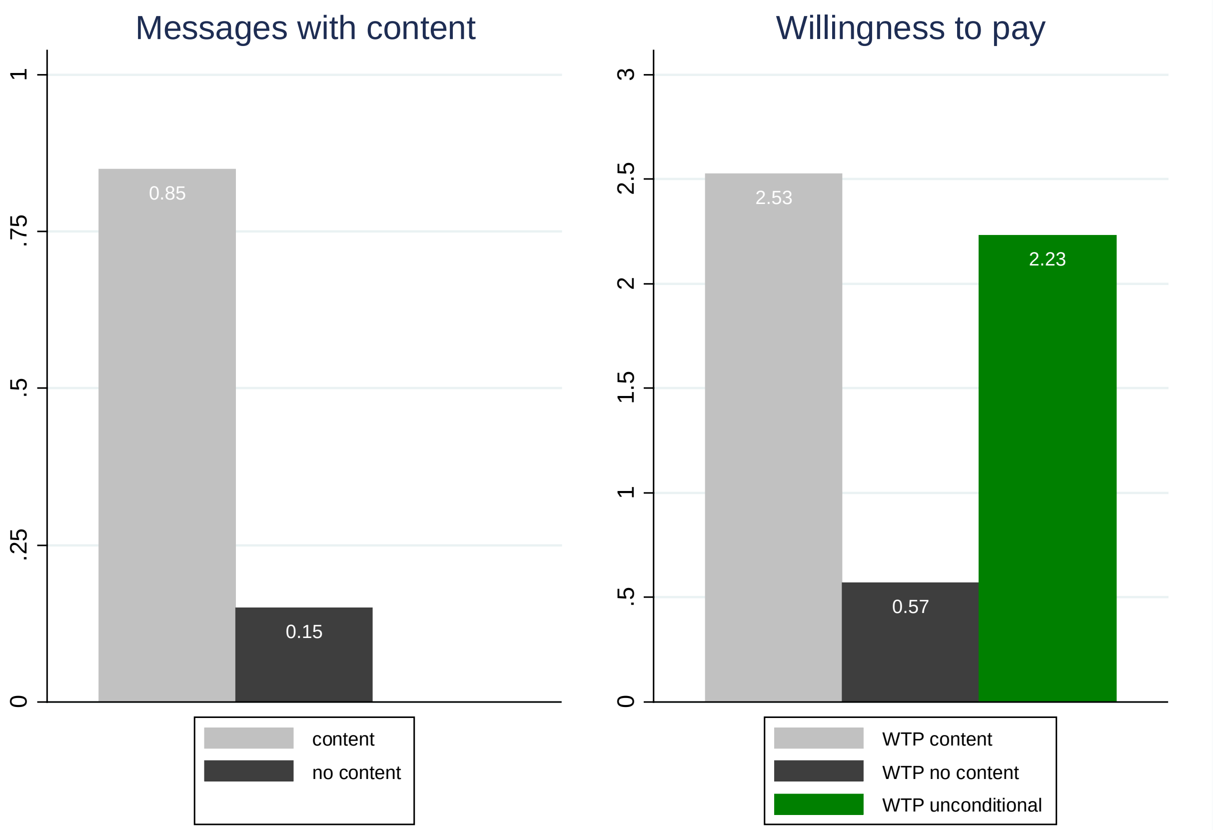

Figure 2: Frequency of gossip and willingness to pay (WTP) in treatment *Gossip*.

Online Appendix

Additional Regressions

Table A1. WTP and gossip content

	dependent variable: WTP		
True message (d)	4.568***		
	(1.282)		
Vague message (d)	4.305***		
	(1.285)		
Positive message (d)		1.123**	
		(0.530)	
Negative message (d)		1.190**	
		(0.568)	
Observed return ratio ≤ 0.33			1.035**
			(0.471)
Round	-0.174***	-0.172**	-0.185***
	(0.066)	(0.068)	(0.064)
Constant	-0.900	2.894***	2.677***
	(1.299)	(0.589)	(0.473)
N	367	367	432
R^2	.04	.02	.01

Notes: * p<0.10, ** p<0.05, *** p<0.01
Variables characterizing messages are based on coder ratings. (d) denotes dummy variable.

Additional Figure

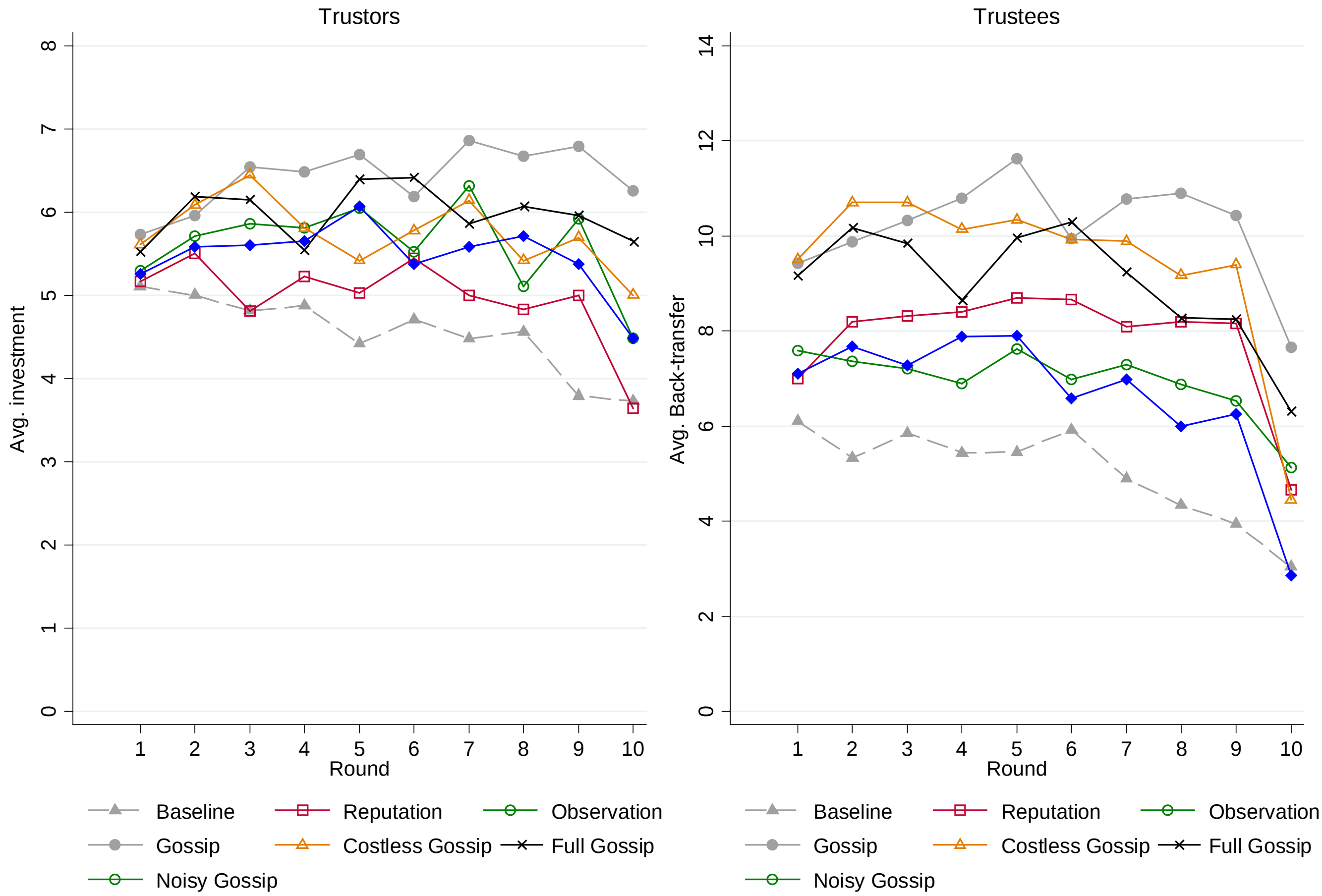

Figure A.1: Evolution of trustor and trustee behavior in all Treatments.

Instructions – *Gossip* Treatment[1]

Welcome to the experiment.

Note that from now on it is not allowed to talk to other participants and to exchange any information. If you have a question, please raise your hand and we will come to your place and answer your question in private. It is important that you do not ask your question in public. If you do not comply with the rules of the experiment, we have to discontinue the experiment.

General Overview

There will be three different player roles in this experiment (player A, B and C). Depending on your player role you will make different decisions. The roles will be determined randomly in the beginning and are fixed throughout the experiment.

The experiment consists of 10 rounds. At the beginning of a round, we will randomly form groups of three. Each group consists of one player A, one player B and one player C. You will neither learn the identity of the other players in your group nor the identity of players in other groups. That is, you remain anonymous throughout the experiment and afterwards. No other participant can associate you with your role and your decisions in the experiment.

Your endowment and all payoffs in the experiment will be denoted as ECU (Experimental Currency Units) and converted into Euro at the end of the Experiment. The conversion rate is:

10 ECU = 1 Euro

Task Description

In the following we will give you an overview of the tasks of the three players in this experiment.

In each round each player will be endowed with a certain amount of ECU. Player A has the possibility to send any share of their endowment to player B. Each sent ECU will be tripled by the experimenter. Player B will then decide how much of the available ECU to return to player A. Player C will observe the decision of player B. More specifically, Player C will learn which share of the received amount (in percent) player B returned to player A. Player C can then decide whether to comment the behavior of player B and to send a message to the player A who is next paired with the observed player B. This message will be available before this player A will make their decision in the next round.

In the following, we will describe each player role for you in more detail.

Player A

You are randomly matched with a player B and a player C. In each round you will receive and endowment of 8 ECU.

Your task is to decide how much of your endowment to send to player B. You can send any amount between 0 and 8 ECU. The amount you send will be tripled by the experimenter and credited to the

[1] The other treatments have analogous instructions. In treatments *Baseline* and *Reputation* there are no third parties involved (players C). In the other treatments with third parties (*Observation, Costless Gossip, Full Gossip, Noisy Gossip*) we varied the costs of gossiping (zero costs in *Costless Gossip*), the information available to gossipers (absolute investments and back-transfers and return ratio in *Full Gossip*, compared to only return ratio in *Gossip*), the informational value of gossip (20% chance of transmitting a message about a trustee with whom the trustor is *not* matched in the current round in *Noisy Gossip*, compared to zero chance of transmission errors in *Gossip*), and whether the third party was able to send a message (this was not possible in *Observation*, although third parties got the same information about the trustee as in *Gossip*). All instructions are available upon request from the authors.

account of Player B (in addition to their endowment). Player B then decides how much of the available amount to return to you.

Example: If you send 4 ECU to B, player B will receive 12 ECU. If you send your whole endowment of 8 ECU, player B will receive 24 ECU.

In addition you have to indicate how much you expect back from player B (based on your decision). Note that this information will not be transferred to player B.

If some player C decides to send you a message at some point during the experiment, you will get this information before you make your decision of how much to send to player B. The message may contain some information on the past behavior of player B you are paired with.

Your payoff in a given round is:

Payoff = Endowment – Amount sent + returned Amount of Player B

<u>Player B</u>

You are randomly matched with a player A and a player C. In each round, you will receive an endowment of 8 ECU. Player A has the option to send you any amount between 0 and 8 ECU. This amount will be tripled by the experimenter. That is, you can receive up to 24 ECU in addition to your endowment of 8 ECU in each round. You will see all necessary information on your screen.

You will then decide how much of your total available ECU to return to player A. You can return any amount to player A.

Example: Suppose Player A sent you 6 ECU. This amount is tripled and you receive 18 ECU in addition to your endowment. That is, your total available amount is 26 ECU. You can now return any amount between 0 and 26 ECU to player A.

Player C will learn which share of the received amount (18 ECU in the example above) you returned to player A. Player C can use this information to send a message to the next player A you are paired with. That is, in the next round, player A will possibly learn about your behavior in this round.

Your payoff in a given round is:

Payoff = Endowment + received Amount – Return to Player A

Player C

You are randomly matched with a player A and a player B. In each round, you will get information about the behavior of player B. You will learn how much player B returned to player A, expressed as the share of the amount that player B received from player A (return ratio).

Example 1: Player A sent 6 ECU. This amount was tripled such that player B received 18 ECU. Player B returned 6 ECU. That means the return ratio is 33.3 percent. Calculation: Return (6) divided by the received amount (18) multiplied by 100 (6/18 x 100 = 33.3%).

Example 2: Player A sent 6 ECU. This amount was tripled such that player B received 18 ECU. Player B returned 0 ECU. That means the return ratio is 0 percent.

Example 3: Player A sent 0 ECU. This amount was tripled such that player B received 0 ECU. Player B returned 0 ECU. That means the return ratio is 0 percent. However, in this case you will also learn that player A has sent 0 ECU.

Based on this information, you can write a message, which will be transmitted to the player A, who is paired next with the player B you have observed in this round. This player A will receive your message before making a decision. Whether and how your message will be transmitted is explained below.

If you decide to write a message, you have 300 characters to formulate your message. **Note that you are not allowed to use offensive language and to reveal your identity or others identity, for example by revealing your computer number, sex, appearance, etc.**

When will your message be transmitted?

After you wrote your message, you will be asked to indicate your willingness to pay to transmit your message to player A. You can indicate any amount between 0 and 8 ECU (and up to 2 decimal points). In each round you will get an endowment of 16 ECU.

In each round the computer will draw a random number, which will be compared to your willingness to pay. If your willingness to pay is equal to or higher than the random number drawn by the computer, your message will be transmitted and you will have to pay the random number. If your willingness to pay is smaller than the random number, your message will not be transmitted and you will pay nothing.

Note that if your message is transmitted to player A, you will not pay your stated willingness to pay but the random number drawn by the computer, which is always *lower or equal to* your stated number. Therefore, it is in your best interest to state your true willingness to pay.

If you want to increase the probability that your message is transmitted, you should state a high willingness to pay. If it is not so important for you that a player A gets your message, you should state a smaller amount. This will reduce the probability that your message is transmitted.

Example: You write a message and your willingness to pay is 5.20 ECU. Suppose the random number is 4.01. Since your willingness to pay is greater than the random number, your message will be transmitted to player A and you have to pay the amount of the random number, i.e., 4.01 ECU. That is, your payoff in this round is 11.99 ECU

Your payoff in a given round is:

Willingness to pay ≥ random number → ***Message transmitted***

Payoff = Endowment – random number

Willingness to pay < random number → ***No Message transmitted***
Payoff = Endowment

Final Earnings

At the end of the experiment, your payoffs in ECU from all rounds are added up and converted into Euro according to the conversion rate stated in the beginning of these instructions. Your final earnings will be rounded to nearest 0.5 Euro.

Are there any remaining questions? If yes, please raise your hands. We will answer your questions in private.

We would like to thank you for participating in this experiment.

Instructions – Coders

Thank you for participating in this study. Through your participation you contribute in significant ways to the scientific analysis of economic decision making. You will receive 15 Euro for your participation today.

If you have questions, please raise your hand. We will come to your place and answer your question in private. Please do not talk to others during this session.

General Overview

Your task will be to evaluate statements and comments from a previous experiment. To give you a better sense of the context in which these statements and comments were made, we will first describe the experiment and then explain your task.

Experiment

There were three different player roles in the experiment (A, B and C), which were randomly assigned in the beginning. The experiment consisted of 10 rounds and in each round one player A, one player B and one player C were randomly matched into a group of three. At the beginning of each round, player A and B received an endowment of 8 points and player C received an endowment of 16 points. The players faced the following task: Player A had to decide how much of their endowment to send to player B. Each sent point was tripled by the experimenter, such that player B received three times the sent amount of player A (in addition to their endowment). Player B had then to decide how much of the available amount to return to player A. The returned amount was not tripled.

Example: Player A sent 8 points. These were triple such that player B received 24 points. Thus the total available amount was 32 points for player B. Player B could therefore return any amount between 0 and 32 points to player A.

Player C observed the decision of player B. That is, player C learned which share of the received amount (return ratio) player B returned to player A.

Examples:

> *Suppose player B returned 8 points in the example from above. In this case player A would have earned 8 points and player B 24 points. Player C would have seen the following information in this case: 33.3%.*
>
> *Suppose that Player B returned 12 points. In this case player A would have earned 8 points and player B 20 points. Player C would have learned that the return ratio was 50%.*
>
> *Suppose that Player B returned 16 points. In this case both players would have earned 16 points. Player C would have learned that the return ratio was 66.6%.*
>
> *Suppose that Player B returned 0 points. IN this case the return ratio would be 0% (Player C would learn if a player A sent nothing to player B).*

Player C could then comment on player B's behavior and write a message to the player A, who was paired next with the observed player B.

Task

Your task is now to evaluate the comments of player Cs. We present you with a list of comments of player Cs along with the corresponding return ratio that player Cs saw when making their comment. Below you will see a table with four different pre-defined categories each consisting of several attributes. For each comment we will show you, you have to assign one or more attributes from each category from below.

Category I	**Category II**	**Category III**	**Category IV**
positive	detailed	evaluates behavior	fair
negative	vague	does not evaluate behavior	generous
neutral	wrong	--	praise
--		--	advice
			selfish, greedy
			warning
			neutral
			wrong, non-sense
			comparing
			not applicable

Please assign only one attribute from each of category I to III, whereas you can assign multiple attributes from category IV.

Example: Suppose you see that the return ratio was 66.7% and that player C wrote the following comment: „B has returned 66.7%, which is a fair distribution." In this case the following attributes may apply:

> *Category I: positive*
>
> *Category II: detailed (because the message includes explicit information on the return ratio)*
>
> *Category III: evaluates behavior*
>
> *Category IV: fair, generous*

Important: You should evaluate the different comments from an objective view point and you should try to be consistent. Please take your time when evaluating the messages.

Thank you for your participation.