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Communication, Expectations and Trust: an Experiment with Three Media

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Abstract

We study how communication under differ popular media affects trust game play. Three communication media are considered: traditional face-to-face, Facebook groups, and anonymous online chat. We consider post-communication changes in player expectations and preferences, and further analyze the contents of group communications to understand the channels though which communication enhances sender and receiver behavior. For senders, social, emotional and game-relevant contents of communication all matter, significantly influencing both their expectations of fair return and preferences towards receivers. Receiver increased trustworthiness is mostly explained by their adherence to the social norm of sending back a fair share in return for the full amount received. Remarkably, these results do not qualitatively differ among the three communication media; while face-to-face had the largest volume of messages, all three media proved equally effective in enhancing trust and trustworthiness.

Keywords: communication technology; laboratory experiments; trust games; contents analysis
JEL Classification: C72, C92, D83

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1 Introduction

Trust and trustworthiness are important determinants of economic performance. Trust engenders voluntary cooperation, which, in turn, increases economic production in a society where many contracts are incomplete and efficient behavior cannot be enforced formally (Gächter et al. 2004). Trust and trustworthiness have been found to lower the incidence of violence and increase tolerance toward outgroups (Rydgren et al. 2013), increase workplace productivity (Pappas and Flaherty 2008), and improve environmental management (Carpenter et al. 2004). Trust is also an important component of social capital, a determinant of economic growth (Knack and Keefer 1997). All these underline the importance of understanding what affects trust and trustworthiness, explaining an impressive number of studies that explore key features of these situations in the economic laboratory (Camerer 2003).

In this paper, we investigate how communication through different media affects trust and trustworthiness in a standard laboratory trust game of Berg et al. (1995). We consider three communication media that are now commonly used in everyday life: face-to-face communication, communication via Facebook group posts, and communication via anonymous online chat, and compare their effectiveness in enhancing trust and trustworthiness. While face-to-face is traditionally considered the most common and effective medium (Davis and Holt 1992), online social media are becoming equally common, with Facebook leading in popularity among social media sites (Perrin and Anderson 2019).[1]

We solicit participant's beliefs about their counterpart's actions to investigate the mechanisms through which communications via different media affect behavior. This allows to study whether and how communication under each media changes trust and trustworthiness; specifically, we consider if communication changes behavior through it effect on player beliefs about the other's play, or though other channels, such as changing player preferences and

[1] According to Pew Research Center which tracks adoption of social media, in 2005, just 5% of American adults used social media platforms. By 2011 that share had risen to half of all Americans, and in 2019, 72% of all adults in the U.S., and 90% of the adults of age 18-29, use online social media; see https://www.pewresearch.org/internet/fact-sheet/social-media/ Aside from Youtube, Facebook remains the most widely used social media site among adults in the U.S. (Perrin and Anderson 2019).

reducing social distance. We further consider whether these effects are any different across the media.

Finally, we analyze communication contents under each media using two complementary communication analysis techniques: (1) a human-coded content analysis similar to Chen and Chen (2011) and Cooper and Kühn (2014); and (2) a linguistic analysis using the content analysis software package "Linguistic Inquiry and World Count 2007" (LIWC) (Wojcik et al. 2015; Rheault et al. 2016; Crossley et al. 2017). Content analysis allows us to consider which components of communication are especially effective, and which are detrimental for trust and trustworthiness under the media that we study.

Communication among agents has been extensively studied as a mean to enhance economic performance. In the context of the laboratory trust game, Ben-Ner and Putterman (2009) demonstrate that pre-play communication via structured proposals and chat messages increases trusting and trustworthy behavior, and that both trustors and trustees favor fair and efficient proposals; Ben-Ner et al. (2011) provide further evidence that communication contents matter for behavior. Several experimental studies consider the effects of specific communication media. While traditionally, face-to-face was found to increase economic performance more effectively than other forms of communication (Brosig et al. 2003; Bochet et al. 2006), more recent literature suggests that online communication is becoming as effective. Charness and Dufwenberg (2006) find strong effects of written free-form messages in experimental games studying trust in partnerships. Chen and Li (2009) report that communication through online chat is effective in inducing group identity and increasing economic productivity. Abatayo et al. (2018) find that communication via online chat as well as post and replies in Facebook groups are just as effective in fostering cooperation in a voluntary contributions public good game as face-to-face communication. For the trust game, Bicchieri and Lev-On (2011) find that game-relevant online anonymous chat has the same positive effect on trust as game-relevant face-to-face chat, while "irrelevant" communication, both face-to-face and online, had a much smaller effect on trust and trustworthiness. Fiedler and

Haruvy (2009) study communication in Second Life (virtual reality world) using avatars and text chat. They find that anonymous and irrelevant pre-play communication in groups of three or four had a large and positive effect on trust (the amount sent), and - for university students, but not for Second life residents - a positive effect on the proportion returned.[2] Babin (2020) finds a large effect of text-messages and emoji on trust, but only a modest effect on reciprocation. However, none of these papers compare three most commonly-used communication media in the trust game, the task that we undertake in the present study.

The paper further contributes to studies of how communication influences player beliefs in the trust game, and whether observed post-communication changes in behavior are attributable to changes in beliefs or other factors. Experimental literature has long established a high correlation between own behavior and expectations of other player's actions (Nyarko and Schotter 2002; Guerra and Zizzo 2004; Ashraf et al. 2006; Sapienza et al. 2013); Costa-Gomes et al. (2014) establish the causality between expectations and actions. Guerra and Zizzo (2004) confirm the hypothesis on "trust responsiveness", the tendency of individuals to fulfill trust because they believe that the trust - through expectations - have been placed on them. Ashraf et al. (2006) report that variations in trust and trustworthiness are explained both by expectations of the counterpart's action and by unconditional kindness. Sapienza et al. (2013) also argue that sender behavior is driven by both beliefs and preferences, and find that the World Values Survey question on trust captures the beliefs. Finally, Blanco et al. (2014) find evidence that preferences and beliefs in sequential social dilemmas are not independent.

Another relevant strand of literature discusses the effect of communication on player beliefs. Dawes et al. (1977) report that in a social dilemma game, communication increases the proportion of subjects who correctly predict a defection.[3] In his survey on games with

[2] Greiner et al. (2014) also find that communication had little effect on Second Life residents in an ultimatum game experiment, suggesting environmental or selection effects among Second Life residents.

[3] In non-experimental contexts, researchers have considered how expectations are influenced by social media (Schivinski and Dabrowski 2016; Narangajavana et al. 2017) and by central bank communications (Eusepi and Preston 2010).

communication, Crawford (1998) writes that cheap talk may help coordinate player beliefs in games with multiple equilibria, or focus player beliefs on certain fairness norms under bargaining. Much of recent literature discuss the effect of one-way communications such as promises on second-order beliefs (Charness and Dufwenberg 2006);[4] Ellingsen et al. (2018) further establish that one-way messages have a significant impact on beliefs and behavior in a wide range of two-payer one-shot games. Unlike the above studies, we explore, in the context of a trust game, the effect on player expectations of free-from multi-way group communications of various degrees of anonymity, where participants' respective roles of sender or receiver may remain undisclosed.

In sum, the contributions of this study are threefold. First, we link the effects of communication on actions and expectations 1

in the trust game, and consider if after-communication changes in behavior are solely due to changes in expectations or to changes in preferences as well. To do this, we solicit incentivized expectations from participants before and after communication and consider the changes in actions and expectations before and after communication. Second, we compare the traditional face-to-face communication with two relatively new but now common online media, Facebook discussion and online chat. Third, we contribute to the studies of communication contents by using two complimentary approaches, content analysis using human coders, and computational linguistic analysis LWIC.

We focus on three main research questions in this study. First, does traditional face-to-face communication outperform other forms of communication at fostering trust and trustworthiness, and do richer and less anonymous formats (Facebook) increase trust and trustworthiness more than anonymous text messages (chat)? Second, do different modes of communication affect sender and receiver expectations and preferences differently? Third,

[4] Charness and Dufwenberg (2006) report that promises in partnerships may enhance trustworthy behavior because players believe that their promises change others' expectations of their action; a guilt-averse player would then tend to live up to these expectations and choose an efficient but costly action. Vanberg (2008) questions these conclusions and suggests that people have a preference for keeping their promises per se. See also Charness and Dufwenberg (2010), Ederer and Stremitzer (2017) and Di Bartolomeo et al. (2019).

which verbal and emotional components of communication, including its volume and contents, have the most pronounced effect on sender and receiver behavior, and do these elements differ across communication media?

We find that all three communication media are equally effective in enhancing trust and trustwothiness. Following group communication, almost two-thirds of sender-receiver pairs achieved joint-payoff-maximizing and egalitarian outcomes. Face-to-face had the highest communication volume, whereas Facebook had the lowest volume but the highest share of game-relevant messages. While sender trust under Facebook was slightly lower than under face-to-face or anonymous chat, this is likely attributable to differences in sender initial predispositions rather than to differentiated media effect. We further find that communication had markedly different effect on senders and receivers. While communication increased senders' trust both via increasing their expectation of fair return and via changing preferences towards the receivers, its effect on receivers was mostly via enhanced expectations of the amount sent; conditional on receiver expectations, the share returned remained unchanged before and after communication. Furthermore, senders were much more likely to send full amounts and expect fair return if such play was explicitly discussed, whereas communication content had little direct effect on percentage returned by receivers. Interestingly, game-irrelevant social communications also enhanced trusting behavior, likely through affecting sender preferences.

2 Experimental Design

Participants were recruited from the student population of the University of Hawai'i at Mānoa (USA) using the Online Recruitment Software for Experimental Economics (ORSEE) (Greiner 2015). For consistency across treatments, only individuals who had a Facebook account were invited to participate. Each experimental session consisted of three parts: Part 1, pre-communication trust game; Part 2, communication; and Part 3, post-communication

trust game. We describe each part below.

2.1 Stage game

We used the standard trust game (hereafter, TG) of Berg et al. (1995) to measure trust and trustworthiness. Participants were randomly assigned to either sender or receiver role; the roles remained unchanged for the duration of the session. Senders and receivers were given 10 dollars each. The sender could send any part of their endowment to the receiver. The amount sent was tripled. The receiver then decided on how much of the money received to send back to the sender. Receiver's expectations of the amount sent and sender's expectations of the amount returned were elicited in an incentive compatible way (Buchan et al. 2008) while their counter-parts were making decisions. Both pre-communication (Part 1) and post-communication (Part 3) trust games were one-shot. Participants remained in the same sender or receiver role throughout the session, but were re-matched into new sender-receiver pairs between Part 1 and Part 3.

2.2 Communication Stage and Treatments

To assess the effect of communication per se and specific communication media on sender and receiver behavior, we implemented four different treatments using between-subject design. The treatments differed only in how Part 2 of a session, the communication stage, was implemented, and were exactly the same in Parts 1 and 3. In each treatment, the communication stage lasted for ten minutes and was implemented as follow.

No Communication (NC) Participants were told that experimenters needed time to setup for the next stage of the experiment. During the ten-minute "setup" time, participants were allowed to open their internet browsers and surf the web but could not communicate with one another. Participants were not given any new information about other people in their session.

Face-to-Face communication (FTF) Participants in a group were seated around a table. These tables were situated as far as possible from one another so that one group did not hear the discussions of the other group. Participants could see and listen to each other "live," but were not given each others' names. Communications were audio-recorded with participants' consent.

Facebook-to-Facebook communication (FB) Participants communicated in Facebook groups created by the experimenter. Participants belonging to the same group could post messages and reply to each others' messages via the Facebook group. They could see each other's Facebook profiles, pictures and names, but did not see or listen to each other "live;" the experimenter could monitor their online communication as group administrator. Once the communication time was over, the experimenter removed all the participants from the Facebook group and asked them to log out from Facebook. At the end of each session, Facebook group communication logs were saved, and the groups were then deleted.

Online Chat (Chat) Participants interacted with their group members via the z-Tree software's online text messaging option, "Chat box". Participants were only identified using their Subject ID number, were not shown each others' names or pictures, and could not see or hear each other "live." The experimenter monitored communications among participants via the experimental software; chat logs were saved in z-Tree.

In all three communication treatments (other than NC), communication among participants occurred in groups of four[5]. Before communication started, participants in these treatments were informed that after the stage was over, they will "participate in another game with one of the individuals they just communicated with" (see Experimental Instructions in Supplementary Materials).

[5] Bicchieri and Lev-On (2011) find the effectiveness of group communication to be lower than dyadic, two-person, communication. Hence, we employ communication in groups of four: two senders and two receivers.

2.3 Procedures

The experiment adopted standard protocols. Participants were seated in computer stations and were not allowed to communication with one another except during the communication stage. The game and the chat part of the experiment were implemented via z-Tree (Fischbacher 2007). A standard web browser was used for the communication session in FB. To standardize procedures across treatments, at the beginning of each session participants in all treatments were asked to open a web browser before initializing the z-Tree software. Experimental instructions were read out loud, distributed as hard copies, and displayed on the participants' screens. At the end of Part 3, we conducted a short questionnaire which asked the participants basic demographic information and several questions on their use of online technologies. Both the questionnaire and the experimental instructions are available in the Supplementary Materials.

3 Results

We conducted 12 experimental sessions with eight participants each, for the total of 96 participants. Table 1 provides a summary of sessions by treatment. All participants were college students, mostly undergraduates, from various majors. The gender split was close to 50/50. Out of 96 participants, only two participants (one in NC treatment and one in FTF treatment) did not have Facebook accounts. 69% of all participants reported using Facebook every day and 72% had more than 100 Facebook friends. Average earnings were about $23, including the $5 show-up fee. The sessions lasted for an average of 70 minutes.

Behavioral benchmarks for TG We discuss several behavioral benchmarks against which we will evaluate the observed behavior in the trust game. The *selfish outcome* corresponds to the subgame perfect equilibrium prediction under the assumption of selfish preferences: senders send zero, and receivers return zero for any amount sent. At the other

Table 1: Trust Game: Treatment Summary

Treatment	Nos. Sessions	Nos. Participants	Nos. of Sender-Receiver Pairs	Nos. of Comm. Groups
NC	3	24	12	6
FTF	3	24	12	6
FB	3	24	12	6
Chat	3	24	12	6

extreme is the set of *joint payoff-maximizing outcomes*, which are achieved as long as sender sends all \$10 (which is then tripled); receiver's action affects only the distribution of payoffs, not their sum. If parties care about the distribution of final payoffs, an *egalitarian outcome* is achieved if, for any amount sent by the sender, the receiver returns back twice the amount sent, i.e., two thirds of the amount received.[6] We will refer to this return as *fair*. Among all egalitarian outcomes, the unique *fair joint-payoff-maximizing outcome* involves sender sending all ten dollars and receiver returning \$20, which gives both parties the payoff of \$20 each.

Results overview Table 2 summarizes the results, including the actual amounts sent and frequencies of sending all, and percentage returned and frequencies of fair return. In addition to actual decisions, the table summarizes the participants' corresponding expectations about their counter-part's actions. 'Before' refers to Part 1, and 'After' to Part 3 observations, which occurred after communication in all but NC treatments. Consider the actual actions first. From Table 2, first observe that the "selfish" behavioral benchmark has very low explanatory power for our data: senders sent zero in only four out of 96 observations, and receivers returned zero in only one out of 92 observations. Next, we see that all forms of group communication increased the amount sent and did not change (under FTF) or increased (under FB and Chat) the percentage returned. In Part 1, before communication, senders

[6]To see this, remember that both the sender and the receiver start with an equal initial endowment of \$10. Letting x, $0 \leq x \leq 10$ be the amount sent, and y, $0 \leq y \leq 3x$ be the amount returned, the final wealth of the sender is given by $W^s = 10 - x + y$, and that of the receiver by $W^r = 10 + 3x - y$; hence $W^s = W^r$ if and only if $y = 2x$. Likewise, $W^s < W^r$ if $y < 2x$, and $W^s > W^r$ if $y > 2x$.

in the three communication treatments sent on average $5.56, while receivers returned on average of $9.00; both amounts are no higher than what senders sent on average ($6.58) and receivers returned on average ($ 10.17) under the no communication baseline. In Part 3, after group communication, senders in the three communication treatments sent on average $3.58 more, while receivers returned, on average, $8.33 more than before. This contrasts sharply with non-positive changes in the amounts sent and percentage returned in Part 3 in the NC baseline.

Table 2: Amounts Sent and Returned Before and After Communication

Treatment		Amount Sent, $		Frequency of Sending all, %		Percentage Returned, %		Frequency of Fair Return, %	
		Before	After	Before	After	Before	After	Before	After
NC	actual	6.58	6.17	41.67	41.67	54.84	48.25	54.55	60.00
	expected	6.00	6.42	25.00	33.33	47.37	42.00	9.09	10.00
FTF	actual	5.83	9.17	16.67	83.33	58.76	59.03	41.67	75.00
	expected	6.25	9.50	33.33	91.67	41.36	65.28	8.33	75.00
FB	actual	4.17	8.42	25.00	58.33	51.16	63.61	27.27	83.33
	expected	4.75	8.08	0.00	58.33	51.16	57.04	45.45	66.67
Chat	actual	6.67	9.83	33.33	91.67	51.99	62.50	33.33	75.00
	expected	6.00	9.92	16.67	91.67	50.61	66.67	33.33	83.33

Notes: 'Before' refers to Part 1, and 'After' to Part 3 observations. For four observations with zero amount sent, the corresponding values of amount returned and expected return are treated as missing.

Figures 1 and 2 illustrate the behavior of senders and receivers in the TG before and after communication. The figures display the tripled amount each sender sent (in light grey) and the amount that the corresponding receiver returned, for each sender-receiver pair before and after communication, by treatment.[7] While we observe a considerable number of senders sending the full amount of 10 dollars in both Parts 1 and 3 even in the NC baseline, we see an increased number of senders sending 10 dollars in Part 3 in all communication treatments. In fact, the frequency of sending all 10 dollars increased from 25% in Part 1 to 77.8% in Part 3 in treatments with communication, whereas is remained at 41.67% in the No Communication

[7]Figures 3 - 6 in Supplementary Materials D show the frequencies of amounts sent by senders and amount returned by receivers, by treatment.

treatment. The frequency of fair 200% return also increased from Parts 1 to Part 3 much more, from 34.2% to 77.8% under communication, compared to a small change, from 54.6% to 60.0%, under no communication. The share of fair joint-payoff-maximizing outcomes increased from 13.9% to 64.6% between Parts 1 and 3 in the communication treatments, whereas it dropped from 25% to 16.7% between Parts 1 and 3 under no communication.

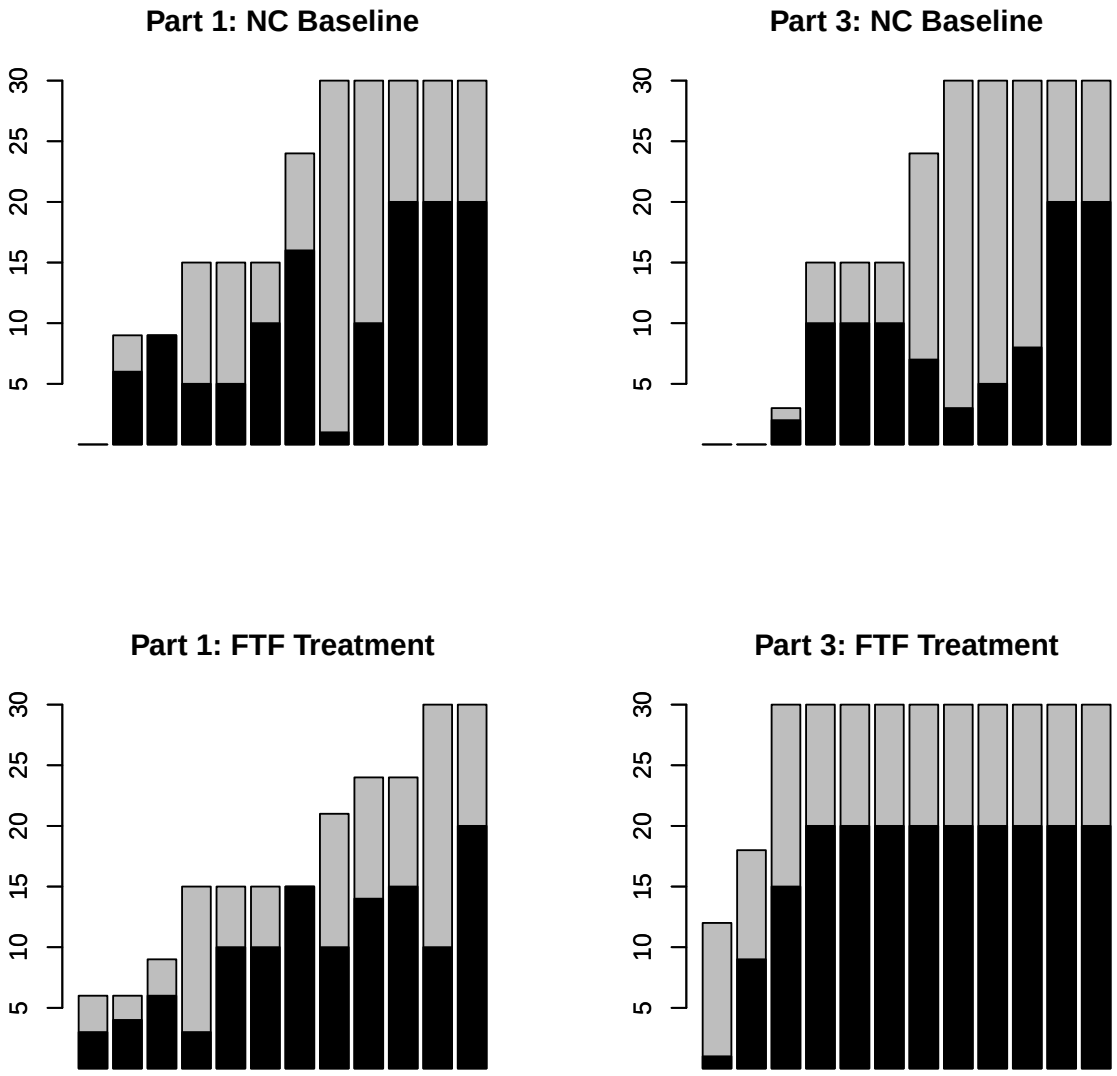

Figure 1: NCand FTF: Amount Sent Tripled (Grey) and Amount Returned (Black), By Match

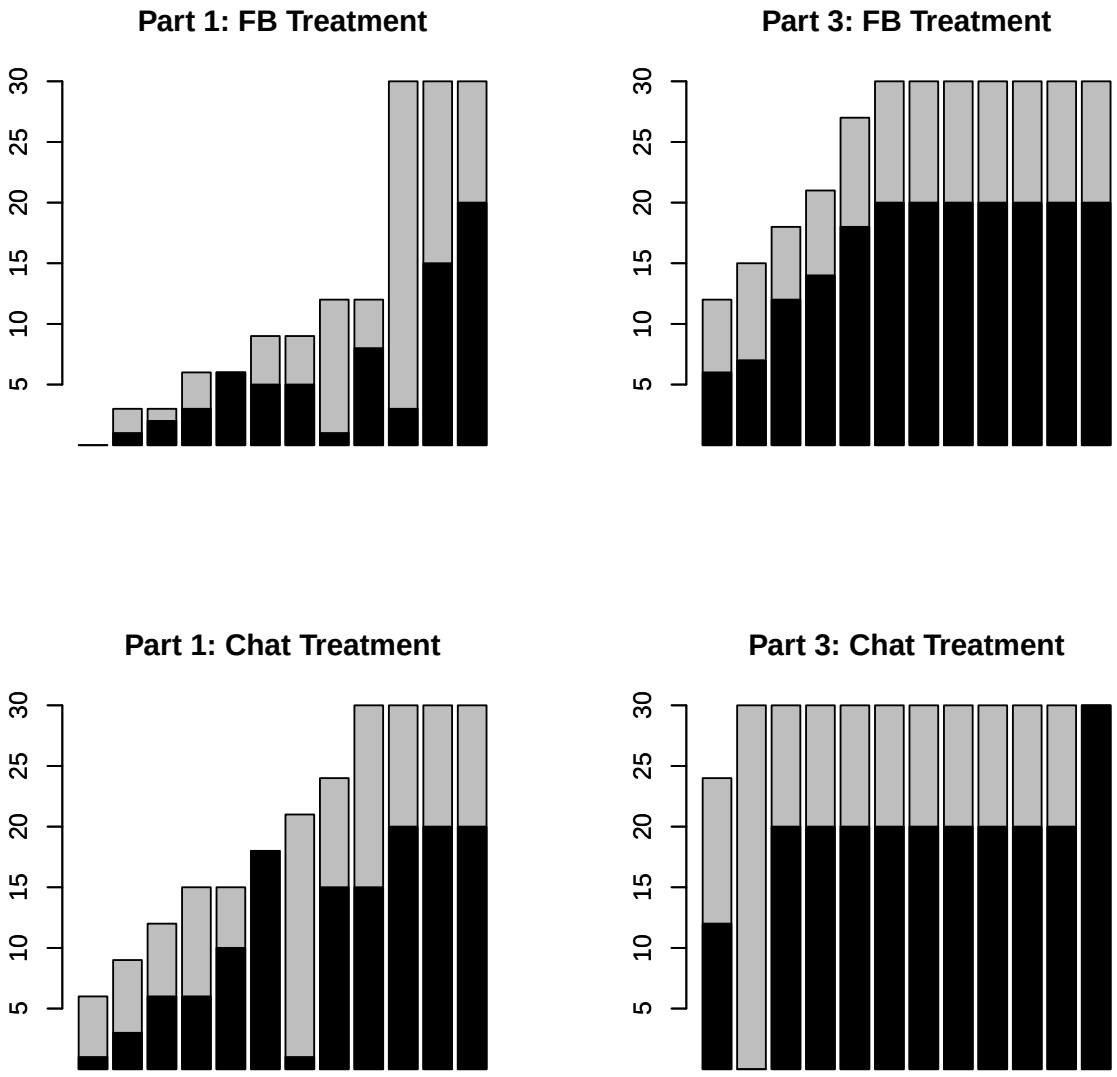

Figure 2: FB and Chat: Amount Sent Tripled (Grey) and Amount Returned (Black), By Match

To assess the effect of different communication modes on sender and receiver behavior, we turn to statistical analyses next.

Sender behavior and expectations Consider sender behavior first. Table 3, columns (1), (3) and (5), display the results of difference-in-difference regressions of amounts sent by

senders on part and treatment dummies, and their interaction terms. For robustness purposes, we consider three regression specifications: a linear and a tobit regression of amount sent; and a logit estimation of probability of sending all ten dollars. To account for possible inter-dependencies of observations within sessions, and for a relatively small number of independent sessions, we conducted, for each regression, 1000 bootstrap estimations based on 12 clusters on session (Efron and Tibshirani 1994).[8]

We observe a positive and significant effect of each communication treatment on the amount sent under all three regression specifications. First observe that coefficient on "After" (Part 3) dummy is negative and significant (for linear and tobit regressions, $p < 0.05$) or zero (for logit regression), indicating that the amount sent decreased, and the probability of sending the full amount did not increase from Part 1 to Part 3 in the baseline No Communication treatment. In contrast, the amount sent increased in Part 3, as compared to No Communication baseline, in all communication treatments: the coefficients on "FTF After", "FB After" and "Chat After" are all positive and significant at 1% or 5% significance level; in addition, the probability of sending all increased under all communication treatments, and significantly so ($p < 0.05$) under both FTF and Chat. Further, based on chi-squared tests, post-communication amounts sent and probabilities of sending all 10 dollars are not statistically different among the three communication treatments at 5% level of significance, indicating that all three communication modes resulted in similar, close to the maximal, amounts sent, and high probabilities of sending all.[9]

To understand the mechanism behind the effect of communication, we consider sender expectations of receiver behavior next. From Table 2, we observe noticeable increases of expected percentage returned under communication treatments, with the average expected

[8]Regression diagnostics indicated that the bootstrap distributions of estimated coefficients (part and treatment coefficients, in particular) did not closely follow a normal distribution. Therefore, we use the percentile method to compute the bootstrap confidence intervals for all estimated coefficients.

[9]Under the difference-in-difference approach, one should compare the changes, rather the absolute amounts, of the amounts sent across treatments. Yet we believe comparing the absolute levels after communication is more informative in our setting because the amount sent was bounded by \$10. The differences in changes in the amount sent and the probability of sending all after communication among three communication treatments were not significantly different at 5% level either.

Table 3: Sender decision, regression estimation

	Amount Sent, $ Linear regression		Amount Sent, $ Tobit estimation		Prob. Send All Logit estimation	
	(1)	(2)	(3)	(4)	(5)	(6)
expect fair return		2.65***		5.89***		3.07***
		(0.39)		(1.03)		(0.71)
FTF	-0.75	-1.33	-1.46	-2.31	-1.27**	-1.66**
	(1.52)	(1.11)	(2.47)	(1.56)	(0.85)	(0.81)
FB	-2.42*	-3.60***	-3.21	-5.52***	-0.76**	-2.53***
	(1.40)	(0.80)	(2.35)	(1.33)	(0.74)	(0.95)
Chat	0.08	-1.16	-0.01	-2.17	-0.36	-1.58*
	(1.40)	(0.96)	(2.45)	(1.58)	(0.79)	(0.82)
After	-0.42**	0.19**	-0.69**	0.36**	-0.00	0.18*
	(0.39)	(0.12)	(0.75)	(0.27)	(0.00)	(0.23)
FTF After	3.75***	1.37***	8.51**	3.45**	3.22***	1.77***
	(1.20)	(0.74)	(13.03)	(10.12)	(0.93)	(0.61)
FB After	4.67***	3.11***	7.11**	4.24**	1.44	1.04
	(1.10)	(0.47)	(9.12)	(5.89)	(1.00)	(1.22)
Chat After	3.58***	1.65**	10.01**	5.73**	3.09***	2.32**
	(0.81)	(0.73)	(12.03)	(10.37)	(0.80)	(1.32)
constant	6.58***	6.94***	7.79***	7.97***	-0.34	-0.38
	(1.30)	(0.75)	(2.24)	(1.21)	(0.74)	(0.56)
sigma			5.07***	3.82***		
			(0.73)	(0.35)		
Number of obs.	96	92	96	92	96	92
Adjusted R-squared	0.2270	0.3577				

Notes: Fair return denotes returning twice the amount sent. "After" refers to Part 3 decisions, which occurred after communication in all but NC treatments. Bootstrap replications based on 12 clusters in session. In four instances where senders sent zero amounts, expectations of fair return are treated as missing, resulting in reduced numbers of observations in even-numbered regressions. */**/*** indicate significance at the 10/5/1 percent level. Significance levels are from bootstrap bias-corrected and accelerated confidence intervals.

share returned at or close to fair return of 66.7% in two out of three (FTF and Chat) communication treatments; following communication, three-quarters or more of all senders expected fair return on their amount sent in all three communication treatments, compared to only ten percent of senders expecting fair return in Part 3 under no communication.

We ask, therefore, whether communication increased the amount sent through affecting sender's beliefs about the amount to be returned by receivers, or through some other channels such as changing preferences towards the receivers (e.g., change in preference because of reduced social distance), or both. While several studies use expected percentage returned as an explanatory variable for the amount sent (Ashraf et al. 2006; Costa-Gomes et al. 2014), in our case a simple indicator variable for sender expecting a positive and fair 200% return on the amount sent explains sender behavior better: the correlation coefficient with the amount sent is higher for "expect fair return" (Spearman's $\rho = 0.5256$) then for the expected percentage returned ($\rho = 0.4417$). As discussed in the Behavioral Benchmarks above, the special value of 200% return on the amount sent would guarantee, for any amount sent, equal payoffs for sender and receiver. Further, if the full amount of \$10 is sent, it guarantees the fair joint-payoff-maximizing outcome, with both sender and receiver getting \$20. Hence, an expectation of 200% return on the investment would make a social-welfare maximizing and inequality-averse sender (Charness and Rabin 2002; Fehr and Schmidt 1999) inclined to send more.

Regression results with the expectation of fair return explanatory variable included are given in Table 3, columns (2), (4) and (6). The coefficients on "expect fair return" are positive and highly significant ($p < 0.01$) under all three regression specifications, suggesting that an increased amount sent after communication is due, to a significant extent, to increased expectations of fair return. Variables "FTF After" and "Chat After" representing corresponding treatment effects (through channels other than expectations) maintain their significance ($p < 0.05$), while "FB After" remains positive but insignificant. Thus communication through all three media affected the amount sent both through increasing sender

expectations of the amount returned, and through changing sender preferences towards the receiver. One exception is FB treatment where the probability of send all $10 appears to be affected by communication mainly through increasing sender expectation of fair return, and only insignificantly through affecting sender preferences.

To verify that communication indeed had a significant effect on expectations, we present, in Table 4, regression analyses of sender expectations on treatment. We find that the expected percentage returned decreased significantly from Part 1 to Part 3 under No Communication (the coefficient on 'After' is negative and significant, $p < 0.05$, under linear and tobit specifications (see columns (1) and (2)); in contrast, it increased significantly after communication under all three communication treatments (the coefficients on 'FTF After', 'FB After' and 'Chat After' are all positive and significant at 5% level under both linear and tobit estimations). The probability of expecting a fair return of 200% also increased under FTF and Chat after communication (column (3)). Note that these regressions are likely to under-estimate the effect of communication since in four cases when senders sent zero (three of which occurred under NC treatment, one in Part 1 and two in Part 3; and one – in Part 1 under FB; see Figures 1-2), the expected returns are treated as missing. This may explain why the change in the expectation of fair return from Part 1 to Part 3 is estimated to be no different between NC and FB treatment, although the frequency of expected fair return remained unchanged under NC (9% in Part 1 and 10% in Part 3), whereas it increased from 45.5% in Part 1 to 66.7% in Part 3 under FB.[10] We conclude:

Result 1. *The amount sent and the probability of sending all ten dollars increased significantly under all communication treatments, but not under no communication. This increase is explained by communication increasing sender expectations of fair return, but also by affecting senders through other channels, such as changing sender preferences towards receivers. There is no clear evidence of any differentiated effect of communication media on*

[10] If, alternatively, the expected returns on zero amount sent are considered to be zero, then the results of the linear and tobit estimations (columns (1)-(2)) remain unchanged. For logit estimation of the probability of expecting fair return (column (3)), the coefficient on 'After' becomes zero, and the coefficient on 'FB After' becomes positive and significant at 5% level.

Table 4: Sender expected return on amount sent, regression estimation

	Sender Expected Return on Amount Sent		Prob. Expect Fair Return
	Linear regression	Tobit estimation	Logit estimation
	(1)	(2)	(3)
FTF	-0.18	-0.19	-0.10
	(0.18)	(0.18)	(9.39)
FB	0.11	0.11	2.12**
	(0.24)	(0.25)	(6.56)
Chat	0.10	0.10	1.61**
	(0.13)	(0.13)	(6.57)
After	-0.16**	-0.17**	0.11**
	(0.13)	(0.15)	(0.08)
FTF After	0.88***	0.92***	3.39**
	(0.15)	(0.16)	(6.52)
FB After	0.34**	0.35**	0.77
	(0.18)	(0.19)	(0.52)
Chat After	0.64***	0.66***	2.20***
	(0.20)	(0.21)	(0.68)
constant	1.42***	1.42***	-2.30**
	(0.09)	(0.09)	(6.55)
sigma		0.45***	
		(0.05)	
Number of obs.	92	92	92
Adjusted R-squared	0.2230		

Notes: Expected return is normalized by the amount sent. Fair return denotes returning twice the amount sent. In four instances where senders sent zero amounts, expected returns are treated as missing.
Bootstrap replications based on 12 clusters in Session. */**/*** indicate significance at the 10/5/1 percent level. Significance levels are obtained from bootstrap bias-corrected and accelerated confidence intervals.

sender behavior or expectations.

Receiver behavior and expectations We now turn to receivers. Regression estimations of receiver decisions on the amount and share returned, and on the probability of fair return, are presented in Table 5. As with senders, first consider the direct effect of communication treatments on receiver behavior (columns (1), (3) and (5) in the table). We observe that the amount sent affects the amount returned, but not the share returned by receivers: the coefficient on 'amount sent' is positive and significant in regression (1), but not in regression (3); the probability of fair return is significantly positively associated with senders sending all (column (5)), but not with other amounts sent. Next, while both the amount and the share returned decreased in Part 3 under no communication (the coefficient on 'After' is negative and significant, $p < 0.05$), all three communication treatments displayed a significant increase in the amount returned after communication even controlling for the amount sent: the coefficients on 'FTF After', 'FB After' and 'Chat After' are all positive and significant at 5% level (column (1)); however, the share returned is estimated to increase after communication only under Chat (column (3)), while the probability of fair return increased significantly under FB only (column (5)).

Can the increase in the amount returned observed in all communication treatments, conditional on the amount sent (column (1) above), be attributed to changes in receiver expectations? We we now add receiver expectations of the amount sent by sender to the set of explanatory variables of receiver behavior, as displayed in columns (2), (4) and (6) in Table 5. We observe that expectations have a robust, significant and positive effect on receiver behavior. In the presence of receiver expectations, most other explanatory variables lose significance, although the amount sent remains significant in the estimation of the amount returned (column (2)), and the indicator on 'sent all' stays significant in the estimation of the probability of fair return (column (6)). In other words, receiver behavior is driven by receiver expectations of the amount sent as well as by the actual amount sent. Furthermore,

Table 5: Receiver decision, regression estimation

	Amount Returned, $ Linear regression		Share Returned Tobit estimation		Prob. Fair Return Logit estimation	
	(1)	(2)	(3)	(4)	(5)	(6)
receiver expectation		0.74***		0.04***		0.36*
		(0.16)		(0.01)		(0.21)
amount sent	1.37***	1.55***	-0.01	-0.00	-0.20	-0.16
	(0.31)	(0.34)	(0.02)	(0.02)	(0.15)	(0.18)
sent all	1.22	0.16	0.06	-0.01	2.30**	2.32**
	(1.73)	(1.92)	(0.09)	(0.11)	(1.06)	(1.19)
FTF	1.10	0.92	0.04	0.03	-0.16	-0.30
	(2.45)	(2.52)	(0.15)	(0.15)	(5.50)	(5.48)
FB	-0.99	0.23	-0.06	0.01	-1.32*	-0.92
	(2.63)	(2.82)	(0.16)	(0.15)	(0.78)	(1.03)
Chat	1.01	1.04	-0.03	-0.03	-0.79	-0.94
	(2.29)	(2.27)	(0.14)	(0.13)	(0.57)	(0.89)
After	-1.94**	-1.65	-0.07**	-0.06	0.18**	0.31
	(1.01)	(1.48)	(0.05)	(0.05)	(4.43)	(4.79)
FTF After	3.66**	1.06	0.07	-0.08	0.45	-0.85
	(1.43)	(1.85)	(0.08)	(0.08)	(6.89)	(6.96)
FB After	6.42**	3.33	0.22	0.04	2.70**	1.88**
	(2.95)	(2.54)	(0.15)	(0.11)	(4.52)	(4.76)
Chat After	4.16***	1.01	0.18**	-0.00	1.01	-0.48
	(1.29)	(2.02)	(0.07)	(0.08)	(4.70)	(4.81)
constant	0.73	-4.61	0.62***	0.31*	0.57	-1.89
	(2.31)	(3.45)	(0.16)	(0.18)	(0.83)	(2.20)
sigma			0.22***	0.20***		
			(0.02)	(0.02)		
Number of obs.	92	92	92	92	92	92
Adjusted R-squared	0.5544	0.6090				

Notes: Share returned is out of tripled amount sent. Fair return denotes returning twice the amount sent. Bootstrap replications based on 12 clusters in session. */**/*** indicate significance at the 10/5/1 percent level. Significance levels are from bootstrap bias-corrected and accelerated confidence intervals.

the effect of expectations maintains its significance in all regression specifications considered, whereas the actual amount sent affects significantly only the amount, not the percentage returned. Sender sending all ten dollars increases the probability of fair return, but not the percentage returned, indicating a substantial variability of the latter.

We therefore confirm a positive association between receiver expectations and actions that has been documented in other studies (Guerra and Zizzo 2004; Costa-Gomes et al. 2014). We next explore whether and how these expectations changed between Parts 1 and 3 of the experiment, and whether these changes, if any, were any different between communication and no communication treatments, and across communication media.

The results of regression estimations of the effect of treatments on receiver expectations of the amount sent, and of the probability that receivers expect senders to send all, are presented in Table 6. While receivers expectations did not change significantly (at 5% significance level or better) between Parts 1 and 3 under no communication, these expectations increased after communication in all three communication treatments. The expectations change was significant in two out of three communication treatments, FTF and Chat (the coefficients on 'FTF after' and 'Chat After' are positive and significant at 5% level under both linear and tobit estimations; see columns (1) and (2)); for the FB treatment, the expectation change was also highly positive on average but insignificant, likely due to large variability of these changes across individuals. Furthermore, FTF, FB and Chat all displayed a significant (at 1% level) increase in the share of receivers expecting senders to send all ten dollars following the communication stage (see column (3)), with FB exhibiting the highest increase (from 0 percent before to 58.3 percent after communication).

Turning to the differences across communication treatments, we observe that post-communication shares of receivers expecting 'sent all' were marginally significantly different (lower) under FB as compared to either FTF or Chat treatments ($p = 0.0575$ in both cases, chi-squared test, two-sided, although the null hypothesis of no difference in expectation changes among the three treatments cannot be rejected: $p = 0.1188$, chi-squared test). Indeed, from Table 2,

Table 6: Receiver expectation of amount sent, regression estimation

	Receiver Expectation of Amount Sent, $		Prob. Expect Send All
	Linear regression	Tobit estimation	Logit estimation
	(1)	(2)	(3)
FTF	0.25	0.45	0.41*
	(1.00)	(1.24)	(0.28)
FB	-1.25	-1.89**	-15.34***
	(0.85)	(1.06)	(0.54)
Chat	-0.00	-0.17	-0.51*
	(1.08)	(1.23)	(0.43)
After	0.42	0.50	0.41*
	(0.83)	(1.10)	(0.37)
FTF After	2.83**	6.67**	2.69***
	(1.16)	(8.04)	(0.56)
FB After	2.92	4.65	16.37***
	(2.02)	(7.10)	(1.18)
Chat After	3.50**	8.48**	3.60***
	(1.37)	(9.41)	(0.93)
constant	6.00***	6.50***	-1.10***
	(0.36)	(0.38)	(0.00)
sigma		3.70***	
		(0.31)	
Number of obs.	96	96	96
Adjusted R-squared	0.3020		

Notes: Bootstrap replications based on 12 clusters in session. */**/*** indicate significance at the 10/5/1 percent level. Significance levels are obtained from bootstrap bias-corrected and accelerated confidence intervals.

91.7% of receivers under both FTF and Chat expected senders to send all 10 dollars after communication, compared to only 58.3% under FB. However, we believe that the difference is explained by receivers lower initial expectations under FB, rather than lower effectiveness of FB communication compared to other media (FTF or Chat). Compared to other treatments, receivers under FB before communication had significantly lower expectations of the amount sent overall, and fewer receivers expected senders to send all (columns (2) and (3) in Table 6); in fact, no receiver under FB expected senders to send all 10 dollars before communication (Table 2). Our findings suggest that while receiver expectations adjusted upward dramatically after communication under all treatments, the differences between subject initial expectations persisted even after communication, with FB receivers remaining the least "optimistic" about sender behavior. It is notable that these lower expectations did not translate into lower, compared to FTF and Chat, returns by receivers, with receivers under FB returning as high a share of the amount received, and making a fair return more frequently than receivers under FTF and FB treatments (Tables 2 and 5).

We conclude:

Result 2. *The amount returned increased significantly after communication under all three communication treatments. This increase is due to both the increase in the actual amount sent by senders, and to the increase in receiver expectations of the amount sent. Receivers who observed senders send all were significantly more likely to make a fair return, resulting in a high frequency of fair joint-payoff-maximizing outcomes after communication. There is no evidence of differentiated effect of communication on receiver actions or expectations across the FTF, FB and Chat media. Receivers in the FB treatment had lower, compared to other treatments, initial expectations of sender behavior; while these lower expectations persisted to some degree even after communication, they did not translate into lower shares returned or fewer fair returns following communication.*

We summarize these results as follows. Communication had a strong effect on senders, causing them to send significantly more dollars to the receivers, both because they expected

receivers to return more, and because their preference towards receivers has changed after communication. In contrast, communication did not directly affect the percentage receivers sent back to senders. However, since both the amount sent and receiver expectations of the amount sent significantly increased after communication, so did the absolute amount returned. Senders expecting a fair return were significantly more likely to send the full amount, and receivers receiving the full amount were significantly more likely to return a fair share, resulting in almost two thirds of sender-receiver pairs obtaining the fair joint-payoff maximizing outcome after communication. Moreover, these results do not differ, qualitatively, across the three communication media. All three communication media, FTF, FB and Chat, were equally effective in enhancing trust through the increased expectations of fair return and enhanced preferences channels, and in enhancing trustworthiness through the increased expectation of amount sent channel.

4 Communication Analysis

To better understand the reasons for the effectiveness of communication under the three communication media, we now turn to a detailed analysis of participant conversations. First, we consider whether FTF, FB and Chat media differ in communication volume and in the composition of messages - specifically, the proportions of "irrelevant" social, and game-relevant messages. Further, we search for the types of message contents that had a significant impact on the enhancement of trust and trustworthiness. Was engaging in game-relevant conversation alone important, or was the social and emotional aspect of communication important as well? Which game-relevant topics had a significant impact on sender and receiver behavior?

All TG communication sessions were recorded, using an audio recorder under FTF, computer logs under FB, and z-tree chat session logs under Chat. FTF sessions were then transcribed by a stenographer. We conducted content analyses of communication logs us-

ing two complementary approaches: using human coders (similar to Chen and Chen (2011) and Cooper and Kühn (2014)) and using a standard Content Analysis software package *Linguistic Inquiry and Word Count 2007* (LIWC). We focus on human-coder analysis in Subsection 4.1, and turn to the computational analysis in Subsection 4.2.

4.1 Game-relevant and social communications

Two independent human coders classified all messages into either social or game-relevant content categories, and into three statement types: (i) proposals and explanations, (ii) questions, and (iii) approvals and agreements. Game-relevant categories included: discussion of norms and goals (money maximization, equal split, fairness), division of payoffs (how much to send and return), and implementation and enforcement issues (not cheating, trust, etc.). Detailed classification categories are available in Supplementary Materials E. We allowed for one content category per message; disagreements between the two coders were rare. A measure of inter-coder agreement for Message Content and Message Type, κ (Cohen 1960), along with the distribution of messages by content category and by statement type, are reported in Table 7.

Before analyzing the content, we consider communication volume. Table 8 summarizes the average number of messages (uninterrupted statements) and the share of game-relevant messages per communication group by treatment. We see that FTF groups are characterized by a much higher communication volume: 120.67 messages on average per group as compared to only 35.1 messages under FB and 76.33 messages under Chat. The differences between all three treatments are highly significant according to Wilcoxon Mann-Whitney (WMW hereafter) test: $p = 0.0011$ (FTF vs FB), $p = 0.01$ (FTF vs Chat), $p = 0.0011$ (FB vs Chat). Interestingly, the share of game-relevant messages is the highest under FB: 69.98%, followed by 56.41% under FTF, and the lowest, 54.06%, under Chat; the difference in shares between FB and Chat is significant ($p = 0.0465$). This indicates that FB, while characterized by relatively low communication volume, was more focused on game-relevant conversations

Table 7: Communication Content by Treatment

Message Description	FTF Treatment % observed	κ	FB Treatment % observed	κ	Chat Treatment % observed	κ
Message Content Categories						
Empty Content	0.14		0.94		8.03	
Social Discussion	46.48		31.13		45.58	
Norms and Goals Discussion	7.17		9.91		6.83	
Strategy: Division and Payoff	15.45		29.25		27.11	
-in particular, send 10	3.17		6.13		4.82	
-in particular, send 10, return 20	5.66	0.7798	15.09	0.7186	15.26	0.6047
Strategy: Implementation	9.93		16.04		4.42	
-in particular, messages on cheating	0.97		3.30		0.20	
-in particular, messages on trust	7.31		7.08		1.00	
Payoff/Game Discussion	8.97		7.55		6.02	
Personal Game-Related Discussion	11.86		5.19		2.01	
Message Type Categories						
Empty Content	0		0.94		7.83	
Statement/Proposition	71.57		67.45		66.27	
Question/Doubt/Confusion	21.00	0.7381	18.40	0.7625	13.45	0.5973
Approve/Agree/Ok	7.43		13.21		12.45	

compared to the other two treatments.

Table 8: Group Communication Volume by Treatment

	FTF Treatment		FB Treatment		Chat Treatment	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Nos. Messages	120.67	(30.26)	35.17	(6.82)	76.33	(19.36)
Share of game-relevant messages	0.56	(0.24)	0.70	(0.13)	0.54	(0.23)
Nos. of Communication Groups	6		6		6	

We also find some evidence reminiscent of Rocco and Warglien (1996) who report that that anonymous online chats are often characterized by large volumes of chaotic, nonsensical chatter: 8% of the content under Chat was categorized as "Empty Content" but less than 1% of the content in FTF and FB was "empty". The findings in Section 3 above indicate, however, that a higher share of empty content under Chat did not make this communication media less effective in enhancing trust and trustworthiness.

Result 3. *Among the three communication media, Face-to-Face was characterized by signifi-*

cantly higher communication volume, whereas Facebook had the lowest volume but the highest share of game-relevant messages. Almost half of all messages under FTF and Chat, but only one-third of the messages under FB, were social, game-irrelevant discussions.

We now conduct regression analysis of trust (amount sent) or trustworthiness (share returned) of individual senders and receivers in the post-communication trust game with the content and volume of communication as explanatory variables. Due to a limited number of independent communication groups, we keep the number of explanatory variables low, and consider these analyses exploratory.[11] We chose the set of content variables to provide the best fit; therefore, not all content categories are included.[12] Aside from the variables on number of social and specific game-relevant messages, the explanatory variables include FB and Chat treatment dummies (FTF treatment is the omitted variable), the pre-communication amount sent for senders or the pre-communication percentage returned for receivers (to control for initial individual differences), and, for receivers, the amount they have been sent. To allow for comparison across treatments, the number of messages in each category is normalized by the average communication volume by treatment. The results are presented in Table 9.

We can make several observations of interest. The sender's pre-communication amount sent and receiver's pre-communication percentage returned both have a positive but insignificant effect on post-communication sender and receiver behavior. For senders (column (1) in Table 9), the number of social messages have positive and marginally significant effect ($p < 0.1$), and the number of game-relevant messages significantly increase the amount sent ($p < 0.05$), indicating that both social and game-relevant communications improve trust. Messages on sending the full amount of 10 (implying joint payoff maximization) without discussing the amount returned have an insignificant effect on the amount sent, while mes-

[11] Maximum likelihood estimations of the probability of sending all and the probability of fair return could not be completed as convergence was not achieved in either case. Likewise, bootstrap replications could not be successfully completed.

[12] Message type categories, such as the share of questions and approvals, had an insignificant effect on behavior and were dropped from the set of explanatory variables.

Table 9: Effect of communication volume and relevance on after-communication decisions

	Amount sent, tobit estimation (1)	Share returned Linear regression (2)	Share returned Tobit estimation (3)
amount sent before	0.25		
	(0.23)		
amount sent to receiver		0.06***	0.06***
		(0.02)	(0.01)
percentage returned before		0.25	0.26
		(0.19)	(0.18)
number of social messages	7.89*	-0.21**	-0.22**
	(4.04)	(0.10)	(0.09)
number of game-relevant messages	24.02**	-0.33	-0.34*
	(10.46)	(0.21)	(0.18)
number of messages on send 10	24.36	-0.31	-0.29
	(17.50)	(0.46)	(0.42)
number of messages on send 10, return 20	49.33***	-0.10	-0.12
	(12.00)	(0.37)	(0.33)
number of 'no cheating' messages	-134.01***	0.80	0.81
	(43.78)	(0.68)	(0.63)
number of messages on trust	9.61	0.07	0.07
	(14.08)	(0.35)	(0.30)
FB	-3.87*	0.13**	0.13***
	(2.19)	(0.05)	(0.04)
Chat	-1.69	0.04	0.04
	(2.03)	(0.06)	(0.06)
constant	-8.52	0.19*	0.19*
	(8.86)	(0.11)	(0.09)
Number of observations	36	35	35
square root of the residual variance	2.63***		0.12***
	(0.58)		(0.03)
R-squared		0.49	

Notes: Number of messages are normalized by the average communication volume per treatment. In the receiver regression, we dropped one observation where the sender sent zero in Part 1. 'Before' refers to Part 1 decisions. FTF is the baseline/omitted treatment. Standard errors are adjusted for 18 clusters in communication groups. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

sages on sending 10 and returning 20 (implying joint payoff maximizing and fair outcome) significantly increase the amount sent ($p < 0.01$). Interestingly, messages on cheating, although stated mostly as appeals not to cheat, significantly reduced the amount sent by senders ($p < 0.01$). Such messages likely expressed sender concerns about receiver trustworthiness, or anchored sender attention to the receivers' lack of incentives to send anything back. Mentioning trust had an insignificant effect on sender behavior.

Turning to receiver behavior (columns (2) and (3) in the table), we observe that, curiously, the number of social messages had a negative effect on the percentage returned. Further, consistent with Section 3 findings, the content of communications had little effect on the percentage returned: the coefficients on content variables are insignificant. However, the share returned was positively associated with the amount sent to receiver ($p < 0.01$). Hence, for receivers, communication contents appears to have little relevance; yet, as we obtained in Section 3, the act of communication itself increased receiver expectations of trust, and increased receiver trustworthiness through the expectations channel.

Considering whether FTF, FB and Chat media had a differentiated effect via channels other than verbal contents, we observe that senders under FB sent marginally significantly ($p < 0.1$) lower amounts than under FTF, other things being equal; but receivers under FB exhibited higher trustworthiness in spite of lower trust shown by senders ($p < 0.05$). However, these differences are likely due to variations in participant initial characteristics which persisted through the session. We find no evidence of significant differences among the communication media.

Result 4. *Both social and game-relevant discussions had a positive effect on sender behavior. Specifically, discussions of 'sending 10, returning 20', had a strong, positive and significant effect on the amount sent. Discussion of cheating resulted in lower amount sent, and messages on trust were of no significance. For receivers, communication contents had little effect on behavior. Controlling for communication contents, there were no significant differences in the effect of communications via FTF, FB and Chat media.*

4.2 Linguistic analysis

The words used in each Trust Game communication session were also analyzed using a Content Analysis software package: *Linguistic Inquiry and Word Count 2007* (LIWC). The software processes each word spoken or written by searching for it from a list of category dictionaries and then incrementing the score of any category that the word appears in. For example, the word "distrust" is part of three word categories: (i) affect, (ii) negative emotion, and (iii) anger. Hence, if "distrust" is found in the text for a group, each of these three category scores gets incremented for that group.

We use the output from the software to explore whether differences in the words used by groups are associated with individual-level differences in trust and trustworthiness. We consider the following word categories which may impact the amount of money sent and returned: the number of words per sentence, numerals, money, positive emotions, negative emotions, question mark, and exclamation mark. The numerals category include words like "second" and "thousand"; the money category includes words like "cash", "audit", and "owe"; the positive emotions category includes words like "love", "nice" and "sweet"; the negative emotions category includes words like "hurt", "ugly", and "nasty"; and the question mark and exclamation mark categories include their respective punctuation marks.

Table 10 present the results of regressions of sender and receiver actions on the above word categories. Both the "Amount Sent" and the "Share Returned" estimation results are consistent with, and complement, the results from the content analysis that used human coders (Table 9). The shares returned by the receivers are only affected by the amount sent by the senders. The amounts sent, on the other hand, increase the more participants talk about numerals, decrease the more participants use words that evoke negative emotions, and decrease the more participants use question marks. The results for numerals and question marks hold even after controlling for individual sender predispositions (measured by the amount sent in Part 1). We also reconfirm that senders under FB are less trusting, as they

Table 10: Effects of Communication on Amount Sent and Returned (LIWC)

Dependent Variable:	Amount Sent ($)		Share Returned		
	(1)	(2)	(3)	(4)	(5)
Amount sent before		0.09			
		(0.09)			
Share returned before					0.24
					(0.15)
Amount sent to receiver				0.08***	0.08***
				(0.02)	(0.02)
FB	-1.60*	-1.58*	-0.04	0.09	0.09
	(0.86)	(0.88)	(0.10)	(0.07)	(0.07)
Chat	0.47	0.08	-0.00	-0.04	-0.10
	(1.40)	(1.27)	(0.19)	(0.13)	(0.12)
Words per sentence	-0.01	0.01	0.01	0.01	0.01
	(0.06)	(0.06)	(0.00)	(0.00)	(0.00)
Numerals	0.36**	0.35**	0.02	-0.01	-0.00
	(0.13)	(0.14)	(0.02)	(0.02)	(0.02)
Money	0.50	0.57	0.04	-0.00	0.02
	(0.53)	(0.54)	(0.04)	(0.05)	(0.04)
Positive emotions	0.20	0.17	-0.01	-0.03	-0.02
	(0.27)	(0.27)	(0.02)	(0.02)	(0.02)
Negative emotions	-0.7544*	-0.69	-0.01	0.05	0.06
	(0.44)	(0.41)	(0.06)	(0.04)	(0.04)
Question marks	-1.13***	-1.09***	-0.05	0.05	0.05
	(0.38)	(0.35)	(0.05)	(0.04)	(0.04)
Exclamation marks	0.45	0.49	-0.01	-0.05	-0.02
	(0.34)	(0.33)	(0.07)	(0.06)	(0.05)
Constant	9.69***	8.84***	0.56***	-0.25	-0.46*
	(1.54)	(1.70)	(0.16)	(0.26)	(0.27)
R-squared	0.58	0.6	0.27	0.53	0.6
Nos. Obs.	36	36	36	36	36

Notes: Ordinary Least Squares regressions ran. Robust standard errors clustered on a group level in parentheses. *Share Returned* is the ratio of amount returned by the receiver and three times the amount sent by the sender. *FB y* and Chat are treatment dummies corresponding to the FB and Chat treatments. 'Before' refers to Part 1 decisions. The independent variables counting words by categories are obtained using the LIWC software. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

send less compared to other treatments.

Result 5. *Senders in groups that discussed specific numerical proposals sent higher amounts, while senders in groups that used more negative emotion words and questioned more sent lower amounts. Receivers were not significantly affected by communication contents or emotions but returned a higher share when they received higher amounts.*

5 Conclusion

We presented an experiment that considers how communications under different popular media affect trust game play through player expectations and preferences. Our findings are quite stark. The three communication media that we study, – the traditional face-to-face, the popular online media Facebook, and anonymous chat, – all lead to equally significant increases in trust and trustworthiness. While face-to-face was characterized by the highest communication volume, Facebook had the smallest volume but the highest share of game-relevant content, with all three media proving equally effective in enhancing trust and trustworthiness. These findings are in contrast with earlier studies documenting superior effects of face-to-face (Brosig et al. 2003; Bochet et al. 2006), but in agreement with more recent evidence on the growing effectiveness of online media (Abatayo et al. 2018). Apparently, having access to any kind of free-form communication prior to making decisions in the trust game allowed participants to discuss and achieve joint-payoff-maximizing and fair outcomes. These outcomes were achieved in spite of the group, no-dyadic nature of communications, and irrespective of participants' ability to see or hear other participants live (as under face-to-face), or see others' pictures, names and public profiles (as under Facebook).

We further explore the reasons for the high effectiveness of communication. We establish a special, focal role of sender expecting a fair return, and receiver expecting the maximal amount sent. Senders expecting a fair return were significantly more likely to send the full amount, and receivers expecting and receiving the full amount were significantly more likely

to return a fair share. These expectations, that were greatly enhanced through communication, resulted in almost two thirds of sender-receiver pairs obtaining the joint-payoff maximizing fair outcome after communication, providing evidence of participant preferences for efficiency and fairness (Charness and Rabin 2002; Fehr and Schmidt 1999). Indeed, using contents analysis, we confirm that discussing sending the full amount and returning a fair share had a strong positive impact on implementing these outcomes.

Our findings are consistent with Ben-Ner and Putterman (2009) who report that both senders and receivers favor fair and efficient divisions. However, in our experiments, communication affected senders and receivers via somewhat different channels. Communication had a strong effect on senders, causing them to send significantly more dollars to receivers, both because they expected receivers to return more, and because their preferences towards receivers changed after communication. This finding agrees with Ashraf et al. (2006) and Sapienza et al. (2013) who report that sender trust is driven by both beliefs and preferences. For receivers, we find that communication did not directly influence the percentage they sent back to senders. However, since both the amount sent and receiver expectations of amount sent increased significantly after communication, so did the amount returned.

The finding on an insignificant direct effect of communication on percentage returned by receivers may appear puzzling, although not inconsistent with Fiedler and Haruvy (2009) and Babin (2020). Receivers do not seem to be significantly affected by communication contents either. Apparently, receivers' behavior in our experiment is largely driven by their adherence to a social norm of giving back a fair share in response to the full amount sent; communication enhances receiver expectation of senders sending the full amount, thus making receivers more likely to return a fair share.

We further obtain interesting insights into communication contents. Not only we find that game-relevant discussions are critical for achieving efficient and fair outcomes; social discussions also increase the amount sent, most likely though enhancing sender preferences towards receivers. Using computational linguistics analysis, we further document a detri-

mental effect of negative emotions and question marks on trust: participants in groups who expressed negative emotions and asked more questions sent less. The finding on the negative effect of question marks is in curious contrast with Chen and Chen (2011), who report that participants who asked more questions during problem-solving stage chose higher efforts in a minimum-effort coordination game. It appears that the effect of questions is highly context-dependent; while it may indicate constructive inquiry and higher group involvement under problem-solving, it may also signal doubts and and concerns about cheating in settings such as trust game.

In sum, we demonstrate that online communication, traditionally a limited medium, has become as effective as direct face-to-face communication in inducing individuals to trust and return trust in a simple laboratory settings. We observe no differences in either overall effects of different communication media, or in the channels through which these media affect sender or receiver behavior. The next challenge is to consider features of economic situations where such media equivalence breaks down. We leave this challenge for future inquiry.

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Appendices

A Instructions

A.1 Part 1 Instructions (ALL)

Introduction
Welcome to the experiment. This is an experiment funded by a research foundation to study decision making. For showing up on time, you will be paid a $5 show-up fee. You may receive additional earnings based on your and others decisions. All payoffs will be in "computer dollars".

This experiment is composed of several parts. At the end of the experiment, the computer will randomly pick a part for which you will get paid for. We will pay you in cash an amount equal to $1.00 for every computer dollar that you earn.

Today's session will take about an hour and a half. Please do not communicate with other participants during the experiment.

Click CONTINUE when you are ready to go on.

Decisions and payoffs
In this part of the experiment, you will be randomly matched with another person. You and the person you are matched with will receive ane endowment of 10 computers dollars each. One of you will be randomly assigned as Person A and the other will be assigned as Person B. Person A will have the opportunity to send some, all or none of their endowment to B. Each computer dollar sent to B will be tripled. B will then decide how much money to send back to A. B can send back some, all or none of what they received from A.

Click CONTINUE when you are ready to go on.

Examples
To help you determine the potential payoff you and the other person you are matched with can make, you will have access to the Calculator on the left at all times. This allows you to explore hypothetical situations before actually making decisions.

Let's try it now.

EXAMPLE 1:

A decides to send 6 computer dollars, B sends back 4 computer dollars

A's payoff = 8 computer dollars = 10 computer dollars endowment – 6 computer dollars sent to B + 4 computer dollars sent back by B

B's payoff = 24 computer dollars = 10 computer dollars endowment + 3*(6 computer dollars sent by A) – 4 computer dollars sent back to A

EXAMPLE 2:

A sends 3 computer dollars, B sends back 8 computer dollars

A's payoff = 15 computer dollars = 10 computer dollars endowment – 3 computer dollars sent to B + 8 computer dollars sent back by B

B's payoff = 11 computer dollars = 10 computer dollars endowment + 3*(3 computer dollars sent by A) – 8 computer dollars sent back to A

Feel free to experiment with the calculator now. Enter any number between 0 and 10 under "How much A sends to B" and any number between 0 and the amount received from A under "How much B sends to A" to explore how the earnings change. Feel to experiment as many times as you like.

ARE THERE ANY QUESTIONS?

Click NEXT when you're done.

Entering Decisions for A
Your computer screen will display your type (A or B) and your ID number. Your type and ID number will be the same for the entire experiment.

If you are assigned as Person A, you will decide how much of your endowment to send to Person B.

While Person A is making their decision, Person B will be asked how much they expect A to send to them. Person B will receive a $1 bonus if their expectation exactly matches A's decision and the bonus will decrease as B's expectation gets further away from A's decision. The lowest value for the bonus is $0.

Please practice entering A's decision in the top left box and B's expectation in the bottom left box now. This is for practice and it will not affect your payoff in the actual experiment.

ARE THERE ANY QUESTIONS?

Entering Decisions for B
After Person A has made their decision, if you are assigned as Person B, you will be informed how much you received from A and you will decide how much of that amount you would like to send back.

While Person B is making their decision, Person A will be asked how much they expect B to send back to them. Person A will receive a $1 bonus if their expectation exactly matches B's decision and the bonus will decrease as A's expectation gets further away from B's decision. The lowest value for the bonus is $0.

Please practice entering B's decision in the top left box and A's expectation in the bottom left box now. This is for practice, and it will not affect your payoff in the actual experiment.

ARE THERE ANY QUESTIONS?

Click CONTINUE when you are ready for a review.

A.2 Review Questions

Use the calculator on the left to answer the following questions.

Suppose Person A sent 7 computer dollars and Person B sent back 11 computer dollars. What is:

1. Person A's payoff:

2. Person B's payoff:

Once the experimenter has checked your work, press NEXT.

Results will not be shown until the end of the experiment. At the end of the experiment, you will be informed of your decision, the decision of the person you were matched with, and your payoff.

ARE THERE ANY QUESTIONS?

Click CONTINUE when you are ready to go on.

A.3 Part 2 Instructions (FTF)

In this part of the experiment, you will participate in the same experiment as before, with a different person. In some previous experiments, participants found it beneficial to communicate with each other. We will now give you an opportunity to communicate in person. After the communication time is over, you will participate in the same experiment as before, with one of the people you just communicated with.

You will have an opportunity to communicate in groups of four people. You will be facing the other people in your group. The people in your discussion group are picked at random from all of the experiment participants and do not necessarily include the person that you were matched with in Part 1 of the experiment. Your discussion group does include the person you will be matched with in Part 2.

The experimenter will direct you to your discussion group now. Please do not start communication until the experimenter says so.

ARE THERE ANY QUESTIONS?

Has everyone joined the group now? You will now be given 10 minutes to communicate with the people in your group.

Please start communication now.

[PAUSE]

The communication time is now over. Please stop talking and return to your computer terminals.

You will now participate in the same experiment as before, with one of the people you just communicated with.

ARE THERE ANY QUESTIONS?

A.4 Part 2 Instructions (FB)

In this part of the experiment, you will participate in the same experiment as before, with a different person. In some previous experiments, participants found it beneficial to communicate with each other. We will now give you an opportunity to communicate through a Facebook group. After the communication time is over, you will participate in the same experiment as before, with one of the people you just communicated with.

In your screens please enter your email address that is connected to your Facebook account. When you're done entering your email address, please press OK.

Please give the experimenter a few minutes to invite your email addresses to a Facebook group. The experiment will invite you to join a Facebook group. In the email address that you have provided us earlier, you will find a message from Facebook inviting you to a group. You will have an opportunity to communicate in groups of four people. The people in your discussion group are picked at random from all of the experiment participants and do not necessarily include the person that you were matched with in Part 1 of the experiment. Your discussion group does include the person you will be matched with in Part 2. Prior to starting communication, we will give you a few minutes to log in to your Facebook account and join the group. Please do not start communication until the experimenter says so.

ARE THERE ANY QUESTIONS?

Please raise your hand if you cannot find the invitation in your email, or if you need help joining the Facebook group. On the next page, you will find step-by- step instructions on how to join the group, communicate with the other people in your group, and delete your Facebook account.

[PAUSE]

Has everyone joined the group now? You will now be given 10 minutes to communicate with the people in the group via Facebook posts.

Please start communication now.

[PAUSE]

The communication time is now over. Please log off your Facebook accounts and close the web browser. The experimenter will remove you from the discussion group momentarily.

You will now participate in the same experiment as before, with one of the people you just communicated with.

ARE THERE ANY QUESTIONS?

A.5 Part 2 Instructions (C)

In this part of the experiment, you will participate in the same experiment as before, with a different person. In some previous experiments, participants found it beneficial to communicate with each other. We will now give you an opportunity to communicate via computer. After the communication time is over, you will participate in the same experiment as before, with one of the people you just communicated with.

You will have an opportunity to communicate in groups of four people. You will be communicating by sending and receiving text messages to and from the other people in your group. The people in your discussion group are picked at random from all of the experiment participants and do not necessarily include the person you were matched with in Part 1 of the experiment. Your discussion group does include the person you will be matched with in Part 2.

In your screens, you will see a chat box where you can type messages to people in your group. Please do not start communication until the experimenter says so.

ARE THERE ANY QUESTIONS?

You will now be given 10 minutes to communicate with the people in your group via text messages.

Please start communication now.

[PAUSE]

The communication time is now over.

You will now participate in the same experiment as before, with one of the people you just communicated with.

ARE THERE ANY QUESTIONS?

A.6 Part 2 Instructions (NC)

In this part of the experiment, you will participate in the same experiment as before, with a different person. The person you will be matched with is picked at random from all of the experiment participants and is not necessarily the person that you were matched with in the first part of the experiment.

We will need a few minutes to set up your new matches. During this time you may use the web browser to surf the net or check your email or Facebook account if you want. Please do not close the z-Leaf program if you decide go to the web browser.

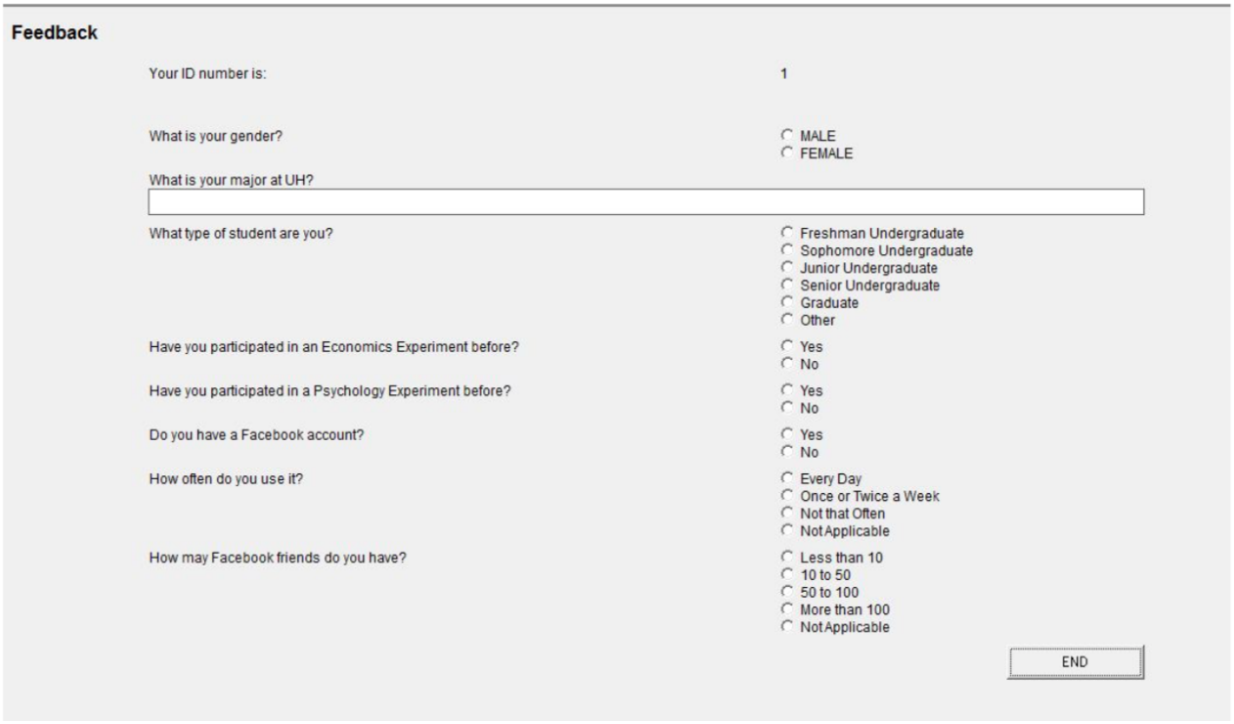
ARE THERE ANY QUESTIONS?

[PAUSE]

The setup time is now over. Please close the web browsers. You will now participate in the

same experiment as before, with a different person. ARE THERE ANY QUESTIONS?

B Exit Questionnaire



Feedback

Your ID number is: 1

What is your gender?
- MALE
- FEMALE

What is your major at UH?

What type of student are you?
- Freshman Undergraduate
- Sophomore Undergraduate
- Junior Undergraduate
- Senior Undergraduate
- Graduate
- Other

Have you participated in an Economics Experiment before?
- Yes
- No

Have you participated in a Psychology Experiment before?
- Yes
- No

Do you have a Facebook account?
- Yes
- No

How often do you use it?
- Every Day
- Once or Twice a Week
- Not that Often
- Not Applicable

How may Facebook friends do you have?
- Less than 10
- 10 to 50
- 50 to 100
- More than 100
- Not Applicable

END

C Additional Tables

Table 11: Summary of Experimental Sessions

Session	**Location**	**Treatment**	**# Subjects**	**Ave. pay, $**
1	UH Manoa	FB	8	17.25
2	UH Manoa	NC	8	17.00
3	UH Manoa	FB	8	16.88
4	UH Manoa	Chat	8	18.25
5	UH Manoa	FTF	8	16.75
6	UH Manoa	Chat	8	18.63
7	UH Manoa	NC	8	18.75
8	UH Manoa	FTF	8	17.13
9	UH Manoa	FB	8	14.75
10	UH Manoa	Chat	8	17.88
11	UH Manoa	FTF	8	18.63
12	UH Manoa	NC	8	13.38

D Additional Figures

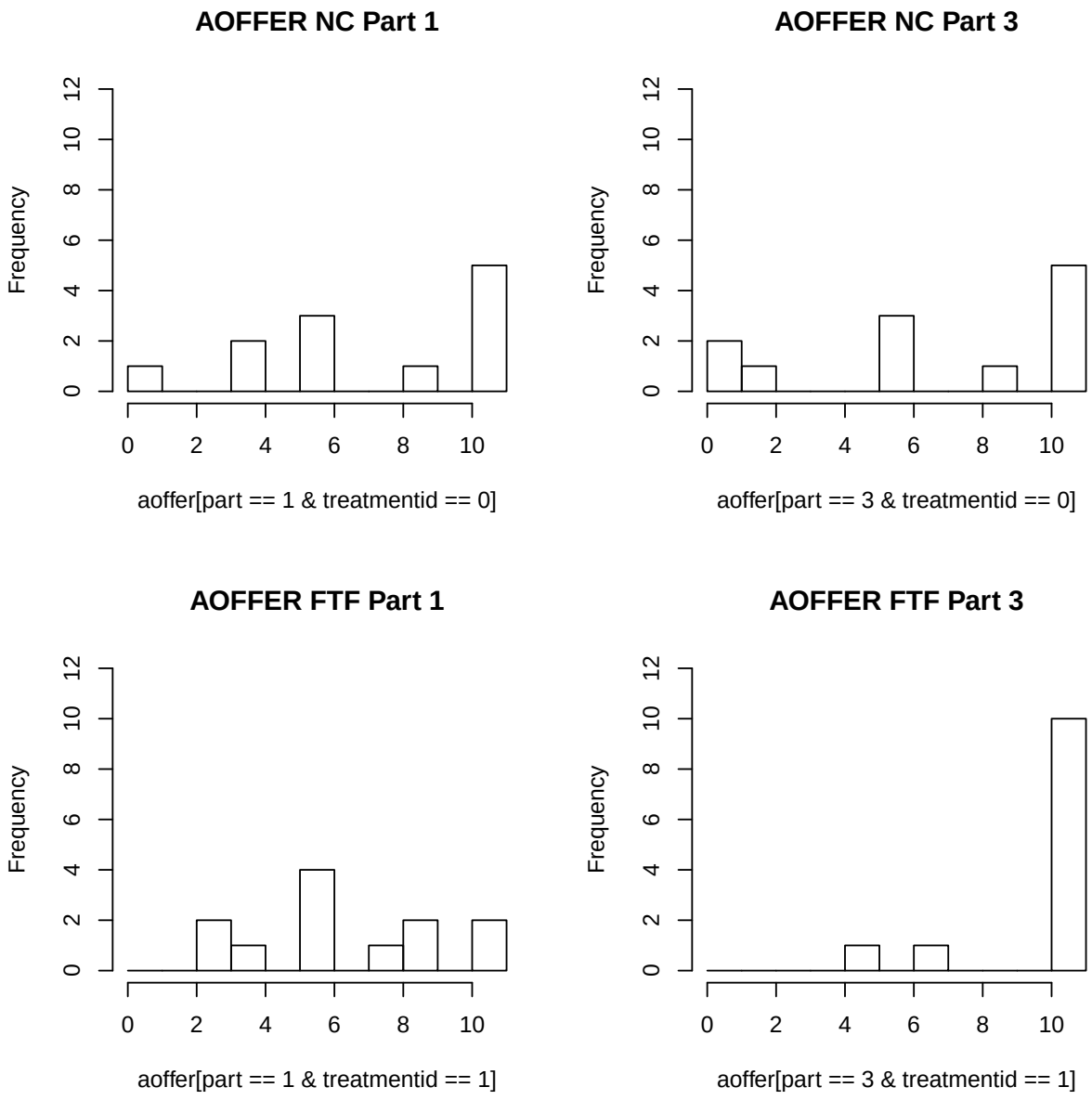


Figure 3: NoCom & FTF: Amount Sent

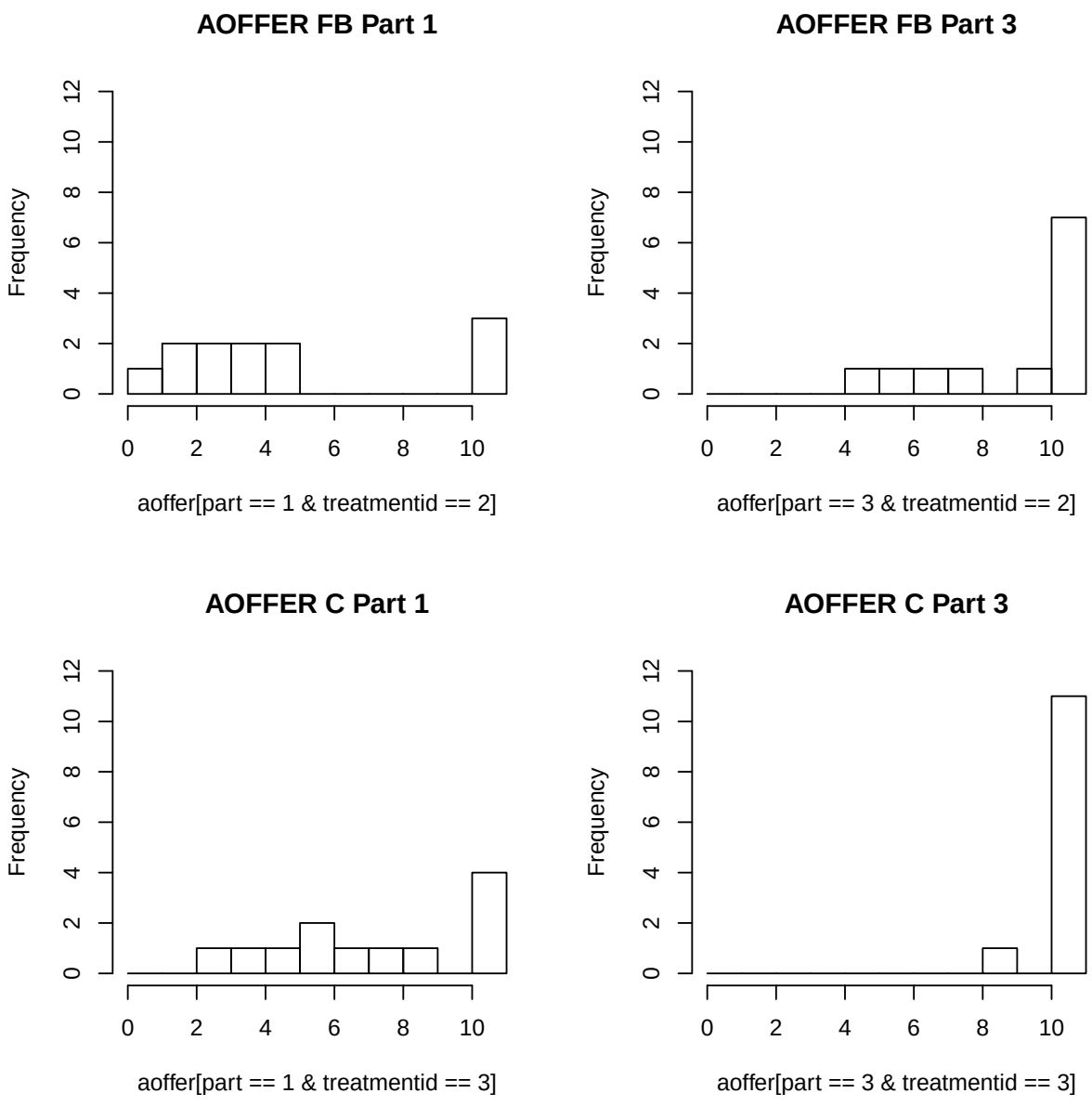


Figure 4: Facebook & Chat: Amount Sent

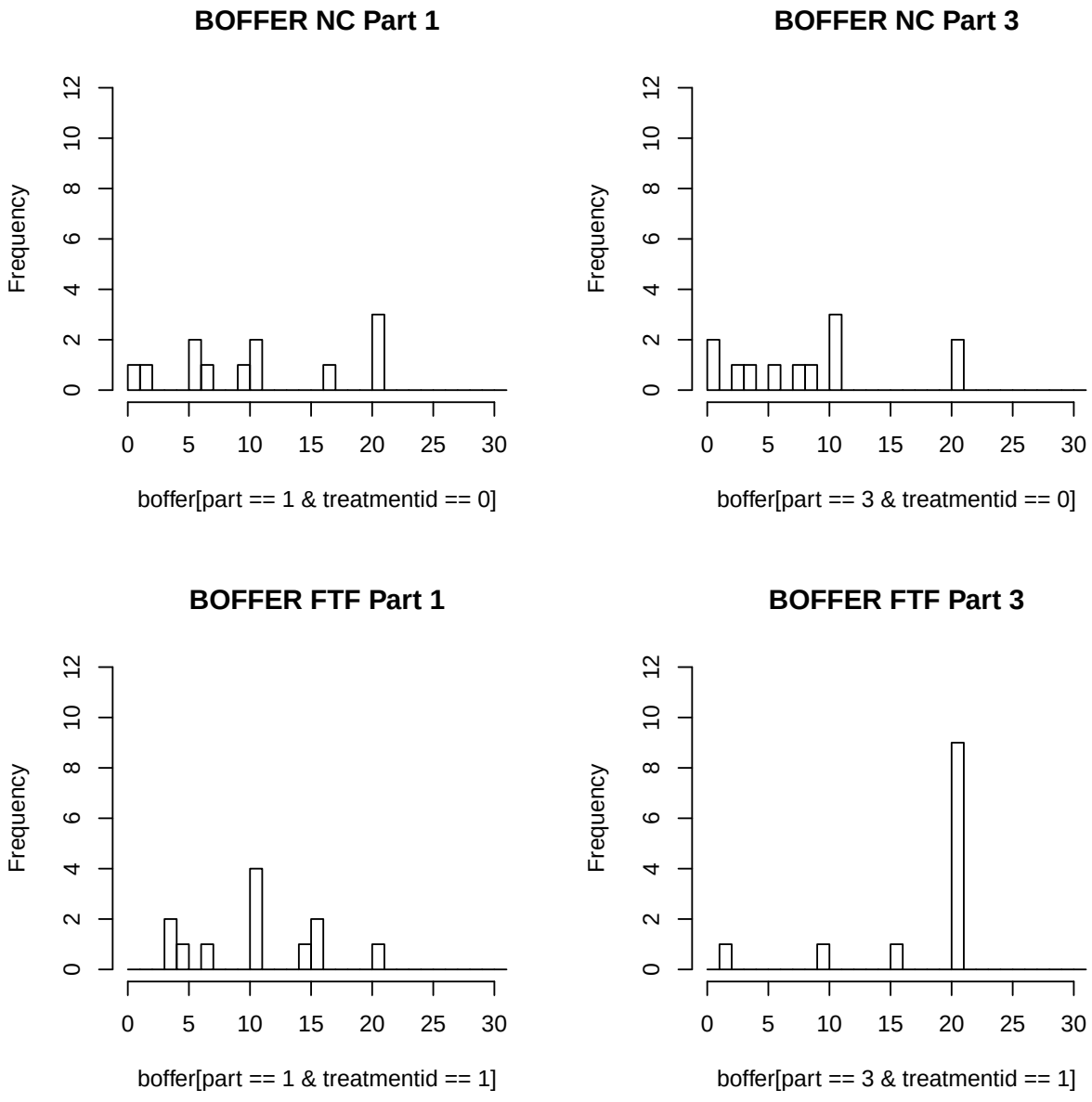


Figure 5: NoCom & FTF: Amount Returned

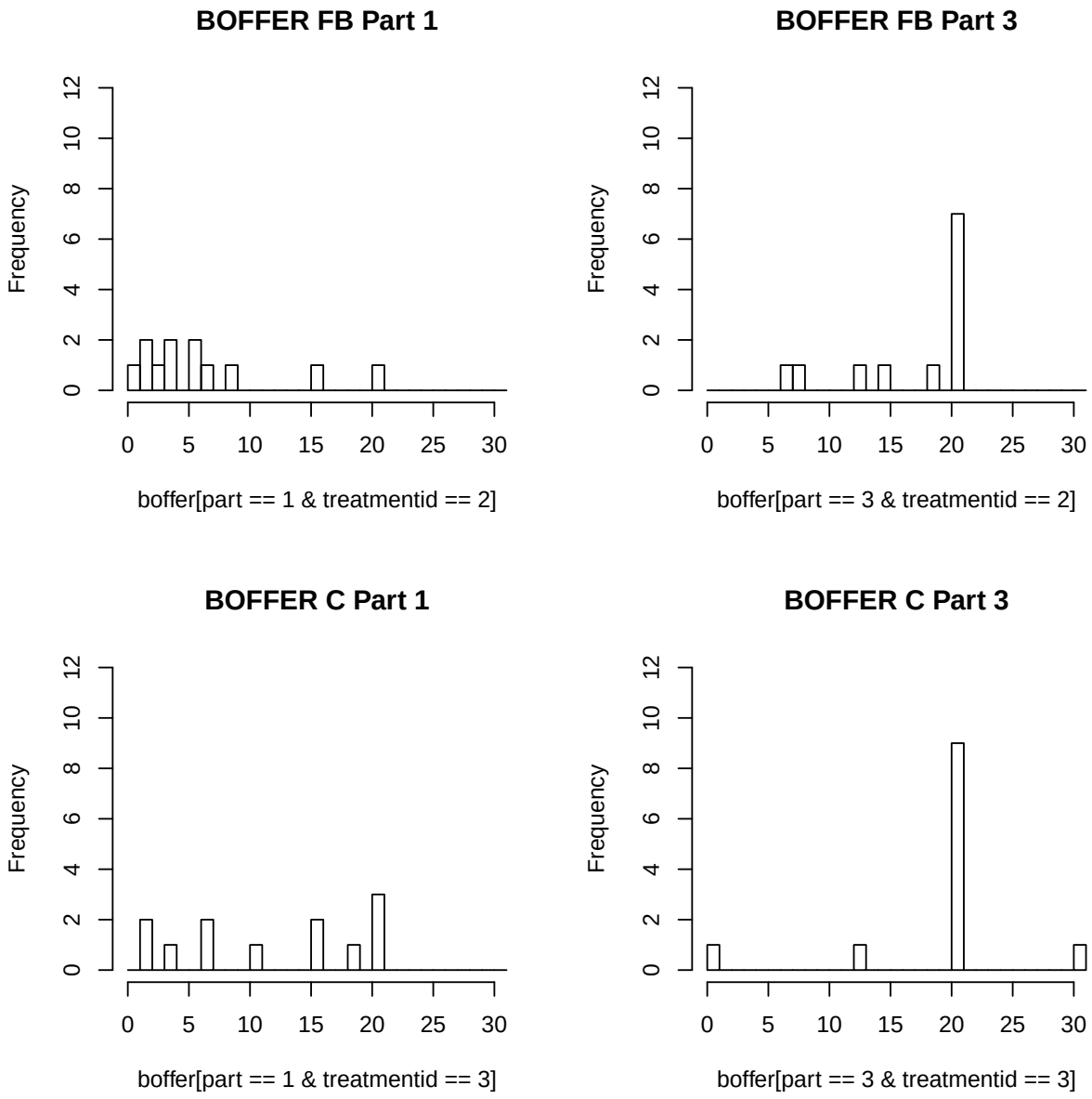


Figure 6: Facebook & Chat: Amount Returned

E Classification Categories for Contents Analysis

Contents Code	Message Content
0	empty comment
Social Talk	
10	general/other
11	hello
12	breaking ice
13	small talk
14	good bye
15	sharing feelings
16	talk about media (calculator, comm media)
17	thank you/sorry
18	TALK ABOUT EXPERIMENTERS/experiment
19	personal info/friends
Norms and goals discussion	
20	general norms discussion
21	equal split /fair
22	maximize money payoff
23	max payoff and equal split
24	sharing with others, empathy
25	we win
26	most beneficial for all
Strategy: Division and payoffs (What to do, how much will get)	
30	call for strategy proposal
31	send 5
32	send 5 / return 10
33	send 10
34	send 10 / return 20
35	send low
36	send 10 / return 15
37	send any/return half triples
38	send any/return same amount
39	send any/return half
Strategy: Implementation (How to make sure everyone follows)	
40	general/other
41	swear/commit
42	do not cheat/not be greedy
43	empathy/generocity
44	trust
45	everyone needs to be on board/work together
Payoff / game discussion	
50	Earning money general
51	money from guessiong
52	number of people/matching
53	play with THIS discussion group
54	time to discuss
55	we are being recorded
56	what the computer shows
57	last round
Personal game-related discussion	
61	My/your Role
62	i/you send
63	i/you return