Marina Fiedler*

Cooperation in Virtual Worlds**

Abstract

This article reports the results of a controlled lab experiment that studies the effects of strategically irrelevant "cheap talk" via 3D world audio communication and 2D text messaging. I also analyze the effects of technical information richness, experience with a communication medium, social distance and collective orientation on cooperation. The findings indicate that persons in a situational setting that allow them to hope that the partner will respond in a cooperative manner show a higher degree of cooperation when engaging in cheap-talk computer-mediated-communication. The results show also that low social distance, collective orientation and experience with a medium is favorable for demonstrating trust, trustworthiness and cooperation.

JEL-Classification: C91, C99, D63.

Keywords: 3D Virtual Worlds; Avatars; Cheap talk; CMC; Communication; Cooperation; Instant Messaging; Trust; Trustworthiness.

1 Introduction

A central issue facing every organization is how employees and business partners can be motivated to invest in trust and cooperation. Three antecedents that seem to be of particular importance for investing in such behavior are communication, close social distance, and a collective orientation (Brosig (2002); Buchan, Johnson, and Croson (2006); Frank (1988)). The effect of communication on cooperation seems to be particularly robust, despite the fact that the communication is costless and irrelevant to the material payoff (i.e., it's "cheap talk") (Berg, Dickhaut, and McCabe (1995); Blume (1998); Bohnet and Frey (1999); Charness and Dufwenberg (2006; 2007); Crawford (1998); Crawford and Sobel (1982); Duffy and

* Marina Fiedler, Ludwig-Maximilians-University, Ludwigstraße 28 VG II, D-80539 Munich, Germany, Tel.: +49 (0)89 2180 2777, Fax: +49 (0)89 2180 99 2777, e-mail: fiedler@lmu.de.

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Feltovich (2002); Ellingsen and Johannesson (2002); Farrell (1987; 1988); Frey and Bohnet (1997); Green and Stokey (1983); Hoffman and Spitzer (1982); Isaac and Walker (1988); Kollock (1998); Nydegger and Owen (1974); Orbell, van de Kragt, and Dawes (1988); Ostrom, Walker, and Gardner (1992); Radner and Schotter (1989); Sally (1995); Scodel et al. (1959)).

However, experimental results suggest that the effect of cheap talk on cooperation seems to depend greatly on what kind of cheap talk it is, i.e., whether the communication is strategically relevant or irrelevant. Most studies focus on the influence of strategically relevant communication, but only a few analyze the impact of strategically irrelevant communication on trust and cooperation (Buchan, Johnson, and Croson (2006); Dawes, McTravish, and Shaklee (1977); Roth (1995); Schmidt and Zultan (2005)). This situation is surprising, since the application of strategically irrelevant communication allows researchers to disentangle guilt, shame, and signaling to explain cooperation.

Another line of research shows that geographical proximity and face-to-face interaction seem to be important to establishing social similarity, shared values, and expectations of collaborative interpersonal relationships (Jarvenpaa and Leidner (1999); Nardi and Whittaker (2002); Nohria and Eccles (1992); O'Hara-Devereaux and Johansen (1994)). However, as the importance of geographically distributed division of work rises, organizations rely more and more heavily on employees to engage in computer-mediated communication to enable collaborative work (Jarvenpaa and Leidner (1999)). This kind of communication often lacks many cues, such as converging on similar speech rates and syntactic complexity, mimicry, warmth, and attentiveness, which are common in face-to-face communication and which individuals use to convey trust and develop relationships. Therefore, researchers often ask the question of whether cooperation can develop in such a computer-mediated setting (Daft, Lengel, and Trevino (1987); Jarvenpaa and Leidner (1999); Ngwenyama and Lee (1997); Sproull and Kiesler (1991); Walther, Anderson, and Park (1994); Walther, Bunz, and Bezarova (2005); Yee (2007)).

For some years now, researchers have analyzed the influence of computer-mediated communication on cooperation. A lot of studies find that computer-mediated communication leads to higher cooperation levels than does no communication at all, but it is less effective than face-to-face communication (Bochet, Page, and Putterman (2006); Brosig, Ockenfels, and Weimann (2003); Duffy and Feltovich (2002); Frohlich and Oppenheimer (1998); Jensen et al. (1999)). Since these studies are among anonymous strangers that interact only once with each other, these results are an indication that even in anonymous, temporary exchange situations with no common past or future, participants tend to show cooperation based on the quality of the communication they experience with others. However, other authors find that although computer-mediated communication has some negative effects (Wilson and Sell (1997)), over time, people compensate for missing cues and demonstrate similar behavior with face-to-face communication (Markus (1994); Walther (1996; 1997); Walther and Parks (2002)).

A recent addition to the possibilities of computer communication are 3D virtual worlds. A 3D virtual world is a computer-based simulated environment through which its users can

interact by creating digital representations called avatars. Not only the success of virtual worlds such as "World of Warcraft", "Habbo Hotel", and "Second Life" and their rapidly falling production costs, but also the worldwide surge and investments in broadband and mobile internet access and the fact that many children grow up with intensely using virtual worlds have led many analysts to predict that a dramatic shift will take place in the way people perceive and navigate at least the interaction dominated parts of the Internet in future (Sharma (2005); Gartner (2007); Nichols (2006)). Hence, contrary to the current flat-image Internet, 3D Internet offers the chance to individualize one's appearance via an avatar, and to interact with others in an avator-mediated environment (Lea, Honda, and Matsuda (1997)). Virtual worlds allow individuals to communicate and conduct interpersonal exchanges in an interactive, multichanneled communication environment with a virtual face and identity. Biocca (1995) states that it is possible to create a wide range of verbal and nonverbal interpersonal messages that offer more possibilities for sending social cues than do other electronic communication services, such as instant messaging or e-mail-services, without really compromising anonymity. The individual can create his or her own personality, take a virtual "walk" to a product, and "touch" it or see what it would look like in offline reality, thus allowing for both push and pull communication and simulation of offline activities. However, at this point in time avatar-based communication is also often critisised for being artificial (Koch (2004)) and it is nor clear wether text-based 2D communication or 3D avatar-based audio-communication is more effictive in creating trust and cooperation.

In the face of the increasing importance of Computer-mediated interaction, as well as the uncertainty of the influence of such communication on cooperation, a better understanding seems to be required. Thus, the purpose of this paper is to investigate the effects of computer-mediated strategically irrelevant "cheap talk" communication, the influence of the communication medium, experience with the communication medium, social distance as well as collective orientation on cooperation.

2 Theory and Hypotheses

2.1 The Influence of Strategically Irrelevant Cheap-Talk Communication on Cooperation

The reported effects of strategically irrelevant cheap talk communication on cooperation are mixed. Dawes, McTravish, and Shaklee (1977), find that there are far fewer defections with strategic relevant than with strategically irrelevant cheap talk communication or no communication. Conversely, Roth (1995) finds that strategically irrelevant personal communication produces an increase in the mean offer, which leads to high cooperation rates. In addition, Schmidt and Zultan (2005) find that strategically irrelevant communication enhances other-regarding preferences, leading to heightened cooperation. Buchan, Johnson, and Croson (2006) compare different kinds of strategically irrelevant communications' effects on trust and trustworthiness and find that personal communication increases these investment levels more than non-personal communication.

While the influence of strategically relevant cheap talk on cooperation can be explained by means of issues such as alignment-of-interests, credibility, guilt, and self-commitment (Bracht

and Feltovich (2007); Charness and Dufwenberg (2006; 2007); Orbell, van de Kragt, and Dawes (1988); Sutter and Strassmair (2005)), strategically irrelevant communication appeals to a different set of motives. First, when people communicate they seem to start caring about others' welfare because communication can lead to concerns for others (Bohnet and Frey (1999)). Thus, communication can increase so called "other regarding preferences" such as altruism and fairness (Buchan, Johnson, and Croson (2006)), which in turn can lead to increased cooperative behavior. Second, strategically irrelevant discussions provide opportunities for self-disclosure and friendship (Preece and Maloney-Krichmar (2003)) and can thus reduce social distance and increase group identity (Buchan, Johnson, and Croson (2006); Sutter and Strassmair (2005)). Third, there are indications that strategically irrelevant communication can appeal to peoples' moods and feeling of self-content by appealing to their preferences, such as their sense of humor (Keltner and Bonanno (1997)), which can in turn lead to positive emotions about themselves and others, which increases their willingness to cooperate. Hence:

H1: *Strategically irrelevant communication enhances the level of cooperation.*

2.2 The Influence of Information Richness on Cooperation

A great many studies not only examine whether communication has an effect on cooperation, but also look at how the medium itself influences behavior. The streams of literature differ regarding their explanation for influencing behavior in focusing either on technical richness (e.g. possibilities of a communication medium to transport speech, tone, gesture, mimic), subjective richness (i.e. experience with the medium) or media naturalness (i.e. degree of similarity of the medium with the face-to-face medium (Kock (2004)). Since there is very little research on the third theory I will focus on the first two streams of literature for developing hypotheses (see Fiedler and Gallenkamp (2008) for an overview).

Theories in the first group are the Theory of Social Presence from Short, Williams, and Christie (1976); the Reduced Social Cues Theory from Kiesler, Siegel, and McGuire (1984); the Media-Richness-Theory from Daft and Lengel (1983), and the Media-Synchronicity-Theory from Dennis and Valacich (1999). Several authors have conducted computer-mediated communication experiments to test the influence of technical information richness on behavior. Jensen et al. (1999) find significant differences between different forms of communication (i.e., text chat, text-to-speech, and voice), with voice communications resulting in the highest levels of cooperation. Brosig, Ockenfels, and Weinmann (2003) find that cooperation levels are significantly higher in video and table conferences than in other treatments such as audio conferences, lectures, and talk shows. In a study on a dictator game, Greiner, Güth, and Zultan (2005) find that while players' cooperation increases when they are able to see the recipients, it escalates even more with the introduction of an audio channel. Wilson (2005) finds that system features that augment messages with images and graphics increase message persuasiveness. These findings indicate that the more information cues that can be transmitted with a computer medium, the higher is the impact on behavior. From this line of research researchers can assume that technical richness of the communication medium corresponds with higher degrees of cooperation.

However, Walther (1997) finds that over time, people apparently learn to compensate for missing cues. Other studies also arrive at the insight that the differences between face-to-face and computer-mediated communications are less the result of the technical richness of the communication medium than they are of the increasing experience with the communication medium (Walther (1994); Kelly and McGrath (1985); Kelly, Futoron, and McGrath (1990), Kayworth and Leidner (2000)). Theories that are more determined by the user's personal experience are the Channel Expansion Theory of Carlson and Zmud (1999) and King and Xia's (1997) Effects of Experience on Media Appropriateness approach. These theories do not regard media richness as a characteristic of a communication medium, but rather as a function of the user's experiences with the communication medium itself. The more experience a user has with a medium, the sooner he or she develops a rich language that is appropriate for the medium and the situation. Doing so simultaneously expands the richness of the communication technology. King and Xia (1997) state: "An individual's experience with a medium also affects the degree to which he or she is aware of the capability of the medium. Individuals who have frequently used a medium or are comfortable and skilful with a certain medium should have a better understanding of the capability and appropriateness of the medium than those who have barely known or rarely used the medium." This stream of research in turn supports the assumption that it is only once an individual's competency and experience with the use of a communication medium has increased does that medium influence behavior. Hence,

H2: *Technical information richness of the communication medium results in higher levels of cooperation.*

H3: *Experience with a communication medium mediates the relation between technical information richness of a communication medium and the level of cooperation.*

2.3 The Influence of Social Distance on Cooperation

Social distance is defined as the perceived distance between individuals or groups (Dufwenberg and Muren (2002); Charness, Haruvy, and Sonsino (2007)). It can be interpreted as the dimension of closeness between interacting people. Orbell, van de Kragt, and Dawes (1988) and Frey and Bohnet (1997) examine group effects and identification, and find significant positive effects of low social distance. In their social dilemma experiment, Orbell, van de Kragt, and Dawes (1988) observe that cooperation is greater among participants of the same group. In a dictator experiment, Frey and Bohnet (1997) find that the dictators are more generous with people with whom they have interacted before. Also, Brewer and Silver's study (1978) confirms the positive in-group bias. They conclude that in-group favoritism is independent of arbitrary separation into different groups, and that even if the out-group is not considered dissimilar, positive in-group bias occurs as long as people identify with their own group. Buchan, Johnson, and Croson (2006) find mixed effects: Americans show higher levels of cooperation to members of their own group than to those of another group, thus demonstrating an in-group bias. Chinese participants show however higher levels of cooperation to out-group than to in-group members. Chen and Li (forthcoming) find that when participants are matched with an ingroup member they show a 47% increase in charity

concerns when they have a higher payoff and a 93% decrease in envy when they have a lower payoff. Likewise, participants are 19% more likely to reward an ingroup match for good behavior, but 13% less likely to punish an ingroup match for misbehavior. Furthermore, participants are significantly more likely to choose social-welfare-maximizing actions when matched with an ingroup member. Hence:

H4: *Low social distance enhances the level of cooperation.*

2.4 The Influence of Collective Orientation on Cooperation

In the experimental economics literature is a lively debate on the influence of other-regarding preferences on cooperation. There is considerable evidence that nonmaterialistic preferences affect behavior (Andreoni and Miller (1993); Bolton and Ockenfels (2002); Cooper et al. (1996); Fehr and Schmidt (1999); Levine (1995); McKelvey and Palfrey (1992); Rabin (1993)). One of the fundamental components of cooperation seems to be the degree of individualism or collectivism a person has internalized as a guiding norm (Brosig (2002); Frank (1988); Zhang et al. (2007)). Individualism can be understood as the degree to which persons view a situation as competition and place emphasis on maximizing their own earnings. Collectivism reflects both a cooperative understanding of the situation and prioritizing maximizing group earnings. According to Frank (1988), there are two types of individuals: cooperative individuals who cooperate even in anonymity, and individualistic (defective) individuals who maximize their own payoff. Buchan, Johnson, and Croson (2006) find evidence that collectively oriented participants send and return higher amounts of money than do individualistically oriented participants. Furthermore, individualistically oriented participants react more strongly to social distance than do collectively oriented participants, i.e., individualistic participants give more to in-group members than to out-group members. Hence:

H5: *Collective orientation increases the level of cooperation.*

3 Experimental Design and Procedures

3.1 The Game

To measure the degree of cooperation, participants played the one-shot investment game from Berg, Dickhaut, and McCabe (1995). Both players receive an initial endowment of ten Lab-Euros (four Lab-Euros were exchanged into one euro).

The one-shot investment game has two stages. In the first stage, player one (also called the proposer or first mover) decides whether to send none, some, or even all of his money to player two (also called the responder or second mover). To create an incentive for cooperation, the moderator triples any money sent by player one. In the second stage, the responder decides how much, if any, money he wants to return to the sender. The players may keep any money they do not send. The game structure is completely open to both players. As it is profit maximizing for the second player to keep all the money and return nothing, which the

first player anticipates due to the open game structure, the subgame perfect Nash equilibrium occurs when both players keep their initial endowment and there is no cooperation. Due to the game structure the first and second mover are in different situations. Even though the first player may anticipate that the second player will return nothing, he is in a situational setting that allows a positive reciprocal gesture from the second player. In other words, if the second player is fair-minded, the first player has a chance of obtaining more money by sending his endowment to the second player than if he keeps it. However, player two knows that he can freely allocate the total amount of money, as player one has no sanction possibility whatsoever due to the guaranteed anonymity and the definitive end of the game. Hence, player two is in a different situation from that of player one.

3.2 Experimental Design

After an extensive pretest with 60 participants to determine adequate group sizes and functions in the virtual 3D world of Second Life, 304 subjects participated in the experiment. Of these participants, 138 communicated via the audio function of the virtual world of Second Life. Another 126 participants communicated via the technical, less information rich, Skype Text-Chat. The remaining 40 participants played the investment game without communication treatment. All the participants were students from the University of Munich. The 304 participants were randomly assigned into 46 Second Life Audio and 42 Skype text chat groups of three participants, and 20 Proposer-Responder pairs for the "No Communication" control treatment.

When the participants arrived to take part in the experiment, they were immediately taken to three separate rooms and single cabins to which they had been randomly assigned. Hence, the members of a Second Life or Skype communication group, while being virtually in one room were actually in different physical rooms. In the cabins, they sat in front of a computer from which they could not observe the other participants. To communicate via Second Life Audio, they wore headphones with microphones. The Skype text chat participants communicated via typing into the keyboard. To take advantage of the technical information richness of Second Life, the Second Life subjects were allowed an additional ten minutes before starting the communication session. They used this time to adapt their standard avatar to their personal preferences. A leaflet gave all the instructions on how to do so.

The participants in each group were then told to discuss, either via the Second Life audio or the Skype text chat function, strategically irrelevant topics. To have some control over the kind of communication, participants had to either discuss five personal or five impersonal topics. Since audio communication is much faster then typing, Second Life participants had ten minutes and Skype text chat participants 15 minutes for the communication process (see Zheng et al. (2001) and Connell et al. (2001) for similar time differences between face-to-face and text chat). As in Buchan, Johnson, and Croson (2006), the personal groups were told to introduce themselves. They were to state their birth date, talk about their favorite birthday as a child, and describe their ideal birthday present. Impersonal discussion groups were told to discuss topics concerning general knowledge about the world. They were to name the most populated cities of the world, the highest mountains, or countries that use the

euro as currency. During the entire communication process, the discussions were observed by virtual monitors who made sure that only the assigned topics were discussed.
After communicating for ten minutes via Second Life Audio and 15 minutes via Skype text chat on strategic irrelevant topics, the participants were asked to click on a link to a website. The subjects learned then that they are about to play the investment game. The website also explained the rules of the investment game and indicated to subjects whether they were to play the role of proposer or responder, and whether they were to be matched with a partner in their own communication group (low social distance) or from another communication group (high social distance). Matching of first and second as well as of ingroup and outgroup movers was done via Ajax. This procedure guaranteed a double-blind experimental structure. After the trust game was over, the amount each participant earned was computed in the database and paid in Euros to the participant after the experimental session was completed.

3.3 Post-Experimental Questionnaire

A post-experimental questionnaire was used to measure the collective orientation and the degree of experience of the participants with the communication medium. To measure collective orientation, the participants had to answer two questions as in Buchan, Johnson, and Croson (2006): they could choose, on a scale of one to seven, whether they saw the situation as a competition or as cooperation; and they had to say whether maximizing individual earnings was more important than maximizing collective earnings. These two questions have a Cronbachs alpha of 0.737. The mean of this scale was 9.7 and the median ten out of 14 rating points, which means that the pool of participants tended to have a more collaborative attitude.

Experience with the communication medium was also measured on a seven-point rating scale with the two questions "I am experienced in using Second Life/Skype Messenger" and "I feel a positive attitude towards Second Life/Skype Messenger". The two questions have a Cronbach alpha of 0.807 and load on one factor. The mean and median for Skype text chat is ten, and the mean and median for Second Life audio chat is 5.8 and six, respectively, indicating much lower levels of experience with Second Life Audio than with Skype text chat.

Control Variables

Gender: To control for gender effects, a gender variable was added in the regression with zero for male and one for female.

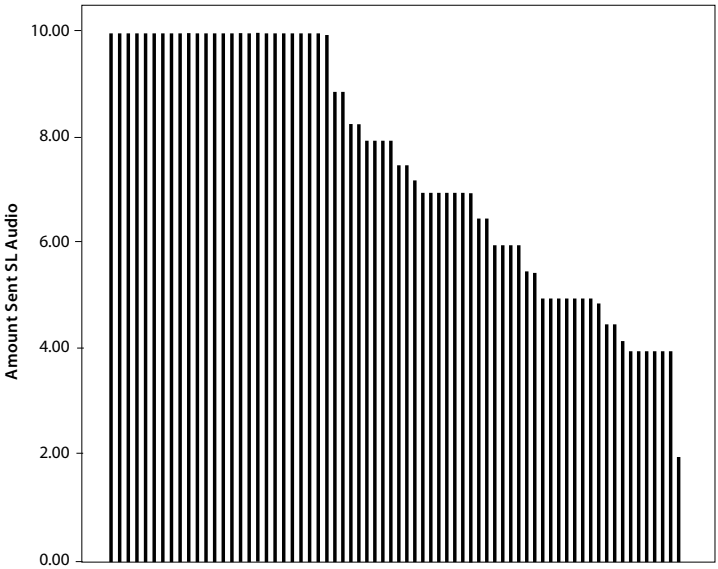
Knowledge of Game Theory: To control for knowledge of game theory, participants were questioned on their level of knowledge of game theory.

4 Results

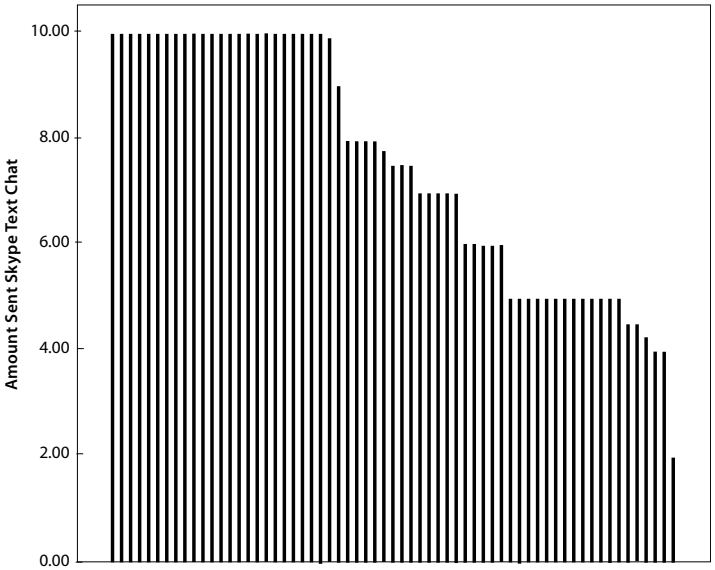
The dependent variables in this experiment are the amounts sent by the senders and the proportions returned by the receivers (see *Figures 1* and *2*).

Figure 1: Observations sorted by amount sent

a) Second Life Audio-Chat (*N* = 69)



b) Skype Text Chat (*N* = 63)



c) No Communication (*N* = 20)

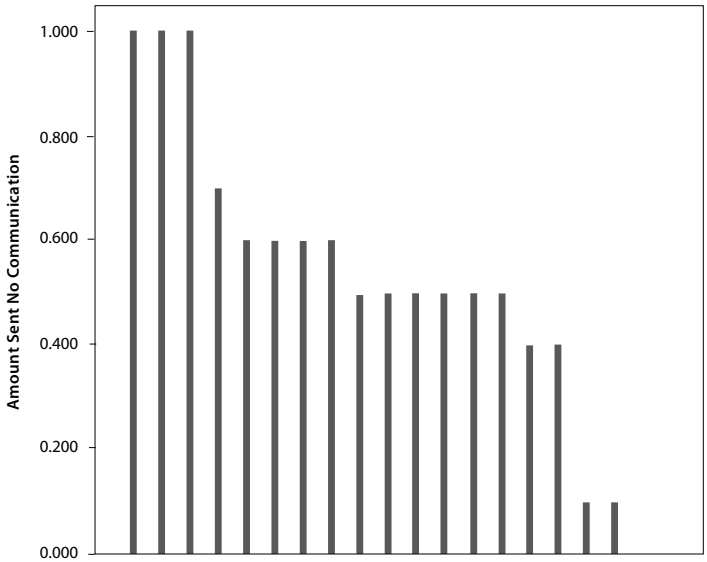
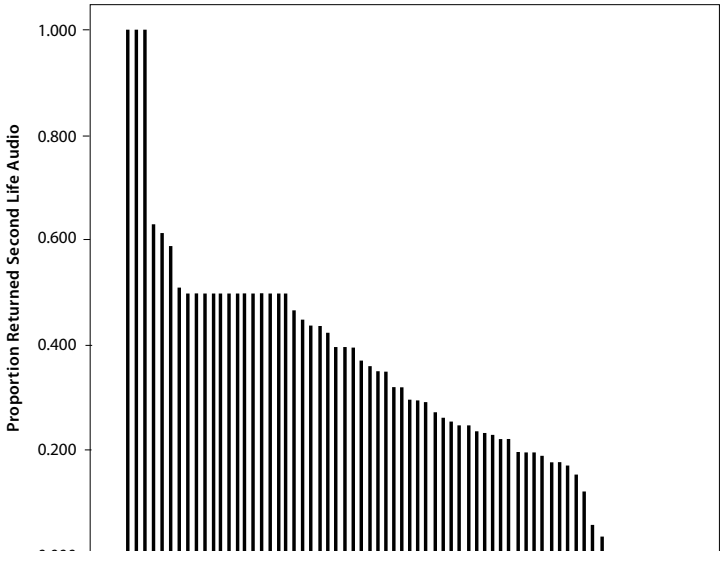
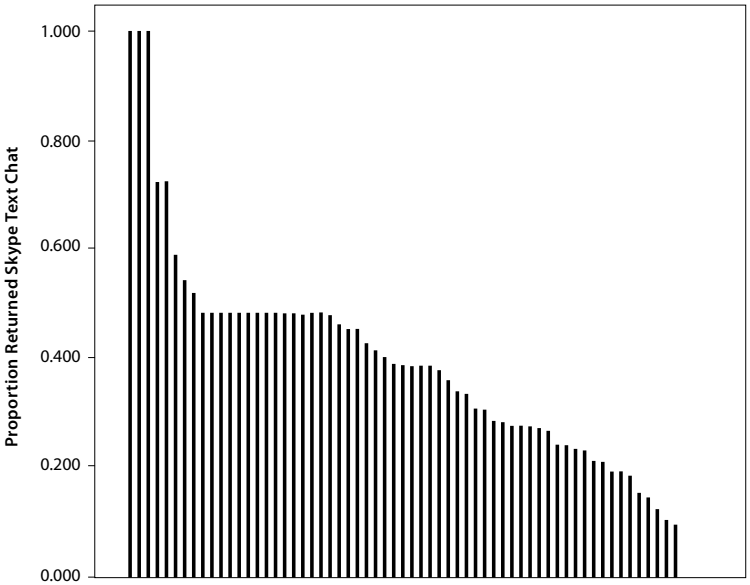


Figure 2: Observations sorted by proportion returned

a) Second Life Audio-Chat (*N* = 69)



b) Skype text chat (*N* = 63)



c) No Communication (*N* = 20)

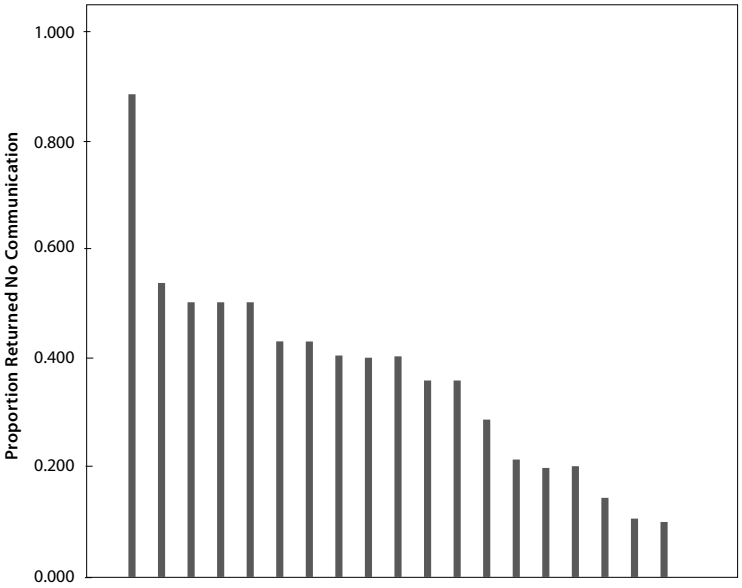


Table 1 summarizes all data containing means, standard deviations, minimums, and maximums for amounts sent and proportions returned from the Second Life Audio, Skype Text Chat, and No Communications treatment.

Table 1: Summary of Data

	Amount Sent	Min/ Max	Personal	Impersonal	Ingroup	Outgroup
Second Life Audio	7.48 (2.34)	2/10 (*n* = 69)	7.50 (2.44) *n* = 36	7.45 (2.26) *n* = 33	7.53 (2.29) *n* = 36	7.41 (2.43) *n* = 33
Skype	7.50 (2.34)	2/10 (*n* = 63)	7.42 (2.27) *n* = 39	7.62 (2.50) *n* = 24	7.92 (2.25) *n* = 39	6.85 (2.38) *n* = 24
No Communication	5.05 (2.96)	0/10 (*n* = 20)	--	--	--	--

	Proportion Returned	Min/ Max	Personal	Impersonal	Ingroup	Outgroup
Second Life Audio	0.33 (0.23)	0/1 (*n* = 69)	0.32 (0.21) *n* = 36	0.33 (0.26) *n* = 33	0.35 (0.24) *n* = 36	0.30 (0.23) *n* = 33
Skype	0.40 (0.20)	0/0.97 (*n* = 63)	0.40 (0.19) *n* = 39	0.39 (0.22) *n* = 24	0.43 (0.21) *n* = 39	0.35 (0.17) *n* = 24
No Communication	0.35 (0.20)	0/0.88 (*n* = 20)	--	--	--	--

Confirmatory Results: Cooperation of First Mover

For the OLS regression analyses, the variables were coded as follows: computer mediated communication (one equals "communication", zero equals "no communication"), technical information richness (Second Life audio communication equals one, Skype text messenger communication equals zero) and social distance (ingroup matching equals one, outgroup matching equals zero). Experience and collaborative orientation were coded with rating scales as described above.

In almost all investment game decisions with communication, the participants decide to send some money, which is contrary to the predictions of subgame perfect Nash equilibrium (see *Figures 1a* and *1b*). The fact that people do not act in accordance with the *homo œconomicus* theory, which proposes that individuals act rationally and in their self-interest, is consistent with what others find in their experiments with the investment game. Berg, Dickhaut, and McCabe (1995) state that even in their "no history" experiment, the average amount sent was $5.16 out of $10, which is almost exactly the amount

that was found within the "no communication" sender group (L€ 5.05). With the face-to-face communication treatment, Buchan, Johnson, and Croson (2006) observed an average amount sent that was much higher than 50% of the initial endowment (between 647.27 and 710.42 units out of 1,000 units, depending on the participants' country of origin).

In this experiment, the mean amount sent for Second Life Audio participants is L€ 7.48 and for Skype text chat participants €7.50. Participants in the "no communication" treatment sent on average €5.05. Thus, linear regression analysis (see *Table 2* column 1) confirms Hypothesis 1. Even though the information richness of Second Life Audio is much higher than the information richness of Skype text chat, the mean amount sent by the Second Life audio participants is almost identical to the Skype text chat participants. These results lead to the rejection of Hypothesis 2. Also, Hypotheses 3 and 4 must be rejected for the first movers (see column 2 in *Table 2*). Neither experience with the communication medium nor low social distance has a significant influence on cooperation. However, there is a strong effect of collective orientation on cooperation of first movers thus confirming Hypothesis 5.

Table 2: Hypotheses test for first mover

Dependent Variable		**Amount sent**	
		1	2
H1: Computer-mediated Communication	H1:	0.334***	–
H2: Technical Information Richness		0.026	–0.003
H3: Experience with Communication Medium			–0.093
H4: Social Distance			0.096
H5: Collective Orientation			0.409***
Gender		–0.149*	–0.188**
Knowledge of Game Theory		0.019	0.010
R^2		0.127	0.222
Adjusted R^2		0.103	0.184

$^{*}p \leq 0.10$, $^{**}p \leq 0.05$, $^{***}p \leq 0.01$, p-values are for two-tailed tests.

Confirmatory Results: Cooperation of Second Mover

The proportion returned refers to the percent of their total wealth (i.e., three times the amount the sender sent plus the endowment) that the second movers returned. This measure has the advantage that it can be compared with the amounts sent in dictator games (Buchan, Johnson, and Croson (2006)). In this experiment, the mean proportion returned was 33% for Second Life Audio participants and 40% for Skype text chat participants. Participants in the "no communication" treatment returned an average of 35%,

Table 3 shows the results of the regression of the proportion returned.

Testing with linear regression analysis Hypothesis 1 and 2 have to be rejected for the second movers. There is no influence of communication on cooperation, nor does the technical information richness of the communication channel influence cooperation in the hypothesized direction. However, column 1 shows that subjects that communicated via Second Life Audio returned significantly less than did the Skype text participants. As can be seen from column two there is a positive significant influence of experience with the communication medium on cooperation. The data show that experience with the communication medium mediates the relationship between technical information richness and cooperation (Baron and Kenny (1986)). According to Baron and Kenny (1986), mediation is indicated if the following four conditions are met: First, the independent variable (technical information richness) must affect the dependent variable (cooperation of the second mover, $\beta = -0.14$; $p < 0.10$). In the second step, the independent variable must be related to the mediator (experience with the communication medium, $\beta = .60$; $p < 0.001$), while the mediator must be related to the dependent variable in the third step ($\beta = 0.22$; $p < 0.05$). In the final step, the strength of the relationship between the independent variable and the dependent variable must be significantly reduced when the mediator is added to the model ($\beta = -0.05$; $p > 0.10$). The Sobel z test was significant ($z = 2.40$; $p < 0.01$), indicating a significant full mediation, thus Hypothesis 3 is confirmed. Also Hypotheses 4 and 5 are confirmed: low social distance and collective orientation have a significant positive influence on cooperation.

Table 3: Hypotheses test for second mover

Dependent Variable		**Proportion Returned**	
		1	2
H1: Computer-mediated Communication	H1:	–0.889	
H2: Technical Information Richness		–0.183**	–0.040
H3: Experience with Communication Medium			0.194*
H4: Social Distance	H2:		0.143*
H5: Collective Orientation	H3:		0.322***
Gender		0.084	0.071
Knowledge of Game Theory		–0.224***	–0.165*
R^2		0.075	0.210
Adjusted R^2		0.049	0.170

*$p \leq 0.10$, **$p \leq 0.05$, ***$p \leq 0.01$, p-values are for two-tailed tests.

5 Discussion and Conclusion

This study set out to understand the effects of strategically irrelevant communication, technical information richness, experience with the communication medium, social distance, and collective orientation on cooperation. I obtain mixed results for the hypotheses on

the influence that communication, technical information richness, experience with the communication medium, and social distance has on cooperation. Although the first player reacts strongly to communication by showing significantly higher amounts of cooperation, the second mover shows no significant reaction to this experimental manipulation. Experience with the communication medium and social distance only influences the cooperation of the second movers. Collective orientation is a significant predictor of cooperation for both the first and second movers.

The results of this study show that even in anonymous first-contact situations, computer-mediated communication in a virtual world or via Skype text chat leads to increased levels of first mover cooperation. Hence, interpersonal dimensions rather than imported stereotypical categorical structures, such as are suggested in the concept of "swift trust" (Meyerson, Weick, and Kramer (1996)), seem to explain the cooperation in these situations. This result is similar to Jarvenpaa and Leidners (1999) conclusion that "trust might be imported, but is more likely created via a communication behaviour established in the first few keystrokes." Also, compared with the face-to-face setup by Buchan, Johnson, and Croson (2006), people seem to react to both avatar-based and text-based communication to almost the same degree as they do to face-to-face communication. In addition, the virtual setting (Second Life Audio and Skype text chat) also allows the responder to reduce social distance, thus making a strong case for the increasing importance of computer-mediated communication for collaboration. Because of the expected lower cost of computer-mediated communication compared to face-to-face communication, this finding offers interesting possibilities in a multitude of business processes, such as inter-firm collaboration, global virtual team dynamics, recruitment, and the design of the interface that the firm presents to the customer.

Second, the results imply that, at least for the responder, experience with a communication medium mediates the relation between technical information richness and cooperation. This finding is important when a manager is thinking about investing in new communication technology with increased performance. To take advantage of technically information rich communication tools such as virtual 3D worlds, firms need to foster experience with this tool. Doing so would allow users to become familiar with adequate communication styles and thus to develop an adequate language.

Third, the results indicate that the institutional setting is a strong predictor for showing cooperative behavior. The first mover (player A) can still hope for cooperation from the second mover (player B), but player B cannot do so, since he has the final decision. Studies indicate that the degree of cooperation depends on the setting in which a participant perceives himself to be. If participants believe that their game partner can reciprocate in a positive manner, then they behave differently than they would if they believe their recipient's response have no influence. Hence, offers in the ultimatum game, during which the second mover influences the utility level of the first mover, are generally higher than in the dictator game, where the second mover has no influence on the first movers utility level (Forsythe et al. (1994); Hoffman, McCabe, and Smith (1996); Güth, Schmittberger, and Schwarze (1982); Güth (1995); Roth (1995); Kagel, Kim, and Moser (1996, 100ff.); Henrich and Smith (1999)). Powell (1990) concludes that when there is a high probability of future association, people

are more likely to cooperate with one another. Thus, it seems that only if participants can hope for a cooperative reciprocal reaction, can communication influence cooperation.

Fourth, since the participants in this experiment only played the investment game once and the applied communication was of strategic irrelevance, reputation effects can be ruled out. Thus, questions on the influence of other regarding preferences on cooperation are also addressed.

Fifth, although avatar-based communication makes use of traditional aspects of face-to-face communication, such as the use of a face, it allows for a much more controlled situation. Where other experiments have demonstrated that even the simplest of visual contact increases cooperation levels (Greiner, Güth, and Zultan (2005)), this experimental design demonstrates its advantages when compared with face-to-face communication.

Since avatar-based communication is in an early stage of development, these results provide insights for subsequent examinations of selected phenomena. It would be interesting to analyze the influence of strategically relevant cheap-talk communication on cooperation with this kind of computer-mediated design, since they trigger completely different motives and beliefs. It could also be interesting to see how group decisions influence the degree of cooperation, specifically, on how teams are formed by means of avatar-based communication. Finding the answers to these questions could be especially interesting when we consider international participants who have different cultural values and native languages. Further empirical research devoted to avatar-based communication against the background of increasing globalization offers equally exciting fields, since other studies demonstrate that culture has a significant influence on IT diffusion.

Third, it would be interesting to compare different experimental set-ups, starting with fully controlled lab experiments with students as subjects, such as the experiment reported in this study, to field experiments with residents of virtual worlds. The degree of identification between the participants and their avatars as well as their experience with the communication medium should be much higher in the latter.

Moreover, it is important to analyze whether avatar-based-communication is applicable to different organizational levels and tasks. Meta-studies on the use of different communications media suggest that managers and executives differ significantly in their usage when compared to that of other employees (Rice and Shook (1990)). Other studies also indicate that virtual teams adapt their communication patterns to the task (Maznevski and Chudoba (2000)). Fourth, from a management point of view, it would be interesting to analyze whether one-way or two-way communication is more effective in designing a customer interface, since experimental results suggest that in certain situations one-way communication leads to higher levels of cooperation than two-way communication. (Cooper et al. (1989; 1992)).

Thus, this article is a starting point for the examination of communication in virtual worlds.

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