

THE LAB VERSUS THE VIRTUAL LAB AND VIRTUAL FIELD – AN EXPERIMENTAL INVESTIGATION OF TRUST GAMES WITH COMMUNICATION

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ABSTRACT. We study trust games in a virtual world environment and contrast results with lab studies, with and without personal interaction enabled by the virtual world platform. Particular attention is given to the motives that drive behavior in the various environments and to issues that are context dependent, particularly communication and social distance. We find that allowing for personal interaction through a virtual world interface increases the amount sent relative to laboratory results but that subjects recruited in the virtual world give and return less than the control group with the same personal interaction.

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1. Introduction

Academic debates on the merits of the laboratory versus the field have contrasted the relatively greater control in the lab with the better realism and context of the field (e.g., Harrison and List, 2004; Levitt and List, 2007a, 2007b, 2009). The emergence of the virtual world as an environment where tens of thousands of residents interact provides a possible compromise in that it gives the researcher reasonable control while allowing for interaction in an environment familiar to virtual world residents (Bainbridge, 2007; Bloomfield, 2007; Castronova, 2001). In particular, it might be useful to replicate known experiments in a virtual environment (e.g., Chesney et al., 2007; Spann et al., 2008) while taking advantage of environmental features not previously available in laboratory experiments (Bainbridge, 2007). A particularly important feature of virtual worlds in our view is the ability to have virtual-face-to-virtual-face communication without compromising real-world anonymity.

We study trust games in such an environment and contrast results with lab studies, with and without the virtual world platform. Particular attention is given to issues that are context dependent: communication, both personal and impersonal, and social distance as measured by group orientation and perceptions. We find that allowing for personal interaction through the use of a virtual world interface increases both the amount sent and the percentage returned relative to a faceless lab study, but that subjects recruited in the virtual world give and return less than subjects who interact in the virtual world interface from the lab. Particular attention is given to the motives that drive such behavior—including trust, reciprocity, cooperation, and utilitarian motives.

A persistent state virtual world is a computer-mediated environment which simulates the real world, in which human participants interact but which continues to exist independent of the human players (Bloomfield, 2007). In this work, we use a virtual world known as Second Life for our experiments. Second Life is not the largest virtual world. To date, *World of Warcraft* is the largest virtual world (for a nice dictator game study in World of Warcraft, see Spann et al., 2008). Second Life may be better suited for some types of research (Bainbridge, 2007; Bloomfield and Rennekamp, 2008). According to Bainbridge (2007), Second Life is especially ideal for formal experiments in social and cognitive sciences, because the researcher can construct a facility

comparable to a real-world laboratory and recruit research subjects. Bloomfield (2007) argues that Second Life is ideal for research due to its rich economy, naturally evolving markets, and active commerce. The first economic study of virtual world economies and markets is by Castronova (2001), involving the virtual world of Norrath. At the time, Norrath was the most market-oriented virtual environment. Today, Second Life is the most widely covered virtual world in the business press, with numerous S&P500 companies, including IBM, Wells Fargo, and Nike establishing presence online. Other examples of business applications in virtual worlds are hotels that allow their customers and business partners to walk through the virtual hotel, thus providing useful and inexpensive feedback; clothing companies that enable customers to try out clothes and furniture based on their avatar's specifications, as well as intercultural sensitivity simulations (Piller and Salvador, 2007).

Over 150 educational institutions own land, hold events or collaborate in Second Life. Companies and universities use it to test concepts and designs, conduct work meetings, seminars, lectures, recruiting, advertising and any kind of collaborative activity. It has a functioning and active stock exchange and numerous businesses that sell virtual and real products and services to residents. Second Life users come from all walks of life and are there for various reasons, including socializing and role play. Many of the residents spend a sizable portion of their time in the virtual world, own or rent virtual real estate and many have virtual jobs.

According to Linden Lab, of the 500,000 active users 41% are female and 59% are male. Active users reside in over 100 different countries with approximately 60% from the United States, United Kingdom, Germany, Japan and France, combined. The largest age group (34%) of active users is in the 25-34 years old range, but 20% of all in-world hours are spent by the people over 45 years old (Linden Lab, 2008). Thus Second Life offers a participant pool with a wider range of demographic characteristics as well as more experience with virtual face-to-face communication than the average college student subject pool.

Virtual worlds are ideally suited to the study of communication and social distance since individuals can communicate and conduct interpersonal exchanges in an interactive communication environment. It is possible to create a wide range of verbal

and nonverbal interpersonal messages which offer more possibilities for sending social cues than other electronic communication without compromising anonymity (Biocca, 1995). There is virtually no academic research on the effects of avatar-based chat communication on strategic behavior in games. The purpose of the present work is thus to investigate the effects of avatar-based strategically irrelevant cheap-talk communication on behavior in the trust game, taking into account the influence of social distance.

Cheap talk has been shown important for economic behavior—particularly in increasing the incidence of cooperative outcomes (Charness and Dufwenberg, 2006). Few studies look at the impact of strategically irrelevant communication on behavior in games and the findings are mixed. Dawes et al. (1977) find hardly any effect, but Roth (1995) in bargaining games and Buchan et al. (2006) in trust games find that strategically irrelevant cheap talk has positive effect on cooperation.

A related line of research concerns anonymity and social distance. Charness and Gneezy (2007) show that anonymity can increase selfishness, whereas Dufwenberg and Muren (2002) suggest that anonymity may at times reduce selfishness. The main effect of anonymity, according to both of these works, is to increase social distance, which in turn impacts behavior and preferences towards others. With avatar-based interaction, real-world anonymity is maintained in that participants do not know the real-world identities of those they interact with. Moreover, with participants recruited in the virtual world, they are likely to be from geographically distant locations, hence farther increasing social distance (Charness et al., 2007). However, participants communicate face-to-face, although the faces are virtual. To the extent that virtual faces matter, social distance may be reduced. The concept of computer-mediated face-to-face interaction has not been previously explored. Face-to-face interaction seems to be important to collaborative interpersonal relationships (Jarvenpaa and Leidner, 1999; Nardi and Whittaker, 2002; Nohria and Eccles, 1992; O'Hara-Devereaux and Johansen, 1994). Although computer-mediated communication leads to higher cooperation levels than no communication, it produces weaker cooperation than that of face-to-face communication (Bochet et al., 2006; Brosig et al., 2003; Duffy and Feltovich, 2002; Frohlich and Oppenheimer, 1998; Jensen et al., 2000). Other works have argued that computer-mediated communication

may help individuals to communicate more clearly than face-to-face communication since the interference of many stigmatized features can be reduced (Sheeks and Birchmeier, 2007). The concept of computer mediated face-to-face interaction via a virtual world may provide a hybrid that allows for features from both environments. The present investigation is an important first step in that regard.

2. Experimental Design

The game. Participants were first engaged in 15-minute pre-play irrelevant communication in groups of three to four participants. We describe the communication process in detail shortly

Half of the participants were designated as proposers and the other half as responders. Participants were matched in proposer-responder pairs, either with members of their own (ingroup) or another (outgroup) communication group. The actual matching between proposers and responders as well as ingroup and outgroup allocation was done via Java Script in combination with PHP Hypertext Preprocessor protocol.

In the current version of the trust game, a first mover-- the proposer-- sends an amount from his initial endowment to a second mover—the responder. Any amount not sent is kept by the proposer. The amount sent to the responder is multiplied by 3 and the responder then chooses an amount to send back to the proposer.

We endowed both proposers and responders with equal initial endowments. The initial endowments are 10 Lab-Euros (4 Lab-Euros = 1 Euro) in the lab and 1000 Linden Dollars in Second Life (374 Linden Dollars=1 Euro).

To control for experimenter effects as well as to avoid collusion between the participants the trust game in Second Life was played via a web browser. The link to the web was implemented via Linden Scripting Language (LSL), which allows for self developed programs within objects in Second Life and more specifically interoperability between Second Life and the World Wide Web. By clicking on a link in Second Life, a web browser opened displaying the web page for the experiment. The web page explained the rules of the trust game and indicated to subjects whether they were in the role of proposer or responder, and whether they were to be matched with a partner in

their own communication group (ingroup) or from another communication group (outgroup). Neither the participants nor the experimenter knew with whom they were matched and all investment decisions were done in private. All data-- communication treatment, ingroup or outgroup allocation, amount sent and returned as well as all the questionnaire data and IP addresses - were saved in a SQL database. After the trust game was over, the amount each participant earned was computed in the database and paid to the participant instantly in Linden Dollars.

Communication. We wanted to generate personal interaction of the kind one might experience in a virtual community, while maintaining some control over the topics of discussion. To examine whether the topic of discussion influences behavior, we allowed for two sets of topics—personal and impersonal (see Buchan, Johnson and Croson, 2006). Personal topics discussion groups were told to introduce themselves, talk about their favorite birthday as a child and describe their ideal holiday, among other topics. Impersonal topics discussion groups were told to discuss topics concerning general knowledge about the world: to name the most populated cities of the world, the highest mountains, or countries that have the highest cost of living according to the UN. While these topics are framed as impersonal questions, the answers to these questions were discussed by the group in a collaborative environment, where group members inevitably disclosed information about themselves, although this was monitored and controlled to some extent. During the entire communication process, the discussions were observed by monitor avatars who ensured that only the assigned topics were discussed. The specific questions for the personal and impersonal treatments are given in appendix A.

University Subjects. A total of 176 university participants took part in the experiment. All 176 participants played the trust game with no knowledge of the real world identities of the people they interacted with. All the participants were students from the Ludwig-Maximilians-University of Munich. University participants were recruited via website posts, class announcements, and posters and leaflets in the different faculties—specifically psychology, informatics, communication science, medicine, and law.

Of 176 participants, 40 participants played the trust game without prior chat. This is condition 1. The remaining 136 participants were assigned to chat sessions in the virtual world of Second Life prior to playing the trust game. This is condition 2. The 136 participants in condition 2 were organized randomly into 45 small discussion groups: 44 groups of three participants and 1 group of four participants.

Second Life Subjects. Condition 3 involves 216 Second Life residents recruited via posts in several SL forums, blogs, ads and group notices. Individuals sent an email or an in-world instant message indicating that they were interested in participating. Participants were informed that no critical real world information had to be revealed and that it would take approximately 35 minutes to complete the experiment. Participants were then scheduled for communication sessions each hour between 9am and 3pm (Pacific Standard Time) since this seemed to be the time that was most convenient for the majority of the participants from Australia/New Zealand, Europe and North America. Participants were asked to be logged into the virtual world five minutes prior to the assigned time slot to avoid delay. They then received an invitation either via teleport or a landmark that teleported them directly into the assigned communication group. After participants arrived they were asked to take a seat and remain silent until the official start of the experiment. Communication groups were usually filled within 5 minutes. When possible, two communication groups were scheduled for the same time slot. Once everyone arrived and took a seat, a standard procedure was employed where the monitor avatar asked the participants to open their chat history and to state whether they knew anyone in the room. If so, participants were rescheduled. Every avatar was only allowed to participate once. Participants were told they would communicate for 15 minutes on the assigned topics and then asked to make a decision as well as to fill out a questionnaire. Participants were asked to text chat for the next 15 minutes about topics posted on the walls of the room where the communication took place. After indicating that they understood the instructions they chatted for 15 minutes.

Following the completion of the chat session, participants were told to click on a positioned script on the table in front of them that led them to the trust game interface. After finishing the trust game as well as answering the questionnaire participants sent an

instant message to us indicating that they are done. They then received their earnings in Linden Dollars (which can be instantly converted to Dollars) via Second Life pay.

The 216 participants assigned to communication in Second Life were organized randomly into 72 small discussion groups: one group of two participants, 70 groups of three participants and one group of four participants.

The demographic composition of the Second Life population is similar to the university population but Second Life subjects are somewhat older on average and the nationality of participants in Second Life is more heterogeneous. A summary of basic demographic information is shown below:

Insert Table 1 about here

3. Results.

3.1. Actions

The dependent variables in our analysis are the amount sent by the proposer to the responder and the proportion returned by the responder. We calculate the proportion returned as the amount responders returned divided by their total wealth- three times the amount sent plus the initial endowment.

The first aspect to note is that the patterns of behavior of university students (conditions 1 and 2) are similar to known results. Our laboratory no-communication treatment (condition 1) resulted in proportion sent of 50.5% (std. dev. 29.6%) and proportion returned of 34.7% (std. dev. 20.0%). In comparison, in the seminal trust game of Berg, Dickhaut and McCabe (1995), the average sent is 53.6% (59.7% in Cox) and the average returned is 35% of the amount received. These results have been replicated numerous times with a surprisingly tight range around these proportions (see Camerer, 2003 for an overview of replication studies, including cultural differences).

University students in the Virtual Pre-play Chat condition (condition 2) send 74.5% (std. dev. 27.5%) and return 38.2% (std. dev. 22.0%). The amount sent is significantly more than the same laboratory subject pool in the no-communication lab condition (which sent 50.5%), with a p-value of 0.001. The proportion returned is higher than the no-communication lab condition but not significantly so, with a p-value of 0.52.

Second Life resident proposers (condition 3) send 59% (std. dev. 34.9%). This is significantly (p-value of 0.003) less than laboratory subjects interacting in the Virtual Pre-play Chat condition, where giving is 74.5%. Second Life resident responders in condition 3 return 29.1% (std. dev. 28.6%). This is significantly (p-value of 0.028) less than laboratory subjects interacting in the Virtual Pre-play Chat condition, where the proportion returned is 38.2%.

Insert Table 2 about here

In the regression reported in the second column of Table 3, money sent by the proposer is the dependent variable and the treatments and demographics are explanatory variables. The results indicate that university recruited subjects are different from SL-recruited subjects, controlling for gender age and treatment variations, and send a greater proportion of their endowment to the responder. Note that motives are not included as explanatory variables. This is because motives are presumably determined by the other explanatory variables, resulting in endogeneity. We will revisit motives shortly.

The third column in Table 3 has the proportion returned as the dependent variable and treatment variables as well as demographics as the explanatory variables. It shows that the subject pool differences are large, controlling for gender and age, and that university subjects return a significantly higher proportion than SL subjects.

The regression also indicates that ingroup affiliation makes a significant and positive difference in the proportion returned by the responders.

Insert Table 3 about here

3.2. Motives

We established that laboratory subjects interacting via the virtual world appear to send and return more than SL-recruited subjects. However, there are several motives that could account for the observed behavior. We report some averages on a number of other-

regarding motives that have been proposed in the literature as explanations for observed behavior in the trust game.

The first motive we examine is a cooperative sentiment, which could be viewed as a proxy for altruism. Subjects were asked to indicate how cooperative they felt towards their partners. The second motive is trust in one's partner. This motive was broken down by ingroup and outgroup partners. The third motive is feeling of obligation towards one's partner. Lastly, the utilitarian motive was the subject's indicated importance to maximizing joint earnings.

Insert Table 4 about here

For lab proposers, ingroup trust (4.07) was significantly higher than outgroup trust (2.88) ($p\text{-value} < 0.001$) in a matched pair t-test. For SL proposers, ingroup trust (4.44) was significantly higher than outgroup trust (3.08), with a $p\text{-value}$ of $p < 0.001$. This despite the fact that money sent is not significantly different for those matched with ingroup members and those matched with outgroup members.

The $p\text{-value}$ for matched comparison of ingroup and outgroup trust for lab responders is less than 0.001. For SL responders as well ingroup trust is significantly higher than outgroup trust at $p < 0.001$ (matched pair t-test). This is consistent with the finding that responder's proportion returned is significantly higher for ingroup members.

Responders on SL have significantly more ingroup trust ($p\text{-value} = 0.004$) and more outgroup trust ($p\text{-value} = 0.070$) than Responders in the lab interacting via SL. No other motives in Table 4 exhibit significant difference though both SL proposers and SL responders subjects give higher trust scores than lab subjects. The differences between lab and SL subjects on cooperative, utilitarian and obligation sentiments are small and not consistent between roles or motives, suggesting that there is likely not much difference there.

We next estimate, in Table 5, the impact of the various motives on proposer and responder choices in the trust game. The amount sent by proposers, in both the lab and the field, is increasing in cooperative and utilitarian motives, but not in trust. As

discussed earlier, the first two motives do not appear different in lab subjects relative to the field subjects. Due to the high correlation between the various motives, we also examined each motive separately. In that case, trust shows to significantly affect the amount sent in both the lab and the field. Given the evidence that the lab and SL subjects (responders more than proposers) might have different levels of trust, this could explain the different amounts being sent.

The proportion returned by responders, in both the lab and the field, is significantly increasing only in utilitarian motives. Given that the lab and field are not significantly different in levels of utilitarian sentiment, this cannot explain the different amounts being sent. Even though ingroup and outgroup trust should not affect responder behavior, we checked these as potential explanatory variables and they did not come out significant. As a sole explanatory variable, the level of obligation is significant with $p\text{-value}=0.03$ in SL subjects but not lab subjects. Hence, it may be that the explanation for the differences between the lab and SL subjects is that the level of obligation-- about the same in both conditions-- is only mapped into action in SL.

4. Conclusions

In the search for the ideal experimental environment, there is an inherent tradeoff between control and realism, where the laboratory is advantaged in the former and the field is advantaged in the latter. A compromise between the lab and the field may be found in virtual world experiments, which provide both limited realism and a considerable measure of control. It is important to stress that the increased realism of virtual world relative to the lab comes from the participants' familiarity and everyday experience with social interaction in virtual worlds. Without that familiarity and experience, virtual world communication is no more realistic than computerized communication in the lab-- much as an internet auction is no more realistic than a laboratory auction to someone uninitiated with such a platform.

The term "field experiment" is still under debate and may mean different things to different audiences. Harrison and List (2004) differentiate between artefactual field experiments, framed field experiments, natural field experiments, social experiments, natural experiments and thought experiments and Levitt and List (2009) add to this list propensity score estimation, instrumental variables estimation and structural modeling. We justify our claim to have conducted a "field experiment" by the fact that we went to the field (the virtual world), recruited subjects from the field as opposed to the usual university subject pool, and permitted them to interact in the virtual field as they would normally do in the field (face-to-face unstructured communication). To the extent that the term "field experiment" is still under debate, we hope that this clarified what we meant by it.

A framework for evaluating the generalizability of lab behavior to the field has been proposed by Levitt and List (2007a), building on Harrison and List (2004). The framework raises several important aspects for comparison between lab and field. Key aspects from that framework in the present context are (1) Scrutiny (2) Anonymity, (3)

Context, (4) Stakes, and (5) Selection. We find this framework useful for highlighting the merits of the present setting.

Scrutiny. Similar to other experiments that compare field and lab settings, such as Gneezy, Haruvy and Yafe (2004) we find that participants exhibit considerably higher levels of trusting behavior in the lab than in the framed field experiment. Levitt and List (2007a) suggest that scrutiny will exaggerate the importance of pro-social behaviors relative to environments with less scrutiny. Even though we applied the same kind of monitoring in the lab as in the field experiments (a monitor avatar was present in the virtual room during all experimental chat sessions) and the monitoring was only regarding the chat procedure not regarding the investment decision (the investment decision was done via a website) we believe that the moral costs of non-social behavior are higher in the lab than in the field since participants know that the monitors are within spatial proximity whereas in the field experiments the monitors might be located in a different city, country or even on a different continent.

Anonymity. We implemented a double-blind experimental procedure (Hoffman et al., 1994) that allowed for anonymity between experimenter and participants regarding their investment decisions in the field as well as in the lab experiments. Anonymity between subjects regarding their true identity is also largely maintained to the extent that Second Life participants value their real world identities and reputation (and most do) and lab participants used standard avatars that were generated for the experiment and then disposed of. Anonymity is however reduced in the virtual setting due to the pre-play chat. What is interesting is that lab subjects with Second Life avatars greatly alter their behavior. Haley and Fessler (2005) find that dictator game giving increases when a pair of eyes is shown on the screen. In our case, this pair of eyes is accompanied by a face and a body, so in that sense anonymity decreases.

Context. Another crucial difference between the lab and the field is context. As Harrison and List (2004) and Levitt and List (2007a) point out, social norms can be extremely sensitive to context. The environment, including furniture arrangement and décor may influence behavior (Harrison and List, 2004). We tried different room decors in Second Life but found no significant effect. Nevertheless, the physical characteristics of the environment are much more easily manipulated in virtual worlds and this is

perhaps an avenue for future research (see Atlas and Putterman, 2009). List (2006) found that sports-card dealers behaved very similarly to subjects in the lab while being in the lab but very differently in their natural field. To the extent that our Second Life subjects felt that the controlled environment we placed them in resembled their “natural habitat” (was less artificial than either the laboratory or the Second Life setting would seem to the typical university subject), this might account for the results we observed. More relevant for the present investigation is the task itself. Pre-play chat for laboratory subjects may feel forced, as subjects arrive for an experiment—not a chatting exercise. In Second Life, subjects’ primary activity is social interaction. The chat tools are familiar and natural and the conversation flows freely. As such, a study of pre-play chat has a much more natural feel to it in Second Life.

Stakes. High stakes are generally known to reduce social considerations (Slonim and Roth, 1998; Parco et al., 2002). In the present setting, while the dollar incentives were the same between the lab and Second Life, they were considered very high relative to wages in Second Life. This might be responsible for the less social behavior observed by Second Life subjects relative to the university recruited subjects interacting in a Second Life platform.

Selection. There is some research (see reviews in Harrison and List, 2004 and Levitt and List, 2007a) to indicate that university subjects may be different than the population at large and may be more prone to seek social approval. The population we accessed in our Second Life experiments is clearly more diverse in age, nationality and occupation than our university population. Furthermore, the emphasis in Second Life on profit-making and entrepreneurial behavior may create a self-selection of subjects that are less likely to be do-gooders.

Virtual worlds such as Second Life have more realism than the lab regarding the reduced level of scrutiny and anonymity as well as the richer context, relatively higher stakes and selection diversity thus contributing to a higher level of generalizability. At the same time virtual worlds enable the experimenter to exert a high level of control over the experimental process. Virtual worlds such as Second Life allow for example screening and blocking of undesired participants, double-blind procedures, randomization regarding recruitment and matching of participants and identification of IP addresses and

participating client names (see Bloomfield and Rennekamp (2008) and Atlas (2008) for an overview on possible measures to exercise control in virtual world experiments). Further more, unlike social experiments, artefactual and framed experiments in virtual worlds such as the ones conducted here do not need to worry about randomization, attrition and substitution bias since subjects are unaware that the experimenter is using randomization and the experiments are short-lived (Levitt and List, 2009). Also, artefactual and framed field experiments in virtual worlds lend themselves to replication regarding reanalyzing of existing data, running new experiments following existing protocols, and design new experiments testing the same hypotheses (Levitt and List, 2009).

We are however also aware that studies of virtual world participants like studies of sumo wrestlers or sports-card traders cannot be seamlessly extrapolated to other economic settings (Levitt and List, 2007a). Also, as in any internet-based research endeavor, measures such as running double-blind procedures, ensuring that participants believe that they are matched with a real person, appeals directed to the honesty and fairness of the participants, requiring a certain experience, collecting IP addresses and guaranteeing an anonymous data analysis and strict confidentiality are helpful in reducing problems associated with self-reported measures and playing the game more than once but are no guarantee for eliminating them (Anderhub et al., 2001; Drehmann et al., 2005, 2007; Eckel and Wilson, 2006).

There are two possible approaches in using virtual world interfaces for artefactual and framed experiments. The first is to bring student subjects to the lab with the usual recruiting methods, and to use the virtual world as a laboratory platform. The second approach, the field approach, is to recruit the subjects and run the experiment in the virtual world. In this work, we examined both approaches.

We presented results from trust games conducted in Second Life using both approaches as well as a control treatment. This provided us with the ability to assess both subject pool and platform effects. We found that the personal interaction enabled by the virtual world platform significantly increased the amount sent by proposers. Hence, if the populations and social norms emerging in virtual worlds were the same as in the lab with university recruits, one should expect to see more money sent in the virtual world as well

a greater proportion returned. However, controlling for the experimental platform, it appears that the population residing in the virtual world sends less and returns less than university-recruited laboratory subjects using the SL platform to communicate.

The population difference in behavior between SL-residents and university students could be due to two main reasons: First, people who reside on virtual worlds may be more selfish or less social than university students. This could be due to heterogeneity that is manifested in self-selection. The second explanation would be different norms that might have emerged in Second Life, possibly due to increased physical and social distance. The two explanations are not independent of each other. Though we cannot fully separate out the two explanations, we attempted to tease out the motives through direct disclosure by participants. The only reported motives that came out significantly different between the treatments were ingroup and outgroup trust in the responder role. This is not naturally a very meaningful motive since responders are not required to trust anyone. So it may just be a reflection of what responders expect from proposers, which is primarily self-serving. Or it could be a noisy proxy to social distance which might be greater between subjects recruited in the virtual world than between subjects recruited in a university, though reported measures of perceived social distance (perceived similarity) were not significantly different between the environments.

6. References

- Anderhub, V., Müller, R., Schmidt, C., 2001. Design and evaluation of an economic experiment via the Internet. *Journal of Economic Behavior and Organization* 46(2), 227-247.
- Atlas, S., 2008. Inductive Metanomics: Economic Experiments in Virtual Worlds. *Journal of Virtual Worlds Research* 1(1), 1-15.
- Atlas, S., Putterman, L., 2009. Trust among the Avatars: Playing Trust Games in a Virtual World, with and without Textual and Visual Cues. Unpublished Working Paper, Brown University.
- Bainbridge, W., 2007. The scientific research potential of virtual worlds. *Science* 317(5837), 472-476.
- Berg, J., Dickhaut, J., McCabe, K., 1995. Trust, reciprocity and social history. *Games and Economic Behavior* 10(1), 122-142.
- Biocca, F., 1996. Intelligence augmentation: The vision inside virtual reality. In: Gorayska, B., Mey, J. (Eds.). *Cognitive technology: in search of a humane interface*. Amsterdam: Elsevier, 59-73.
- Bloomfield, R., 2007. Worlds for Study: Invitation. Working Paper. Cornell University.

- Bloomfield, R., Rennekamp, K., 2008. From the Laboratory to the Virtual World. Unpublished Working Paper, Cornell University.
- Bochet, O., Page, T., Putterman, L., 2006. Communication and Punishment in Voluntary Contribution Experiments. *Journal of Economic Behavior and Organization* 60(1), 11-26.
- Brosig, J., Ockenfels, A., Weimann, J., 2003. The Effect of Communication Media on Cooperation. *German Economic Review* 4(2), 217-241.
- Buchan, N., Johnson, E., Croson, R., 2006. Let's get personal: an international examination of the influence of communication, culture and social distance on other regarding preferences. *Journal of Economic Behavior and Organization* 60(3), 373-398.
- Castronova, E., 2001. Virtual Worlds: A First-Hand Account of Market and Society on the Cyberian Frontier. Working Paper. Indiana University Bloomington.
- Camerer, C.F., 2003. *Behavioral Game Theory*. Princeton: Princeton University Press.
- Charness, G., Dufwenberg, M., 2006. Promises and Partnership. *Econometrica* 74(6), 1579-1601.
- Charness, G., Gneezy, U., 2007. What's in a Name? Reducing the Social Distance in Dictator and Ultimatum Games. Forthcoming in *Journal of Economic Behavior and Organization*.
- Charness, G., Haruvy, E., Sonsino, D., 2007. Social Distance and Reciprocity: An Internet Experiment. *Journal of Economic Behavior and Organization* 63(1), 88-103.
- Chesney, T., Chuah, S., Hoffman, R., 2007. Virtual World Experimentation: An Exploratory Study. Working Paper. Nottingham University.
- Dawes, R.M., McTavish, J., Shaklee, H., 1977. Behavior, Communication, and Assumptions About Other People's Behavior in A Commons Dilemma Situation. *Journal of Personality and Social Psychology* 35(1), 1-11.
- Drehmann, M., Oechssler, J., Roider, A., 2005. Herding and Contrarian Behavior in Financial Markets: An Internet Experiment. *American Economic Review* 95(5), 1403-1426.
- Drehmann, M., Oechssler, J., Roider, A., 2007. Herding with and without payoff externalities – an internet experiment. *International Journal of Industrial Organization* 25(2), 391-415.
- Duffy, J., Feltovich, N., 2002. Do Actions Speak Louder Than Words? Observation vs. Cheap Talk as Coordination Devices. *Games and Economic Behavior* 39, 1-27.
- Dufwenberg, M., Muren, A., 2002. Discrimination by Gender and Social Distance. Working Paper. University of Arizona.
- Eckel, C., Wilson, R., 2006. Internet cautions: Experimental games with internet partners. *Experimental Economics* 9(1), 53-66.
- Frohlich, N., Oppenheimer, J., 1998. Some Consequences of Email vs. Face-to-Face Communication in Experiments. *Journal of Economic Behavior and Organization* 35(3), 389-403.
- Gneezy, U., Haruvy, E., Yafe, H., 2004. The Inefficiency of Splitting the Bill: A Lesson in Institution Design. *The Economic Journal* 114, 265-280.
- Haley, K.J., Fessler, D.M.T., 2005. Nobody's watching? Subtle clues affect generosity in an anonymous economic game. *Evolution of Human Behavior* 26, 245-256.

- Harrison, G.W., List, J.A., 2004. Field Experiments. *Journal of Economic Literature* 42(2), 1009–1055.
- Hoffman, E., McCabe, K., Shachat, K., Smith, V., 1994. Preferences, property rights and anonymity in bargaining games. *Games and Economic Behavior* 7(3), 346–380.
- Jarvenpaa, S., Leidner, D., 1999. Communication and Trust in Global Virtual Teams. *Org. Science* 10(6), 791-815.
- Jensen, C., Farnham, S.D., Drucker, S.M., Kollock, P., 2000. The effect of communication modality on cooperation in online environments. *Proceedings of the SIGCHI conference on Human factors in computing systems*, The Hague, The Netherlands, 470-477.
- Kelly, J., Futoran, G., McGrath, J., 1990. Capacity and capability: seven studies of entertainment of task performance in task performance rates. *Small Group Research* 21(1), 283-314.
- Kelly, J., McGrath, J., 1985. Effects of time limits and task types on task performance and interaction of four person groups. *Journal of Personality and Social Psychology* 49(2), 395-407.
- Levitt, S.D., List, J.A., 2007a. What do laboratory experiments measuring social preferences reveal about the real world? *Journal of Economic Perspectives* 21(2), 153-174.
- Levitt, S.D., List, J.A., 2007b. Viewpoint: On the generalizability of lab behaviour to the field. *Canadian Journal of Economics* 40(2), 347-370.
- Levitt, S.D., List, J.A., 2009. Field experiments in economics: The past, the present, and the future. *European Economic Review* 53(1), 1-18.
- Linden Lab, 2008. Economic Statistics, http://secondlife.com/whatis/economy_stats.php.
- Nardi, B., Whittaker, S. 2002. The Place of Face-to-Face Communication in Distributed Work. In: Hinds, P., Kiesler, S. (Eds.). *Distributed Work: New Research on Working Across Distance Using Technology*. Cambridge: MIT Press, 83-110.
- Nohria, N., Eccles, R.G., 1992. *Networks and Organizations: Structure, Form, and Action*. Boston: Harvard Business School Press.
- O'Hara-Devereaux, M., Johansen, R., 1994. *Globalwork: Bridging Distance, Culture, and Time*. San Francisco: Jossey-Bass.
- Parco, J.E., Rapoport, A., Stein, W.E., 2002. Effects of Financial Incentives on the Breakdown of Mutual Trust. *Psychological Science* 13(3), 292-297.
- Piller, F., Salvador, F., 2007. A Total Makeover of Retail - Rather Than Pursuing Marginal Improvements in Speed, the Next Source of Competitive Advantage For Retailers Lies in Creating Virtual Representations of Their Customers and Assortments. Working Paper. Technische Universitaet Muenchen.
- Roth, A.E., 1995. Bargaining Experiments. In: Kagel, J.H., Roth, A.E. (Eds.). *The Handbook of Experimental Economics*. Princeton: Princeton University Press, 253-348.
- Sheeks, M.S., Birchmeier, Z.P., 2007. Shyness, Sociability, and the Use of Computer-Mediated Communication in Relationship Development. *CyberPsychology and Behavior* 10(1), 64-70.
- Slonim, R., Roth, A.E., 1998. Learning in high stakes ultimatum games: An experiment in the Slovak Republic. *Econometrica* 66(3), 569-596.

- Spann, M., Hinz, O., Hann, I.H., Skiera, B., 2008. The validity of decision making in virtual worlds: An experimental test of altruism, fairness, and presence. Working Paper. University of Passau.
- Walther, J., 1994. Anticipated ongoing interaction versus channel effects on relational communication in computer mediated interaction. *Human Communication Research* 20(4), 473-501.

Appendix A. Discussion Questions for Interaction in Second Life

Personal Topics

- 1) Each person in the group should introduce themselves and say what school they attend/attended, what year they are or were in school, and what day is their birthday.
- 2) Each person in the group should tell about their favorite birthday when they were a child.
- 3) Each person in the group should tell how they would normally celebrate their birthday with their family.
- 4) Each person in the group should explain what their ideal birthday celebration would be.
- 5) Each person in the group should explain what their favorite holiday looks like.

Impersonal Topics

- 1) What are the ten most populated cities in the world?
- 2) As recorded by the United Nations, what five countries have the highest cost of living in the world?
- 3) Using both the Fahrenheit and Celsius (Centigrade) Scales:
 - A) What is the boiling point of water?
 - B) What is the freezing point of water?
 - C) What temperature is absolute zero?
- 4) What country contains the highest mountains in the world? Name them?
- 5) What 6 countries border Zambia in Southern Africa?
- 6) Name 3 countries which refer to their unit of currency as the “dollar”?
Name 3 countries which refer to their unit of currency as the “franc”?
Name 3 countries which refer to their unit of currency as the “peso”?
- 7) Estimate the distance in miles or kilometers between Paris and the following world cities:

Paris ----- > Hong Kong
Paris ----- > Sydney
Paris ----- > Moscow
Paris ----- > Stockholm

Tables

Table 1. Basic Demographic Composition

	Gender	Age: Mean, (std. dev.), range	Country in which they were at the time
Second Life Participants	40% males	33 (11), 16-70	USA: 84 Europe: 99 Other: 15 Unknown: 18
University Recruited Participants	41% males	24 (5), 18-57	Germany: All

Table 2. Subject Choices in the Trust Game

	N	Proportion Sent	Proportion Returned
Condition 1. University Participants without pre-play chat	40	50.5 (29.6)	34.7 (20.0)
Condition 2. University Participants with Second Life pre-play chat	136	74.5 (27.5)	38.2 (22.1)
Condition 3. Second Life Participants with Second Life pre-play chat	216	59.5 (34.9)	29.1 (28.6)

Table 3. Proposer and Responder Regressions.

Proportions sent and returned are the dependent variables and treatment and personal characteristics are the independent variables. Standard errors are in parentheses.

	Dependent variable: Proportion Sent by Proposer	Dependent variable: Proportion Returned by Responder
Intercept	30.826** (11.618)	5.694 (7.744)
Personal Communication	5.823 (4.985)	2.308 (3.916)
Ingroup Partner	0.272 (4.911)	8.041** (3.952)
Male	6.659 (4.985)	1.938 (4.069)
Age	0.694** (0.307)	0.547** (0.207)
University recruited	21.682** (5.668)	12.472** (4.418)

*Significant at 10% level

** Significant at 5% level

Table 4. Average scores, on a 7-point Likert scale, on other-regarding motives in different settings and roles.

Role	Setting	Cooperative	Ingroup Trust	Outgroup Trust	Obligated	Utilitarian
Proposer	Second Life	4.52	4.44	3.08	3.27	4.95
	Lab	4.87	4.07	2.88	2.74	5.13
Responder	Second Life	4.88	4.44	3.36	4.33	4.78
	Lab	4.81	3.74	2.91	4.78	4.67

Table 5. Regressions on Motives for Proposers and Responders

Proportions sent and returned are the dependent variables and treatment and motives are the independent variables. Standard errors are in parentheses.

Table 5a. Proposers

	Lab Proposer	Lab Proposer	SL Proposer	SLProposer
	Dependent variable: Proportion Sent Full Regression	Dependent variable: Proportion Sent Trust Only	Dependent variable: Proportion Sent Full Regression	Dependent variable: Proportion Sent Trust Only
Intercept	17.355** (8.228)	52.627** (7.615)	0.284 (7.292)	29.244** (7.125)

Trust	-0.898 (1.599)	5.147** (1.633)	1.284 (1.806)	8.421** (1.790)
Cooperative	6.391** (2.144)	-----	8.433** (1.686)	-----
Utilitarian	5.817** (1.713)	-----	3.330** (1.513)	-----

*Significant at 10% level

** Significant at 5% level

Table 5b. Responders

	Lab Responder	SL Responder
	Dependent variable: Proportion Sent	Dependent variable: Proportion Sent
Intercept	15.030* (7.708)	0.654 (7.346)
Obligated	-0.825 (1.506)	2.401 (1.433)
Cooperative	1.138 (1.743)	-0.628 (1.711)
Utilitarian	4.624** (1.508)	4.418** (1.389)

*Significant at 10% level

** Significant at 5% level