Social distance in a virtual world experiment*

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Abstract

We report on lab and virtual world experiments to explore the effect of social distance on the choice of economic opportunities. We study trust games with partner selection, in which the proposer can choose between two different responders. Potential responders vary in social distance from the proposer, and the investment multiplier *increases* with social distance. This design allows us to study how individuals make decisions involving tradeoffs between economic opportunities and social distance. Compare participants' behavior to that in a benchmark standalone trust game, we find that the proposers are more likely to select the socially closer responders despite the lower rate of investment returns, and the latter reciprocated by returning a higher proportion than the socially distant responders. Virtual communications also play an important role on the proposers' selection of partners and the responders' reciprocity. In contrast, social distance and virtual communication has less impact in the lab experiment in which a college student sample is used.

Keywords: Experiments, Social Distance, Trust, Partner Selection, Communication, Cheap Talk, Virtual Worlds.
JEL classification: C93, C99, D63

* We are indebted to Rachel Croson and the behavioral/experimental economics reading group at UT–Dallas for helpful advice. We thank Tian Yu and Yufei Ren for excellent research assistance. Fiedler: Institute for Information, Organization & Management, Ludwig-Maximilians University, Ludwigstraße 28 VG II/Zi. 203, Munich, Germany 80539 (Email: fiedler@lmu.de). Haruvy: School of Management, SM 32, the University of Texas at Dallas, 800 West Campbell Road, Richardson, TX 75080-3021 (Email: eharuvy@utdallas.edu). Li: School of Economic, Political and Policy Sciences, University of Texas at Dallas, 800 West Campbell Road, Richardson, TX 75080-3021 (Email: sherry.xin.li@utdallas.edu).

1. Introduction

Social distance can greatly affect economic outcomes (Eckel and Wilson, 2002; Charness, Haruvy and Sonsino, 2007; Cox and Deck, 2005; Rao and Schmidt, 1998). Studies show that social distance may play a crucial role in one's choice between alternative partners in economic interactions, and result in a selection of partners that are perceived as more trustworthy (Eckel and Wilson, 2000; Slonim and Garbarino, 2006).

Over the past decade, the concept of social distance has been enriched by the rapidly growing popularity of virtual worlds – computer-mediated online communities where human participants interact via their computerized graphical representations called avatars. The largest virtual worlds, for example, World of Warcraft and Norrath, have more than tens of millions of registered accounts. A virtual world simulates many aspects of the physical world, for example, groups of users meet to play games, share information, discuss mutual interests, shop, or carry out business (Bloomfield, 2007). Different from in the real world, users are brought from physically distant locations to virtual communities, and interact via avatars without exposing their real-world identities. These activities range from entertainment, virtual social gathering to economic transactions. Users may trade a wide range of commodities varying from some virtual goods (e.g., a light saber, a speeder bike on the online computer game Star Wars Galaxies) to labor (e.g., service to develop some virtual real estate). In sum, virtual interactions have become an important form of modern socialization; economic activities in virtual worlds have created a vast world market, in which such large volume of real incomes are generated that the U.S. Congress started looking into the tax noncompliance issue related to the virtual economy (see the National Taxpayer Advocate's 2008 Annual Report to Congress). The size and scope of virtual worlds make them a new front for social interactions, and an interesting and fast growing sector of the economy.

Since the virtual world users come from all over the world and interact through their avatars an interesting question is how communications may change the perceived social distance which may impact economic decision making. We investigate this question by designing a quasi-field experiment and a lab experiment. Specifically, we examine the impact of social distance and virtual communication on individuals' decisions in a trust game that involves partner selection. In the trust game we vary the social distance between the proposer and the two potential responders, and make the investment multiplier *increase* with the social distance. The proposer makes a choice between the two trust games with the two different responders, facing a tradeoff between economic opportunities and social distance. We compare results to the benchmark standalone trust game and investigate three questions. To what extent are the proposers willing to sacrifice potential payoffs in favor of lower social distance? To what extent does social distance affect the amount sent by proposers? Does the socially closer responder justify the trust placed in her by returning a greater proportion to the proposer?

We implement this experiment in a quasi-field study conducted on a virtual world called Second Life, and in the lab for comparison. Second Life suites our study since it has a large economic component. Its currency, Linden dollars, is exchangeable with the U.S. dollar. Their users engage in various economic transactions ranging from buying or selling real estate to providing or consuming entertainment. There are many shopping malls, entertainment venues, banks, and other businesses, and several in world active stock markets. Moreover, many major corporations and educational institutions have a virtual presence on Second Life. We will provide more background information on Second Life in Section 2.

Compared to a traditional laboratory setting for studying social distance and partner selection, the virtual world provides a natural social context for a large body of users that is far more diverse than the college students sample in many aspects, e.g., age, education level, race, ethnicity and country of origin. On the one hand, the presence of the vast physical distance amongst users (users participate from different countries) offers researchers much flexibility to try out various experimental manipulations of social distance while preserving participants' anonymity. On the other hand, it offers reasonable control by researchers while allowing for social interaction in a natural environment familiar to virtual world users (Bainbridge, 2007; Bloomfield, 2007; Castronova, 2001), a combination of features not previously available in a traditional laboratory (Bainbridge, 2007). Previous studies on partner selection are conducted in the lab and involve pre-play observation (Mulford et al., 1998) or communication (Frank et al., 1993) through face-to-face interaction. The problem of the design is that face-to-face interaction introduces social confounds (Eckel and Wilson, 2000). The alternative, proposed by Eckel and Wilson (2000), is to substitute faces with experimenter-generated smiley or frowning faces. This latter option removes confounds inherent in face-to-face interaction but also removes the information about the partner that comes with communication. In contrast, virtual worlds offer the possibility for users to have virtual-face-to-virtual-face communication without compromising real-world anonymity.

We acknowledge that the use of a virtual world as a platform for an economics experiment is unconventional, and the advantages it presides come with shortcomings—particularly some loss of control. To address comparability issues to other lab studies, we ran all treatments in both the virtual world and the laboratory. We will elaborate on the experimental design in Section 3.

The paper is organized as follows. Section 2 reviews the related literature and introduces virtual worlds. Section 3 outlines the experimental design. Section 4 presents a theoretical framework and introduces the hypotheses. Section 5 presents the main results, compares and contrasts the Second Life experiment with the lab experiment. Section 6 concludes and discusses implications of the results.

2. Background and Literature

Our paper crosses the boundaries of three related streams of the literature. First, we discuss works on partner selection in trust and ultimatum games. Second, we highlight seminal works on social distance in games, which will allow us to speculate on the merger of social distance with partner selection. Third, we review recent literature on virtual worlds, which is essential to understanding both the advantages and limitations of the present setup.

2.1. Partner Selection in Trust games

In the small but growing literature on partner selection in trust games, Eckel and Wilson (2000) is most closely related to our study. In their experiment, the first mover faced a choice between trust games with different responders and different rates of return. The two potential responders were labeled with facial icons that appeared friendly, neutral, or unfriendly. In two of the four trust games, the returns on the branches associated with the second mover's choice differed between the potential partners. These different returns for the two responders could be interpreted as multipliers of 2 and 2.2.[1] This design allows researchers to gauge the strength of the preference one has for the differentiating variable – the facial icon in this case. The study found that first movers showed a strong tendency to choose a responder represented by a friendlier looking icon. Trust was not significantly affected by the choice of icon, but this is likely due to the restricted choice space (two branches) given to the first movers.

Slonim (2006) and Slonim and Garbarino (2006) examined how selection affected choice in a trust game with a multiplier of 3, with and without partner selection. Available responders were identified by gender and one other attribute (score on an addition task in Slonim, 2006; age in Slonim and Garbarino, 2006). In the selection treatment, first movers could choose between partners (three in Slonim, 2006; two in Slonim and Garbarino, 2006), whereas in the no selection treatment, first movers were not given a choice between possible partners. They found that selection increased the amount sent and thus efficiency and that first movers' selection was not independent of the amount sent.

Partner selection has several potential implications. First, the choice of one partner over another is in itself a favorable action towards the chosen partner, and may be reciprocated by that partner (e.g., Segal and Sobel, 2007), thereby fundamentally changing both proposer and responder's behaviors relative to those in the standalone trust game. Second, partner selection reflects the beliefs of the first mover about the comparative payoffs of the two alternatives, and therefore reflects beliefs and attitudes towards differentiating characteristics between the two potential second movers, such as gender (see overview in Croson and Gneezy, 2004), ethnicity (e.g., Fershtman and Gneezy, 2001), or facial expressions (Eckel and Wilson, 2000). This decision task could apply to hiring or promotion differentials between genders or races as well as to business cronyism (Khatri and Tsang, 2003; Khatri, Tsang and Begley, 2006) and reluctance to enter joint ventures with foreign entities (e.g., Weiss, 1993; McLarney and Rhyno, 1998). When beliefs are correct, selection increases the amount sent and therefore efficiency

[1] Alternatively, they could be interpreted, as different amounts passed, 5 to one and 6 to the other, and then multiplied by the same multiplier of 3.

relative to no selection (Slonim and Garbarino, 2006). However, when beliefs are incorrect, inefficiency may result. Attitudes also matter. Slonim (2006) found that the preference of male first movers for female second movers in the trust game is primarily driven by taste, rather than expectations. Such preferences, even when well intentioned, may reduce social welfare (Becker 1957). Third, social preferences such as altruism and equity preferences now involve one passive player and may enter in various ways. In other works (e.g., Guth and Van Damme, 1998; Chakravarti and Haruvy, 2003) it appears that proposers have some regard for passive players.

2.2. Social Distance

Social distance is defined as the perceived distance between individuals or groups (Dufwenberg and Muren, 2006). It can be interpreted as the perceived dimension of closeness between interacting people or groups. Social distance has been shown to be a central concept in understanding phenomena in management, psychology, sociology, anthropology and political science. Akerlof (1997) pointed out that researchers need to incorporate social distance to explain individual decisions bearing social consequences. Social distance plays a role in hiring, in business success, and in job performance, e.g. by enabling the gathering of information, blocking competition, and collusion in setting prices or policies (Wasserman and Faust, 1994). Low social distance increases trust and reciprocity (Charness, Haruvy and Sonsino, 2007; Cox and Deck, 2005; Eckel and Wilson, 2002) which in turn can have positive effects on work performance, cooperation, dilemma experiment, Orbell et al. (1988) observe that cooperation is greater among participants with low social distance. 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 effects of low social distance. Buchan et al. (2006) find that Americans show higher levels of cooperation to members with low social distance. Social distance increases with the degree of anonymity. Economic research on the impact of anonymity on behavior and preferences yield mixed results. Charness and Gneezy (2008) show that anonymity can increase selfishness, whereas Dufwenberg and Muren (2006) suggest that anonymity may at times reduce selfishness.

Anonymity or its absence interacts with preferences of individuals over a number of personal and demographic characteristics they value in a partner. For example, findings in the extant literature from dictator, bargaining and trust games appear to suggest that males are more generous to females than to other males (Kahn, Nelson, and Gaeddert, 1980; Saad and Gill 2001a, 2001b; Dufwenberg and Muren, 2006; Slonim, 2006). This finding seems contradictory to the gender gap in earnings that substantially favors males. However, this finding abstracts from selection, and it is possible that men prefer to partner with other men in business relationships. Dana et al (2004) and Dana et al. (2005) show that selection and the amount contributed need not go in the same direction. Dana et al. (2005) found that about one third of participants were willing to exit a $10 dictator game and take $9 instead, a behavior that clearly shows the contradiction between selection and giving.

In a virtual environment, the direction of social distance can be difficult to pinpoint. That is, the virtual interaction may either increase or decrease perceived social distance. On the one hand, with avatar-based interaction, real-world anonymity is maintained in that participants do not know the real-world identities of those who they interact with. Many people enjoy participating in activities in virtual worlds because they do not have to behave in the consistent ways as they do in the real life. By this argument, one could say that anonymity, and therefore social distance, increases in virtual worlds. Adding to this point of view is the fact that participants recruited in the virtual world are likely to be from geographically distant locations, hence farther increasing social distance

(Charness et al. 2007). On the other hand, the virtual persona is very real to many participants, and so is its reputation. The medium is used by many for the exact purpose of fostering deep relationships (Bainbridge, 2007), and to the extent that the medium is used in this way, it may construct duplicates of facilities that are comparable to a real-world laboratory, and in the meantime minimize the potential confounds in traditional lab setting because some subjects may know each other *ex prior*. Logistically, it is a much easier proposition given the multi-room setup and the need to monitor and control communication. Bloomfield (2007) argues that Second Life suites economics research due to its rich economy, naturally evolving markets, and active commerce.

One main feature of our experiment design is that participants communicate face-to-face, although it is done virtually. 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 *real* face-to-face communications (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.

3. Experimental Design

The experiment design includes two treatments (*Selection 2-3* and *Selection 2-4*) where three subjects participate in trust games with partner selection, and two controls (*Control 3* and *Control 4*) where two subjects participate in a standard standalone trust game.[2] We design the trust games with partner selection by manipulating potential responders' social distance from the proposer, and imposing different investment multipliers such that the potential rate of return *increases* with social distance. Specifically, the proposer can

[2] In our design the responder is allowed to return up to her endowment plus the amount sent times the multiplier. In Berg, Dickhaut, and McCabe (1995) the responder pockets the endowment and may return up to the amount sent times the multiplier.

choose to invest in a socially closer responder at the same (virtual) lab with whom the proposer has had prior communication, or invest in an anonymous stranger sitting in another lab with whom the multiplier is higher. When making such choice, the proposer faces a tradeoff between economic opportunities and social distance. In contrast, the control sessions consist of only two players who participate in a standard standalone trust game. The proposer has no choice over the responder. The four experiment treatments are summarized in Table 1.

The experiment was conducted at the Second Life virtual labs using the Second Life users (hereafter referred to as the "SL experiment"), and also using university student subjects (hereafter, the "lab experiment"). Next, we will explain the experimental protocol and procedure in detail. We will first focus on the SL experiment when introducing each stage of the design, and then introduce the university student subjects and explain the differences in the lab experiment.

Table 1: The experimental treatments

Treatments	Number of Players	Chat	Choice of Responder	Multiplier	Number of Sessions
Control 3	2	No	No	All: 3	31 SL pairs; 48 lab pairs
Control 4	2	No	No	All: 4	31 SL pairs; 48 lab pairs
Selection 2-3	3	Yes	Yes	In-room: 2 Out-room: 3	69 triplets in SL; 30 triplets in the lab
Selection 2-4	3	Yes	Yes	In-room: 2 Out-room: 4	69 triplets in SL; 30 triplets in the lab

Communication. In the treatment with partner selection, the variation in the social distance between the proposer and responders is introduced by changing the *perceived* physical distance (i.e., in the same or a different virtual lab) and the possibility of communication. The three subjects in the partner selection sessions were randomly assigned to two virtual labs, upon arrival, with two people's avatars in the same lab (hereafter "lab 1") and the third person's avatar in a separate lab (hereafter "lab 2"). Communication via the Second Life's imbedded text-messaging window was allowed only between the two subjects whose avatars were in the same virtual lab. Before the trust games started, these two subjects were engaged in 10-minute communication on suggested topics including a self introduction, favorite holiday, and a memorable birthday celebration (Buchan et al., 2006). These topics were posted on the walls of the virtual lab 1 where the communication took place, and were accessible to both subjects. All communications started from the suggested topics, and some deviated to other topics of common interests. Since subjects were not informed about the next stage of the experiment no communication was related to the trust games that they would play later. The purpose of the communication is to generate the kind of personal interactions that one normally experiences in a virtual community, while letting experimenters maintain control over the topics. The third person whose avatar was in lab 2 was aware of the fact that communication was taking place between the other two subjects in lab 1, but was not informed of the content of the communication. Screenshots of the chat sessions and the suggested topics are included in Appendix A. The control sessions involved only two subjects whose avatars were seated in the same virtual lab. No communication was allowed. The two subjects participated only in one-shot standalone trust game and the post-experiment survey.

For the entire experiment, there was one experimenter avatar in each virtual lab. The avatars were the same for all treatments, and were generically constructed (with no physical embellishments). The experimenter avatars were visible to all subjects in the same virtual lab, and their responsibilities included monitoring chat, making sure instructions were properly followed, and helping answer questions. The step-by-step experimental instructions were cut from a pre-prepared script, pasted into the text-messaging window, and sent to subjects. Since the experimenter avatars were not actively involved in the experiment the experimenter demand effects are unlikely.

The trust games. In the treatment conditions, trust games with partner selection followed the communication stage. The two avatars in lab 1 who chatted with each other were randomly designated as person A (the proposer) and person B (the in-room responder). The avatar in lab 2 was referred to as person C (the out-room responder). Each of the subjects was given an endowment of 1000 Linden Dollars. Subjects were then given the instructions on the trust games with partner selection.

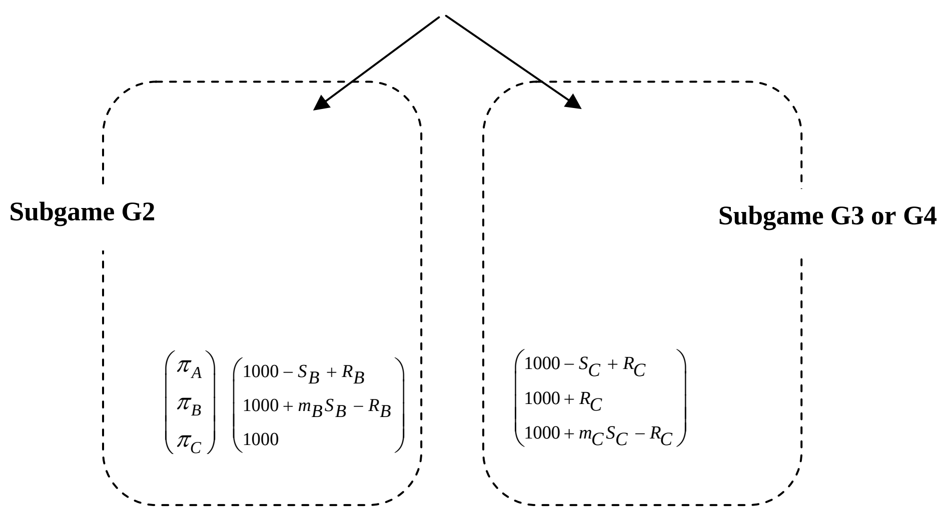
The game is illustrated in Figure 1 as a three-stage extensive form game. The first stage is the proposer’s choice between the two trust games. The next two stages are the proposer's decision on the amount sent and the responder's decision on the amount returned in the trust game selected. Alternatively, we could collapse, without loss of generality, the first two stages into a single stage where the proposer makes a simultaneous decision on the selection of responder and the amount sent. The three-stage structure is for the expositional purposes as it permits us to present the trust games as subgames of the sequence of moves.

Take the *Selection 2-3* treatment as example, person A can choose between two trust games, each of which is a subgame: a game with multiplier 2 (hereafter subgame "G2") with in-room responder B whom she just finished conversing with, or the other game with multiplier 3 (hereafter subgame "G3") with out-room responder C who was an anonymous stranger. In each trust game, person A needed to decide on the amount to be sent to the responder. The amount may be up to the 1000 Linden Dollars endowment. If A chose B the amount sent S_B would be multiplied by 2 when it reached B (the multiplier is denoted by m in Figure 1). Person B then decided on the amount returned R_B, up to his initial endowment plus the amount sent by person A multiplied by the multiplier, i.e., ($1000 + 2S_B$). Then payoffs would be $\pi_A = 1000 - S_B + R_B$ for person A, $\pi_B = 1000 + 2S_B - R_B$ for B, and for $\pi_C = 1000$ for C. If A chose to play G3 with person C, the amount sent S_C would be multiplied by 3 by the experimenter when it reached C. Person C then decided on the amount returned R_C, up to ($1000 + 3S_C$). In addition, the amount sent back to person A, S_C, was also awarded to person B, the in-room responder. This design is to eliminate any potential guilt feelings of the proposer's that may prevent her from choosing the out-room responder. Each subject's payoff in this case would be $\pi_A = 1000 - S_C + R_C$ for person A, and for $\pi_B = 1000 + R_C$ for B, and $\pi_C = 1000 + 3S_C - R_C$ for C. The treatment *Selection 2-4* had the same structure as *Selection 2-3*. The only difference is that in *Selection 2-4* person A chose between trust games G2 and G4, and the multiplier in G4 for the out-room responder is 4.

The control conditions involved only two subjects without communication. They were randomly designated as the proposer (A) and the responder (B), and played a standalone trust game. Specifically, the proposer decided how much to send to the responder who then decided how much to return, up to the sum of the endowment and the amount sent multiplied by the multiplier. The multiplier was 3 in *Control 3*, and 4 in *Control 4*.

The trust games were played one time only. At the end of the session, subjects were asked to fill out a survey. They were paid with Linden dollars, the currency used in the Second Life that can be instantly converted to U.S. dollars. The exchange rate was 374 Linden dollars for 1 Euro, or 265 Linden dollars for 1 U.S. dollar. Subjects' earnings were immediately deposited into their Second Life accounts before they were dismissed.

Figure 1: Illustration of trust game with partner selection



Second Life subjects. The SL experiment was conducted in January and February 2008. Subjects in the Second Life experiment were the Second Life users recruited via website postings in various Second Life forums and group notices. They indicated interest in participating via email or an in-world instant message. Subjects were asked to check in five minutes prior to the assigned time slot to avoid delays. Once everyone's avatar checked in, a standard procedure was followed by the experimenter avatar asking them to open their "chat history", a standard feature imbedded in Second Life used to send and receive text messages. We also made sure that the two avatars in the same lab did not know each other, and rescheduled those who had prior acquaintance to avoid any potential confounds. Each treatment session lasted 25 minutes on average and each control session 15 minutes. In total, 538 Second Life users participated in 200 sessions including 138 treatment sessions and 62 control sessions. Of these participants 43.6% self-reported as male, and the average age was 33.2 with standard deviation 11.1. 33% self-reported as coming from the United States, 37% from Europe, and 30% from other places, including Australia, New Zealand, Canada, Mexico, South America, and the Middle East. The average earnings were 1584 Linden dollars.

Lab experiment and university student subjects. The lab experiment was conducted at the Munich Experimental Laboratory for Economic and Social Sciences in July and September 2009. The 372 subjects were students from the University of Munich. They participated in 156 sessions including 60 treatment sessions and 96 control sessions. Subjects were seated at the computer terminals that were separated by blinders so they made decisions individually in private. They were brought to the virtual labs with the setting identical to what was used in the SL experiment. Each subject was randomly assigned with an avatar of his/her sex. Subjects were also shown a 5-minute tutorial video to get familiarized with the Second Life and the use of the chat window. They were then randomly assigned into groups of 2 (in control) or 3 (in treatment), and were randomly assigned with roles—A, B, or C.

The lab protocol mirrored the SL experiment protocol except the following differences for practical reasons. Persons A and B were given 15 minutes to chat, rather than 10 minutes in the SL experiment, due to their lower level of familiarity with the Second Life interface. Instructions were given in German and read aloud in the lab. The initial endowments in the trust games were 10 Lab-Euros (3 Lab-Euros = 1 Euro) for each subject in the lab, instead of 1000 Linden Dollars in the SL experiment.[3] In addition these subjects each received a show-up fee of 4 Euros. There were between 12 and 24 subjects presiding at the physical lab at the same time. Since decisions were made anonymously in private and there were multiple parallel sessions, it was impossible to link any specific avatar in the virtual lab to any subject in the physical lab. Otherwise, the trust games played and the procedures were the same as in the SL experiment.

Each treatment session lasted 30 minutes, and each control session lasted 15 minutes. The post-experiment survey shows that the average age of the lab subjects was

[3] Linden dollars were not used in the lab experiment since one needs to have a legitimate Second Life account for fund transfers.

23.5 (standard deviation of 3.0), and 37% were male. The payoffs were converted to Euros based on the exchange rate, 3 Lab-Euros = 1 Euro, and were paid to individual subjects using cash in private. The average earnings were 4.9 Euros.

4. Theory

We begin the investigation by characterizing the behavior of proposers and elected responders. We first introduce an extensive form game representation that allows us to characterize interior solutions of the amount sent and returned as observed in our empirical data. The model is further illustrated using a theoretical model of players' utility functions. We then discuss the propositions and hypotheses regarding the impact of social distance on partner selection, the amount sent by the proposer, and the amount returned by responders.

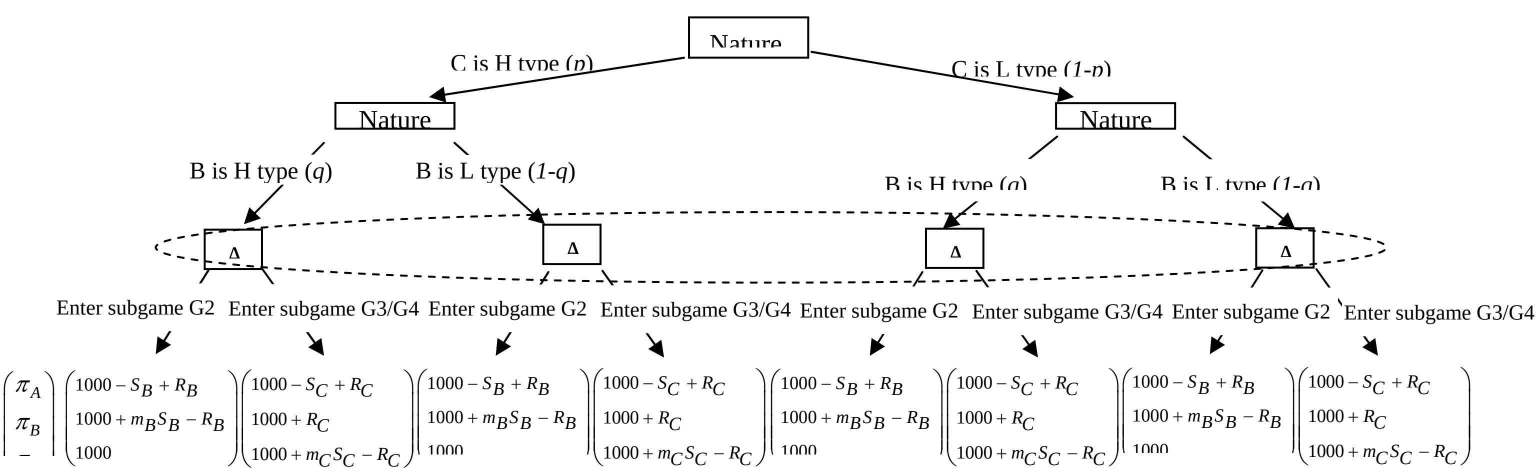
Figure 1 presents the sequence of moves as a three-stage extensive form game. However, this simple representation of the game does not yield useful theoretical predictions under the assumption of purely selfish players. Selfish responders should always keep the entire amount sent, and in expectation of this response, selfish proposers should always send nothing and hence be indifferent between the two available responders. To capture the positive amount sent and returned, models of other-regarding preferences (e.g., altruism, inequity aversion, reciprocity, some other variant, or some combination of these motives) are typically used (e.g., Fehr and Schmidt, 1999; Bolton and Ockenfels, 2000; Charness and Rabin, 2002).

To allow the interior solutions that are observed in our empirical data, we introduce a non-linear utility function of other-regarding preferences for the responders on the one hand, and introduce uncertainty into the proposer's decision on the other hand. The uncertainty in the proposer's decision stems from the responders' heterogeneous preferences (called responders' types). We assume that the proposer does not know the responders' types and rather forms beliefs on the distribution of the types. It is the proposer's uncertainty over the responders' types that causes the former to "hedge her bets" by sending her endowment partially and keeping the rest of it.

Before introducing the theoretical model, we try to incorporate the responders' heterogeneous preferences into the extensive form representation since they are critical to explaining the observed outcomes in our study. The modified extensive form game is presented in Figure 2 which captures the heterogeneity in responders' types using moves by nature.[4] We assume there are two types of responders: High and Low, denoted by H and L. The H type responder returns an amount that is higher than the amount sent by the proposer, whereas the L type responder returns an amount lower than the amount sent.[5]

Although the proposer has no information *a priori* about either responder, she forms beliefs about the distribution of responder types. For an out-room responder, her belief on the probability of H type is p and the probability of L type is $(1 - p)$. For an in-room responder, the proposer believes the fraction of H type is q and the fraction of L type is $(1 - q)$. This latter belief could be conditioned on the virtual chat, something we will later test for empirically. The parameter q may be the same as or different from p. As shown in Figure 2, nature selects responders B and C's types, respectively. The proposer needs to decide which responder to select (i.e., which subgame to enter) and how much to send to the responder selected. The responder B or C, once chosen, decides on the amount returned R.

Figure 2: A framework that incorporates uncertainty



[4] The two steps moves by nature in Figure 2 can be understood as nature's simultaneous selection of players B and C's types.

[5] The two type assumption is clearly an abstraction since there is no reason to expect two discrete types. However, it clearly demonstrates the point that the proposer is facing a risk as well as an opportunity and thus the optimal decision is in the interior. Keeping the number of types to a minimum helps with tractability. With the present data, we are not able to empirically distinguish the distribution of types. We thank one of the anonymous referees for suggesting this analysis.

We next introduce a theoretical model where the players' preferences are captured by their utility functions. Since backward induction is used to solve the model the responders' utility functions will be presented before the proposer's. We assume that a responder, if selected by the proposer, is averse to the payoff gap between him and the proposer, and the degree of inequality aversion determines whether the responder is an H type or an L type – the inequality aversion preference is assumed to be stronger for an H type than for an L type.[6] Specifically, the responders' utility function takes the following form:

$$U_R^T = \pi_R - \beta^T \frac{(\pi_R - \pi_A)^2}{S} \tag{1}$$

where the subscript R = {B (in-room), C (out-room)} denotes the responder, T = {H, L} denotes the responder type, S the amount of sent by the proposer, π_R

type, and $\pi_A(j;L) = 1000 - S_j + R_j^L$ the proposer's payoff by investing in *j* who is a L type. The proposer's partner choice can be specified by the following logistic transformation from the latent utility functions:

$$\Pr_A(j) = \frac{\exp(EU_A(j))}{\exp(EU_A(B)) + \exp(EU_A(C))} \quad (3)$$

The model can be solved by backward induction – the selected responder chooses the amount returned *R* to maximize his utility in equation (1); the proposer chooses the responder *j* and amount sent *S* in equation (2) in order to maximize her expected utility. The propositions below are derived based on the comparative statics of this model. All the proofs are relegated to Appendix D.

Recall the proposer believes that the fraction of H type is *p* and *q* for the out-room and in-room responders, respectively. Depending on the proposer's impressions about the in-room responder during the chat, the newly formed belief *q* may be higher/lower than, or equal to *p*. If *q* was sufficiently low or equal to *p* it would be a dominant strategy for the proposer to select the out-room responder not only because the latter is at least as likely to be of H type but also because the rate of return is higher (3 or 4 compared to 2). If *q* was sufficiently high the proposer would have to face a dilemma. On the one hand, the risk of making a loss is lower if she sends tokens to the in-room responder. On the other hand, conditional on the responders' types, the potential investment return is higher with the out-room one. Hence, the proposer has to make a decision by balancing this tradeoff. Proposition 1 (see proof in Appendix D) provides the lower bound of *q*, above which a rational proposer will prefer the in-room to the out-room responder, despite the higher out-room multiplier.

Proposition 1: *When the probability q assigned by proposers to a "high-return" (H) in-room responder is sufficiently higher than the corresponding probability p for an out-room responder, proposers are more likely to choose the in-room over the out-room responder.*

By the similar reasoning to Proposition 1, conditional on the partner choice, the amount sent to the in-room will be greater than to the out-room responder. This leads to Proposition 2.

Proposition 2: *When the probability q assigned by proposers to a "high-return" (H) in-room responder is sufficiently higher than the corresponding probability p for an out-room responder, proposers invest more in in-room than in out-room responders.*

Note that the proposer's favoritism toward the socially closer responder is manifested in both Propositions 1 and 2, the conditions for the two propositions to hold do not coincide. In other words, whether both propositions will hold depends on the empirical realization of the parameters.

Another question of interest in the proposer's decision is to what extent she responds to the change of incentives in an investment with a socially distant responder. Both of the treatments, *Selection 2-3* and *Selection 2-4*, are designed such that the multiplier is kept constant with the in-room responder, and it increases from 3 to 4 with the out-room responder (i.e., the price of choosing the in-room responder increases by 33 percent from 1.5 to 2). As long as the (perceived) likelihood that the out-room responder is an L type is not forbiddingly high, the risk of losing money (by dealing with out-room) will cease becoming the hurdle, and the out-room responder will become more appealing than the in-room one. Proposition 3 summarizes this substitution effect in response to the increase in the investment return with the socially distant option. The proof of Proposition 3 in Appendix D provides a threshold of *p* (the likelihood the out-room is an H type), above which the substitution effect will occur. Below this threshold, the proposer will be always better off selecting the in-room responder, regardless of the out-room multiplier.

Proposition 3: *When the probability p assigned by proposers to a "high-return" (H) out-room responder is sufficiently high proposers substitute the out-room responders for the in-room ones when the out-rooms' relative rate of return increases.*

Next we discuss the responder actions. A reasonable conjecture is that higher investments would result in a higher percentage returned. We expect it to be true in the present setting regardless of the social distance. This can be expressed as follows:

Proposition 4: *The percentage returned by the responders increases with the amount invested.*

The next question is whether responders who differ in social distance to the proposer may act differently when chosen to respond. Due to the difference in the multipliers across treatments, we compare the percentage (rather than amount) returned by the responders. The percentage returned is calculated as the amount returned normalized by the sum of the responders' initial endowment (1000 Linden Dollars in the SL experiment or 10 Lab-Euros in the lab experiment) and the amount sent times the multiplier. The proof of Proposition 5 in Appendix D shows that when the difference between q and p is sufficiently large and the amount sent to the in-room responder is greater than that to the out-room responder, the in-room responder will return a percentage higher than the out-room responder. This is consistent with Chen and Li (2009) that finds in their lab experiment the second movers are more likely to award the ingroup first movers if the latter's behavior shows good intentions in the first place.

Proposition 5: *When the difference between the perceived likelihood of H type for in-room (q) and out-room (p) is sufficiently large and the amount sent to the former is greater than that to the latter, in-room responders return more in percentage terms than out-room responders.*

In sum, the theoretical model predicts that under certain conditions, both the proposers and the responders show favoritism towards their socially closer counterpart. The proposers are more likely to select the socially closer responder and send a higher amount to this responder than to the socially distant responder. When selected, the socially closer responder will return a higher percentage to the proposer than the socially distant one. We test these theoretical predictions in the next section.

5. Results

In this section, we first describe some main features in chat, discuss subjects' motives for their choices, describe the data and present the summary statistics. We then present the econometric analyses and results. We will also compare and contrast the results in the Second Life and the lab experiments.

5.1. Summary Statistics

We begin with some descriptions on the virtual chat between the proposer and the in-room responder. Almost all the virtual chat focused on the suggested topics. What was notable was 81.1 percent of subjects in the SL experiment and 95 percent in the lab experiment used acronyms and emoticons – Internet languages that originated for the sake of saving keystrokes. Acronyms – shortened words or abbreviations – are another kind of Internet language commonly used in texting and instant messaging, and social networking websites. Some popular acronyms include "lol" (laughing out loud), "rofl" (rolling on floor laughing), "omg" (oh my god), and "thx" (thanks). Emoticons are textual portrayals of one's mood or facial expression in the form of keyboard symbols. They are often used to convey emotions without cognition of faces, which can change and improve interpretation of plain text. For example, a combination of colon and bracket or colon hyphen and bracket portraits a smiley face. Since the usage of both acronyms and emoticons adds more socio-emotional content to the virtual conversations (Bolter, 1996; Utz, 2001) we use them to approximate the level of social interactions in the analysis subsection 5.2.

In the post-experiment questionnaire, we solicited the reasons on proposers' choices. Table 2 presents some proposers' quotes that are representative of the main motives. Most proposers who favored in-room responders indicated that they did so because of reduced anonymity, perceived shortened social distance and perceived lower risk, and increased feeling of familiarity and trust due to the virtual communication. Many subjects mentioned some "connection" with the person they chatted with. They feel that after the communication they "know" (or can "see") the other person and hence thought the other person was more "trustworthy", despite of the fact that the virtual communication was conducted anonymously through text messages, was on certain suggested topics, and lasted only for ten (fifteen in the lab) minutes. In contrast, most of the subjects who chose the out-room responders indicated that this choice was motivated by the higher rate of return, either out of self-interest, or out of some efficiency concerns for the group (of the proposer and the in-room responder) or for the three participants altogether. These proposers often mentioned the multiplier (or returns), or win-win situation in the survey. Some other proposers who chose out-room perceived the two responders as indifferent because he knew little about either of them in spite of the virtual communication. One subject explained that his choice of out-room was to avoid dealing with money issues with someone he knew since it may cause "trouble" (see quote number 9 in Table 2). This motive is not as representative as others yet his preference does not appear unreasonable.

Table 2: Selected quotes from Second Life proposers on why they selected in-room or out-room

Choosing in-room responder	Choosing out-room responder
1. As person B and I spoke and had become *familiar*, I figured that due to this *connection* it was more likely she would return money. 2. The fact that person B had *communicated* with me meant they were *less anonymous* and therefore more '*trustworthy*' in my mind. 3. Because I felt a *connection* with her. 4. I had established a *rapport* with Person B. Person C is an *unknown* quantity, he may choose not to give anything back. Person B might not either, however at least I've had a chance to get to *know* him. I have a better idea of whether he would or not. 5. I have somebody *in front of* me. I feel better *seeing* the person. I know it's virtual and I don't know him/her, but the decision was easier for me.	1. The money is *tripled* and I'm hoping he'll be generous, instead of just *doubled* with B, and I don't know either person very well. 2. It has the most *potential* based on the *multiplier* so I took the risk. 3. Best chance of making *greater return*. 4. The possibility of a *higher return* for myself and Person B. 5. It was *better for the group*. I think it was worth the risk. 6. I'm looking for a *win/win* situation, with this decision I'm hoping that C will decided to return the money for a *win/win* situation also. 7. So *all of us can win*, not only two of us. 8. There will be *more money available to share* among the players. 9. I like to give my money to the people I don't know so if something happens I don't know him. I don't like to get money stuff with persons that I know because it causes trouble.

* In the experiment, person B and C refer to the in-room and out-room responder, respectively. Key words are *italicized* for the convenience of readers. They were not in italics in participants' response in the questionnaire.

Table 3 presents the summary statistics on the main variables including proposers' choices of responders, the amount sent, the amount returned, the fraction of proposers who received more than the amount sent.

We find that the proportion of proposers who choose either the in-room or the out-room responder are both significantly greater than zero, and that proposers are more likely to choose in-room than out-room responders ($p = 0.006$) in the treatments with partner selection.[8]

Table 3: Summary statistics

Platform	*Second Life*				*Laboratory*			
Treatment	*Selection 2-3*	*Selection 2-4*	*Control 3*	*Control 4*	*Selection 2-3*	*Selection 2-4*	*Control 3*	*Control 4*
Number of cohorts	69	69	31	31	30	30	48	48
Proportion of proposers choosing in-room/out-room	64% / 36%	55% / 45%	n. a.	n. a.	63% / 37%	60% / 40%	n. a.	n. a.
Amount sent to in-room	710	582	n. a.	n. a.	687	644	n. a.	n. a.
Amount sent to out-room	708	650	534	757	677	617	442	681
Proportion returned by in-room responder	43%	40%	n. a.	n. a.	35%	29%	n. a.	n. a.
Proportion returned by out-room responder	31%	32%	23%	37%	34%	23%	17%	28%
Faction of proposers who received more than they sent to in-room	0.95	0.92	n.a.	n.a.	0.84	0.72	n.a.	n.a.
Fraction of proposers who received more than they sent to out-room	0.76	0.87	0.65	0.94	0.64	0.75	0.65	0.77
Fraction of subjects who used acronyms and emoticons	78.6%	84%	n. a.	n. a.	93.3%	96.7%	n. a.	n. a.

Note that the in-room favoritism occurs despite the greater rate of potential *private* returns (multipliers of 2 vs. 3 and 2 vs. 4) and *social* returns (2 vs. 6 and 2 vs. 8) with an out-room responder.[9] In fact, the proposer's election of in-room responder not

[8] The *p*-value is the binomial distribution probability of observing 82 in-room choices out of 138 choices under equal probability assumption.
[9] Recall that in the selection treatments, if the out-room responder was selected, the amount sent back to the proposer is also awarded to the in-room responder in the room. The design is meant to eliminate any potential guilt feelings of the proposer's that may prevent her from choosing the out-room responder.

only risks his own private earning but results in a loss of social efficiency, due to a smaller multiplier and the fact that money returned by in-room is received only by the proposer whereas money returned by the out-room accrues to both the proposer and in-room responder.

Table 4 reports players' average private payoffs by role as well as joint payoffs of the three players. We find that although the Second Life proposers' choice of in-room responders yields a higher but insignificant private payoff compared to the alternative (1352 for in-room vs. 1299 for out-room, $p = 0.75$) in *Selection 2-3*, it leads to a lower but insignificant private payoff from the in-room choice relative to the alternative (1344 for in-room vs. 1523 for out-room, $p = 0.14$) in *Selection 2*-4.

For lab proposers, private returns are higher for a choice of an out-room responder than a choice of an in-room responder (1192 for in-room vs. 1314 for out-room for Selection 2-3, $p = 0.62$; 1000 for in-room vs. 1267 for out-room for Selection 2-4, $p = 0.17$).

The joint payoffs of the three players are used to measure social efficiency. In the Second Life treatments, average joint payoffs of the three players are 32% and 41% lower ($p < 0.0001$ in both cases) in the in-room selection than in the out-room selection for *Selection 2-3* and *Selection 2-4*, respectively. In the laboratory treatments, the losses in joint payoffs are 31% and 36% ($p < 0.0001$ in both cases) for *Selection 2-3* and *Selection 2-4*, respectively.

Why does a proposer prefer the in-room responder even if it may lower private earnings and social efficiency? One explanation is favoritism towards socially closer responder, i.e., the proposer values social connection, and is willing to forgo certain amount of private earnings to honor obligations arising from low social distance. An alternative explanation is the proposers' perceived investment premium from the in-room responder, i.e., risk-averse proposers (as detailed in section 4) foresee that the probability of getting rewarded (getting back more than the amount sent) by in-room responders is higher than the corresponding probability for out-room responders. Thus, it is possible that proposers opt for the safer choice. Table 3 shows that in-room responders, particularly in the SL experiment, are more likely to reward proposers and this evidence is consistent with a risk-averse proposer explanation.

Table 4: Payoff Summary

Environment	Treatments	Matching	Average Payoffs (in lab tokens) Proposer	In-room responder	Out-room responder	Joint Payoffs
Second Life	*Selection 2-3*	Out-room	1299	2007	2117	5423
	Selection 2-3	In-room	1352	1358	1000	3710
	Selection 2-4	Out-room	1523	2173	2427	6123
	Selection 2-4	In-room	1344	1238	1000	3582
Laboratory	*Selection 2-3*	Out-room	1314	1991	2041	5345
	Selection 2-3	In-room	1192	1495	1000	3687
	Selection 2-4	Out-room	1267	1883	2583	5733
	Selection 2-4	In-room	1000	1644	1000	3644

Although an in-room responder is more likely to be chosen, the amount sent to in-room responders is not significantly greater than the amount sent to out-room responders. In the Second Life treatments, the amount sent to the in-room and out-room responders is almost the same in *Selection 2-3,* and even slightly *lower* for in-room responders in the Selection 2-4 treatment, as shown in Table 3. In the laboratory treatments, the amount sent to in-room responders is higher but not significantly so. Last but not least, Table 3 shows that in-room responders return a larger proportion than out-room responders. On average, the Second Life in-room responders returned 43% in Selection 2-3 (40% in Selection 2-4), in comparison with 31% (32% in Selection 2-4) returned by the SL out-room responders, with p value 0.04 ($p = 0.09$ in Selection 2-4). The differences between out-room and in-room responders proportion returned shrink in the laboratory treatments (1% difference for Selection 2-3, $p = 0.85$; 6% difference for Selection 2-4, $p = 0.39$) but are directionally the same in that in-room responders return slightly more than out-room responders in percentage terms.

5.2. Estimation Results

In this subsection, we use statistical models to analyze the effect of social distance on the proposers' choice over responders, the amount sent, and the responders' reciprocal behavior (i.e., their choice over the percentage returned). For all the analysis, we present the results on the SL experiment, followed by discussions on the lab results. The 5-percent statistical significance level is used to as the threshold to establish the significance of an effect.

5.2.1. Partner Selection

We use a logistic model of choice to investigate the proposers' decision on partner selection. The dependent variable is the likelihood that the proposer selects the in-room responder. The analysis consists of the two selection treatments – *Selection 2-3* and *Selection 2-4*, since the two control treatments did not involve the proposer's choice of responder. The logistic specification is given by

$$\Pr(\text{Choosing in-room responder}) = \frac{e^{z}}{1+e^{z}}$$

where $z = \alpha_0 + \alpha_1 M4 + \alpha_2 AE + \alpha_3 M4 \times AE + \alpha_4 Male + \alpha_5 Age + \varepsilon$.

The explanatory variables include a dummy variable (*M4*) for the treatment *Selection 2-4* (i.e., *Selection 2-3* is the omitted category), the number of acronyms and emoticons (*AE*) used in chat, their interaction term, the proposer's gender (*Male*) and age. The coefficient α_0 measures the probability difference in *Selection 2-3* that the in-room versus the out-room responders will be chosen. Similarly, $\alpha_0 + \alpha_1$ measures this probability difference in *Selection 2-4*. The average difference in the probabilities across the two treatments is $\alpha_0 + 0.5\alpha_1$.

Table 5: Logistic Model of Proposer's Partner Selection. Dependent Variable: Choice of In-room partner.

	SL experiment			Lab experiment		
	(1)	(2)	(3)	(4)	(5)	(6)
Selection 2-4 (*M4*)	-0.362	0.865	0.691	-0.141	0.114	0.164
	(0.348)	(0.561)	(0.568)	(0.531)	(0.850)	(0.910)
Acronyms/Emoticons (AE)		0.319**	0.296**		0.031	0.027
		(0.129)	(0.129)		(0.072)	(0.0780)
AE × *M4*		-0.377***	-0.350**		-0.034	-0.038
		(0.145)	(0.143)		(0.081)	(0.086)
Proposer gender (male)			-0.106			0.879
			(0.378)			(0.629)
Proposer age			-0.018			-0.150*
			(0.018)			(0.083)
Constant	0.565**	-0.435	0.298	0.547	0.334	3.619*
	(0.250)	(0.440)	(0.852)	(0.379)	(0.623)	(2.126)
Log likelihood	-92.6	-87.4	-83.6	-39.9	-39.8	-37.5
Number of observations	138	138	132	60	60	60

The dependent variable is the likelihood that the proposer selects the in-room responder. Standard errors are in the parentheses. * significant at 10 percent level, ** significant at 5 percent level, *** significant at 1 percent level.

Table 5 presents the results. Columns 1-3 pertain to the SL experiment and columns 4-6 the lab experiment. As shown in columns 1 and 4 that include only the treatment variables, the average difference in probabilities ($\alpha_0 + 0.5\alpha_1$) that the in-room and the out-room responders are chosen is 0.384 (p = 0.027) in the SL experiment and 0.476 (p = 0.073) in the lab experiment. This suggests that the SL proposers are more likely to select the in-room responders over the out-room responders, despite the higher rate of investment returns with the latter. We further control for the number of acronyms and emoticons and its interaction with *M4* in columns 2 and 4, and find the favoritism toward the in-room responder disappears ($p > 0.10$). This suggests that the favorable selection of in-room responder is mediated through chat.

The coefficient of *AE* ($\alpha_2 = 0.319$, $p < 0.05$) suggests that in the *Selection 2-3* treatment the number of acronyms and emoticons significantly increases the likelihood that the in-room responder is chosen. In the *Selection 2-4* treatment, however, the effect of *AE* (measured by $\alpha_2 + \alpha_3$) becomes -0.058 ($p > 0.10$). It suggests that the positive effect of social ties mediated through chat is counterbalanced by the impact of the increase in the out-room multiplier. In the lab experiment, acronyms and emoticons used in chat did not have any impact on proposers' choice – the effect of *AE* is 0.114 (p = 0.673) in *Selection 2-3*, and 0.08 (p = 0.923) in *Selection 2-4*. This finding suggests that the virtual chat does not generate sufficient social connection between the proposers and the in-room responders in the lab. Since 95 percent of lab subjects (compared to 81.1 percent of SL subjects) used acronyms and emoticons, the lack of the impact of these Internet languages cannot be explained by the lab subjects' unfamiliarity with the *form* of virtual communications. Rather, it may be due to the lab proposers' lack of social bond with their in-room responders despite of chat. We will return for more discussions in subsection 5.3.

We also find that in both experiments proposers' favoritism over the in-room responders declines as the out-room multiplier increases from 3 to 4. The effect, however, is not statistically significant – the coefficient of the out-room multiplier is -0.362 (p = 0.299) in column 1 and -0.590 (p = 0.131) in column 2 for the SL experiment, and -0.141

(p = 0.791) in column 3 and -0.208 (p = 0.715) in column 4 for the lab experiment.[10] The proposers' gender has insignificant impact on their choice of partners; older proposers are (weakly) more likely to select the out-room responders ($p > 0.10$ for SL and $p < 0.10$ for the lab study). The discussions above lead to result 1.

Result 1 *(Proposers' partner selection). Proposers are more likely to choose an in-room responder than an out-room responder. The favorable selection of in-room responder can be explained by the impact of virtual communication. Proposers' in-room favoritism decreases (but insignificantly) as the out-room multiplier increases from 3 to 4.*

Result 1 supports Proposition 1 that proposers are more likely to choose the in-room responders. Although result 1 does not support Proposition 3 statistically the direction of the impact of the out-room multiplier is consistent with the theoretical prediction, i.e., an increase in the investment returns attracts more proposers to the socially distant options.

5.2.2. Proposer Amount Sent

The next question is whether the in-room favoritism is manifested by the amount of investment. The proposers' decision on how much to send may depend upon the (perceived) social distance with the responders, the content of virtual chat, and the rate of return of the investment (i.e., the multiplier). We pool the data of all the four treatments, which enables a direct comparison between the amounts sent to in-room or out-room responders with those in the control. Since the dependent variable – the amount sent – is censored (at 0 and 1000 Linden dollars in the SL experiment; at 0 and 10 Euros in the lab) the empirical analysis adopts the following tobit model.

$$Amount\ Sent = \beta_0 + \beta_1 \cdot InRoom + \beta_2 \cdot OutRoom + \beta_3 \cdot M4 + \beta_4 \cdot InRoom \cdot M4 + \beta_5 \cdot OutRoom \cdot M4 + \beta_6 \cdot AE + \beta_7 \cdot AE \cdot M4 + \beta_8 \cdot Male + \beta_9 \cdot Age + \eta$$

[10] The effect of the out-room multiplier on proposers' choice of responders is measured by $\alpha_1 + \alpha_3 \overline{AE}$ where the number of acronyms and emoticons is evaluated at its mean.

In the analysis the control treatments are treated as the omitted category. *InRoom* and *OutRoom* are dummy variables indicating that the in-room or out-room responders are selected, respectively. To capture the effect of the change in the multiplier we include a dummy variable *M4* which takes on the value of 1 for *Control 4* and *Selection 2-4*, and zero for *Control 3* and *Selection 2-3*. The interaction between *M4* and *InRoom* (or *OutRoom*) measures how the multiplier influences the difference in amounts sent to the *InRoom* (or *OutRoom*) responder and that in the control.[11] Similar to the analysis in the previous subsection, we control for the chat content measured by the number of acronyms and emoticons (*AE*). The interaction of *AE* and *M4* measures the interplay between social distance (mediated through virtual communication) and potential monetary payoffs. The explanatory variables also include proposers' gender and age.

Table 6 presents the coefficient estimates and standard errors of the tobit model. We find that in the SL experiment the amounts sent to the in-room and out-room responders are not significantly different in *Selection 2-3* since we cannot reject $\beta_1 = \beta_2$ ($p > 0.10$). They are not significantly different in *Selection 2-4* since we cannot reject $\beta_1+\beta_4 = \beta_2 + \beta_5$ ($p > 0.10$). This suggests that social distance only affects the proposer's *choice* of the responders. Once the responder is selected, the amount of investment (i.e., the level of trust) is not affected by social distance. We also find that the effect of *InRoom* on the amount sent becomes much smaller when we control for the number of acronyms and emoticons in columns 2 and 3; the number of acronyms and emoticons has a significant and positive impact on the amount sent. Specifically, the average effect of *AE*, measured by $\beta_6 + 0.5\beta_7$, is 29.6 ($p = 0.038$) in column 2 and 31.6 ($p = 0.025$) in column 3. In contrast, neither the social distance nor the acronyms and emoticons affect the amount sent in the lab experiment.

Results also show that in both experiments, the amounts sent to the in-room and the out-room responders both reduce by insignificant amount ($p > 0.10$) when the out-room multiplier increases from 3 (in *Selection 2-3*) to 4 (in *Selection 2-4*).[12] Male proposers

[11] Recall that the out-room multipliers (3 in *Selection 2-3*, and 4 in *Selection 2-4*) are designed to be the same as those in the control treatments (3 in *Control 3*, and 4 in *Control 4*), whereas the in-room multipliers are always 2.

[12] We find that the increase in the multiplier from 3 (in *Control 3*) to 4 (in *Control 4*) leads to a significant increase in the amount sent. We reject $\beta_3 = 0$ in favor of $\beta_3 > 0$ ($p < 0.01$) in both the SL and the lab experiments.

send more than female proposers ($p > 0.10$ in SL; $p < 0.01$ in the lab). Older proposers tend to send more than younger ones ($p < 0.01$ in SL; $p < 0.10$ in the lab).

This leads to result 2.

Table 6: Tobit Model on the Amount Sent by Proposer

	SL experiment			Lab experiment		
	(1)	(2)	(3)	(4)	(5)	(6)
In-room	226.5**	88.50	1.593	3.558***	3.936**	3.264**
	(92.42)	(113.8)	(115.1)	(1.157)	(1.674)	(1.592)
Out-room	230.1**	228.9**	162.2	3.135**	3.133**	2.650*
	(106.6)	(104.8)	(108.3)	(1.396)	(1.394)	(1.355)
Multiplier4 [b]	328.4***	326.1***	304.1***	3.176***	3.175***	3.087***
	(102.4)	(100.6)	(103.0)	(0.855)	(0.854)	(0.819)
In-room × *Multiplier4*	-473.3***	-432.6**	-289.6*	-3.939**	-3.821	-2.898
	(134.5)	(169.6)	(170.6)	(1.636)	(2.345)	(2.223)
Out-room × *Multiplier4*	-405.0***	-402.4***	-330.6**	-3.879**	-3.878**	-2.998
	(147.9)	(145.5)	(147.7)	(1.938)	(1.936)	(1.860)
Acronyms/Emoticons (AE)		30.58*	36.65**		-0.050	0.015
		(15.65)	(15.17)		(0.159)	(0.152)
AE × *Multiplier4*		-1.900	-10.03		0.008	-0.063
		(28.35)	(27.87)		(0.188)	(0.178)
Proposer gender (male)			56.58			2.265***
			(56.65)			(0.678)
Proposer age			11.74***			0.188*
			(2.614)			(0.104)
Constant	547.9***	547.6***	147.1	4.305***	4.306***	-1.055
	(70.49)	(69.32)	(109.6)	(0.596)	(0.595)	(2.421)
Log likelihood	-1070.9	-1068.2	-990.7	-349.6	-349.5	-340.6
Observations	200	200	189	156	156	156

The tobit model is censored at 0 and 1000 in the SL experiment; it is censored at 0 and 10 in the lab experiment. Standard errors are in the parentheses. * significant at 10 percent level; ** significant at 5 percent level; *** significant at 1 percent level.

Result 2 (Proposers' investment amount). *In both the SL and lab experiments, the proposers send similar amounts to the in-room and the out-room responders.*

According to result 2, we reject proposition 2 that proposers invest a greater amount in in-room responders. Results 1 and 2 indicate when the proposers face uncertainty in the responders' types, social distance plays a crucial role in helping them identify the responder whom can be trusted. However, this role of social distance only limits to partner selection. Once the decisions on the responders are made, the proposers do not discriminate based on the social distance, i.e., the level of their trust does not differ between the in-room and out-room responders.

5.2.3. Responder Proportion or Amount Returned

In this subsection, we investigate what factors determine the responders' choices on how much to return. Recall that responders may choose to return up to the amount sent by the proposer times the multiplier plus the initial endowment. The dependent variable is the proportion returned by responders. We use a tobit model given by the following specification since the dependent variable is censored at 0 and 1 by definition.

$$Proportion\ Returned = \gamma_0 + \gamma_1 \cdot InRoom + \gamma_2 \cdot OutRoom + \gamma_3 \cdot M4 + \gamma_4 \cdot InRoom \cdot M4 + \gamma_5 \cdot OutRoom \cdot M4 + \gamma_6 \cdot AE + \gamma_7 \cdot AE \cdot M4 + \gamma_8 \cdot Amount\ Sent + \gamma_9 \cdot Male + \gamma_{10} \cdot Age + \zeta$$

The same set of explanatory variables as in Table 6 is included here. We further include the amount sent by the proposer (*Amount Sent*) to examine the responders' reciprocity. Results are presented in Table 7. Appendix E reports the same analysis with the *amount* returned as the dependent variable. Results are largely consistent with those in Table 7.

We first find that the coefficient of *Amount Sent* (γ_8) is 0.026 ($p < 0.01$) for the SL experiment, suggesting the *direct reciprocity* – the higher amount sent by the proposer generates the greater proportion returned by the responder. In addition to direct reciprocity, the in-room responders treat the proposer more favorably than the out-room responders. They return a significantly higher proportion than the out-room responders in the SL experiment. Note that the average difference in the proportion returned between the in-room and out-room responders is measured by $[(\gamma_1 - \gamma_2) + 0.5(\gamma_4 - \gamma_5)]$ across the two selection treatments. This difference is statistically significant for the SL experiment ($p < 0.01$ for columns 1-3). We note that this difference is primarily driven by the high proportions returned by the in-room responders, since the out-room responders returned the similar proportions as the responders do in the control treatments ($p > 0.10$). This finding suggests that the in-room responders not only reward the proposers for the amount sent but also reciprocate them based on the closeness in social distance. More importantly, the degree of positive reciprocity from the in-room responder is not weakened when the effect of acronyms and emoticons ($p > 0.10$) is considered in the analysis. Hence, unlike the role that the chat content plays in mediating the proposer's decision on trust, the content of the virtual communication does not mediate the responders' reciprocity.

Table 7: Tobit model on Proportion Returned by Responders

	SL experiment			Lab experiment		
	(1)	(2)	(3)	(4)	(5)	(6)
In-room Responder (*In-room*)	0.183***	0.222***	0.255***	0.169***	0.083	0.091
	(0.052)	(0.063)	(0.061)	(0.063)	(0.089)	(0.088)
Out-room Responder (*Out-room*						

out-room responders are insignificantly different ($p > 0.10$ for columns 4-6). The number of acronyms and emoticons does not affect the proportion returned.

In both the SL and lab experiments, the proportion returned also increases with responders' age ($p < 0.05$ for Second Life and $p > 0.10$ in the lab). The gender difference is marginally significant in SL and insignificant in the lab.

These findings lead to result 3.

Result 3 (Responders' reciprocity). The SL *in-room responders return significantly higher proportions than out-room responders and responders in the control treatment. In both the SL and the lab experiments, proportions returned significantly increase with the amount sent by the proposer*.

Result 3 supports proposition 4 that higher level of amount sent by proposers lead to greater proportion returned by responders. It supports proposition 5 that in-room responders reciprocate more than out-room responders do – it holds only for the SL experiment.

To compare and contrast the Second Life and the lab experiments, we find that the results from both experiments are directionally consistent. In addition, the SL results are generally more sizable and more statistically significant than the lab results. For example, in the SL experiment, the proposers are significantly more likely to choose the in-room responders; the in-room responders return significantly greater proportions than the out-room responders. In the lab experiment, however, the social distance only marginally affects the proposers' choice of partner. Furthermore, in the SL experiment, the number of acronyms and emoticons significantly increases the likelihood of selecting the in-room responders, and the amount sent by the proposers. The chat content, however, affects neither partner selection nor amount sent in the lab experiment.

There are two possible explanations on why the effects of social distance and chat differ in the two experiments. First, whether the virtual communication can work effectively in changing (perceived) social distance is contingent on the *initial physical distance* among subjects. In the SL experiment, the two in-room subjects were brought to the same virtual lab randomly from two spatially distant locations (in many cases from different countries) and engaged in 10-minute virtual chat. The perceived social distance between these two subjects may be substantially changed before and after the virtual conversation. It may be in sharp contrast to their social distance with the out-room participant since nothing is known about this out-room person besides that he may come from any country on the planet. In the lab setting, however, the impact of this experimental manipulation is greatly compromised since all the subjects (including the proposers, the in-room and out-room responders) were physically sitting in the same laboratory. They all knew that others participants were, like themselves, students of the same university. Therefore, the salience of the physical distance and the common affiliation with the university may dominate the impact of the virtual chat on subjects' perceived social distance.

Second, although the experimental setting may appear artificial to the lab subjects, it is undoubtedly a natural and social environment to the SL subjects. Compared to the lab subjects, the SL subjects are on average more familiar with the interface, and are more accustomed to the type of avatars-mediated virtual interactions. More importantly, unlike in the lab experiment in which avatars were assigned to subjects, the Second Life users *create* their own avatars based on their preferences. These users consider the cartoon-like computerized images their representations at the virtual society, and they take very seriously their interactions with others in this online society. Many of them spend great amount of time, effort, and financial resources designing their avatars, since it is important not only to make their avatars attractive but also to showcase the avatar owners' technical skills. Over time, the SL users may have developed a strong sense of attachment with their avatars. This inherent human-avatar bond in SL is absent in the lab experiment by design. To the lab subjects, the human-avatar match may be perceived as artificial and temporary. Hence, the lab subjects' interactions through avatars share merely the same mode of communication but do not necessarily carry the personal bond or social content beyond a simple text chat.

6. Conclusions

The rise of virtual worlds enriches the concept of social distance. It poses new questions on how social distance may influence economic decision making in the midst of the new forms of socialization in modern life. In this study, we investigate how social distance affects proposers and responders’ decisions in trust games (with partner selection) in the virtual world of Second Life.

We find that among the Second Life users, proposers are more likely to select the

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distanc. Fforexarm am8.6(Se)ond rkifetslpo directions for fruitful future research. We hope to study to what extent the social distance may be influenced by the forms (e.g., text, audio, or video) and time durations of communications. It would be also interesting to study how multilateral communications (rather than bilateral communications in this study) may change the decisions on partner selection. We also hope to extend our investigation to virtual *fields*, and study how social distance impacts market transactions of virtual or non-virtual commodities.

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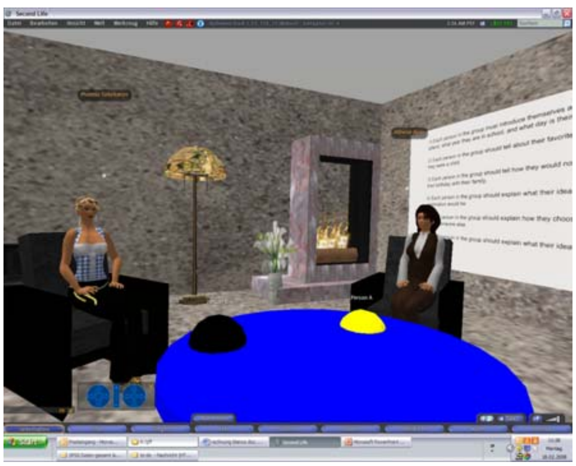
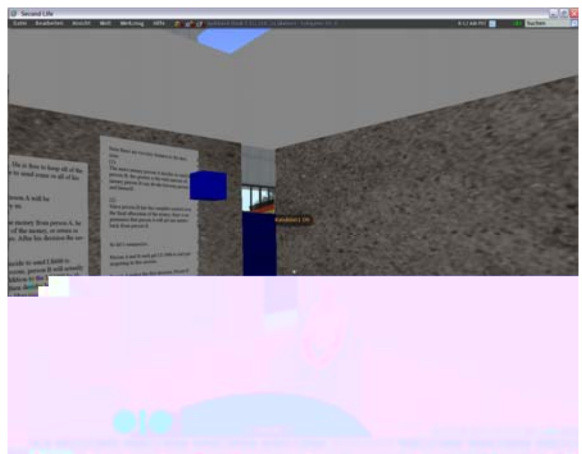
Appendix A. Screenshots from the experiment.



Proposer and in-room responder



Out-room responder

Appendix B. Experiment Instructions

__Instructions Script for in-room-out-room sessions__

Hello Everyone. Thank you for participating in this session. Before we begin we would like to ask you to open your chat history. Please type in “ok”, if your chat history is open.

Do you know each other?

We will first ask you to talk for 10 minutes exclusively via Chat to get acquainted. We will then give you detailed instructions on the experiment and ask you for a decision. Altogether this session will take approximately 25 minutes. All communication in this experiment is done via public chat.

Please type ok if you have understood so far.

Please use the next 10 minutes to introduce yourself and to chat about any other topics you like. If you like you can talk about the topics on the wall but you can also choose other topics. Please start now.

Thank you. We will now start with the instructions for the game.

The purpose of this experiment is to study how people make decisions in a particular situation. Feel free to ask questions as they arise.

Everyone will receive 1000 Linden-Dollars to start in this session. The final earnings depend on the decisions that you and others make. You cannot lose any personal money.

Upon completion of the session, your earnings will be paid to you individually and privately in your Second Life account.

Participants in this session are referred to as person A, person B and person C. The decision who is person A, person B and person C is done via random generator.

In this session [X] is person A and [Y] is person B. Person A and Person B are both in room blue. Person C is waiting in a different room.

We guarantee that there is a person C recruited just like person A and B in SL. Person C is getting the instructions as well.

Every participant will be given L$1000 to start the session.

Person A decides first. He is free to keep all of the L$1000, or can choose to send some or all of his L$1000 to person B or to person C.

Any money sent by person A will be multiplied by us. Examples will follow in a minute.

Once the receiver gets the money from person A, he can decide to keep all of the money, or return as much to person A as he likes.

Note there are two key features to the decision:

(1) The more money person A decides to send to the receiver, the greater the total amount of money the receiver can divide between person A and himself.

(2) Since the receiver has the complete control over the final allocation of the money, there is no guarantee that person A will get any money back from the receiver.

Please type in ok, if you have understood so far. Please feel free to ask questions.

Person A can choose between person B in this room and person C in the other room as receiver.

We will double any amount person A sends to person B.

For example, if person A decides to send L$600 to person B, person B will actually receive L$1200 (in addition to the L$1000 he already has). Person B then decides how much of the L$ 2200 he would like to send back to person A.

. If person A decides to choose the anonymous person C in the other room we will triple <quadruple> any amount person A sends. For example, if person A decides to send L$600 to person C in the other room, person C will actually receive L$1800 (in addition to the L$1000 he already has). Person C then decides how much of the L$ 2800 he likes to send back. <This is for 2/3 treatment. In 2/4 treatment: L$ 2400 respectively L$3400> If person A chooses the anonymous person C in the other room, person B will get the same amount as person A, so person B is not necessarily worse off, if A chooses person C. That is, if person C decides for example to return L$600 from his L$ 2800, both person A and person B will receive L$600. So person A will get L$ 1000 and person B will receive L$1600. After the receiver makes the decision the game is over. <This clause for 2/3 treatment, In 2/4 treatment: L$ 3400 respectively L$1000, L$ 1600 and L$ 2800>

So let's summarize:

Person A, B and C each gets L$ 1000 to start participating in this session.

Person A makes the first decision, Person B or C makes the final decision.

If person A chooses B any amount he sends is doubled by us.

If A chooses C any amount he sends is tripled by us. <This is for 2/3 treatment, In 2/4 treatment: quadrupled>

If A chooses C, person B will get the same amount as A receives from C.

Please type in "Ok" to indicate that you understand these rules. Feel free to ask us questions.

Person A has now 1 minute to decide whether s/he wants to play with person B in this room or the anonymous person C in the other room. Please type in your answer in this window once you have decided whether you want to play with person B in this room or person C in the other room.

Continuation of Instructions for Person A

Please type in the chat window whether you would like to play with person B in this room or with person C in the other room. The decision is up to you.

Please type in the chat window how much money you would like to send to person B <or person C if chosen>.

If person B <person C if chosen) decides to keep everything you will earn L$ xxx, correct? Please confirm.

A: Please click on the yellow hemisphere in front of you and answer the questionnaire that opens. Please return to SL once you are finished. We will tell you then the decision of the receiver.

- -

Continuation of Instructions for Person B

Person A has decided to send you L$XXX. This amount was doubled, so that you receive L$ XXX. Now you have L$ XXX (the amount you received plus your initial L$ 1000). Please decide how much, if any, you wish to send to person A. The decision is up to you.

Please type in the amount now ___________

So you will earn L$ xxx, correct? Please confirm.

Please click on the black hemisphere in front of you and answer the questionnaire that opens. Please return to SL once you are finished to receive your earnings.

- -

Continuation of Instructions for person C

Please read through the instructions positioned on the wall.

Feel free to ask us questions as they arise.

Person A has decided to send you L$ YYYY. This amount is tripled, so that you receive L$ YYYY. Now you have L$ XXXX (the amount you received plus your initial L$ 1000). Please decide how much, if any, you wish to send to person A. The decision is up to you. <This is for 2/3 treatment, In 2/4 treatment: quadrupled>

Please type in the amount now _______________

So you will earn L$ xxx, correct? Please confirm.

Person A has decided to play with Person B.

Please click on the hemisphere in front of you and answer the questionnaire that opens. Please return to SL once you are finished to receive your earnings.

Instructions script for Control Sessions

Instructions for person A

Thank you for participating in this session.
Please read through the instructions positioned on the wall.
Feel free to ask us questions as they arise.
So if person B decides to keep everything you will earn L$ xxx, correct? Please confirm.
Please click on the yellow hemisphere in front of you and answer the questionnaire that opens.
Please return to SL once you are finished. We will tell you then the decision of the receiver.

Instructions for person B

Thank you for participating in this session.
Please read through the instructions positioned on the wall.

Feel free to ask us questions as they arise.
Person A has decided to send you L$ XXX. This amount is tripled, so that you receive L$ XXX. Now you have L$ XXX (the amount you received plus your initial L$ 1000) Please decide how much, if any, you wish to send to person A. <This is for control 3 treatment, In control 4 treatment: quadrupled>

Please type in the chat window how much money you would like to send to person A.
The decision is up to you. Feel free to ask questions.
So you will earn L$ xxx, correct? Please confirm.
Please click on the black hemisphere in front of you and answer the questionnaire that opens. Please return to SL once you are finished to receive your earnings.

<u>Instructions on the wall:</u>

The purpose of this experiment is to study how people make decisions in a particular situation. Feel free to ask questions as they arise.

Everyone receives 1000 Linden-Dollars at the start of this session. Final earnings depend on the decisions you and others make. You cannot lose any personal money.

Upon completion of the session, the amount will be paid to you individually and privately in your Second Life account.

Participants in this session are referred to as person A, person B *<in in-room-out-room treatments, add "and person C">*. The assignment into person A, person B <*and person C*> is done randomly.

You are person _________.

<In the Instructions for person C in the in-room-out-room treatments>: Person A and person B are in the other room and have a chance talking to each other. Altogether this session will take about 25 minutes. Person A makes a decision first. He is free to keep all of the L$1000, or can choose to send some or all of his L$1000 to person B or C.

<In the instructions in the control treatments>: Person A decides first. He is free to keep all of the L$1000, or can choose to send some or all of his L$1000 to person B. Any money sent by person A will be multiplied by a factor.

Once the receiver gets the money from person A, he can decide to keep all of the money, or return as much to person A as he likes.

Note there are two key features to the decision:
(1) The more money person A decides to send to the receiver, the greater is the total amount the receiver can divide between person A and himself.

(2) Since the receiver has complete control over the final allocation of the money, there is no guarantee that person A will receive any money back from the receiver.

<Instructions for C in in-room-out-room treatments>: Person A can choose between person B in the other room or you. If person A decides to choose person B in the other room we will double any amount person A sends to the receiver. For example, if person A decides to send L$600 to person B in the other room, person B will actually receive L$1200 (in addition to the L$1000 he already has). Person B then decides how much of the L$ 2200 he likes to send back to person A. If person A decides to pick you, person B will get the same amount as person A receives from you. For example, if you decide to return L$600 from your L$ 2800, both person A and person B will actually receive L$600. So person A will get L$ 1000 and person B will receive L$1600 and you would be left with L$ 2200. After your decision the game is over. <In 2/4 treatment: L$ 3400 respectively L$1000, L$ 1600 and L$ 2800>

<Instructions for B in control and to C in in-room-out-room treatments>: If person A decides to choose you, we will ___*triple/quadruple*____ any amount person A sends to you. For example, if person A decides to send L$600 to you, you will actually receive L$1800 (in addition to the L$1000 you already have). You then decide how much of the L$ 2800 you like to send back. *<In control 4 and 2/4 treatment: ___quadrupled___ and L$ 2400 respectively L$3400>*

So let's summarize:

Every participant will be given L$1000 to start the session.

Person A makes the first decision, Person B *<In in-room-out-room add "or C">* makes the final decision.

If person A chooses B any amount he sends is doubled by us. You will leave with the initial L$1000.

If A chooses you, any amount he sends is tripled by us. In this case Person B will get the same amount as A receives from you. *<In control 4 and 2/4 treatment: quadrupled>*

Please type in "Ok" to indicate that you understand these rules. Feel free to ask us questions.

Appendix C. Post-experiment Questionnaires

(A for proposer questionnaire ; B for in-room responder ; C for out-room responder)

1A/1B/1C. What is your Avatars' name?

2A. Did you decide to go with Person **B** (in your room) or Person **C** (in the other room)?
2B/2C. Were you selected as receiver by person A?

3A. Why did you decide on this receiver?
3B/3C How much money did you return to Person A?

4A. How much money did you send to the receiver?
4B/4C Why did you choose to return that amount?

5A. Why did you choose to send that amount?
5B/5C. To what extent did you feel obligated to send money to the person A? (Likert scale: 1=not at all; 7=very much)

6A. To what extent did you feel obligated to send money to the receiver? (Likert scale 1-7, 1=not at all, 7=very much)

7A. To what degree do you trust the receiver to return to you at least as much money as you sent him? (That is, if you sent L$400, he will return at least L$400)? (Likert scale: 1=not at all, 7=very much)

8A. How much do you expect the receiver will return to you?

9A/6B/6C To what extent does it fell like you are competing or cooperating with the other person in this session? (Likert scale: 1=competing; 7 = cooperating)

10A/7B/7C What is more important to you in this session: maximizing the amount of money that you and the receiver will gain together, or maximizing the amount of money you alone will gain? (Liker: 1=Max individual gain; 7=Max joint gain)

8B/8C. To what extent do you trust person A? (Likert: 1=Not at all, 7=completely)

11A/9C. To what extent do you trust person B? (Likert: 1=Not at all, 7=completely)

12A. To what extent do you trust person C? (1=Not at all; 7=completely)

9B/10C To what extent do you feel person A is similar to you (Likert: 1=very similar; 7= very different)

13A/11C. To what extent do you feel person B is similar to you (Likert: 1=very similar; 7= very different)

14A/10B. To what extent do you feel person C is similar to you (Likert: 1=very similar; 7= very different)

15A/11B/12C. Knowledge of economic game theory? (Likert scale: 1=Know nothing; 7=know well)

16A/12B. Please answer the following questions regarding your communication:

	1 Not at all	2	3	4	5	6	7 very much	I don't know
How responsive was the other person to verbal communication that you initiated?								
How responsive was the other person to non-verbal communication (e.g. mimic, posture) that you initiated?								
How natural did your communication seem?								
How credible is your avatar with respect to representing human beings?								

17A/13B/13C. Please indicate to what extent you agree with the following statements:

	1 strongly disagree	2	3	4	5	6	7 strongly agree	I don't know
My avatar does <u>not</u> have much in common with my true personaltiy.								

yourself?								
Does your avatar allow you to express your emotions?								
Does your avatar symbolise your relationship to other people?								
Do you feel an emotional attachment to your avatar?								
Does your avatar disclose information about you?								
Is the avatar representation important for contacting other people in the virtual environment?								
Is the avatar important for identification with the community?								
Does your avatar look similar to you?								

19A/15B/15C. Does your avatar…

	1 Not at all	2	3	4	5	6	7 very much	I don't know
…allow others to see what kind of person you are?								
…symbolise your personality?								
…indicate that you are a member of a particular club?								
…symbolise your social identity?								
…communicate your social identity?								

20A/16B/16C. Please indicate to what extent you agree with the following statements:

	1 Not at all	2	3	4	5	6	7 very much	I don't know
Are you able to anticipate what would happen next in response to the actions that you performed?								
How natural do your interactions with other avatars seem?								

21A/17B/17C. Please indicate to what extent you agree with the following statements (1=Strongly disagree; 7=Strongly agree)

Interaction with the SL-community is <u>not</u> only a game for me.
For me, SL is connected to real life.
I know many members of SL in person.
I often develop real-life relationships to other members of SL.
The boundary between this community and real life sometimes fades away.
I am never sure whether other SL-community members are acting a role in front of me.

22A/18B/18C. Please answer the following questions (1=Not at all; 7=very much)
Do you ever become so involved in a movie or a game that you are not aware of things happening around you?

Do you often find yourself closely identifying with the characters in a storyline?
Are you good at blocking out external distractions when you are involved in something?
Do you ever become so involved in doing something that you lose all track of time?

23A/19B/19C. Please indicate to what extent you agree with the following statements: (1=Not at all; 7=very much)
When I meet someone from my nation or group, I know we will have common goals and aspirations.
If I lose touch with my group, I will be a different person.
In general, I accept the decision made by my group.
When I meet someone from my own nationality or religion, I know we will have common goals and interests.

24A/20B/20C. Demographics:
Gender:
Age
From which City (country) did you log into Second Life?
Nationality
Education Level (<=High School, Some College, Graduate, PhD)
Profession (Self employed, Employee, Official, Student, Trainee, Pupil, Unemployed, Housewife/-husband, Pensioner, Manager, Others)
Mother's tongue?

Appendix D: Theoretical Proofs

The model is solved by backward induction. We first solve for the utility maximizing *R* (amount returned by the responders) as a function of *S* (amount sent by the proposer). We then substitute *R* into the proposer's expected utility function, derive FOCs for the optimal *S* and comparative statics.

An H type responder's utility maximization decision is:

$$\underset{R_j^H}{Max}\ u_j^H = \pi_j^H - \beta^H \cdot \frac{(\pi_j^H - \pi_A(j;H))^2}{S_j} \quad (1)$$

where $j = \{B, C\}$ denotes the in-room/out-room responder, S_j the amount sent to responder *j*, R_j^H the amount returned by an H type responder *j*, $\pi_j^H = 1000 + m_j S_j - R_j^H$ responder *j*'s payoff, $\pi_A(j;H) = 1000 - S_j + R_j^H$ proposer A's payoff, $m_B = 2$, $m_C = \{3,4\}$, β^H the inequality aversion parameter for the H type.

Solve (1), we get

$$R_j^{H*} = \frac{1}{2}(m_j + 1 - \frac{1}{4\beta^H}) \cdot S_j \quad (2)$$

It suggests $R_j^{H*} > S_j$ if $m_j > 1 + \frac{1}{4\beta^H}$.

Similarly, an L type responder's utility maximization decision is:

$$\underset{R_j^L}{Max}\ u_j^L = \pi_j^L - \beta^L \cdot \frac{(\pi_j^L - \pi_A(j;L))^2}{S_j} \qquad (3)$$

where $\pi_j^L = 1000 + m_j S_j - R_j^L$, $\pi_A(j;L) = 1000 - S_j + R_j^L$, β^L the inequality aversion parameter for the L type. Assume $\beta^L < \beta^H$.

Solve (3), we get

$$R_j^{L*} = \frac{1}{2}(m_j + 1 - \frac{1}{4\beta^L}) \cdot S_j \qquad (4)$$

It suggests $0 \le R_j^{L*} < S_j$ if $-1 + \frac{1}{4\beta^L} \le m_j < 1 + \frac{1}{4\beta^L}$.

Equations (3) and (4) indicate that there exist β^H and β^L ($\beta^H > \beta^L$ and $1 + \frac{1}{4\beta^H} < m_j < 1 + \frac{1}{4\beta^L}$) such that $R_j^{L*} < S_j < R_j^{H*}$.

The proposer's (player A's) expected utility when selecting proposer *j* is:

$$EU_A(j) = f \cdot u(\pi_A(j;H)) + (1-f) \cdot u(\pi_A(j;L)) \qquad (5)$$

where $f = \{q, p\}$ denotes the fraction that the in-room/out-room responder is an H type, $\pi_A(j;H) = 1000 - S_j + R_j^{H*}$ proposer A's payoff if selecting an H type responder, $\pi_A(j;L) = 1000 - S_j + R_j^{L*}$ A's payoff if selecting an L type responder.

Substitute equations (2) and (4) for R_j^{H*} and R_j^{L*} into equation (5) and rewrite the proposer's expected-utility maximization problem as

$$\underset{S_j}{Max}\ EU_A(j) = f \cdot u(1000 + \frac{1}{2}(m_j - 1 - \frac{1}{4\beta^H}) \cdot S_j) + (1-f) \cdot u(1000 + \frac{1}{2}(m_j - 1 - \frac{1}{4\beta^L}) \cdot S_j)$$

FOCs:

$$\frac{\partial EU_A(j)}{\partial S_j} = \frac{1}{2} f \cdot u'(\pi_A(j;H))(m_j - 1 - \frac{1}{4\beta^H}) + \frac{1}{2}(1-f) \cdot u'(\pi_A(j;L))(m_j - 1 - \frac{1}{4\beta^L})$$

$$\left.\frac{\partial EU_A(j)}{\partial S_j}\right|_{S_j^*} = 0 \qquad (6)$$

Equation (6) holds since $1 + \frac{1}{4\beta^H} < m_j < 1 + \frac{1}{4\beta^L}$ (i.e., $R_j^{L*} < S_j < R_j^{H*}$.)

From Equation (6), the optimal amount sent S_j^* can be expressed using a function of *f* and m_j, i.e., $S_j^* = S(f, m_j)$.

Derive comparative statics, we get:

$$\frac{\partial S_j^*}{\partial f} = \frac{u'(\pi_A(j;L))(m_j - 1 - \frac{1}{4\beta^L}) - u'(\pi_A(j;H))(m_j - 1 - \frac{1}{4\beta^H})}{\frac{1}{2} f \cdot u''(\pi_A(j;H))(m_j - 1 - \frac{1}{4\beta^H})^2 + \frac{1}{2}(1-f)\cdot u''(\pi_A(j;L))(m_j - 1 - \frac{1}{4\beta^L})^2} > 0 \qquad (7)$$

$$\frac{\partial S_j^*}{\partial m_j} = \frac{-f \cdot u'(\pi_A(j;H)) - (1-f)\cdot u'(\pi_A(j;L))}{\frac{1}{2} f \cdot u''(\pi_A(j;H))(m_j - 1 - \frac{1}{4\beta^H})^2 + \frac{1}{2}(1-f)\cdot u''(\pi_A(j;L))(m_j - 1 - \frac{1}{4\beta^L})^2} > 0 \qquad (8)$$

Inequalities (7) and (8) hold since $1 + \frac{1}{4\beta^H} < m_j < 1 + \frac{1}{4\beta^L}$, $u'(\cdot) > 0, u''(\cdot) < 0$.

Proof of Proposition 1: *When the probability assigned by proposers to a "high-return" (H) in-room responder is sufficiently higher than the corresponding probability for an out-room responder, proposers are more likely to choose the in-room over the out-room responder.*

We begin the proof of Proposition 1 by computing the difference in the proposer's utilities from the in-room (*B*) and out-room responder (*C*). Recall that *q* denotes the probability that *B* is of type *H* whereas *p* denotes the probability that *C* is of type *H*.

$$EU_A(B) - EU_A(C) = [q \cdot u(\pi_A(B;H)) + (1-q)\cdot u(\pi_A(B;L))] - [p \cdot u(\pi_A(C;H)) + (1-p)\cdot u(\pi_A(C;L))]$$

where $\pi_A(B;H) = 1000 - S_B + \frac{1}{2}(m_B + 1 - \frac{1}{4\beta^H})\cdot S_B = 1000 + \frac{1}{2}(m_B - 1 - \frac{1}{4\beta^H})\cdot S_B$;

$$\pi_A(C;H) = 1000 - S_C + \frac{1}{2}(m_C + 1 - \frac{1}{4\beta^H})\cdot S_C = 1000 + \frac{1}{2}(m_C - 1 - \frac{1}{4\beta^H})\cdot S_C$$

$$\pi_A(B;L) = 1000 - S_B + \frac{1}{2}(m_B + 1 - \frac{1}{4\beta^L})\cdot S_B = 1000 + \frac{1}{2}(m_B - 1 - \frac{1}{4\beta^L})\cdot S_B;$$

$$\pi_A(C;L) = 1000 - S_C + \frac{1}{2}(m_C + 1 - \frac{1}{4\beta^L})\cdot S_C = 1000 + \frac{1}{2}(m_C - 1 - \frac{1}{4\beta^L})\cdot S_C$$

The sufficient condition for $EU_A(B) > EU_A(C)$ is that *q* is sufficient higher than *p*. We can compute the minimum *q* in terms of *p* that would result in the selection of the in-room responder (*B*)

$$q > \frac{p\cdot[u(\pi_A(C;H)) - u(\pi_A(C;L))] + u(\pi_A(C;L)) - u(\pi_A(B;L))}{u(\pi_A(B;H)) - u(\pi_A(B;L))}. \qquad ■$$

Proof of Proposition 2: *When the probability assigned by proposers to a "high-return" (H) in-room responder is sufficiently higher than the corresponding probability for an out-room responder, proposers invest more in the in-room than in the out-room responder.*

The function of the optimal amount sent is $S_j^* = S(f, m_j)$. Hence, $S_B^* = S(q, m_B) = S(q,2)$, and $S_C^* = S(p, m_C)$ where $m_C = 3$ in the *Selection 2-3* treatment and $m_C = 4$ in *Selection 2-4*.

Since $\frac{\partial S_j^*}{\partial f} > 0$ and $\frac{\partial S_j^*}{\partial m_j} > 0$, for *Selection 2-3* there exist $\bar{q}$ and $\bar{p}$ ($\bar{q} > \bar{p}$) such that $S(\bar{q},2) = S(\bar{p},3)$, i.e., $S_B^* = S_C^*$. If $q > \bar{q}$ and $p \le \bar{p}$ then $S_B^* > S_C^*$. If $q \le \bar{q}$ and $p > \bar{p}$ then $S_B^* < S_C^*$.

Similarly, for the *Selection 2-4* treatment there exists $\tilde{q}$ and $\tilde{p}$ ($\tilde{q} > \tilde{p}$) such that $S(\tilde{q},2) = S(\tilde{p},4)$, i.e., $S_B^* = S_C^*$. If $q > \tilde{q}$ and $p \le \tilde{p}$ then $S_B^* > S_C^*$. If $q \le \tilde{q}$ and $p > \tilde{p}$ then $S_B^* < S_C^*$. ■

Proof of Proposition 3: *Proposers substitute the out-room responder for the in-room one when the out-room's relative rate of return increases.*

We need to show $\frac{\partial \text{Prob}_A(\text{selecting C})}{\partial m_c} > 0$, and it is sufficient to show $\frac{\partial EU_A(\text{selecting C})}{\partial m_c} > 0$.

Take derivative with respect to m_c on both sides of equation (5), we get

$$\frac{\partial EU_A(\text{selecting } C)}{\partial m_c} = \frac{1}{2}[p \cdot u'(\pi_A(C;H)) + (1-p)\cdot u'(\pi_A(C;L))]\cdot S_C$$
$$+ \frac{1}{2}[p \cdot u'(\pi_A(C;H))(m_c - 1 - \frac{1}{4\beta^H}) + (1-p)\cdot u'(\pi_A(C;L))(m_c - 1 - \frac{1}{4\beta^L})]\cdot \frac{\partial S_C}{\partial m_c}$$

Since $\frac{\partial S_C}{\partial m_c} > 0$ (inequality 8), the sufficient condition for Proposition 3 to hold is

$$p \cdot u'(\pi_A(C;H))(m_c - 1 - \frac{1}{4\beta^H}) + (1-p)\cdot u'(\pi_A(C;L))(m_c - 1 - \frac{1}{4\beta^L}) > 0,$$

i.e., $$\frac{p}{1-p} > \frac{-u'(\pi_A(C;L))(m_c - 1 - \frac{1}{4\beta^L})}{u'(\pi_A(C;H))(m_c - 1 - \frac{1}{4\beta^H})}.$$

Therefore, if *p* is sufficiently large (i.e., the proposer A's perceived likelihood is sufficiently high that the out-room responder is of type *H*), the likelihood of choosing the out-room responder *C* increases with the out-room multiplier m_c. ■

Proof of Proposition 4: *The percentage returned by the responder increases with the amount invested.*

Let r^T denote the percentage returned by type *T* responder ($T = \{H, L\}$). Then

$$r^T = \frac{R_j^{T*}}{1000 + m_j S_j} = \frac{\frac{1}{2}(m_j + 1 - \frac{1}{4\beta^T}) \cdot S_j}{1000 + m_j S_j} = \frac{\frac{1}{2}(m_j + 1 - \frac{1}{4\beta^T})}{\frac{1000}{S_j} + m_j}$$

We find $\frac{\partial r^H}{\partial S_j} > 0$ holds since $m_j > 1 + \frac{1}{4\beta^H}$ (see equation 2.)

Similarly, $\frac{\partial r^L}{\partial S_j} \geq 0$ holds since $m_j \geq -1 + \frac{1}{4\beta^L}$ (see equation 4.)

Therefore, $\frac{\partial r^T}{\partial S_j} > 0$ holds for both H and L types, i.e., the percentage returned will increase with the amount sent *S*. ■

Proof of Proposition 5: *In-room responders return more in percentage terms than out-room responders.*

Let $\bar{r}_B$ and $\bar{r}_C$ denote the percentage of expected return by the in-room and out-room responder, i.e., $\bar{r}_B \equiv \frac{q \cdot R_B^{H*} + (1-q) \cdot R_B^{L*}}{1000 + m_B S_B}$ and $\bar{r}_C \equiv \frac{p \cdot R_C^{H*} + (1-p) \cdot R_C^{L*}}{1000 + m_C S_C}$

where $R_j^{H*} = \frac{1}{2}(m_j + 1 - \frac{1}{4\beta^H}) \cdot S_j$ and $R_j^{L*} = \frac{1}{2}(m_j + 1 - \frac{1}{4\beta^L}) \cdot S_j$, $j = \{B, C\}$.

Both $\bar{r}_B$ and $\bar{r}_C$ can be rewritten as a function:

$$\bar{r}_j = r(f, m_j, S_j) = \frac{1}{2} \cdot \frac{f \cdot (m_j + 1 - \frac{1}{4\beta^H}) \cdot S_j + (1-f) \cdot (m_j + 1 - \frac{1}{4\beta^L}) \cdot S_j}{(1000 + m_j S_j)}$$

$$= \frac{1}{2} \cdot \frac{(m_j + 1) + (\frac{1}{4\beta^L} - \frac{1}{4\beta^H}) \cdot f - \frac{1}{4\beta^L}}{(\frac{1000}{S_j} + m_j)}$$

where $j = \{B, C\}$, $f = \{q, p\}$ and $m_B < m_C$.

To show $\bar{r}_B > \bar{r}_C$, we need to show

$$\frac{(m_B + 1) + (\frac{1}{4\beta^L} - \frac{1}{4\beta^H}) \cdot q - \frac{1}{4\beta^L}}{(\frac{1000}{S_B} + m_B)} > \frac{(m_C + 1) + (\frac{1}{4\beta^L} - \frac{1}{4\beta^H}) \cdot p - \frac{1}{4\beta^L}}{(\frac{1000}{S_C} + m_C)} \qquad (9)$$

If $q - p \geq \frac{m_C - m_B}{\frac{1}{4\beta^L} - \frac{1}{4\beta^H}}$, then $(m_B + 1) + (\frac{1}{4\beta^L} - \frac{1}{4\beta^H}) \cdot q > (m_C + 1) + (\frac{1}{4\beta^L} - \frac{1}{4\beta^H}) \cdot p$.

Hence, the sufficient conditions for (9) to hold are $q - p \geq \frac{m_C - m_B}{\frac{1}{4\beta^L} - \frac{1}{4\beta^H}}$ and $S_B \geq S_C$. ■

Appendix E: Tobit Model on Amount Returned by Responders

	SL experiment			Lab experiment		
	(1)	(2)	(3)	(4)	(5)	(6)
In-room Responder (*In-room*)	232.8	339.2*	452.1**	1.995	0.0812	0.177
	(160.7)	(193.1)	(180.1)	(1.837)	(2.613)	(2.616)
Out-room Responder (*Out-room*)	132.8	129.4	89.09	3.508	3.497	3.667*
	(184.2)	(183.9)	(177.4)	(2.204)	(2.196)	(2.201)
Multiplier4 [a]	620.4***	616.1***	738.8***	4.155***	4.144***	4.073***
	(174.6)	(174.3)	(165.8)	(1.416)	(1.411)	(1.436)
In-room × *Multiplier4*	-556.6**	-674.1**	-717.0***	-5.803**	-3.055	-2.999
	(232.2)	(293.7)	(270.4)	(2.580)	(3.629)	(3.626)
Out-room × *Multiplier4*	-337.9	-332.4	-286.8	-4.772	-4.758	-4.702
	(252.1)	(251.7)	(236.4)	(3.062)	(3.051)	(3.083)
Acronyms/Emoticons (AE)		-23.46	-20.32		0.252	0.235
		(23.72)	(21.32)		(0.244)	(0.245)
AE × *Multiplier4*		27.74	6.515		-0.325	-0.312
		(47.41)	(43.74)		(0.289)	(0.289)
Responder gender (male)			-209.0**			0.744
			(92.66)			(1.136)
Responder age			11.99***			0.118
			(3.999)			(0.192)
Amount sent [b]	151.3***	153.4***	150.7***	1.345***	1.347***	1.365***
	(17.40)	(17.63)	(16.60)	(0.187)	(0.187)	(0.190)
Constant	-251.1	-262.7*	-667.2***	-2.910**	-2.917**	-6.106
	(157.5)	(158.2)	(215.1)	(1.318)	(1.315)	(4.777)
Log likelihood	-1478.9	-1478.4	-1371.3	-445.4	-444.8	-444.34
Observations	200	200	189	156	156	156

The tobit model is censored at 0.
[a] The *condition* variable takes the value of one for the treatments *Select 2-4* and *Control 4*. [b] The amount sent is measured in 100 Linden dollars in the SL experiment, and Euros in the lab experiment. Standard errors are in the parentheses. * significant at 10 percent level; ** significant at 5 percent level; *** significant at 1 percent level.