Social Distance in a Virtual World Experiment*

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Abstract

We conduct a quasi-field experiment in a virtual world environment to investigate the impact of social distance on economic choices. We design trust games with partner selection, in which the proposer chooses between a familiar responder and a stranger with a higher multiplier. When choosing between the two responders, the proposer faces tradeoffs between economic opportunities and social distance. Comparing participants' behaviors to those in a standalone trust game, we find that in the virtual world experiment the proposers are more likely to select the socially closer responders despite the lower rate of investment returns, and the latter reciprocate by returning a higher proportion than the socially distant responders. Virtual communication also plays an important role on the proposers' choice and the responders' reciprocity. In contrast, social distance and virtual communication have less impact in the lab with a student sample.

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1. Introduction

Social distance is defined as the perceived distance, or perceived dimension of closeness between interacting individuals or groups (Dufwenberg and Muren, 2006). It is an important concept in management, psychology, sociology, anthropology and political science. Akerlof (1997) points out that social distance needs to be incorporated into economic modeling to explain individual decisions bearing social consequences. Empirical studies show that social distance can greatly affect economic outcomes (Rao and Schmidt, 1998; Eckel and Wilson, 2002; Cox and Deck, 2005; Charness, Haruvy and Sonsino, 2007). Specifically, it may influence individual choices between alternative partners in economic interactions, and result in a selection of partners that are perceived as socially closer and hence more trustworthy (Eckel and Wilson, 2000; Slonim and Garbarino, 2006). While previous literature focuses on the impacts of social distance on economic behaviors in the *physical* world, few studies have examined its impacts in the fast growing *virtual* worlds.

Over the past decade, the concept of social distance has been enriched and even transformed by the rapidly growing popularity of virtual worlds. Virtual worlds are computer-mediated online communities where registered human users can interact via their computerized graphical representations called avatars. The largest virtual worlds, for example, World of Warcraft and Everquest, have attracted tens of millions of registered users from all over the world. A virtual world simulates many aspects of the physical world. Groups of users may meet to play games, share information, discuss mutual interests, shop, or carry out business (Bloomfield, 2007). Different from in the physical world, virtual worlds make it possible for users to meet others from geographically distant locations, in many cases from different countries, without having to physically travel thousands of miles. In many virtual communities, users interact via their avatars without exposing their real-world identities. Virtual worlds not only have become an important form of modern socialization but also have become a fast growing sector of the economy. Users may trade a wide range of commodities varying from virtual goods (e.g., a speeder bike on an online computer game Star Wars Galaxies) to labor (e.g., service to develop virtual real estate). These economic activities have created vast world markets where such large volume of *real* incomes have been generated that the U.S. Congress started looking into the tax noncompliance issue related to the virtual economy.[1] In sum, virtual worlds have made it possible for people to engage in social and economic activities that are not constrained by geographic boundaries or nationalities at such low costs that no one could imagine before. The size and scope of the virtual worlds has made them a new front for socialization and an important sector of the global economy, and therefore an interesting new arena for economic research.

How does the vast physical distance among users and the (possible) anonymity nature of the social interactions influence the perceived social distance in virtual worlds? How does the perceived social distance in turn impact economic decision making? This study contributes to the literature by investigating these questions using a quasi-field experiment complemented by a lab experiment. Specifically, we examine the impact of social distance and virtual communication on individuals' decisions in trust games that involve partner selection. In the trust games the social distance is varied between the proposer and two potential responders, and the investment multiplier *increases* with the social distance. The proposer chooses between two trust games with two different responders, facing a tradeoff between economic opportunities and social distance. We construct a theoretical model to incorporate partner selection into the trust games. 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 to the responders? How does the social distance influence the responders' reciprocation?

We implement this experiment in a 3D virtual world called Second Life. Second Life is a very popular virtual community for social gathering. It is so popular that in order to reach the large population of potential voters on Second Life, then Presidential candidate Hilary Clinton established her presence during the 2010 Presidential campaign. Second Life suits our study also because of its rapidly growing economic components. Economics activities range from virtual to economic transactions (trading virtual real estates, providing or consuming entertainments). There are many shopping malls, entertainment venues, banks, and other businesses, and several in world active stock

[1] See the National Taxpayer Advocate's 2008 Annual Report to Congress. URL: http://www.irs.gov/advocate/article/0,,id=202276,00.html.

markets. Many major corporations (e.g., IBM, Well Fargo, and Nike) and educational institutions have established their virtual presence on Second Life. According to Second Life's economic statistics (http://secondlife.com/statistics/economy-data.php), in April 2010, about 492,000 customers spent some money on Second Life (in-world). More than half of these customers spent under 2000 L$ (just under US$ 8) for that month, whereas about 20% of the customers spent more than 10,000 L$ (about US$38) for the month. About 5% spent more than 50,000 L$ (US$ 190) for the month. The currency on Second Life, Linden dollars, is exchangeable with U.S. dollars.

This study also contributes to the literature from the methodological front. Compared to the 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 (many users come from different countries) offers researchers greater flexibility to try out various experimental manipulations of social distance while preserving participants' anonymity. On the other hand, it offers researchers reasonable control while allowing social interaction to occur in a natural environment that is 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 is that the 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 design 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 economic 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 complement the quasi-field experiment on Second Life by a lab study using university students. Although results in both experiments are largely consistent the effects of social distance and virtual communications are substantially more salient in the virtual world setting than in the lab. The contrast of the results, as will be discussed in detail in Section 5, reveals great potentials of online communities as a *complementary* platform for the laboratory for research on social distance.

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 results in the Second Life experiment with the lab experiment. Section 6 concludes and discusses implications of the results.

2. Background and Literature

In this section, we discuss three related streams of literature on partner selection in trust games, social distance, and virtual worlds. We will focus on the advantages and limitations of conducting an experimental study on social distance using a virtual world.

2.1. Partner Selection in Trust games

In the literature on partner selection in trust games, Eckel and Wilson (2000) is most closely related to our study. In their experiment, the first mover faces a choice between trust games with different responders and different rates of return. The two potential responders are labeled with facial icons that appear friendly, neutral, or unfriendly. In two of the four trust games, the returns on the branches associated with the second mover's choice differ between the potential partners. These different returns for the two responders could be interpreted as multipliers of 2 and 2.2.[2] 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 finds that first movers show a strong tendency to choose responders represented by friendlier looking icons. Trust is 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.

[2] 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.

Slonim (2006) and Slonim and Garbarino (2006) examine how selection affects choice in a trust game with a multiplier of 3, with and without partner selection. Available responders are 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 are able to choose between partners (three in Slonim, 2006; two in Slonim and Garbarino, 2006), whereas in the no selection treatment, first movers are not given a choice between possible partners. The study finds that selection increases the amount sent and thus efficiency and that first movers' selection is 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 relative to no selection (Slonim and Garbarino, 2006). However, when beliefs are incorrect, inefficiency may result. Attitudes also matter. Slonim (2006) find that the preference of male first movers for female second movers in the trust game is primarily driven by taste, rather than expectation. 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.

Selection can shed light in other settings as well where previously only within-setting decisions were studied. For example, Ivanova-Stenzel and Salmon (2004) examine bidder choices between alternative auction institutions and find that bidders select (and therefore revealed a preference for) an ascending auction over a sealed bid auction.

2.2. Social Distance

Existing literature on social distance focuses on its impacts on economic behaviors in the physical world. Wasserman and Faust (1994) find that social distance influences hiring decision, business success, and job performance through venues such as information gathering, competition blocking, and prices/policies collusion. Low social distance is found to increase trust and reciprocity (Charness, Haruvy and Sonsino, 2007; Cox and Deck, 2005; Eckel and Wilson, 2002) which in turn has positive effects on work performance, cooperation, risk taking, and inefficient organizational behavior such as shirking (Colquitt et al., 2007; Rao and Schmidt, 1998). Examples of these effects include employees contribute to the innovativeness of the firm by helping colleagues, providing suggestions for organizational improvement, and exchanging information and ideas beyond their work description and incentive contract (Das & Teng, 1998; Sherwood & Coven, 2008). Fan (2002) shows that in China low social distance (*guan xi*, or *ren qing*) contributes to the manifestation of a right for calling upon services and favors. A multitude of findings also points to the positive effects of low social distance on investments. Orbell et al. (1988) and Frey and Bohnet (1997) examine group effects and identification, and find significant positive effects of social distance. In a social 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 those they interacted before. 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, often resulting in more selfish behavior (e.g., Charness and Gneezy, 2008). However, the impact of anonymity on individual preferences depends on partners' demographic characteristics. For example, findings in the extant literature from dictator, bargaining and trust games 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).

The present study considers the effect of anonymity on behavior in line with the existing literature, but it considers endogenous selection as well. This is important because seemingly generous behavior towards a recipient does not necessarily indicate a preference for that recipient. For example, Dana et al. (2005) show that about one third of dictator game participants are willing to forego $10 dictator game and take $9 instead.

Compared to social interactions in the physical world, how interactions in virtual worlds change the perceived social distance is an empirical question. On the one hand, the virtual interactions may reduce social distance since the virtual persona is 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). On the other hand, users in virtual communities are likely to come from geographically distant locations. The avatar-based interactions help maintain anonymity of users' real-world identities—a favorable feature of virtual interactions since users do not have to act in the ways they do in real life. These factors may increase social distance in virtual worlds (Charness et al. 2007).

2.3. Virtual Worlds

Recent years have witnessed an increasingly popular use of virtual world for conducting research (Bainbridge, 2007; Bloomfield, 2007) and business. For example, Castronova (2001) describes the first economic study on virtual world economies and markets in Norrath, the most market-oriented virtual environment at the time. Our experiment is conducted on Second Life, a free 3D virtual world where users can socialize, customize an avatar, connect and create using free voice and text chat. Many users spend enormous amount of time and resources in designing their avatars and developing their residence or business on Second Life, and take their virtual social interactions seriously. As of April 2010, according to Second-Life-published statistics (http://secondlife.com/statistics/economy-data.php), Second Life has about 1.5 million unique residents visiting within a 60 day period. It is the most widely covered virtual world in the business press, with numerous S&P500 companies and universities establishing presence online.

A virtual world, particularly Second Life, is well suited for our research as an experimental platform for three primary reasons. First, partner preference is a complicated paradigm with many influencing factors. This is the reason the studies on the issue of partner selection hitherto have elected to avoid face-to-face interaction and limit partner identification to a few factors such as age, gender, score, or a smiley icon. If we were to conduct this experiment in the laboratory, and allow face-to-face communication we would need to control for many possibly important features of partners. In virtual worlds, the features of the partner can likewise be varied (potentially, as partner could have blue skin, spikes, wings, a tail, or may not even be human), but the stereotypes and associations that these features evoke are presumably weaker. Second, we believe virtual worlds are a promising experimental platform, providing access to a diverse pool and practically infinite number of subjects and access to potentially more flexible experimental designs. Third, Second Life offers great convenience in infrastructure and logistics for formal experiments in social and cognitive sciences. It allows researchers to 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 argue 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.[3] 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 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.

[3] 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.

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 two different virtual labs. 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.

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 L$. Subjects were then given the instructions on the trust games with partner selection.

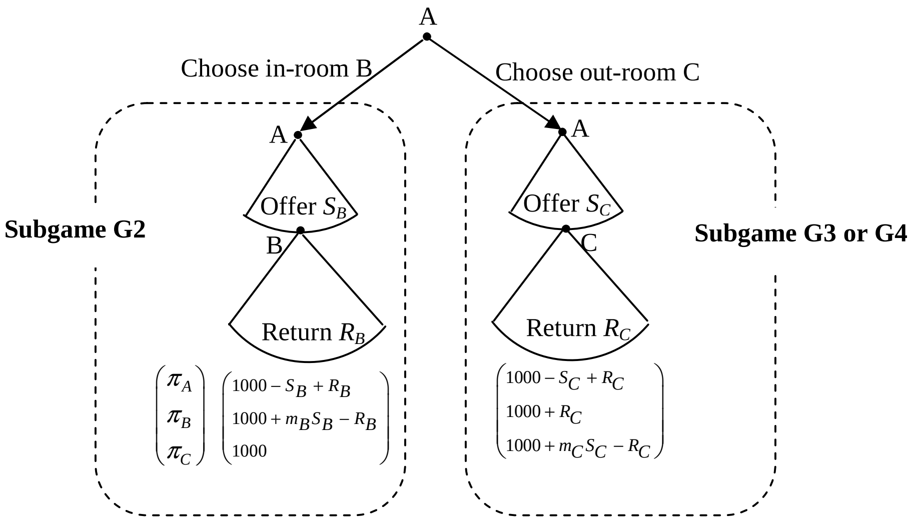
The game is illustrated in Figure 1 as a three-stage extensive form game. The first stage is the proposer's choice between the two trust games. The next two stages are the proposer's decision on the amount sent and the responder's decision on the amount returned in the trust game selected. Alternatively, 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 allows 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 L$ 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 $\pi_C = 1000$ 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. 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 in L$, 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 percent self-reported as male, and the average age was 33.2 with standard deviation 11.1, 33 percent self-reported as coming from the U.S., 37 percent from Europe, and 30 percent 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 (MELESSA) 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 lab subjects' unfamiliarity 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.[4] 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 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 23.5 (standard deviation of 3.0), and 37 percent were male. The payoffs were converted to Euros based on the exchange rate, 3 Lab-Euros = 1 Euro, and were paid in cash. The average earnings were 4.9 Euros.

4. Theory

We begin the investigation by characterizing the behavior of proposers and elected responders. We introduce an extensive form game representation, and present a theoretical model based on utility functions. We then discuss the propositions and

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

hypotheses regarding the impact of social distance on partner selection, the amount sent by the proposer, and the amount returned by responders.

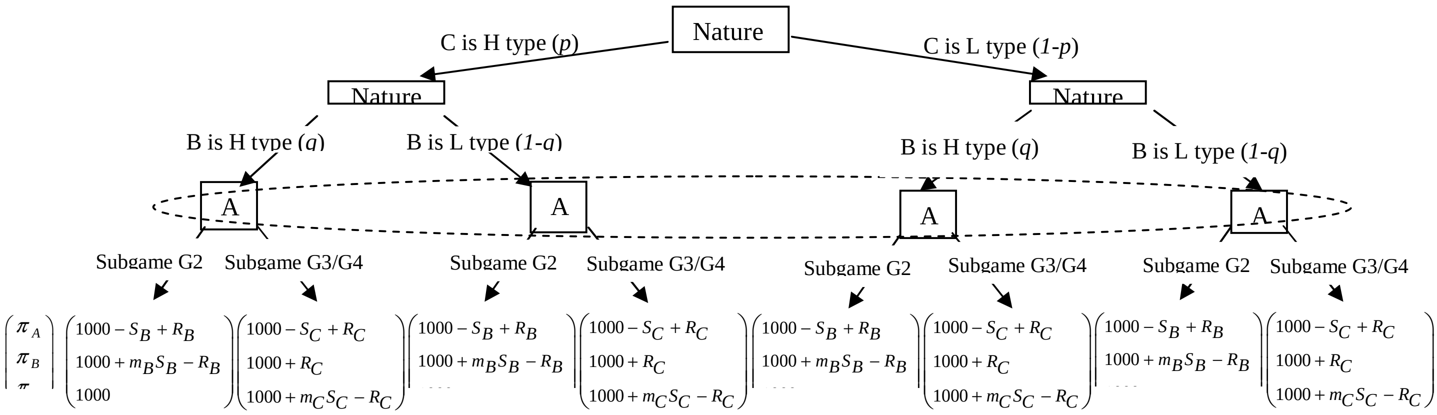
Note that in the three-stage extensive form game (illustrated in Figure 1), selfish responders should always keep all that was sent by the proposer; anticipating this, rational proposers should send nothing, and hence be indifferent between the two responders. Therefore, in order to capture the possibility of interior solutions (i.e., positive amount sent and returned) as observed in the empirical data, we present a modified extensive form game in Figure 2. It incorporates uncertainty into the proposer's decision on the one hand, and introduces a non-linear utility function of other-regarding preferences for the responders on the other hand.[5] The uncertainty in the proposer's decision, captured by the moves by nature in Figure 2, stems from the responders' heterogeneous preferences (hereafter "types").[6] Assume there are two types of responders: High and Low. 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.[7] Therefore, a proposer's trust only pays off if she is able to identify an H type responder. Assume the proposer does not know the responders' types, but only forms beliefs on the distribution of the types. Her belief of the probability that an out-room responder C is an H type is p; her belief of the probability that an in-room responder B is an H type is q. Her belief about B may be influenced by the virtual communication, so q may be different from p. It is the proposer's uncertainty over the responders' types that causes the former to "hedge her bets" on whom to choose and how much to sent. The responder B or C, once chosen, decides on the amount returned R.

[5] See Fehr and Schmidt (1999), Bolton and Ockenfels (2000), and Charness and Rabin (2002) for theoretical models on other-regarding preferences.

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

[7] 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.

Figure 2: A framework that incorporates uncertainty



To allow interior solutions on the amount returned by responders, we assume that they are averse to the payoff gap between them and the proposer, and the H type responder is more inequality averse than the L type. Specifically, the responders' preferences of inequality aversion take the following non-linear utility form.[8]

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

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 the net payoff of the responder, π_A the net payoff of the proposer, and β_T denotes the inequality aversion parameter with $\beta_H > \beta_L$.[9] The second term of equation (1) is assumed to be a quadratic form to allow interior solutions, and is rescaled back (to the monetary scale) by being divided by S.

The proposer's latent utility takes the following expected utility form:

[8] Note the simplistic model proposed here is only meant as an illustration of how the observed outcomes in our experiment can be delivered by a simple model of social preferences. It is by no means the only approach since the inequality aversion preferences are *not* a necessary condition for the existence of High and Low types of responders.

[9] This is a relatively standard variation on the formulation of social utility. The inequality aversion is based on models proposed by Fehr and Schmidt (1999) and Bolton and Ockenfels (2000). For tractability, we assume that the responders are equally averse to the advantageous and disadvantageous inequality in payoffs although some studies in the literature show that their magnitudes may differ (see Charness and Rabin 2002, Chen and Li 2009). This utility function does not explicitly model reciprocity. However, this does not prevent it from predicting reciprocal outcomes (see Proposition 4 below.)

$$EU_A(j) = f \cdot u[\pi_A(j;H)] + (1-f) \cdot u[\pi_A(j;L)] \quad (2)$$

where j = {In-room B, Out-room C} denotes proposer A's in-room/out-room partner choice, $f = \{q, p\}$ the (perceived) probability that the selected responder j is of H type, $u(\cdot)$ the concave Bernoulli utility function (assume $u'(\cdot) > 0$ and $u''(\cdot) < 0$), $\pi_A(j;H) = 1000 - S_j + R_j^H$ the proposer's payoff by investing in j who is a H 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, i.e., 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 to maximize her expected utility in equation (2). 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 for a stranger (in this case, the out-room responder). After the virtual communication, her belief is updated to become q for the in-room responder, and q may be higher/lower than, or equal to p. If q is sufficiently lower than or equal to p it is a dominant strategy for the proposer to select the out-room responder, not only because the out-room person is at least as likely to be an H type but also because the rate of return is higher (3 or 4 compared to 2). If q is sufficiently higher than p the proposer faces a dilemma. On the one hand, the risk of making a loss is lower if she chooses the in-room responder. On the other hand, conditional on the responders' types, the potential investment return is higher with the out-room person. Therefore, the proposer has to make a decision by balancing these tradeoffs. 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, the 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 q is sufficiently higher than p the proposers will send more to the in-room than to the out-room responders.*

Propositions 1 and 2 suggest that under certain conditions, the proposers will favor the socially closer responder. Note the conditions for the two propositions to hold do not coincide. Whether both propositions will hold depends on the empirical realization of the parameters.

Another interesting question regarding the proposer's decision is to what extent she responds to the change in the rate of returns with a socially distant responder. The comparison between the two treatments, *Selection 2-3* and *Selection 2-4,* helps answer this question, since the in-room multiplier is kept constant while the out-room multiplier increases from 3 to 4 (i.e., the price of choosing the in-room responder increases 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 rate of returns with the socially distant option. The proof of Proposition 3 in Appendix D provides a threshold of *p* (the likelihood of the out-room being 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's actions. A reasonable conjecture is that higher investments results in a higher percentage returned. The proof of Proposition 4 in Appendix D shows that this is true regardless of the social distance.

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

The next question is whether responders' choice on how much to return depends upon their social distance with the proposer. 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 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 higher percentage 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 responder does. We will test these theoretical predictions in the next section.

5. Results

In this section, we first describe some main features in the virtual communication, 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

What was notable in the virtual chat was 81.1 percent of subjects in the SL experiment and 95.0 percent in the lab experiment used acronyms and emoticons, i.e., the Internet languages that originated for the sake of saving keystrokes. Acronyms – shortened words or abbreviations – are one type 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 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.

Table 2 presents some quotes that some proposers used to justify their choices of responders. 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.[10]

[10] 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. 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. [11] Note that the in-room favoritism occurs despite the greater rate of potential *private* returns (multipliers of 2 vs. 3, or 2 vs. 4) and *social* returns (2 vs. 6, or 2 vs. 8) with an out-room responder.[12] In fact, the proposer's election of in-room responder (over the out-room one)

[11] The p-value is the binomial distribution probability of observing 82 in-room choices out of 138 choices under equal probability assumption.

[12] 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.

not only risks his own private earnings but results in a loss of social efficiency since not only the out-room multiplier is larger but also the money returned by out-room would accrue to both the proposer and in-room responder.

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%
Fraction 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.

Table 4 reports players' average private payoffs by role and the joint payoffs of the three players. Column 4 shows that in-room matching leads to *lower* payoffs for the proposers in all cases except *Selection 2-3* in the SL experiment. However, the differences in proposers' payoffs when matched with an in-room or out-room are not statistically significant ($p > 0.10$). Last column shows that when the joint payoffs of the three players (i.e., social efficiency) is significantly lower for the in-room matching than for the out-room matching ($p < 0.01$ in both treatments of both experiments). The loss of efficiency varies from 31 percent (*Selection 2-3* in the lab experiment) to 41 percent (*Selection 2-4* in the SL experiment).[13]

Why does a proposer prefer the in-room responder even if it may lower her private earnings and social efficiency? One explanation is favoritism towards a 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. Another explanation is that the proposer has updated her belief on the in-room responder's type after the virtual chat. She may believe that the in-room responder is more likely to be a high reciprocal type, hence foresee a higher probability that her trust will pay off (as detailed in section 4). Empirically, as shown in Table 3, the proposer's belief about the in-room responder is true particularly in the SL experiment, i.e., the proposers are more likely to receive more than they sent to the responders when matched with an in-room than when matched with an out-room.

Table 4: Payoff Summary

			Average Payoffs (in lab tokens)			
Environment	Treatments	Matching	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

Table 3 also shows that although an in-room responder is more likely to be chosen, the amount sent to them is not significantly greater than that to the 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. In the laboratory treatments, the amount sent to in-room responders is higher but not significantly so. Last but not least, Table 3 shows

[13] The efficiency loss is calculated as the difference in the joint payoffs between in-room and out-room matching divided by the joint payoffs of out-room matching.

that in-room responders return a larger proportion than out-room responders. On average, in *Selection 2-3* of the SL experiment, in-room responders returned 43 percent, compared to 31 percent by out-room responders ($p < 0.05$); the proportions returned are 40 percent by in-room and 32 percent by out-room in *Selection 2-4* ($p < 0.10$). These differences shrink in the lab experiment ($p > 0.10$) but the in-room responders still return slightly higher proportions than out-room responders.

5.2. Estimation Results

In this subsection, we use statistical models to analyze the effects of social distance on the proposers' and responders' choices. We present the results on the SL experiment, followed by discussions on the lab results. The 5-percent statistical significance level is used 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 given by $\alpha_0 + 0.5\alpha_1$.

Table 5: Proposer's Partner Choice (logistic model)

	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

Note: 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 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.[14] 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 the virtual communication. The coefficient of *AE* ($\alpha_2 = 0.319$, $p < 0.05$) suggests that in *Selection 2-3* the number of acronyms and emoticons significantly increases the likelihood that the in-room responder is chosen. In *Selection 2-4*, 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 the virtual communication is counterbalanced by the impact of the increase in the out-room

[14] Recall the average difference across the two treatments is given by $\alpha_0 + 0.5\alpha_1$.

multiplier. In contrast, 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 95.0 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, this finding reflects the lab proposers' lack of social bond with their in-room responders despite of the virtual communication. We will return for more discussions when we contrast the SL and the lab results at the end of this section.

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 in the lab.[15] 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 provide statistically significant support for Proposition 3, 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.

[15] 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.

5.2.2. Proposer's 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 (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.

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

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.[16] 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

[16] 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.

$\beta_1+\beta_4= \beta_2 + \beta_5$ ($p > 0.10$). 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 the SL and the lab experiments, the amounts sent to the in-room and the out-room responders reduce insignificantly ($p > 0.10$) when the out-room multiplier increases from 3 (in *Selection 2-3*) to 4 (in *Selection 2-4*).[17] Male proposers send more than female proposers ($p > 0.10$ in SL; $p < 0.01$ in the lab). Older proposers send more than the younger subjects ($p < 0.01$ in SL; $p < 0.10$ in the lab).

This leads to result 2.

Table 6: Amount Sent by Proposers (tobit model)

	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***

[17] 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.

			(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

Note: The dependent variable is the amount sent by proposer. 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.

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* – on average the higher amount sent by the proposer generates the greater proportion returned by all responders. 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 low 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: Proportion Returned by Responders (tobit model)

	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*)	0.051	0.050	0.044	0.163**	0.162**	0.171**
	(0.060)	(0.059)	(0.060)	(0.076)	(0.076)	(0.076)
Multiplier4 [a]	0.107*	0.106*	0.139**	0.096*	0.095*	0.086*
	(0.057)	(0.056)	(0.056)	(0.049)	(0.048)	(0.049)
In-room × *Multiplier4*	-0.100	-0.154	-0.164*	-0.154*	-0.047	-0.044
	(0.075)	(0.095)	(0.092)	(0.089)	(0.124)	(0.123)
Out-room × *Multiplier4*	-0.074	-0.073	-0.064	-0.208*	-0.207*	-0.194*
	(0.082)	(0.081)	(0.080)	(0.106)	(0.105)	(0.106)
Acronyms/Emoticons (AE)		-0.008	-0.008		0.011	0.010
		(0.008)	(0.007)		(0.008)	(0.008)

AE × *Multiplier4*		0.013	0.007		-0.013	-0.012
		(0.015)	(0.015)		(0.010)	(0.010)
Amount sent [b]	0.026***	0.026***	0.026***	0.017***	0.017***	0.019***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Responder gender (male)			-0.061*			0.053
			(0.032)			(0.039)
Responder age			0.003**			0.002
			(0.001)			(0.007)
Constant	0.062	0.059	-0.056	0.053	0.053	-0.030
	(0.050)	(0.051)	(0.073)	(0.044)	(0.044)	(0.162)
Log likelihood	-4.4	-3.8	7.5	-19.8	-18.8	-17.8
Observations	200	200	189	156	156	156

Note: The dependent variable is the proportion returned by the responders.
The tobit model is censored at 0 and 1. Standard errors are in the parentheses. * significant at 10 percent level; ** significant at 5 percent level; *** significant at 1 percent level.
[a] The variable *Multiplier 4* 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.

In the lab experiment, the coefficient of *Amount Sent* varies between 0.017 and 0.019 ($p < 0.01$), showing that the responders who received a higher amount reciprocate by returning a significantly higher proportion. However, there lacks social-distance-based-reciprocity in the lab experiment – the proportions returned by the in-room and 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, however it holds only for the SL experiment.

5.3 Comparisons of the Lab and Second Life Experiments

To compare and contrast the Second Life and the lab experiments, we find that the results from both experiments are quantitatively 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 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 modern forms of socialization and the expansion of the economy to the virtual worlds. In this study, we investigate how social distance affects individuals' 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 socially closer responders at a loss to themselves and to the community as a whole; proposers' preferences over socially closer investment options are mediated by the impact of virtual communication. It may be because communication provides cues for proposers to gauge other's reciprocal type. Indeed, the in-room responders, when selected, returned significantly higher proportions than the out-room responders.

Results also show that on average players in every single role of the trust games suffer a monetary loss when the proposer selects the in-room responder. This is a stark example that greatly lowered social distance may result in loss of efficiency and welfare for all parties that are involved. Many virtual communities such as Second Life have large volumes of online transactions that involve increasing number of users. These users' economic decisions, just as in the brick-and-mortar world, are influenced by social distance. For example, traders in the various stock markets operating in Second Life also tend to communicate with one another via forums, groups, and boards. A high level of communication is also visible in the popular land auctions, and other types of exchange on Second Life. This study shows that social distance in a virtual world is highly malleable to communication, which may distort economic agents' decisions, make them forego better opportunities, and result in welfare loss for the community.

Over all, we find that results are quantitatively consistent when using the virtual world users or the college students sample in our studies. As the main differences, the impacts of social distance and virtual communication are absent on proposers' partner selection and responders' reciprocal decisions when the college students sample is used. On the one hand, these differences underscore the great potentials that the online communities offer for studying social distance. On the other hand, they suggest that social distance may be more malleable by communications in a virtual environment where information can only be conveyed through limited channels compared to the real-person-to-real-person interactions in the physical world. These observations point to 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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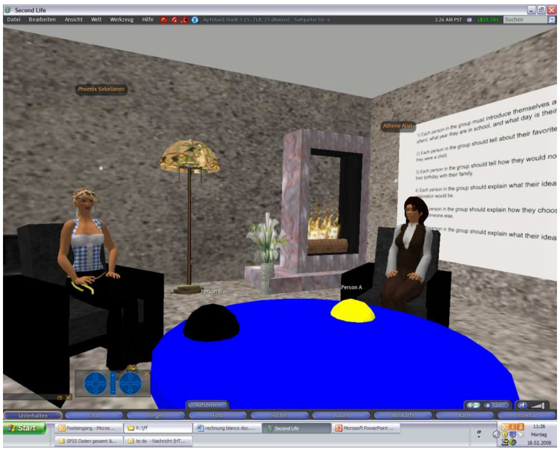
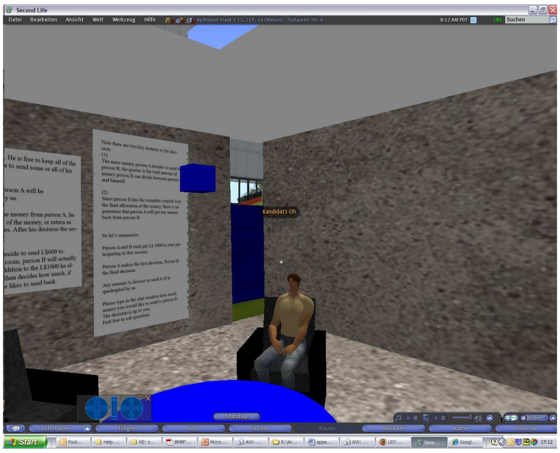
Appendix A. Screenshots from the experiment.





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.

<u>Continuation of Instructions for Person A</u>

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.

Instructions on the wall:

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 not have much in common with my true personaltiy.								
My avatar's behaviour is very similar to mine.								
My behaviour in SL is not different from that in real life.								
My avatar's character is very similar to mine.								
I identify myself with my avatar								
I perceive other avatars only as computerized images, not as real persons.								
It often crosses my mind that the avatars I interact with are not real persons.								

18A/14B/14C. Please answer following questions:

	1 Not at all	2	3	4	5	6	7 very much	I don't know
Does your avatar allow you to express 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:

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

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

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

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:

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

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

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

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:

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

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

(8)

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

$$\frac{\partial S_j^*}{\partial m_j} > 0 \text{ if } \frac{f}{1-f} > -\frac{u''(\pi_A(j;L))(m_j - 1 - \frac{1}{4\beta^L})}{u''(\pi_A(j;H))(m_j - 1 - \frac{1}{4\beta^H})}.$$

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*)

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

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:

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

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

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: Amount Returned by Responders (tobit model)

	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

Note: The dependent variable is the *amount* returned by responders.
The tobit model is censored at 0.
Standard errors are in the parentheses. * significant at 10 percent level; ** significant at 5 percent level; *** significant at 1 percent level.
[a] The variable *Multiplier 4* 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.