EFFECTS OF CUES OF OBSERVATION ON TRUST

EFFECTS OF CUES OF OBSERVATION ON TRUSTING AND TRUSTWORTHY BEHAVIOURS

By EVAN A. HARVEY, B.Sc.

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AUTHOR: Evan A. Harvey (McMaster University)

SUPERVISOR: Dr. Judith M. Shedden

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ABSTRACT:

Certain factors associated with online video communication have negative effects on the quality of an interaction. One's propensity to trust others or reciprocate trust with others online may be influenced by these factors of video-mediated communication. I investigated the effects of two such factors on pro-social behaviours in two separate experiments. In the first experiment I assessed levels of reciprocation in the presence of absence of a web-camera, to see if the presence of a camera was a sufficient enough cue of observation to induce trustworthy behaviours. In the second experiment I tested the effect eye gaze had on trusting and trustworthy behaviours. Results from the current research suggest that direct eye gaze is an important factor in deciding whom to trust and with whom to reciprocate trust. The current research introduces methodological changes that help to combat high levels of variability in participant responses. Future directions for research on eye gaze and other factors of video-mediated communication are discussed.

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Introduction

The way that individuals interact is shaped by the medium they use to communicate with each other. With advances in communication technology, different modes of communication have come with corresponding advantages and disadvantages. Although instantaneous and convenient, email and text-messaging lack communicative gestures and expressions typical in a face-to-face interaction. Researchers have begun to address questions about how the medium of communication changes the quality of an interaction. Experimenting with different media offers an opportunity to study how communication media influence decision-making in social interactions.

A major goal of new communication media has been to replicate the experience of face-to-face communication as closely as possible, but from a distance. In other words there is a desire to combine the experience of communicating face-to-face with the remote convenience of other media. Video phones, or video conferencing, have offered an acceptable compromise for many people. In a video conference, parties communicate instantaneously and remotely through the use of microphones and video cameras over the internet. Both parties are able to see and respond to each other in real time, as they would in a face-to-face conversation.

However, the use of video conferencing as a proxy of face-to-face communication has several limitations. Delays are caused by the transmission speed of the audio and visual signals. These delays can disrupt timings of when to respond to or

interject into a conversation, giving it an awkward or unnatural feeling. Secondly, both parties must first have access to the internet as well as the necessary equipment, i.e. a video or web camera, microphone, and relevant software. Moreover, the hardware may create unintended consequences on an individual's behavior in ensuing interactions, which I address throughout this report.

In this report I will discuss two research questions related to the use of video cameras (or web cameras) in computer mediated communication. First I discuss how the mere presence of a web camera may alter an individual's behavior, as the camera represents an object capable of observation. I compare the mere presence of a web camera to the presence of on-looking eyes by contrasting the results of my research with related studies in economics and evolutionary psychology. In the ensuing chapter I discuss a central issue in the design of current web cameras, the viewing parallax, and its effect on decision-making in a simple interaction.

One factor that greatly affects how two people behave toward each other is trust. To address how decision-making may be influenced through the use of web cameras I chose to assess how trusting individuals felt towards others in an interaction in two different experiments. In both experiments trust was operationalized by instances of trusting behaviours made by participants in structured economic games. Economic games are convenient because each decision has a small set of possible outcomes that can be easily classified as trusting or not. I outline how trust can be modulated by conditions common to communication that takes place via web cameras.

Chapter 1: Effects of Contemporary Cues of Observation on Trustworthy Behaviour

Without trust, it would be difficult to form lasting relationships. Trust is represented by encapsulated interests; one individual's interests are taken into account through another person's actions (Hardin, 2004). In this way trust can be defined through one's behaviour. Trusting behaviours may incur a personal cost or vulnerability with the expectation of personal gain in the future (Fehr, 2009). Trust allows individuals to rely on others to behave predictably in the future. Thus, trust is a critical component in an ongoing relationship, which has many sequential interactions.

The formation of trust involves two parties. Both parties must assess how trustworthy the other is before making a decision about whether to trust or not. Over the course of many interactions the formation of trust is facilitated by many trusting behaviours between both parties (Brosig, Weimann & Ockenfels, 2002; Kreps, Roberts, Milgrom & Wilson, 1982). The formation of trust is slower for computer mediated interactions but eventually reaches levels similar to face to face communication (Wilson, Strauss & McEvily 2006; Bos, Olson, Gergle, Olson & Wright 2002).

Less is known about how one judges trustworthiness before any interaction has taken place. There are many unanswered questions, therefore, about how one judges the trustworthiness of a stranger. These questions are especially pertinent in the domain of computer-mediated communication, as more and more individuals meet for the first time online. From the perspective of a potential employer, an individual seeking

a companion, or a business entering into negotiations, erroneously judging the trustworthiness of strangers carries large consequences.

There are different ways to measure levels of trust. Surveys, such as the General Social Survey, may ask about one's attitudes towards others, or how trusting one is of organizations. This information can be used to compare levels of trust between different populations and cultures (Mutz, 2005; Franzini, 2008). Surveys and questionnaires may be used at the scale of individuals as well, in conjunction with other assessment techniques.

Economic games can be particularly useful in predicting and quantifying trusting and trustworthy behaviors. The Trust Game is one example, developed by Kreps, which was designed to differentiate trusting behaviors from non-trusting behaviors (Kreps, 1990 from Berg, Dickhaut & McCabe, 1995). By designing experiments using economic games, researchers can isolate factors that influence trusting behaviours. For example, certain personality traits, such as agreeableness and unconditional kindness have been associated with trusting (Ben-Ner & Halldorsson, 2010; Ashraf , Bohnet & Oiankov, 2006). Physical information such as attractiveness, gender, and facial expressions can influence the perception of the trustworthiness of another person (DeBruine, 2005; Scharlemann, Eckel, Kacelnik & Wilson, 2001; Eckel & Wilson, 2003; Oosterhof & Todorov, 2009).

It is important to make a distinction between acts of trust, acts of generosity, and acts which reciprocate trust. These different behaviours are captured by the

different structures of the economic games that experiments employ. In a Dictator Game, for example, a participant decides how much of an endowment – usually a sum of money - to give to a recipient (Hoffman, McCabe, & Smith, 1994). This game captures instances of generosity; individuals can give a portion of an endowment away with no further action from either player.

In the Trust Game, one player has the opportunity to trust the other with an investment. If the investment is sent, it is magnified in value by some factor. In response, the other player can choose to return a portion of the new, magnified sum. Thus there are two distinct player roles, each with a different decision. In the first role, which I refer to as the Trustor, the player must decide whether or not to trust the investment to another player. In the second role, which I refer to as the Returner, the player must decide whether or not to return a portion of the endowment to the Trustor. This game captures instances of trusting behaviours from Trustors, and instances of reciprocation or trustworthy behaviours from Returners.

In order to isolate factors that influence trust among strangers, researchers typically employ one-shot economic games. In contrast to sequential games, any one participant will play at most one game with a given partner. Sequential games provide an opportunity for partners to develop a strategy over the course of several games, which can overpower more subtle effects that may be caused by different communication media (Brosig et al, 2003). In a one-shot game design, participants will encounter strangers in every interaction as they make decisions with participants whom

they have not seen previously. With a one-shot game one can ask what factors influence trust in an interaction with a stranger, over the internet, for which no prior information is known?

One theory predicts that displaying trusting and trustworthy behaviours (i.e. behaviours that validate another person's trust and do not show defection) helps to build a good reputation. For example, we tend to trust those who have a reputation of behaving in the interest of the group, and punish those who act on self-interest alone (Barclay, 2004; Fehr & Gätcher, 2000; Fehr & Gätcher, 2002). Trustworthiness is accrued at least in part through a willingness to reciprocate the interests of an individual or group, either directly or indirectly (Nowak & Sigmund, 1998; Alexander, 1987). Indirect reciprocity is important because it offers a theory of why individuals are more trusting than we would expect based on predictions from anonymous economic games. Indirect reciprocity is built around reputation, with the principle 'I scratch your back, and someone else will scratch mine' (Nowak & Sigmund, 2005). This theory of indirect reciprocity predicts that trusting and trustworthy behaviours ought to be demonstrated in instances where an individual's reputation is at stake (Leimar & Hammerstein, 2001; Milinski, Semmann, Bakker, & Krambeck, 2001). Thus, even strangers may be trusted in situations where an individual's actions are being observed by others.

Observation provides an opportunity for others in a group to evaluate one's behavior (McNamara, Stephens, Dall & Houston, 2009; Moteshemi & Mui, 2003). It is possible that we have evolved mechanisms to detect instances in which we are being

observed, as a cue to alter our behavior in order to encapsulate others' interests (i.e. to behave more trustworthily).

Several studies have shown that when visual information is provided about the presence of other players in experimental economic games, individuals are more trusting. Showing pictures of partners during Dictator Games increases generosity relative to complete anonymity (Bohnet & Frey, 1999). Video conferencing and face-to-face communication have been shown to better establish trust in social dilemmas over text-only communication (Bos et al., 2002), and over communication by telephone (Drolet & Morris, 2000). In addition, showing photos of partners before interactions take place has been shown to increase levels of trust (Rocco, 1998; Zheng, Veinott, bos, Olson & Olson 2002).

Showing pictures or video of partners or allowing partners to communicate before playing economic games, may influence decision making in two different ways. First, these manipulations decrease the social distance between partners by providing more information about each individual. Social distance within the context of economic games refers to the degree of reciprocity that two people believe exists in an interaction (Hoffman, McCabe & Smith, 1996). Decreasing social distance means that individuals are more likely to trust each other, and reciprocate trust. Information that helps to identify others, such as a photograph, is one way to decrease the social distance between individuals (Bohnet & Frey, 1999. Second, pictures of partners may influence decision making by serving as cues of observation. A photograph might serve as a cue that others

are watching (in a non-literal sense), and may signal that others are able to evaluate one's behavior. This in turn may influence acts of trust or reciprocity.

Cues of observation may vary in different situations. Even very subtle cues, such as cartoon eyespots on a computer screen, have been shown to induce more generous behaviours (Haley & Fessler, 2005). This effect has also been demonstrated by arrangements of dots in a simplified facial configuration (Rigdon, Ishii, Watabe & Kitayama, 2009). These experiments provide examples of generosity toward complete strangers in the presence of cues that typically indicate observation from others. Similar effects have been seen in more ecologically natural contexts, as shown by an increase in money given for beverages when eyes are drawn on a donation notice over a notice with a picture of flowers (Bateson, Nettle & Roberts, 2006).

Although eye spots seem to increase instances of generous behaviours, as indirect reciprocity would predict, cues of observation may encompass a broader category of objects such as cameras. Security cameras can increase helping behaviours when participants are told that cameras are actively surveying a room (van Rompay, T. J. L., Vonk, D. J. & Fransen, M. L., 2003). Some evidence suggests that priming concepts of religious figures watching increases generosity (Sharriff & Norenzayan, 2007). I was interested to see whether, in the absence of any other information about a partner in an economic game, individuals were more trustworthy toward others in the presence of a web camera acting as a subtle cue of observation. The first experiment I ran addresses this question.

Web cameras served as an innocuous cue of observation while participants played Trust Games with each other. My goal was to achieve as subtle a cue as possible, without the explicit awareness of participants, in order to remain consistent with similar studies that used eyespots (Haley & Fessler, 2005; Rigdon et al., 2009).

For experiment 1, I wanted to see whether the effect of subtle observation cues on generous behaviours (Haley & Fessler, 2005; Rigdon et al., 2009; Bateson et al., 2006) extended to trustworthy behaviours. I was also interested to see if a web camera was a sufficient enough cue to influence these behaviours. Trustworthy behaviours in the Trust Game closely resemble generous behaviours in the Dictator Game. In both roles, the Returner and the Dictator, the player is given an endowment of money. The player must then decide how much of the endowment to return to their partner. In both cases the player, Dictator or Returner, is the last to act. The only difference between the two roles is that the Returner received the endowment from his or her partner, the Trustor. The dictator is given the endowment from an external source, such as the experimenter. Since I was interested to see whether a web camera could induce reciprocity, I focused only on the role of the Returner in a modified Trust Game.

To assess trustworthiness, participants played modified Trust Games with fictitious partners in an experimental setting. I evaluated each player's response as the Returner, to see whether trustworthy behaviours differed between subjects who responded in the presence of a web camera and those who did not. I expected that the

web camera would serve as a subtle cue to observation, which would induce more trustworthy behaviours.

Methods

Participants

Participants were recruited from undergraduate psychology courses at McMaster University. There were a total of 44 students (14 males), with a mean age of 20. Participants completed the study for course credit, with an additional chance to win a cash prize as described below. Prior to recruitment, participants were made aware of the possibility of winning a cash prize. This study was approved by the McMaster University Research Ethics Board (MREB).

Procedure

Each participant came into the lab for one experimental session, which lasted approximately 30 minutes. During this time, participants were informed that they would play a series of Investment Games. Participants each played 40 Investment Games on a computer with fictitious partners. Before the games, participants completed a pre-game questionnaire, and after the games, participants completed a post-game questionnaire. Participants were randomly assigned to complete all of these requirements either in the presence of a web camera or not.

Upon arriving at the experimental room, participants were seated at a desk in front of a computer. The desk was deliberately cleared of any unnecessary objects so that all that remained was a keyboard, a mouse, and a web camera that was focused

directly at the location where the participant would sit. For half of the participants were in the control condition, in which only the keyboard and mouse were on the desk. All participants were then asked to complete a consent form in order to participate in the study. After participants gave their consent, an experimenter explained the rules of the Trust Game to each participant. Prior to the completion of the pre-game questionnaire, the experimenter placed a bell on the desk, which the participants were told to ring once they completed the questionnaire. The bell was deliberately placed in the center of the desk, directly beside the web camera in the experimental condition. The experimenter did not mention the web camera to the participants. The goal was to create a subtle cue of observation, which required no explicit awareness from either the experimenter or the participant.

Pre-game Questionnaire

The goal of the pre-game questionnaire was to acquaint participants with the role of the Trustor. Participants would play all future games as the Returner. In order for them to make an informed decision in future games, it was necessary for them to understand the decision that the Trustor had to make, as well as the associated consequences. Thus the pre-game questionnaire was a stand-alone Trust Game from the perspective of the Trustor, but without any feedback from a partner's response. Participants were presented with a hypothetical scenario. Out of an initial sum of $5 given to them, they were told to denote the amount of money (in whole dollar increments) they were willing to entrust as an investment to an anonymous partner.

They were told that any amount they gave as an investment would triple in value, and that the second player would have the opportunity to return any value of the total investment they saw fit. This decision was made in confidence on a paper ballot after the experimenter left the room.

Modified Trust Game (Investment Game)

I was interested in the influence of cues of observation on trustworthy behaviours. By measuring the amount returned by the Returner in each game, I could assess how trustworthy an individual was. I could then compare the overall amount returned in the observation condition to the amount in the control condition. To accomplish this, I only needed participants to play games as the Returner. Participants were led to believe that a prior set of individuals had already played the games as Trustors. These fictitious players entrusted varying amounts to participants as I explain below. Participants were told that they would be making decisions based on the Trustors' initial actions.

In fact, the investment values presented to each participant were not generated from individuals who had previously played as Trustors, but were instead artificial values created on behalf of fictitious players by the experimenter. Each participant played a total of 40 Trust Games with 40 different fictitious partners on a computer. They were informed that they would play only one game with each Trustor. Each fictitious Trustor entrusted an investment to each participant Returner according to the same rules presented in the pre-game questionnaire scenario. In essence, each fictitious Trustor

was initially given $5. Any amount they entrusted to participants as an investment was magnified by a factor of three. Thus the maximum endowment value was $15. The values of the endowments that participants were given were pre-determined and presented in a random order. Out of the 40 games, 20 endowments were the maximum $15. For the remaining 20 games, $0, $3, $6, $9, and $12 endowments occurred an equal number of times. I chose a disproportionately high number of $15 endowments to allow for the greatest variance in responses from each Returner. As the amount Returners chose to return was restricted to whole dollar increments, with a larger set of possible responses it would be easier to distinguish differences between my experimental groups (presence of a cue of observation or not).

It was important that each participant believed that Trustors' decisions were indeed being generated by a real person, in order to generalize the results of this experiment. In order to ensure this, steps were taken to encourage participants that the actions of the first players were indeed from real players. First, as participants played each game on the computer, initials of each fictitious player were presented to give an identity to the player. Second, responses were randomized so that they were more realistic, with some fictitious players not entrusting any value of investment to participants, as would be expected with real first players. Third, between games the experiment paused to inform participants that the next player's decision was being retrieved from a database, a process that would be unnecessary given a pre-determined set of values.

In this experiment, participants did not play for real money. Although each endowment was presented to participants as a dollar amount and participants were encouraged to play the games as if they were playing for real money, the money at stake in each game was not real. Participants were made aware of this before playing the games. In order to give an incentive for participants to play realistically (as if real money was at stake) I employed a lottery system. Each participant was informed that for every dollar accumulated while playing the games, the chances of winning a substantial cash prize would increase, though the odds for each participant were in reality the same. Thus, as with real money, the optimum choice for each participant was to keep the entire endowment, in order to increase the odds of winning the cash prize.

Post-game questionnaire

The goal of the post-game questionnaire was to account for differences in how participants interpreted the manipulations of the experiment. I was particularly interested in the degree to which participants felt they were being observed, and whether this differed between experimental and control conditions. Additionally, I asked participants the degree to which they made decisions as if they were playing for real money, to test the efficacy of the lottery as a proxy for real money. Finally, I asked participants to rate how much they felt their choices in the games affected other people, to assess whether they believed the fictitious partners' data were indeed from real individuals.

Results

I compared responses on the post-game questionnaire to gauge whether participants in the camera present condition felt they were being watched (Table 1). I expected that responses to this question would not differ between camera present and camera absent groups due to the subtle nature of the cue. A Chi-square test of independence supported this prediction (χ^2 (4) = 6.227 p = 0.183). One participant did question whether the camera would be on prior to the experiment, which may suggest that the presence of the camera was not so subtle that it was irrelevant to participants.

If the presence of a web camera acted as a cue of observation, I would expect to see Returners returning more on average when a camera was present. To test this hypothesis, I ran an independent samples t-test on the average amount returned for the camera present versus camera absent groups. The means of the two groups did not differ (camera present: mean $5.07, standard error 0.63; camera absent: mean $4.76, standard error 0.56, t(1-tailed)(42) = 0.364, p = 0.359).

One explanation for this null effect is that participants may have treated the games unrealistically because they did not play the games with real money. I tested whether my lottery manipulation had an effect on my results in two ways. First, I compared responses on the post-game questionnaire to see whether participants indicated they were playing the games as if real money was involved (Table 2). A Chi-square goodness of fit test revealed that responses differed from chance (χ^2 (4) = 34.9, p < 0.05). Since most participants' responses indicated that they were playing as if real

money was involved, I reasoned that the lottery manipulation was successful and did not impact the null result between camera present and camera absent conditions. To be sure, I reanalyzed the data after removing participants who indicated they did not play the games as if real money was involved. After removing 5 participants (3 from the camera present condition), the pattern of results was the same (camera present: mean $5.77, standard error 0.57; camera absent: mean $5.03, standard error $0.57, t(1-tailed)(37) = 0.906).

Table 1. Frequency of Response on a Post-game Questionnaire:

'I felt like I was being watched during the games'

	Strongly Disagree	Disagree	Indifferent	Agree	Strongly Agree
Camera Present	2	4	6	8	2
Camera Absent	6	6	4	5	1

Table 2. Frequency of Response on a Post-game Questionnaire:

'I played the games as if I was playing with real money'

	Strongly Disagree	Disagree	Indifferent	Agree	Strongly Agree
Camera Present	0	3	1	11	7
Camera Absent	0	2	3	11	6

Table 3. Frequency of Response on a Post-game Questionnaire:

'I felt as though my decisions affected other people'

	Strongly Disagree	Disagree	Indifferent	Agree	Strongly Agree
Camera Present	2	0	3	14	3
Camera Absent	0	5	1	14	2

Despite non-significant results from these t-tests, the differences were at least in the predicted direction. I decided to explore this further by looking at differences across the amount returned for each of the endowment values. The presence of the camera might interact with the endowment amount, such that when Returners were given endowments of greater value they returned more in the camera condition. I compared the amounts returned in a 2 (camera present vs. camera absent) by 5 (endowment value: $3, $6, $9, $12, $15) ANOVA. The results are reported in Table 4. There was no main effect of camera presence ($F(1, 37) = 1.075$, $p = 0.306$), which was to be expected following a null result from t-test above. However, for each endowment value the means for the amount returned were all again in the hypothesized direction (Figure 1). The interaction of camera presence with endowment value was also non-significant ($F(4,168) = 0.117$), which demonstrates that mean differences between camera present and camera absent were consistent and in the same direction for all endowment values.

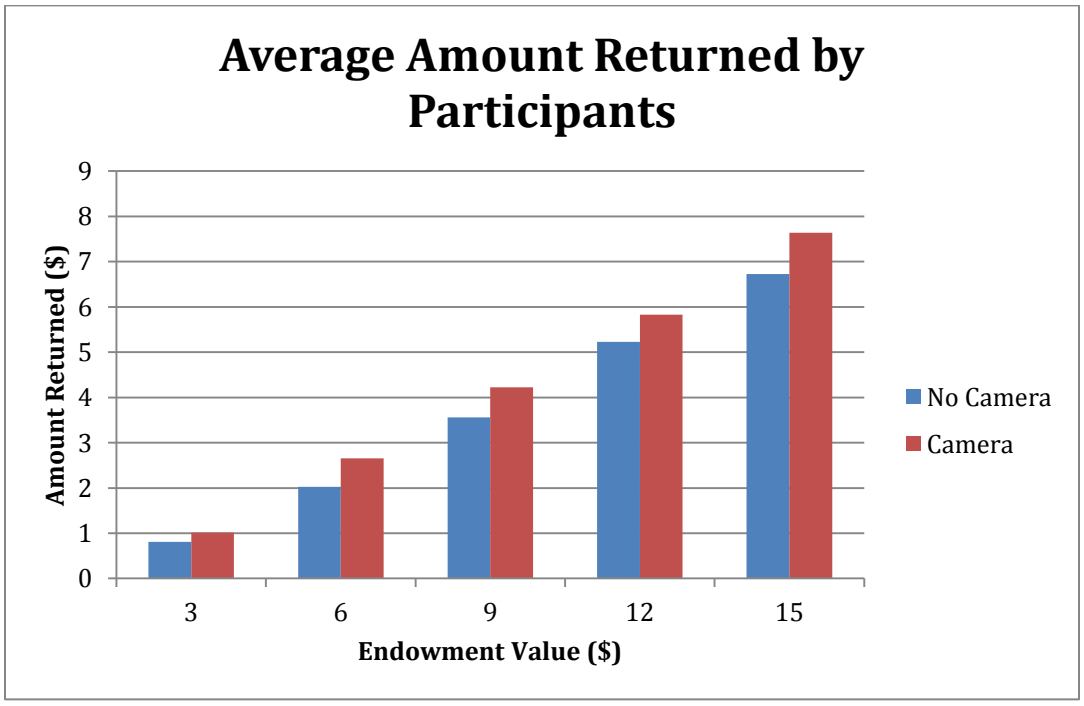
Table 4. Mean (se) Amounts Returned By Endowment Value

	$3	$6	$9	$12	$15
Camera Present	1.01 (.15)	2.67 (.24)	4.22 (.35)	5.83 (.46)	7.64 (.86)
Camera Absent	0.81 (.18)	2.02 (.32)	3.56 (.49)	5.22 (.64)	6.73 (.75)

I also tested whether participants were less likely to return nothing in the condition where no camera was present. This is another metric of trustworthiness. Participants who would otherwise return nothing may return some non-zero value in

the presence of an observation cue. Previous studies report similar results with generosity, where

Figure 1. Amounts Returnered to Trustors as a function of endowment value.



cues of observation decrease the probability that zero dollars were given out of an initial sum (Haley & Fessler, 2005). To test this, I compared the proportion of times zero dollars were returned between the camera present and camera absent conditions in an independent samples t-test. With this test I failed to find a significant result, although again the pattern of results was in the predicted direction (camera present: mean 0.198, standard error 0.077; camera absent: mean 0.229, standard error 0.071; t(1-tailed)(42) = 0.388).

I also tested whether participants were less likely to return nothing in the condition where no camera was present. This is another metric of trustworthiness. Participants who would otherwise return nothing may return some non-zero value in the presence of an observation cue. Previous studies report similar results with generosity, where cues of observation decrease the probability that zero dollars were given out of an initial sum (Haley & Fessler, 2005). To test this, I compared the proportion of times zero dollars were returned between the camera present and camera absent conditions in an independent samples t-test. With this test I failed to find a significant result, although again the pattern of results was in the predicted direction (camera present: mean 0.198, standard error 0.077; camera absent: mean 0.229, standard error 0.071; t(1-tailed)(42) = 0.388).

Discussion

Trust and trustworthiness are important factors that influence decision making in social interactions. Humans tend to be more trusting than predicted based on self-interested, optimal outcomes in economic games. Evolutionary theories of indirect reciprocity offer one explanation as to why this might be the case. By trusting and acting in the interest of others, an individual stands to gain a good reputation, or good image in the minds of others. This in turn increases the probability that others will act favourably towards the individual. Importantly, this theory predicts that in situations where our image is at stake, I sought to behave generously or trustworthily. Evidence

suggests that cues indicative of being observed increase the probability that an individual will act in the interest of others. The current study was designed to assess whether contemporary cues of observation could be used to induce more trustworthy behaviours.

The presence of a web camera did not seem to demonstrably increase occurrence of trustworthy behaviours. This was true for both the average amounts returned in an Investment Game, and for the proportion of times zero dollars was returned. It is important to stress that this does not imply that indirect reciprocity is not a stable mechanism for inducing trustworthy behaviours. Instead, cues that are indicative of observation may need to be evolutionarily salient, i.e. representative of the face, or eyes. Although interpreting null results must be approached with a degree of caution, this result is potentially interesting as it may have important implications for the ways we use cameras to discourage dishonest and untrustworthy behaviours. For example, these results may suggest that security cameras meant to deter self-interested behaviours, such as theft, could be less effective than the presence of a security guard – an individual whose sole purpose is to evaluate the behaviours of others around him.

The data collected from this pilot study gave us confidence in some of the design features of the current study, and highlighted shortcomings of the design that I discuss here and improve upon in the following experiment in Chapter Two of this report. First, the questionnaire data that I collected suggested that the lottery manipulation was successful in motivating participants to behave as if real money was directly involved.

Second, questionnaire data suggested that participants were successfully deceived (and quite easily so) into believing they were playing games with data from other participants (Table 3). The success of these two manipulations allowed for more confidence in the use of a lottery incentive and fictitious players in the following experiment.

It is my opinion that the strongest criticism of the design is that a combination of factors led to low power in the ability to detect a difference in the amount returned, which ultimately led to inconclusive results. As mentioned, *all* of the reported means revealed small effects in the predicted direction, although the differences were non-significant. It seems unlikely that each of these measures would align in the same direction by chance. Any small effect of web camera presence may be easier to detect by reducing variance between participants. Between-subject variability is common in these types of experiments, and many studies collect data from a large number of subjects to overcome it. It is very difficult to create a within-subjects design that ensures a lack of transparency. For example, with this manipulation, placing or removing a web camera from the desk between conditions for a given participant reveals an obvious significance of the web camera. For this reason it is typical of studies that use economic games in their design to use between-subjects measures. Nevertheless, one of my goals was to incorporate within-subjects measures in future experiments, without compromising transparency in the design.

Another concern was the potential that some participants had varying levels of awareness of the web camera. It is possible that participants in the camera present

condition never noticed the camera, while other participants may have been well aware of its presence. This was difficult to control for without making the camera's presence more explicit. Drawing explicit attention to the web camera would undermine the ability to compare this study to similar studies that use subtle, non-explicit cues of observation. Moreover, explicit attention drawn to the camera would reflect, in my opinion, a less interesting research question, as explicit observation through cameras has already been shown to increase other pro-social behaviours such as helping (van Rompay et al., 2008).

Ultimately this study gave us confidence in designing a second experiment, which addresses the concern of viewing parallax in video conferencing, and its effect on trust. It should be noted that the second chapter exists also as a stand-alone manuscript. Although some of the information may be redundant with the information presented in the first chapter, I review more relevant literature on the role of eye gaze and social presence.

Chapter 2: Perceptions of Trust and Trustworthiness in the Absence of Eye Contact

Imagine that an employer is charged with the task of interviewing two qualified applicants. Assuming the applicants are equally qualified, the employer must use other information to judge who is more appropriate for the job. The employer takes a risk in hiring a new employee. Is each applicant answering the questions honestly? Can the employer count on each applicant to work hard in the future? The employer must be able to successfully judge how trustworthy each applicant is in order to make the correct decision. This task is perhaps more difficult if one imagines that the interviews take place by a video conference, with the employer and applicants a great distance from each other. How does the interviewer judge trustworthiness in this case?

Trust is an important factor in building new, positive relationships. Before the extensive use of social media and technology, new relationships were formed almost exclusively through face-to-face interaction. The internet has made it common for individuals to meet for the first time through the use of other media (Baltes, Dickson, Sherman, Bauer & LaGanke, 2002). Opportunities to meet new people exist in text-based forums, interactive dating websites, gaming communities, e-business marketplaces, and dedicated social networking websites. In these contemporary environments, it is important to know what information is useful in determining whether an individual is trustworthy or not. Successfully judging trustworthiness online has implications for whether individuals will secure jobs, create partnerships, or complete future business transactions.

Online media allow varying degrees of information to be shared with others. Often one's photo is available to other members of an online community. Displaying one's photo can make an individual appear more trustworthy, and make others more generous to that individual (Zheng et al., 2002; Bohnet & Frey, 1999). Alternatively, individuals may interact through the use of web cameras and video conferencing software. This kind of dynamic exposure also increases cooperation in the future, relative to complete anonymity (Brosig et al., 2002). In each case, however, the visual information presented is impoverished compared to a face-to-face interaction (Anderson, O'Malley, Doherty-Sneddon, Langton, Newlands & Mullin, 1997).

Video conferencing remains the most widely used proxy of face-to-face communication. This is partly because it allows for rich social cues, like dynamic expressions and gestures. Media richness theory offers an explanation of how interactions differ according to the bandwidth of different communication media. 'Richer' media, such as face-to-face communication, provide more information than 'leaner' media, such as text-based computer-mediated interactions (Daft & Lengel, 1986). One's trust in others has been shown to be mediated in part by the richness of the media the two parties use to interact (Rockman & Northcraft, 2008). The formation of trust is delayed when individuals use leaner, text-only computer mediated communication to interact, and levels of trust are less stable over time (Wilson et al., 2006; Bos et al., 2002). The rate of information transfer is much less with leaner media

because of the absence of non-verbal cues, so the formation of trust takes longer (Walther, 1995).

A similar theory suggests different media affect the feeling of social presence in a given interaction (Lombard & Ditton 1997; Short, Williams & Christie, 1976). Social presence can be defined as "…the feeling one has that other persons are involved in an interaction" (Walther, 1995, p. 188). Information that makes social presence more apparent, such as sharing the names of players in an otherwise anonymous conversation, increase levels of generosity (Charness & Gneezy, 2008). Video conferencing best approximates the social presence of face-to-face communication, followed by a still photo of a conversation partner, and finally text-alone. Many instances of increased pro-social behaviours already discussed (for example, trust in social dilemmas (Brosig et al., 2002) or generosity in Dictator Games (Bohnet & Frey, 1999; Zheng et al., 2002)) can be attributed to increasing social presence. Although the concept of media richness encompasses more than just social cues, the extent to which various communication media provide rich social cues must have a strong effect on social presence, such that richer media convey a high degree of social presence. Both the richness of a medium and its ability to convey a high degree of social presence are important factors that increase instances of trusting and generous behaviours.

Here I highlight a particular problem with video conversations, which I feel has direct consequences for the formation of trust. In a typical web-camera conversation one very important social cue is absent. Because of the configuration of hardware, there

is no eye contact between the two parties. Eye contact refers to the mutual gaze of two individuals into each other's eyes (Kleinke, 1986). In a video conversation, the image of each individual appears on an opposing monitor. However, the individual's image is captured by a camera, which is located somewhere adjacent to the monitor. Because of this, each person's image is cast with an averted gaze while viewing the opposing face. Obviously, with face-to-face communication this problem doesn't exist because the eyes 'record' the image in the same location as the face.

Eye contact is a very important factor in human interaction. Early work on eye contact shows that it aids in judgments of other's attractiveness and helps to facilitate communication, among a host of other functions (Kleinke, 1986). Disturbances in mutual gaze have long been thought to share a link with instances of deception, though this link is inconsistent within research on deception (Akehurst, Köhnken, Vrij & Semin, 1996; Sporer & Schwandt, 2007). Media richness theory would predict that information is displayed through the eyes by richer media, which may cue certain attitudes and preferences. Research suggests that the eye gaze of others can carry predictive information, such as cueing the location of points of interest (Frischen, Bayliss & Tipper, 2007). Moreover, individuals displaying non-predictive gazes, in the sense that their eye gaze is not a reliable indicator of points of interest, are judged as less trustworthy (Bayliss and Tipper, 2006). Thus people can use gaze direction as a cue of how trustworthy a face is in a specific task. I sought to extend this finding by asking whether direct eye contact acts as a ubiquitous cue of trustworthiness.

Many researchers believe that seeing eyes focused on oneself acts as an important social cue. Cues of observation, such as eye contact, may increase pro-social behaviours. One study showed that participants seated in front of a computer screen with cartoon eyespots focused on them are more generous than those seated in front of a control background (Haley & Fessler, 2005). Instances of increased generosity have also been seen by placing eyespots on a donation notice to raise money for community funds (Bateson et al., 2006). Eyes cast directly on oneself may be a particularly salient cue. Seeing eyes directed at us typically means that others have an opportunity to evaluate us, which may cause us to behave in the best interest of others (McNamara et al., 2009; Hoffman et al., 1996; Moteshemi & Mui, 2003).

The effect of eye gaze, specifically, on social presence is less clear. Increasing social presence by introducing pictures or videos of partners in an interaction is typically confounded with introducing eye contact. Instances of increased generosity have been documented using very basic stimuli, merely configuring dots in a facial representation (Rigdon et al, 2009). Findings suggest that even these very basic stimuli may increase feelings of social presence. Individuals scan their environment for cues that others may be evaluating them, and may be sensitive to such stimuli on a non-conscious level (Leary & Kowalski, 1990).

My goal in this experiment was to see whether eye gaze, a rich social cue, influenced feelings of social presence. I have already discussed the importance of social presence in trusting and generous behavior. In order to test the role of eye gaze

specifically, I manipulated the gaze direction of player portraits in an economic game to see if there was an effect of eye gaze on trusting and trustworthy behaviours. My stimuli consisted of portraits of actors whose gaze has been manipulated to be either averted, or direct. By altering only the gaze of each face, I could compare eye gaze direction while keeping other factors that influence social presence constant. I presented these stimuli to participants in a realistic game scenario. This allowed us to take behavioural measures of trust and trustworthiness. By strategically pairing stimuli of different gazes together, I could use participants' preferences to judge whether eye gaze affects perceptions of trust and trustworthiness in a stranger's face.

Research in psychology has employed various economic games that have been used to predict behaviours in controlled scenarios. The Trust Game is one game that was developed to differentiate trusting behaviours from non-trusting behaviours (Kreps, 1990 from Berg et al., 1995). The Trust Game is a simple game played between two partners. The first player must decide whether to trust the second player with an endowment of money. Upon being sent, the endowment is magnified in value. The second player has the option of returning a portion of the magnified sum, or keeping the entire sum. The Trust Game allows researchers to qualify both players' actions. The first player makes a trusting decision or not. The second player, in deciding whether to return some of the endowment, can behave trustworthily or not.

Other economic games closely resemble the Trust Game. For example, the Investment Game is an extension of the Trust Game. In this game the binary decision of

each player is divided into increments based on fractions of the sum of money. Trust and trustworthiness are thus quantified: trust, by how much the first player sends, and trustworthiness by how much the second player returns (Berg et al., 1995). The Dictator Game is another game that closely resembles the Trust Game. In this game one player is selected to act as a Dictator, and must decide how much of an endowment to give to his partner. Note that this game closely resembles the decision faced by the second player in the Investment Game; each must decide how much to give to their partner without future consequence. The aforementioned importance of eye spots has typically been demonstrated in the Dictator Game (Haley & Fessler, 2005; Ridgon et al., 2009).

I felt that employing a standard Investment Game design would incorporate some potential sources of unwanted variance in participant responses. First, there are huge variances within a set of facial stimuli, such as the attractiveness of the stimuli. Attractiveness has been shown to modulate the effect of observation cues, such as eye contact, on pro-social behaviours (Smith, DeBruine, Jones, Krupp, Welling & Conway, 2009). Second, allowing different investment amounts to be sent and returned introduces a lot of variance in the decisions participants are able to make. This may make it difficult to detect a difference in participants' preferences for eye gaze direction. Finally, individual personality differences add an additional source of unwanted variance. For example, one's propensity to trust is related to one's likelihood of taking risks (Naef & Schupp, 2008, from Fehr, 2009). Trusting behaviours are also correlated with levels of extraversion and inversely correlated with levels of

neuroticism, while trustworthiness is related to agreeableness and conscientiousness (Evans & Revelle, 2008).

I sought to attenuate these sources of variance by developing a repeated-measures forced-choice Trust Game. Each participant saw two faces at a time, and was forced to choose whom to trust. By counterbalancing eye gaze direction with the face stimuli, I was able to control for any confounding factors in the face stimuli, such as their attractiveness (Wilson & Eckel, 2006) or their race (Glaeser, 2000). By forcing participants to choose a face on a given trial, there was no longer any variance in how participants could respond. I could simply compare which faces participants selected to see if eye gaze direction affected perceptions of trustworthiness. Each participant played multiple Trust Games so that I could detect preferences of eye gaze direction within a given subject.

With each participant playing in both player roles I could measure how eye gaze direction influenced trust and trustworthiness. In the first player role, participants would select whom to trust out of a pair of faces. If faces with a particular eye gaze direction are selected more often, I can conclude that participants are more likely to trust faces with that gaze direction. In the second player role, participants would select whose trust they would reciprocate – in other words, they would select the face to which they would return the endowment. Again, I can assess whether participants prefer to reciprocate with faces that display a particular eye gaze direction.

By introducing a forced-choice design, I change the experimental question considerably from other experiments that use the Trust Game. Instead of asking about the instances in which people trust, I ask whether eye gaze, specifically, is a factor in the formation of trust. Introducing a forced-choice paradigm replaces the economic predictions associated with the original task with more cognitive predictions. If eye gaze is a critical social cue for the formation of trust, I would expect to see differences in the number of direct gaze faces selected relative to indirect gaze faces. On the other hand, if other cues of social presence overwhelm eye gaze as factors important in the formation of trust, then I should not detect a difference between gaze directions. This prediction assumes that participants would select players preferentially who clearly demonstrate social presence over players who do not. In order to test this prediction I introduced a control stimulus that had low social presence – a blank silhouette outline of a face. Thus if social presence is a key determinant of trust, notwithstanding eye gaze direction, player portraits should be selected more often than blank silhouettes.

The impact of gaze direction may differ according to the roles the participants assume in the games. As previously mentioned, the role of the Returner is very similar to the role of the Dictator in the Dictator Game. Because previous studies have shown the importance of direct eye gaze (even with non-facial stimuli) in the Dictator Game, one might predict that faces with direct eye gaze would be selected preferentially by participants in the role of the Returner. This result would be in line with the predictions of an evolutionary theory of reputation formation (Nowak & Sigmund, 1998; Leimar &

Hammerstein, 2001). There are no in-game consequences in selecting either face of a given pair as the Returner, as each Returner is required to return the points regardless. This means that one's choice of who to return to may be influenced heavily by cues associated with an opportunity for others to evaluate one's behaviour, such as direct eye gaze from another individual.

The predictions for participants in the role of Trustor are somewhat less clear. To start, studies on the role of social presence in trust have not addressed the role of eye gaze (Zheng et al., 2002; Bos et al., 2002; Brosig et al., 2002). One view posits that eye contact serves as an indication of approachability, which is related to how trustworthy a face appears (Todorov, 2008). One might predict based on this view that direct gaze faces would be trusted more often than indirect gaze faces. However, a direct gaze may ambiguously represent an approachable or an avoidable face (Adams & Kleck, 2005). In other words, some participants may view the direct gaze as threatening more than trustworthy. This ambiguity is especially pertinent for faces with neutral expressions, which my stimuli display. The perception of a threatening face would likely detract from trust (Adams & Kleck, 2005).

Method

Participants

A total of thirty-six undergraduate students participated in the experiment. All participants were female, with a mean age of 19.3 years. Most of the participants attended McMaster University, with the exception of one student from Conestoga

College. All participants completed the experiment for course credit, though they were aware of an additional chance to win a cash prize as described below.

I chose to recruit only female participants for a few reasons. First, I sought to diminish any effect the attractiveness of face stimuli had on participant decision-making. Attractiveness affects decision making as participants tend to choose an attractive face over a less attractive face (Wilson & Eckel, 2006). However, since attractiveness was not a critical focus of the experiment, I decided to use female participants exclusively with female stimuli.(I do not suggest that the relative attractiveness of the stimuli do not impact same-gender decision-making at all - I merely sought to diminish the effect of attractiveness). Second, cross-sex measures typically complicate results. For example, tests of cooperation show that opposite gender dyads cooperate more than same sex dyads (Scharlemann et al., 2001). Given the choice between all male participants or all female participants, some evidence suggests that females are more likely to reciprocate trust (Croson and Buchan, 1999; Burnham, McCabe & Smith, 2000). I forced participants to reciprocate trust, so employing female participants exclusively may have yielded more naturalistic responses. However, I recognize potential limitations in generalizing situations of forced trust to trusting behaviours at large.

Stimuli

For all of the trading games, participants chose to allocate points to fictitious players based on the players' portraits. Player portraits fell into three categories; direct gaze faces, indirect gaze faces, and blank silhouettes. For a given trading game (trial),

participants saw two player portraits. Participants would select one of these portraits to which they would allocate points. Each portrait was from a different category on a given trial. In essence, this created three different trials types; i) direct gaze versus blank silhouette, ii) direct gaze versus indirect gaze, and iii) indirect gaze versus blank silhouette.

For the player portraits, I used the headshots of actors from the Karolinska Directed Emotional Faces (KDEF) face database. All of the portraits were of females, displaying a neutral expression. The photos were presented on a computer monitor on the right and left sides of the screen simultaneously. Participants selected a photo by pressing a corresponding right or left response key on the keyboard. There was no time limit for them to make their response.

In total, the photos of 24 different actors were used. These twenty-four photos were then split into two sets of twelve. These sets were consistent for all participants. I used one set of twelve photos to represent the fictitious players in the trading games for each participant. The other set of twelve photos was used in a separate task in which participants explicitly rated the trustworthiness of faces. The sets were counterbalanced between participants.

Each participant played a total of eight trading games - four as the Trustor, and four as the Returner (described in detail below). The trial types were the same in both roles, though the order of trials was randomized for each participant. Each participant completed a single direct gaze versus blank silhouette trial (Direct-Blank), two direct

gaze versus indirect gaze trials (Direct-Indirect), and a single indirect gaze versus blank silhouette trial (Indirect-Blank) in both roles. Participants never played more than one game with each player, and thus never saw a given face more than once. Therefore, each participant saw the full set of twelve actor portraits, as well as four blank silhouettes throughout the eight trading games. Of the twelve portraits shown, six displayed a direct gaze, and six displayed an indirect gaze.

Direct gaze stimuli consisted of unaltered photos from the KDEF face database. The eye gaze of the actors was straight ahead to simulate eye contact, and the actors displayed a neutral expression. I refer to this straight ahead eye gaze as direct gaze. Actors appeared on a beige coloured background, with the neckline of a grey t-shirt visible.

To create the indirect gaze stimuli, the direct gaze portraits were altered using photo-editing software. For a given portrait, the iris was isolated for each eye and shifted either down and to the left, or down and to the right. I chose these gaze directions because they resulted in the largest perceptible gaze difference with the smallest actual displacement of the iris (Chen, 2002). The extent to which the iris was shifted was consistent for all stimuli. In most cases it was necessary to partially reconstruct the previously occluded edge of the iris. Sampling the existing iris and shading it so that it appeared realistic accomplished this. In a few cases, shifting the placement of the iris resulted in a subtle, yet subjective difference in the overall expression of the face. To counteract this, the position of the eyelid was adjusted

downward slightly. This gave a more realistic look to the downward gazing eye, as the eyelid naturally closes slightly while gazing downward. Aside from the difference in eye gaze, these stimuli were otherwise identical to the direct gaze stimuli.

I did not expect that right versus left gaze would affect decision-making. Nevertheless, I decided to include this as a variable and controlled the gaze-direction of the indirect gaze stimuli. Each participant saw an equal number of downward-right and downward-left gaze stimuli for each trial type.

The blank silhouette was constructed as a control stimulus. The silhouette was the same size and general shape as the other face stimuli. It consisted of a shaded outline of a human head, neck, and shoulders with the caption “no photo available” centered over the silhouette. I explained to participants prior to the trading games that at one experimental location the camera used to take participants’ photos was not working. Therefore, some participants may not have a photo. I further explained that if a participant should see multiple players without photos, it was indeed a different player each time. This was important to reiterate, as the rules of the trading games dictated that players would only play with each other once, and the lack of visual cues from the blank silhouette would make the identity of the player ambiguous. The silhouette outline was overlaid on a beige background identical to the rest of the stimuli.

In all, I created three distinct copies of the twenty-four actor portraits. One copy maintained the initial direct gaze. The second copy included all faces with a downward-right gaze. The final copy included all faces with a downward-left gaze.

Figure 2. Directional Gaze Stimuli

Direct (unaltered) *Indirect-Right* *Indirect-Left*

Actor portraits appeared an equal number of times with each gaze direction. Without these counter measures, an effect of eye gaze direction may have been confounded with the identity of the actor. For example, an actor with an attractive appearance shown exclusively with a direct gaze may be preferentially selected to receive participants' trust. It would then be unclear whether this was due to the attractiveness of the actor (or any other actor-specific confound), or to the eye gaze direction. By counterbalancing the gaze of every actor's portrait, I was able to attribute any differences in how points are allocated to differences in eye gaze.

Procedure

Each participant came into the lab for one experimental session, which lasted approximately fifty minutes. During this time, each participant played a series of modified Trust Games with fictitious partners. Participants also completed two questionnaires. The first questionnaire (Big Five Personality Inventory; John et al, 1999; Benet-Martinez & John, 1998; John et al, 2008) assessed five major personality traits of all the participants. The second was constructed by the authors to gauge awareness of eye gaze differences in the stimuli, as well as belief in the active presence of other players. Participants also completed a task in which they objectively rated the trustworthiness of faces.

Each participant was asked to sign a consent form that indicated her photo would be taken and shown to other participants who would play Trust Games with her simultaneously. The experimenter stated that only other participants would see the photo and that it would be stored securely in a digital format after the experiment. In fact, there were no other participants playing with a given subject. I elaborated on this deception throughout the experimental setup, prior to each participant engaging in the Trust Games. This type of deception has been used in similar research (for example, Smith et al., 2009). This use of deception is a debated topic but is generally accepted within the realm of psychological research (for competing views see: Cook & Yamagishi, 2008; Jamison, Karlan, & Schechter, 2008).

The goal of taking a given participant's photo was to further deceive her into believing that she would play with other real players. The suggestion was that the other

players would be completing the same routine before the experiment began. The photo of each participant was taken using a web-camera on a computer. Each participant was required to don a plain grey t-shirt on top of her outfit prior to the photo. The experimenter explained that it was necessary that the clothing of all participants appear uniform. Indeed this was necessary, as the stimuli consisted of actors' portraits with the neckline of a grey t-shirt visible. After taking the photo, the experimenter explained to the participant that her photo would be altered to appear on a neutral coloured background (again, to match the stimuli). Before leaving to alter the photo in an adjacent room, the experimenter announced that he would need to make a phone call. During this time, the participant was asked to read over a set of instructions given to her by the experimenter, which outlined how to play the Trust Games (Appendix, A).

The photo of the participant was inserted into a computer program that participants used to play the Trust Games. This program also served as a tool to further elaborate on the presence of other real players. For example, upon opening the program participants could see other players joining a game lobby. Numbers were assigned to players to distinguish them as they joined the game lobby. Small thumbnail portraits of each player were displayed beside each player's number. Prompts would display the status of other players, and alert the experimenter when all players were ready to begin. This misinformation was presented in front of the participant and experimenter on the computer monitor.

During the time fictitious players were joining the game lobby, the experimenter went over the instructions for the Trust Games extensively. After it was clear that the participant understood how the games worked, she began to play out the Trust Games in privacy.

Halfway through the Trust Games, participants were prompted to take a break. At this point, the experimenter entered the room and asked participants to complete a personality questionnaire (Appendix B). After completing the questionnaire, participants were free to continue with the second half of the experiment. The experimenter reminded each participant of the different role they would take on in the second half of the experiment. I explain these different roles further below.

After completing the Trust Games, participants rated the trustworthiness of a new set of faces. Each face shown in this rating task was not shown previously. Faces were shown to participants one at a time. Participants simply rated how trustworthy they felt the individual was, on a scale of one to five (one being not trustworthy and five being extremely trustworthy).

Finally, participants completed another questionnaire (Appendix C). The goal of this questionnaire was to gauge participants' attitudes as they played through the Trust Games. Participants responded to a number of statements by stating how much they agreed with a given statement. This information was used to judge whether or not participants were convinced of the presence of other players, and whether or not they were motivated by the prospect of a cash prize.

Trust Game Structure

In this experiment participants played a series of modified Trust Games. I referred to these games as 'trading games' to participants. To begin with, all players were given an equal number of trading points and were told that the objective was to secure as many points as possible by the end of the trading games. Like the Trust Game (Kreps, 1990 from Berg et al., 1995), there were two different player roles. In the first role, players decided to whom to trust their points. I refer to this role as the Trustor. In the second role, players decide whose points to return, out of the fictitious players who had trusted them previously. I refer to this role as the Returner. In this variant of the Trust Game, I forced participants to choose a player to allocate points to in each role. In other words, participants were forced to trust, or to reciprocate trust, with only one player out of a pair.

As the Trustor, each participant played 4 trading games. For each game, a given participant was presented with the portraits of two other players. She then chose the player to whom she wanted to trust a set portion of her initial points. The other player of each pair received nothing. At the end of the 4 trading games, each participant was left with no trading points after dispersing them to other players. Participants were aware that whom they trusted was critical, as Returners could choose whom to reciprocate with in the future. Thus, the decision of whom to trust was ostensibly a judgment of which player of a given pair was most likely to reciprocate trust by returning points.

While participants played in the role of the Trustor, other (fictitious) players made decisions of whom to trust, concurrently. I explained to each participant in the instructions prior to the games that other players would see the participant's photo periodically and decide to trust her or someone else. It was important that participants understood that other players made decisions as Trustors concurrently. Other players' decisions were crucial in establishing the Returner role.

After playing as Trustor, each participant played an undefined number of games in the Returner role. For each game, each participant was again presented with the portraits of two other players. However, in this case, both of these fictitious players had purportedly trusted the participant with trading points previously. In other words, Returners only saw portraits from players who had trusted them. The participant had to choose to return points to one of the two trusting players. Points were returned to the selected player, and the participant kept the points of the other player. I explained to participants that the number of games played as the Returner would depend on how many players chose to trust them. For every pair of trusting players, a participant would play one trading game as the Returner (points were returned to any leftover non-paired players). However, the experiment was rigged so that all participants played four trading games as the Returner, with eight fictitious players trusting them previously.

Participants were aware that they only played at most one game with each other player in the experiment. This design is consistent with other one-shot games. For a given game between two players, one player acts as the first mover (the Trustor),

followed by the action of a second mover (the Returner). After the second mover makes a decision the game between the two players is finished. There is no opportunity for further interaction between these two players. This ensures that the players participants see from trial to trial are always novel.

Given the use of fictitious players, the number of trading points participants accrued was meaningless. However, awarding trading points was necessary to create a meaningful structure to the games. Moreover, the trading points provided motivation to make decisions as thoughtfully as possible. I created an incentive to accumulate points by introducing the chance to win a cash prize of $50. Participants were told that odds of winning the prize were weighted based on the number of points they had at the end of the trading games. I reiterated to participants that there were two ways to secure points throughout the trading games. First, they could correctly choose which players would return points to them. This required that participants could accurately judge which players were trustworthy, based on player portraits. Secondly, participants could be trusted with points from other players, which resulted in a net profit of points to the participant.

Results

I first looked at whether the deception I employed was successful. Moreover, it was necessary to see whether the extent to which participants were deceived led to different patterns of results. There were two statements on the post-game questionnaire that addressed participants' belief in the design - statements 15 and 16

(Appendix C). I used the average of participants' responses to these two statements as a measure of belief in the presence of other players. Fourteen out of thirty-six participants had a mean response below three, indicating that they were not convinced of the presence of others. However, the majority of participants were successfully deceived into believing other players were playing with them in the experiment.

Next I checked to see whether participants' belief in the presence of others affected their behaviour in the Trust Games. There were no significant correlations between a given participant's belief in the presence of others and the participant's likelihood of choosing stimuli based on the type of gaze. The frequency of direct gaze faces chosen was independent of participants' belief in the presence of others($r = -0.00$, $p > 0.05$). This was also the case with indirect gaze stimuli ($r = 0.095$, $p > 0.05$), and blank silhouettes ($r = -.120$, $p > 0.05$). Participants' choices of whom to allocate points to during the Trust Games were not contingent on their belief in the presence of others. Therefore I analyzed the Trust Game data of all participants together, irrespective of their belief in the presence of other players.

The critical analyses compared the frequencies of participant responses to stimuli of different eye gaze directions. Each participant played in two roles – first as a Trustor, and then as a Returner. Within each role, there were three trial types that were analyzed separately (i) direct gaze vs. silhouette, ii) direct gaze vs. indirect gaze, and iii) indirect gaze vs. silhouette). For each trial type I performed a Wilcoxon Matched-Pairs Signed Rank Test, to determine if participants reliably chose stimuli with a particular eye

gaze direction more often. The number of times each gaze direction was selected is shown in Table 5.

In the first trial type (direct-blank), participants chose whether to allocate points to a direct gaze stimulus or a blank silhouette. In the role of Trustor, participants chose the direct gaze significantly more often, 72.2% of the time ($T = 185$, $p = 0.008$). In the role of returner participants chose the direct gaze 61.6% of the time which was not significantly different from blank silhouettes ($T = 259$, $p > 0.05$). The fact that the effect of direct gaze over blank silhouettes was not significant for Returners suggests a potential difference the role of the participant has on decision-making.

In the second trial type (direct-indirect), participants chose whether to allocate points to a direct gaze stimulus or an indirect gaze stimulus. I was particularly interested in this result and predicted that a difference between direct and indirect gazes may be more difficult to detect than differences in the other trial types. Therefore, I doubled the number of direct gaze vs. indirect gaze trials for each participant. In the role of Trustor, there was not enough evidence to suggest that direct faces were chosen more often than indirect faces. Trustors chose direct faces 55.6% of the time ($T = 125$, $p > 0.05$). However, in the role of Returner, participants chose the direct gaze face significantly more often, 65.2% of the time ($T = 112$, $p = 0.034$). Only when participants act as the Returner do they selectively allocate points to direct gaze faces rather than indirect gaze faces. Again, the role of the participant seems to have an influence over the types of stimuli to which participants choose to allocate points.

Finally, in the third trial type (indirect-blank) participants chose whether to allocate points to a stimulus with an indirect gaze, or to a blank silhouette. In both the Trustor and Returner roles, participants chose indirect gaze stimuli about as often as the blank silhouettes. An indirect gaze face was not more likely to be chosen versus a blank silhouette in either role.

Table 5. Frequency of Stimuli Chosen Across Participants:

As Trustor

	Direct Gaze	Blank Silhouette	Indirect Gaze
Direct-Blank*	26	10	
Direct-Indirect	40		32
Indirect-Blank		19	17

As Returner

	Direct Gaze	Blank Silhouette	Indirect Gaze
Direct-Blank	22	14	
Direct-Indirect*	47		25
Indirect-Blank		15	21

**Indicates a significant difference at alpha = 0.05*

I was interested in whether individual differences in the personalities of participants led to differences in the types of stimuli participants chose. Certain personality traits such as agreeableness and conscientiousness have been shown to impact one's propensity to trust others. In this vein, certain personality traits may be associated with preferentially trusting faces of a particular gaze direction. Personality correlates may be useful to show which individuals are sensitive to differences in eye gaze, even when a difference does not exist in the overall frequencies with which gaze

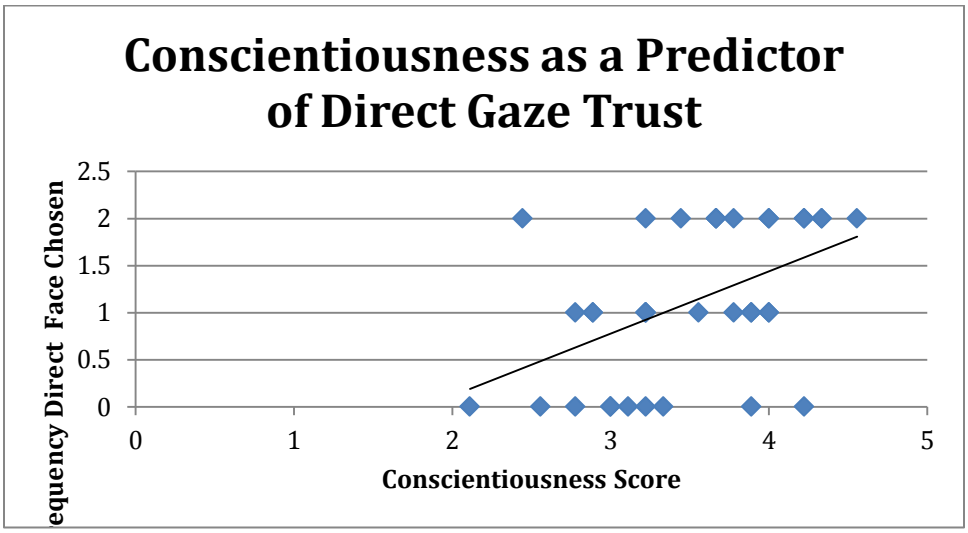
directions are selected. Participants completed a version of the Big Five Personality Inventory, or BFI (John et al, 1999; Benet-Martinez & John, 1998; John et al, 2008) to assess levels of extraversion, agreeableness, conscientiousness, neuroticism, and openness. I checked to see if these personality traits were reliable predictors of which stimuli participants selected by performing a linear regression for each trial type.

As previously mentioned, I found that participants chose direct gaze stimuli more often than indirect gaze stimuli when they acted as Returners. I was curious as to why no difference existed when participants acted as Trustors. Furthermore, I wanted to see whether personality traits could predict whether a participant tended to choose a direct gaze or indirect gaze stimulus specifically for this trial type (Direct-Indirect). One personality trait showed significance as a predictor of decision making. Participants scoring higher on conscientiousness were more likely to choose direct gaze faces over indirect gaze faces, when acting as the Trustor. The correlation between conscientiousness and direct gaze frequency was 0.484 ($r^2 = 0.234$), with a significant regression line of slope 0.637 ($t(35) = 2.806$, $p = 0.009$). Conscientiousness was not a significant predictor when participants acted as the Returner. This is likely due to the fact that most participants chose direct gaze faces over indirect gaze faces more often as the Returner, regardless of their personality profile. In other words the gaze of the stimulus may have overpowered any individual personality differences in decision making for these trials.

None of the remaining personality traits were significant predictors of participants' choices after correcting for multiple comparisons.

Next I checked to see whether participants' ratings of how trustworthy different stimuli appeared to be coincident with their decisions to trust, or to return points to particular players. My stimuli consisted of two sets of twelve fictitious player faces. Each participant saw one set during the Trust Games, and the other set during an explicit trustworthiness rating exercise. Participants were simply asked to rate how trustworthy a given face appeared on a scale of one to five, five being the most trustworthy. The gazes of the twelve faces were counterbalanced between participants, as they were in the Trust Games.

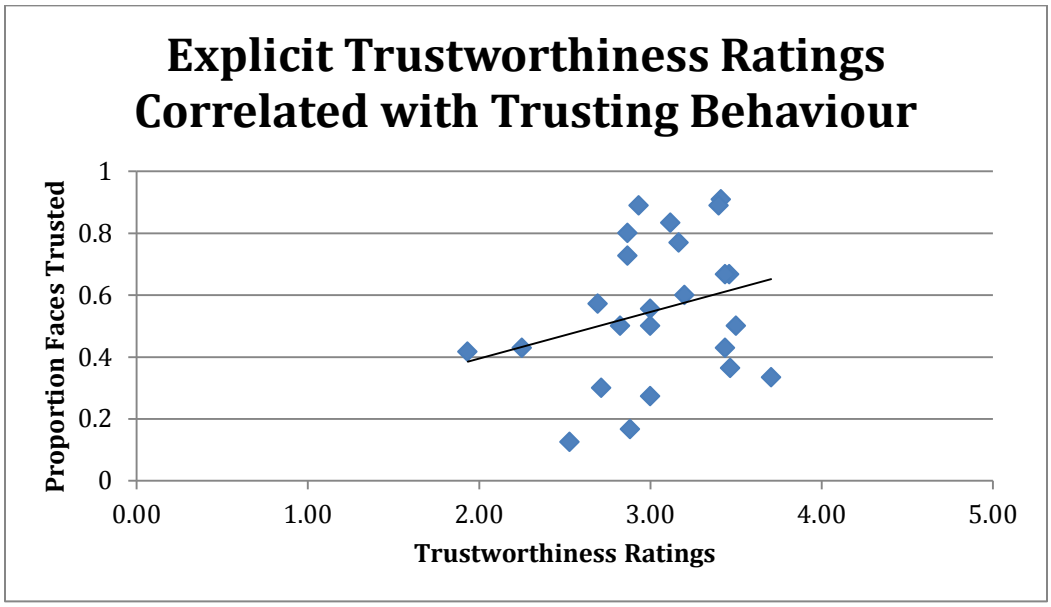
Figure 3. Conscientiousness as a Significant Personality Correlate of Direct Gaze Preferences in Trusting Behaviours



I looked at the proportion of trials on which a given face was selected to either allocate or return points to, out of the number of total trials that face was shown. There

was no correlation between the ratings of trustworthiness and how often faces were chosen overall (r = 0.264, p = 0.212). However, when I isolated trials in which participants acted in the role of Trustor, the correlation was significant (r = 0.448, p (1-tailed) = 0.014). This suggests that participants tended to trust faces that other participants subjectively rated as trustworthy. This is intuitive, as the Trustor role assumes that participants implicitly rate the trustworthiness of faces in making their decision of to whom to trust their points. The lack of correlation in the role of Returner (r = 0.003, p = 0.989) once again highlights the difference in roles between Trustor and Returner.

Figure 4. Explicit Ratings of Trustworthiness Coincide with Implicit Trustworthiness Judgments



Finally, I tested to see whether explicit trustworthiness ratings differed for the different gaze directions of the stimuli. I performed a Wilcoxon Matched-Pairs Signed

Rank Test to compare the ratings each participant gave for direct and indirect gaze stimuli. Direct gaze faces were rated as more trustworthy than indirect gaze faces (direct gaze: mean 3.31, sd 0.62; indirect gaze: mean 2.90, sd 0.66; ($T = 130.50$, p (1-tailed) $=0.0075$). This is interesting, since despite participants rating direct gaze faces as more trustworthy, this was not reflected in their behavior as Trustor. Recall that direct faces were not chosen significantly more often than indirect faces when participants played as Trustor.

Discussion

My results indicate that eye gaze plays an important role trust and trustworthiness. These results have important implications for instances in which no eye contact is present or possible, as with online communication, and video communication. The goal of this experiment was to test the effect of eye contact in social presence, to see whether eye contact specifically affected trusting and trustworthy behaviours. Results from my modified Trust Game demonstrate how eye gaze interacts with the role participants assume, either in trusting someone, or reciprocating trust with someone.

When participants were forced to decide whom to trust in the Direct-Blank trials, they tended to trust players who faced them with a direct gaze more often than players who did not have a photo. This result coincides with my prediction from media richness theory. Given my hypothesis that increasing media richness contributes to a higher degree of social presence, pro-social behaviours ought to favour the player displayed in

a richer medium. There are more cues available in a portrait, which offer more information than the player with no photo.

Interestingly, even though indirect gaze photos contained more social cues than silhouettes, participants did not trust indirect gaze faces more often than the blank silhouette in Indirect-Blank trials. Despite a higher degree of social presence with the indirect gaze stimulus, participants showed no preference in their decision making. It might be reasonable to hypothesize that faces showing an indirect gaze display a lower degree of social presence than faces showing a direct gaze. My failure to detect a difference in the Indirect-Blank condition may reflect a difference in the degree of social presence between direct and indirect gazes.

Another interpretation of these data is that direct eye gaze is a critical cue of trustworthiness, whereas indirect gaze is not. Players may be sensitive to direct eye gaze because a direct gaze is a cue of observation and represents an opportunity for others to form reputations about them. In contrast, on trials where an indirect gaze face is presented with a blank silhouette, there is no strong cue of reputation formation and much less preference to trust one stimulus over the other. Eye gaze may be a critical factor in increasing social presence.

One problem with the interpretation that direct gaze is a major critical cue in deciding whom to trust is that there was no significant difference on Direct-Indirect trials. If direct gaze is such a strong cue then one would expect a preference for direct gaze faces over indirect gaze faces, yet this did not occur. One possible explanation

borrows from research about other-regarding behaviour (Milinski et al., 2001), in which reciprocity occurs with others in a group beyond those observing at a given point in time. On the Direct-Indirect trials, participants could see both faces, one of which presented a strong cue of observation via direct gaze. However, this cue may not affect players' decisions of who to trust because in terms of reputation formation, it may not matter which player is trusted. It is more important to represent oneself as pro-social in the presence of observation cues, and less important whether the recipient is the observer or someone else in the group. To be sure, participants did behave pro-socially in the presence of direct eye contact. Unfortunately, since participants were forced to make trusting decisions and decide between one of two alternatives, it is impossible to tell whether direct gaze motivated them to be more trusting, or prosocial. Nevertheless, this yields an interesting question for future research.

An alternative interpretation for Direct-Indirect trials is that the direction of gaze is just one of many variables contributing to the decision of whom to trust, and that my face stimuli have failed to control for some critical factors. Deciding who to trust has real consequences within the structure of the Trust Game. Players' responses will not only be driven by cues of others evaluating them, but by a myriad of factors associated with what each player associates with a trusting face. Despite efforts to control confounding variables, it seems likely that the variance in face stimuli, combined with idiosyncratic views of what constitutes a trusting face creates too much noise to detect a difference due to eye gaze in the Direct-Indirect condition. However, what is clear is

that an obvious cue of social presence, such as a visual image, paired with direct eye gaze is much more likely to be trusted over no photo at all.

When participants played in the role of Returner, they demonstrated a very different pattern of decision-making. Recall that the decision of the Returner is very different from that of the Trustor. Participants must simply decide to whom they would prefer to return points. Based on the similar role of a Dictator in Dictator games, I predicted that participants would return points more often to direct gaze than to indirect gaze stimuli. My data support these predictions, indicating that players chose the direct gaze faces approximately 65% of the time. In contrast to the role of the Trustor, Returners' choices may not be as influenced by factors inherent in the structure of the game. In other words, Trustors may be motivated by the prospect of selfish gains within the game because their choices will potentially make a difference in whether that have points returned to them. Returners have nothing to lose or gain because they are forced to return points regardless. Their choice of to whom they return the points does not have consequences in terms of accumulation of points, but it is relevant to their reputation. It follows that a Returner's actions are more influenced by factors outside of the game structure, such as the manipulation of eye gaze. Returners may be more sensitive to opportunities of positive reputation formation, which includes being sensitive to cues of direct observation.

This interpretation also predicts that Returners should preferentially choose players with a direct gaze face over players displaying a blank silhouette. However, my

data do not indicate that this difference is significant. Though non-significant, the effect is in the predicted direction (direct faces chosen 61.1% of the time), which may suggest an issue in the power to detect the difference.

Some researchers have questioned the efficacy of the Trust Game in accurately assessing trusting behaviours (Ben-Ner & Halldorsson, 2010). The explicit trustworthiness ratings I collected provide evidence for the validity of my modified Trust Game. Faces which were rated as more trustworthy were indeed trusted more often in the Trust Games. I feel confident that the task I established for the first player was a clear measure of how willing participants were to trust other people. I suggest that this design may improve upon the original Trust Game for future experiments which aim to test specific factors in the formation of trust.

My data correlating eye gaze preferences with personality traits provided some potentially interesting results. Previous research on individual differences and trust has shown that some aspects of trust and trustworthiness can be associated with key personality traits (Ben-Ner & Halldorsson, 2010; Ashraf , Bohnet & Oiankov, 2006). To my knowledge this is the first use of a forced-choice paradigm involving trust and eye gaze, so I was uncertain how personality traits might help predict gaze direction preferences. Interestingly, I did find one significant correlation between levels of conscientiousness and the likelihood a Trustor trusted a direct gaze face over an indirect face. Conscientiousness refers to an individual's willingness to achieve, and is related to one's focus and attention to detail (Costa & McCrae, 1992; Digman, 1990).

Conscientious individuals may be more sensitive to the details of facial stimuli such as eye gaze direction. This may be reflected in their tendency to trust portraits that show a direct gaze, as direct gaze acts as a cue of observation. As mentioned previously, I suspect that other factors clouded my ability to detect overall differences in how often direct and indirect gaze faces were chosen for Trustors. However, conscientious individuals may place less importance on these other factors, in favour of cues that signal social evaluation.

Limitations of the study

There are a few limitations with this design that I feel are important to discuss. First, although I strove to make the stimuli as realistic as possible, the fact remains that all of the averted gaze stimuli were artificially constructed. Subtle inconsistencies in the shape of the iris, focus of the eyes, and overall facial expression of the averted gaze stimuli may have systematically influenced results. However, I feel confident in generalizing these conclusions to encompass genuine photos of individuals with averted gazes. As previously mentioned, the majority of participants were convinced they were playing with real players for the duration of the experiment.

I feel that another limitation is the transparency of the design. When asked in a post-game questionnaire how much participants agreed with the statement “I noticed some of the photographs of participants were not looking straight ahead”, the majority of participants noted that they strongly agreed. One issue with the transparency of the eye gaze manipulation has already been discussed in brief, namely that participants may

have been aware of their own bias in preferentially selecting one gaze direction over another. This is potentially problematic, as participants' responses may not truly reflect their preferences, but may be aligned with their own experimental predictions. Fortunately, I feel that one's awareness of their own preferences in terms of who they would trust is not a dramatic concern. Previous research indicates that one's explicit ratings of how trustworthy a face is largely coincide with his or her actions as a Trustor (van't Wout & Sanfey, 2008). The behaviours I recorded in the Trust Games in conjunction with subjective ratings of trustworthiness replicate these findings. Thus being aware of one's own bias to certain faces does not necessarily indicate that one's behavior will be different.

Due to the use of a forced-choice task in my modified Trust Game, it may be difficult to compare or generalize the results of this study to others that use traditional economic game designs. One may have concerns that the forced-choice design changed the decision that participants made, so that there was no longer variation in how trustworthy participants could be. The power of this design was that it allowed me to test the effects of a particular factor on one's decision of who to trust, or reciprocate trust with. This is in contrast to other experiments that use the Trust game, which assess an individual's propensity to trust or reciprocate trust under different conditions. Participants still made trusting and trustworthy decisions, though in this case the test was whether eye gaze specifically affected those decisions.

Summary

Throughout this article I have demonstrated that eye gaze is an important factor in the perception of trust and trustworthiness of faces. In online environments it is not always possible to establish eye contact with a partner in a conversation. I have shown that displaying a picture with a direct gaze instead of an averted gaze can impact one's perception of how trusting a stranger appears, or how likely one is to reciprocate a kind behavior. There is some concern in generalizing these results to apply to video conversations, as still photos impede the natural flow of visual information from a face (Krumhuber, Manstead, Cosker, Marshall, Rosin & Kappas, 2007). However, I suggest that this research offers encouraging results for future research that manipulates eye contact in video conversations.

There is a human desire to replicate face-to-face communication as closely as is possible when communicating with others from a distance. The persistent issue of a lack of eye contact in online communication has spurred the invention of complex 'telepresence' technology, and the use of stereoscopic cameras to enhance the experience of face-to-face communication by proxy (for example, Muhlbach, Bocker & Prussog,1995; Nguyen & Canny, 2007), though the use of web cameras is still more prevalent and accessible to consumers. The issues addressed here present important implications for the current use of online communication technologies, and address cognitive factors of how we evaluate trust and trustworthiness in strangers.

General Conclusions and Future Research Directions

The results from the current research should encourage future researchers to think critically about the roles that individuals assume in online interactions. I have demonstrated that factors such as eye gaze direction have different effects on behaviour according to the role that players assume in a structured experimental game. Previously I stated the necessity of differentiating between different behaviours based on different player roles – generous behaviours of a Dictator, trusting behaviours of a Trustor, and trustworthy behaviours of a Returner. I predicted that participants acting as Returners would return points preferentially to players who displayed direct cues of observation, based on a similar effect when participants act as Dictators. Although the roles of Returner and Dictator seem subjectively similar, the current data suggest that even subtle changes in player roles may differentially influence participants' decision-making.

One suggestion to test this claim is to incorporate different roles into experimental designs. For example, I could have implemented a dictator condition into the forced-choice design by giving participants additional points and forcing them to donate them to one player out of a pair. This would help to differentiate between effects of eye gaze on different roles and their respective behaviours. Moreover, it would have been constructive to include additional roles in an attempt to replicate previous studies' results.

It is clear from the current and past research in this domain that designs must overcome a tremendous amount of variance in behavioral measures. It is not unusual for studies to include data from over 200 participants. I took steps to reduce variability (and thus the need for so many participants) by collecting multiple observations per participant, and by using a within-subjects forced-choice design. These countermeasures come with advantages and disadvantages. The current research suggests that for cases in which one is interested in the effect of a specific factor such as eye gaze on pro-social behaviours, within-subjects designs can be informative.

Online communication occurs between individuals in a wide variety of different relationships, from spouses to strangers. It is important to note that in this research I suggest that the *initial* impression of another individual is affected by subtle social cues, such as eye gaze, and is perhaps affected by environmental cues, such as the presence of a web camera. I discuss how these factors may affect the *formation* of trust and reciprocity amongst strangers. Factors such as eye gaze may be overpowered by additional factors over the course of repeated interactions, even within the context of structured experimental games. For example, one's past behaviour is a strong indicator of trust. Still, I do not suggest that there is no effect of eye gaze on the quality of computer mediated interactions in established relationships. Extending the current experiments to incorporate dynamic stimuli and effects of eye gaze with familiar individuals would be a productive avenue of future research.

References

Adams, R. B., & Kleck, R. E. (2005). Effects of direct and averted gaze on the perception of facially communicated emotion. *Emotion, 5*(1), 3-11.

Akehurst, L., Köhnken, G., Vrij, A., & Bull, R. (1996). Lay persons' and police officers' beliefs regarding deceptive behaviour. *Applied Cognitive Psychology*, *10*(6), 461-471.

Alexander, R. D. (1987). The biology of moral systems, New York, NY: Aldine de Gruyter.

Anderson, A. H., O'Malley, C., Doherty-Sneddon, G., Langton, S., Newlands, A., & Mullin, J. (1997). The impact of VMC on collaborative problem solving: An analysis of task performance, communicative process, and user satisfaction. In K. E. Finn, A. J. Sellen & S. B. Wilbur (Eds.), (pp. 133-155). Mahwah, NJ, US: Lawrence Erlbaum Associates Publishers.

Ashraf, N., Bohnet, I., & Piankov, N. (2006). Decomposing trust and trustworthiness. *Experimental Economics*, *9*(3), 193-208. doi: 10.1007/s10683-006-9122-4

Baltes, B. B., Dickson, M. W., Sherman, M. P., Bauer, C. C., & LaGanke, J. (2002). Computer-mediated communication and group decision making: A meta-analysis. *Organizational Behavior and Human Decision Processes, 87*(1), 156-179.

Barclay, P. (2004). Trustworthiness and competitive altruism can also solve the tragedy of the commons. *Evolution and Human Behavior*, *25*(4), 209-220. doi: 10.1016/j.evolhumbehav.2004.04.002.

Bateson, M., Nettle, D., & Roberts, G. (2006). Cues of being watched enhance cooperation in a real-world setting. Biology letters, 2(3), 412-4. doi: 10.1098/rsbl.2006.0509.

Bayliss, A. P., & Tipper, S. P. (2006). Predictive gaze cues and personality judgments: Should eye trust you? *Psychological Science, 17,* 514–520.

Berg, J., Dickhaut, J., & McCabe, K. (1995). Trust, reciprocity, and social history. *Games and Economic Behavior, 10*, 122-142.

Ben-Ner, A., & Halldorsson, F. (2010). Trusting and trustworthiness: What are they, how to measure them, and what affects them. *Journal of Economic Psychology, 31*(1), 64-79.

Benet-Martinez, V., & John, O. P. (1998). *Los Cinco Grandes* across cultures and ethnic groups: Multitrait multimethod analyses of the Big Five in Spanish and English. *Journal of Personality and Social Psychology,75,* 729-750.

Bohnet, I., Frey, B.S., (1999). Social distance and other-regarding behavior in Dictator Games: Comment. *American Economic Review*, 89(1): 335–339.

Bos, N., Olson, J.S., Gergle, D., Olson, G.M., Wright, Z., (2002). Effects of four computer-mediated communications on trust development. *CHI2002 Conference Proceedings, April 20-25*, Minneapolis, USA, 135-140.

Brosig, J., & Weimann, J. (2003). The effect of communication media on cooperation. *German Economic Review, 4*(2), 217-241.

Burnham, T., McCabe, K., Smith, V.L., (2002). Friend-or-foe intentionality priming in an extensive form trust game, *Journal of Economic Behavior & Organization,* 43(1),57-73.

Charness, G., & Gneezy, U. (2008). What's in a name? anonymity and social distance in dictator and ultimatum games. *Journal of Economic Behavior and Organization, 68*(1), 29-35.

Chen, M., (2002). Leveraging the asymmetric sensitivity of eye contact for videoconference, *CHI2002 Conference Proceedings, April 20-25*, Minneapolis, USA, 49-56.

Cook, K. S., & Yamagishi, T. (2008). A defense of deception on scientific grounds. *Social Psychology Quarterly, 71*(3), 215-221.

Costa, P. T., & McCrae, R. R. (1992). Normal personality assessment in clinical practice: The NEO Personality Inventory. *Psychological Assessment*, *4*(1), 5-13. doi: 10.1037//1040-3590.4.1.5.

Croson, R., & Buchan, N. (1999). Gender and culture: International experimental evidence from Trust Games. *American Economic Review*, 89(2), 386-391.

Daft, R. L., & Lengel, R. H. (1986). Organizational information requirements, media richness, and structural design. *Management Science, 32*(5), 554–571.

DeBruine, L. (2005). Trustworthy but not lust-worthy : Context-specific effects of facial resemblance. *Proceedings. Biological sciences / The Royal SocietySociety*, *272*(1566), 919-922.

Digman, J. M. (1990). Personality Structure: Emergence of the Five-Factor Model. *Annual Review of Psychology*, *41*(1), 417-440. doi: 10.1146/annurev.ps.41.020190.002221.

Drolet, A. L., & Morris, M. W. (200). Rapport in conflict resolution: accounting for how face-to-face contact fosters mutual cooperation in mixed-motive conflicts. *Journal of Experimental Social Psychology 36,* 26-50.

Eckel, C. C., & Grossman, P. J. (1996). Altruism in anonymous dictator games. *Games and Economic Behavior, 16*(2), 181-191.

Eckel, C. C., & Wilson, R. K. (2003). The human face of game theory: trust and reciprocity in sequential games. In E. Ostrom, & J. Walker (Eds.), *Trust and reciprocity: interdisciplinary lessons from experimental research* (pp. 245-274). New York: Russel Sage Foundation

Evans, A. M., & Revelle, W. (2008). Survey and behavioral measurements of interpersonal trust. *Journal of Research in Personality, 42*(6), 1585-1593.

Fehr, E. (2009). On the economics and biology of trust. *Journal of the European Economic Association*, 7(2/3), 235-266.

Fehr, E., & Gächter, S. (2000). Cooperation and punishment in public goods experiments. *American Economic Review*, *90*(4), 980-994.

Fehr, E., & Gächter, S. (2002). Altruistic punishment in humans. *Nature*, *415*(6868), 137-140.

Frischen, A., Bayliss, A. P., & Tipper, S. P. (2007). Gaze cueing of attention: Visual attention, social cognition, and individual differences. *Psychological Bulletin, 133*(4), 694-724.

Franzini, L. (2008). Self-rated health and trust in low-income Mexican-origin individuals in Texas. Social Science and Medicine, 67(12), 1959-1969.

Glaeser, E. L., Laibson, D. I., Scheinkman, J. A., & Soutter, C. L. (2000). Measuring trust. *Quarterly Journal of Economics*, 115(3), 811-846.

Haley, K. J., & Fessler, D. M. (2005). Nobody's watching? Subtle cues affect generosity in an anonymous economic game. *Evolution and Human Behavior, 26*, 245-256.

Hardin, R. (2004). Trust and Trustworthiness. New York, NY: Russell Sage Foundation

Hoffman, E., McCabe, K., & Smith, V. (1994). Preferences, property rights, and anonymity in bargaining games. *Games and Economic Behavior, 7*, 346-380.

Hoffman, E., McCabe, K., Shachat, K., & Smith, V. (1996). Social distance and other-regarding behavior in Dictator Games, *American Economic Review 86*, 653–660.

Jamison, J., Karlan, D., & Schechter, L. (2008). To deceive or not to deceive: The effect of deception on behavior in future laboratory experiments. *Journal of Economic Behavior and Organization, 68*(3-4), 477-488.

John, O. P., Naumann, L. P., & Soto, C. J. (2008). Paradigm shift to the integrative Big-Five Trait Ttaxonomy: History, measurement, and conceptual issues. In O. P.

John, R. W. Robins, & L. A. Pervin (Eds.), Handbook of personality: Theory and research (pp. 114-158). New York, NY: Guilford Press.

John, O. P., Donahue, E. M., & Kentle, R. L. (1991). The Big Five Inventory--Versions 4a and 54. Berkeley, CA: University of California,Berkeley, Institute of Personality and Social Research.

Kleinke, C. L. (1986). Gaze and eye contact: A research review. *Psychological Bulletin, 100,* 78–100.

Kreps, D, M., Roberts, J. D., Milgrom, P., & Wilson, R. (1982). Rational cooperation in the finitely repeated prisoners' dilemma. *Journal of Economic Theory*, *252*, 245-252.

Krumhuber, E., Manstead, A. S. R., Cosker, D., Marshall, D., Rosin, P. L., & Kappas, A. (2007). Facial dynamics as indicators of trustworthiness and cooperative behavior. *Emotion, 7*(4), 730-735.

Leary, M. R., & Kowalski, R. M. (1990). Impression management: a literature review and two-component model. *Psychological Bulletin, 107(*1), 34-47.

Leimar, O., & Hammerstein, P. (2001). Evolution of cooperation through indirect reciprocity*. Proceedings. Biological sciences / The Royal Society, 268*(1468), 745-53.

Lombard, M., & Ditton, T. (1997). At the heart of it all: The concept of presence. *Journal of Computer Mediated Communication, 3(*2).

McNamara, J. M., Stephens, P. A., Dall, S. R., & Houston, A. I. (2009). Evolution of trust and trustworthiness: social awareness favours personality differences. *Proceedings. Biological sciences / The Royal Society, 276*(1657), 605-13.

Milinski, M., Semmann, D., Bakker, T. C., & Krambeck, H. J. (2001). Cooperation through indirect reciprocity: image scoring or standing strategy? *Proceedings. Biological sciences / The Royal Society, 268*(1484), 2495-501.

Mohtashemi, M., & Mui, L. (2003). Evolution of indirect reciprocity by social information: the role of trust and reputation in evolution of altruism. *Journal of Theoretical Biology*, *223*(4), 523-531. doi: 10.1016/S0022-5193(03)00143-7.

Muhlbach, L., Bocker, M., & Prussog, A. (1995). Telepresence in videocommunications: A study on stereoscopy and individual eye contact. *Human Factors, 37, 290-305*

Mutz, D. C. (2005). Social trust and e-commerce: Experimental evidence for the effects of social trust on individuals' economic behavior. *Public Opinion Quarterly*, *69*(3), 393-416. doi: 10.1093/poq/nfi029.

Naef, M., & Schupp, J. (2008). Measuring trust: experiments and surveys in contrast and combination. Working paper, Royal Holloway College, London.

Nguyen, D. T., & Canny, J. (2007). Multiview: improving trust in group video conferencing through spatial faithfulness. *Proceedings of the SIGCHI conference on Human factors in computing systems,* 1465-1474.

Nowak, M.A., & Sigmund, K., (1998). Evolution of indirect reciprocity by image scoring. *Nature, 393*, 573–577.

Nowak, M. A, & Sigmund, K. (2005). Evolution of indirect reciprocity. *Nature*, *437*(7063), 1291-8. doi: 10.1038/nature04131.

Oosterhof, N. N., & Todorov, A. (2009). Shared perceptual basis of emotional expressions and trustworthiness impressions from faces. *Emotion,9*(1), 128-133.

Rocco, E. (1998). Trust breaks down in electronic contexts but can be repaired by some initial face-to-face contact. *CHI '98:Proceedings of the SIGCHI conference on Human factors in computing systems,* 496-502.

Rockmann, K. W., & Northcraft, G. B. (2008). To be or not to be trusted: The influence of media richness on defection and deception. *Organizational Behavior and Human Decision Processes, 107*(2), 106-122.

Rigdon, M., Ishii, K., Watabe, M., & Kitayama, S. (2009) Minimal social cues in the dictator game. *Journal of Economic Psychology, 30*, 358-367.

Scharlemann, J., Eckel, C. C., Kacelnik, A., & Wilson, R. K. (2001). The value of a smile: Game theory with a human face. *Journal of Economic Psychology*, *22*(5), 617-640. doi: 10.1016/S0167-4870(01)00059-9.

Shariff, A. F., & Norenzayan, A. (2007). God is watching you: priming God concepts increases prosocial behavior in an anonymous economic game. Psychological science : a journal of the American Psychological Society / APS, 18(9), 803-9. doi: 10.1111/j.1467-9280.2007.01983.x.

Short, J., Williams, E., & Christie, B. (1976). The social psychology of telecommunications. London: Wiley.

Sporer, S. L., & Schwandt, B. (2007). Moderators of nonverbal indicators of deception: A meta-analytic synthesis. *Psychology, Public Policy, and Law,13*(1), 1-34.

Smith, F. G., DeBruine, L. M., Jones, B. C., Krupp, D. B., Welling, L. L. M., & Conway, C. A. (2009). Attractiveness qualifies the effect of observation on trusting behavior in an economic game. *Evolution and Human Behavior, 30*, 393-397.

Todorov, A., Baron, S. G., & Oosterhof, N. N. (2008). Evaluating face trustworthiness: a model based approach. *Social cognitive and affective neuroscience*, *3*(2), 119-27. doi: 10.1093/scan/nsn009.

van 't Wout, M., & Sanfey, A. G. (2008). Friend or foe: The effect of implicit trustworthiness judgments in social decision-making. *Cognition, 108*(3), 796-803.

van Rompay, T. J. L., Vonk, D. J., & Fransen, M. L. (2008). The eye of the camera: effects of security cameras on prosocial behavior. *Environment and Behavior*, *41*(1), 60-74. doi: 10.1177/0013916507309996.

Vrij, A., & Semin, G. R. (1996). Lie experts' beliefs about nonverbal indicators of deception. *Journal of Nonverbal Behavior*, *20*(1), 65-80. doi: 10.1007/BF02248715.

Walther, J. B. (1995). Relational aspects of computer-mediated communication: Experimental observations over time. *Organization Science*, 6(2), 186-203. Retrieved from EBSCO*host*.

Wilson, J. M., Straus, S. G., & McEvily, B. (2006). All in due time: The development of trust in computer-mediated and face-to-face teams. *Organizational Behavior and Human Decision Processes, 99*(1), 16-33.

Wilson, R., & Eckel, C. (2006). Judging a book by its cover: Beauty and expectations in the trust game. *Political Research Quarterly (Formerly WPQ),*

Zheng, J., Veinott, E., Bos, N., Olson, J.S., & Olson, G.M., (2002). Trust without touch: jumpstarting long-distance trust with initial social activities. *CHI2002 Conference Proceedings, April 20-25*, Minneapolis, USA, 141-146

Participant Instructions

The experiment that you'll be participating in today has multiple parts to it. Before each part of the experiment, your experimenter will give you specific instructions on what to do.

First you'll be playing a game online with other participants. Participants from other laboratories and universities will meet with you online in a game called 'TradeSpace'. TradeSpace allows players to swap special trading points with each other. At the beginning of the game, every player starts with 20 trading points. The object of the game is to gain as many trading points as you can.

There are two different parts of the game, called 'sessions'. In the first session you will decide how to split your points up amongst other players. During each round, each player is matched up randomly with 2 other players. Your job is to act as the trader - the other 2 players are potential receivers. The trader in each round decides which of the 2 players she will give 5 of her trading points to. After each player plays 4 rounds (acting as the trader) all of her trading points will be distributed to other players. You distribute all of your points to other players during the first session – there is opportunity to make them back later. Whoever you decide to trade with is kept secret. Keep in mind that you will appear as a potential receiver for other players as well.

In the second session, you will be shown photos of the players that decided to trade points to you. In each round you are matched with 2 players as before. However, each of the players you will see will have offered you points in the first session. You will have received 5 points each from both of the players already in the first session. You will never see the photo of any players who did not trade points to you during the first session. Your job is to decide whose points to return – keeping 5 points for yourself, and returning 5 points to one of the players in each round. The number of rounds in the second session will depend on how many people traded points with you in the first session.

Therefore, there are two ways to secure trading points in this game. The first way is by other players choosing to trade their points with you in the first session. The second way is to choose to trade with players wisely; the objective is to trade with players who are more likely to return points to you in the second session.

Importantly, you will trade with different people in every round, as well as different people in both sessions. You will never be asked to trade with the same player twice. At the very end of the experiment, your trading points will be added up. The player with the greatest number of points has the greatest chance of winning the prize.

BFI Response Form and Instructions

Instructions: Here are a number of characteristics that may or may not apply to you. For example, do you agree that you are someone who *likes to spend time with others*? Please write a number next to each statement to indicate that extent to which you agree or disagree with that statement

1 Disagree Strongly	2 Disagree a little	3 Neither agree nor disagree	4 Agree a little	5 Agree Strongly

I see myself as someone who…

1. _____ Is talkative
2. _____ Tends to find fault with others
3. _____ Does a thorough job
4. _____ Is depressed, blue
5. _____ Is original, comes up with new ideas
6. _____ Is reserved
7. _____ Is helpful and unselfish with others
8. _____ Can be somewhat careless
9. _____ Is relaxed, handles stress well
10. _____ Is curious about many different things
11. _____ Is full of energy
12. _____ Starts quarrels with others
13. _____ Is a reliable worker
14. _____ Can be tense
15. _____ Is ingenious, a deep thinker
16. _____ Generates a lot of enthusiasm
17. _____ Has a forgiving nature
18. _____ Tends to be disorganized
19. _____ Worries a lot
20. _____ Has an active imagination
21. _____ Tends to be quiet
22. _____ Is generally trusting
23. _____ Tends to be lazy
24. _____ Is emotionally stable, not easily upset
25. _____ Is inventive
26. _____ Has an assertive personality
27. _____ Can be cold and aloof
28. _____ Perseveres until the task is done
29. _____ Can be moody
30. _____ Values artistic, aesthetic experiences
31. _____ Is someone shy, inhibited
32. _____ Is considerate and kind to almost everyone
33. _____ Does things efficiently
34. _____ Remains calm in tense situations
35. _____ Prefers work that is routine
36. _____ Is outgoing, sociable
37. _____ Is sometimes rude to others
38. _____ Makes plans and follows through with them
39. _____ Gets nervous easily
40. _____ Likes to reflect, play with ideas
41. _____ Has a few artistic interests
42. _____ Likes to cooperate with others
43. _____ Is easily distracted
44. _____ Is sophisticated in art, music or literature

Please check: Did you write a number in front of each statement you intended to respond to?

Appendix C

Investment Game Response Form

Instructions: Here are a number of statements that you may or may not agree with about the games you just played. Recall that you played the games in two different roles. In session 1, you made a choice between two partners regarding who you would rather trade with. In session 2, you made a choice about who to return points to, between players who previously chose to trade with you. Some statements will apply only to one role. For example, do you agree that during the experiment you, in *in session 1, felt it was difficult to decide who to trust?* Please write a number next to each statement to indicate that extent to which you agree or disagree with that statement

1 Disagree Strongly	2 Disagree a little	3 Neither agree nor disagree	4 Agree a little	5 Agree Strongly

During the experiment I...

1. _____ Was really motivated by the chance of a winning the lottery prize
2. _____ In session 1, invested in people who I thought were most likely to return the investment
3. _____ Noticed that some photographs of participants were not looking straight ahead
4. _____ Was concerned that other players could see my face
5. _____ In session 2, chose to return money to people who looked directly at me more often
6. _____ Made decisions in each game as if I was playing with real money
7. _____ In session 1, chose to invest in whoever seemed happier
8. _____ In session 1, thought that faces that looked away from me seemed less trustworthy
9. _____ In session 1, felt it was very difficult to decide who to trust
10. _____ In session 1, traded more often with partners more whose pictures looked directly ahead (at me)
11. _____ In session 2, returned portions of the investment to whoever seemed happier
12. _____ In session 2, returned money more often to partners who seemed more trusting
13. _____ In session 2, returned portions of the investment to whoever seemed like they wanted it more
14. _____ In session 2, felt it was very difficult to decide who to return a portion of the investment to
15. _____ Was convinced that other players were playing at the same time as me
16. _____ Was convinced that I played the games with other real people

Please check: Did you write a number in front of each statement you intended to respond to?