# THE ROLE OF PERCIEVED SIMILARITY IN SOCIAL DILEMMAS

by

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A thesis submitted to the Faculty of the University of Delaware in partial fulfillment of the requirements for the Degree of Psychology with Distinction

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## ABSTRACT

Fischer's (2009) Subjective Expected Relative Similarity (SERS) hypothesis states that the probability of cooperation in the Prisoner's Dilemma Game is a function of two variables – similarity of the partner to one's self (PARSIM) (defined as the probability that the partner will make the same choice as the self) and the similarity threshold of the game itself. According to SERS, cooperation is more likely as PARSIM increases, and as similarity threshold decreases. Additionally, SERS predicts an interaction between PARSIM and the similarity threshold of the game.

In study one of this thesis, a set of 125 facial photos were rated by three groups – one for trustworthiness, and the others for two different types of similarity. All ratings showed high internal consistency. The two types of similarity ratings were highly correlated, and trustworthiness ratings were moderately correlated with both types of similarity ratings.

In study two, a new group of participants indicated how likely they would be to cooperate in a series of 54 trials, across which the rated similarity of the pictured partner, and similarity threshold of the PDG varied systematically and independently. Study two found main effects for the sex of the partner, the similarity threshold of the PDG game, and the perceived similarity of partner, controlling for partner's trustworthiness. However, there was no evidence of an interaction between PARSIM and similarity threshold.

# Chapter 1

# INTRODUCTION

## 1.1 Similarity and Cooperation

Cooperation is integral to society's progression, both on an individual, and a global scale. In society, individuals make decisions every day whether or not to cooperate with others – in academic settings, in professional settings, and in social settings. This cooperation is often made with some amount of risk behind it. Whenever deciding between cooperation and non-cooperation, there is always the possibility of exploitation. So why do so many individuals cooperate, even when faced with this potential for disaster? Sometimes a common goal is not enough; the other entity in the dilemma must be assessed.

Many decisions are made by individuals, while not knowing the thoughts of the others involved. For example, when two drivers wait at a four-way intersection, they must cooperate – otherwise they may face a collision. They must decide not to drive at the same time. Alternatively, in a group project, strangers are often paired together to complete a task or assignment. What about one stranger makes another think that they would be a cooperative (or non-cooperative) partner?

In a world of unknowns and potential problems, *you* are the least threatening person to yourself. So it stands to reason that perhaps, when evaluating strangers in order to cooperate, or not cooperate with them, individuals assess them in relation to their own selves. There is a great body of research on this type of assessment – similarity.

The general concept of similarity has been measured, as well as manipulated, in a multitude of ways. Perhaps the most obvious kind of similarity is the similarity of appearances. This includes, but is not limited to: age, race, gender, body type, and style. McPeek and Gross (1975) found that individuals rated speakers more positively if the speaker in question was similar to them in age and in appearance. Individuals who dress and present themselves a certain way are also more likely to interact with and offer assistance to individuals who dress and present themselves in a similar way (Emswiller, Deaux, & Willits, 1971; Alcorn & Condie, 1975). However, similarity of appearance seems to be especially important when choosing a significant other. Engaged individuals' weights, heights, and BMIs are significantly correlated with those of their partner (Prichard et al., 2015). Additionally, individuals rate faces which are similar to their own as more attractive (Kocsor, Rezneki, Juhász, & Bereczkei, 2011).

Similarity of appearances can also potentially fit into the category of in-group similarity. In-group members are always similar in some respect – whether it be in race, culture, or something more community-based, like attending the same university. Individuals have been found to cooperate more with in-group members as opposed to outgroup members (Balliet, Wu, & De Dreu, 2014). Additionally, the perception of similarity leads to less stereotyping of out-group members (Ames, Weber, & Zou, 2012).

The similarity-attraction hypothesis says that increased similarity between individuals leads to attraction. This similarity is usually studied in the context of similarity of traits, preferences, personality, and attitudes. Similarity of traits and preferences have been shown to predict success in romantic relationships (Lutz-Zois, Bradley, Mihalik, & Moorman-Eavers, 2006) and success in interracial partnerships (West, Magee, Gullett, & Gordon, 2014). Similarity of personality or preferences and traits is usually assessed by the participant with questionnaires or free-response questions, thereby giving a measure of perceived similarity. Indeed, one study found that perceived and peer-rated personality similarity between individuals lead to more friendship intensity, but not *actual* personality similarity (Selfhout, Denissen, Branje, & Meeus, 2009). Attitude-similarity research has found that individuals with similar attitudes are rated more positively and as more attractive partners (Byrne, 1961a; 1961b).

Furthermore, individuals believe they will more successfully cooperate with their partner if that partner is similar to themselves (Toma, Corneille, & Yzerbyt, 2012). So not only is similarity implicated in behavioral cooperation, but individuals also have the belief that having a similar partner will lead to more successful cooperation.

## 1.2 Social Dilemmas and the Prisoner's Dilemma Game

There is a large body of literature in which cooperation is studied through the lens of social dilemmas. A social dilemma is a situation in which an individual must make a choice between (usually) two alternatives – behaving cooperatively and non-cooperatively (Dawes 1980). Behaving non-cooperatively has more immediate benefit for the individual making a decision. However, if all parties behave non-cooperatively, then everyone will be worse off than if they had behaved cooperatively.

In laboratory studies, the outcomes of a social dilemma are represented numerically. These numerical payoff matrices allow the individual to evaluate their own possible outcomes, as well as the possible outcomes of the other player, and make a decision on whether or not to cooperate.

The most commonly researched social dilemma comes in the form of the two-person prisoner's dilemma game (PDG), which is shown in Table 1.Both the row player, and the column player have a choice between cooperation and non-cooperation. In a PDG there are four types of outcomes, known as "payoffs": Reward for Mutual Cooperation (R), Punishment for Mutual Defection (P), Temptation to Defect (T), and Sucker's Payoff for Being the Only Cooperator (S). In a PDG with numerical outcomes, the payoffs follow this rule: T>R>P>S. Table 1 presents the PDG in general form and shows the three specific PDG's used in Study 2 of this thesis. As can be seen in Table 1, it is individually beneficial for a player to choose the non-cooperative (Defection) option (T>R and P>S). However, if both the row and the column player defect, they are worse off than if they had both cooperated – the payoffs for mutual defection (P) are less than the payoffs for mutual cooperation (R).

The PDG's in Table 1 differ in terms of their K (or Cooperation) Index, and also in terms of their "similarity threshold" ($p_s$, Fischer (2009). Both K and $p_s$ will be explained below.

**Effects for Payoff Variations in PDG.** There are decades of research on the payoffs of the PDG and how changing these payoffs affects cooperation. Each PDG has a K-index value, which is calculated based on the R, P, T, and S payoffs, where K= [(R-P)/(T-S)]. For all three games shown in Table 1, the numerator of this ratio (T-S) is the same: 100. However the games differ in terms of the difference between the payoff for mutual Cooperation (R) and mutual Defection (P). As the game's K-index increases the importance of mutual Cooperation compared to mutual Defection increases. Rapoport and Chammah (1965a) showed that people become more cooperative as this difference (K) increases. From here on, we will refer to the game that is known to produce low levels of Cooperation (K = 0.2) as the Low-C game. The games that produce moderate (K = 0.45) and high levels of Cooperation (K = 0.8) will be referred to as Moderate C and High C games respectively. Common features of K-index research are that each game is played only once, without feedback as to the partner's choice, and with no-knowledge of any partner characteristics. Such studies show the effect of game payoffs, and nothing else.

Table 1. Prisoner's Dilemma in General Form and Three Numerical Examples

General Form

| | | Player 2 | |
|---|---|---|---|
| Player 1 | | Cooperation | Defection |
| | Cooperation | **R, R** | **S, T** |
| | Defection | **T, S** | **P, P** |

Numerical Payoffs for the "Low C" Game Used in Study 2. K = 0.2, $P_s$ = 0.83

| | | Player 2 | |
|---|---|---|---|
| Player 1 | | Cooperation | Defection |
| | Cooperation | **60, 60** | **0, 100** |
| | Defection | **100, 0** | **40, 40** |

Numerical Payoffs for the "Middle C" Game Used in Study 2. K = 0.45, $P_s$ = 0.69

| | | Player 2 | |
|---|---|---|---|
| Player 1 | | Cooperation | Defection |
| | Cooperation | **75, 75** | **0, 100** |
| | Defection | **100, 0** | **30, 30** |

Numerical Payoffs for the "High C" Game Used in Study 2. K =0.8, $P_s$ = 0.56

Player 2

| Player 1 | | Cooperation | Defection |
|---|---|---|---|
| | Cooperation | **90, 90** | **0, 100** |
| | Defection | **100, 0** | **10, 10** |

**Effects for Partner Information in PDG.** Cooperation in PDG is risky, in that it might not be reciprocated by one's partner. This issue was addressed by Pruitt and Kimmel (1977) in their "Goal Expectation Theory", which states that two conditions must be satisfied before cooperation is likely: the participant him/herself must have the goal of mutual cooperation, and also the belief or expectation that the partner will cooperate. The concept of Social Value Orientation (SVO), (discussed in more detail below) inspired by Messick and McClintock (1968) corresponds to the *goal* aspect of this theory. Research on the *expectation* aspect has largely focused on trust. The more trustworthy an individual believes their partner to be, the more likely they are to cooperate with said partner, in both one-shot and repeated Prisoner's Dilemma games (Balliet & Van Lange, 2013; Yamagishi, 2011; Yamagishi, Kanazawa, Mashima, & Terai, 2005). This thesis will address the effects of another type of information regarding the partner, namely similarity.

### 1.3 Ilan Fischer's Subjective Expected Relative Similarity (SERS) Theory

Fischer (2009, 2012) has developed and tested a theory of similarity (Subjective Expected Relative Similarity [SERS]) which defines similarity as the perceived probability that a stranger will make the same choice in a social dilemma as you. The following scenario models Fischer's idea of similarity:

> You have agreed to meet someone in New York City, either at the Empire State Building or at Radio City. Unfortunately, you have forgotten to agree where to meet, and now you must go to one site or the other, in the hopes that the someone will go to the same place.

Your estimate of the probability that the two of you will meet at the same place is what Fischer means by perceived similarity.

According to SERS, cooperation in a given PDG depends on two things. One is the perceived similarity (in the sense described above) of the partner and the other is based on the specific payoffs (R, S, T and P) in the game itself. Just as all PDG's have a K-index value, they also have a feature which Fischer calls the "similarity threshold" ($P_s$). The similarity threshold of a PDG is calculated using the payoffs of the game, where $P_s^* = [(T-S)/(T-S+R-P)]$. The similarity threshold is highly and <u>negatively</u> correlated with the K-index. That is for games that produce a high level of cooperation (High C games, or High K games), the similarity threshold is quite low. For such games the partner's similarity is not very important. For games that produce a low level of cooperation (Low C game, or Low K games), the partner's similarity becomes quite important.

In other words, the similarity threshold of a game is a measure of how high the other player's similarity to the individual must be in order for cooperation in that game to occur. So for cooperation to occur in a PDG with a high similarity threshold, the partner must be perceived as highly similar. However, for cooperation in a PDG with a low similarity threshold, the perceived similarity of the partner does not matter as much. A low similarity threshold means that most individuals will be considered similar enough in order for the participant to cooperate.

Fischer has tested his SERS theory by experimentally manipulating participants' perception of partner's similarity in two different ways. In one procedure participants were seated in front of an opaque screen and given cards with differing symbols on each side. The goal of this task was for participants to coordinate symbols with their partner. After selection, the screen was revealed so the participants could see if their selected symbol matched that of the partner. This happened three times – so participants matched either 0, 1, 2, or 3 times. Participants then played a prisoner's dilemma game – some in a condition where the game had a high similarity and others with a low similarity threshold.

Fischer (2009) found that people were more likely to cooperate in the low similarity threshold game overall, and were more likely to cooperate across both threshold conditions as the number of card coordinations increased. Fischer (2009) also found similar results when the manipulation of similarity involved a bogus questionnaire being shown to participants. Cooperation was more likely in subjects who believed their partner had answered the questionnaire similarly to themselves, as well as more likely in games with a low similarity threshold.

**Social Value Orientation**: There are other influences on cooperation in the prisoner's dilemma game as well. As stated in Pruitt and Kimmel's Goal Expectation Theory, a condition necessary for cooperation is that the participant have a goal or motive to achieve mutual cooperation. Messick and McClintock (1968) introduced the idea that there are different possible motivational orientations for playing the Prisoner's Dilemma Game – joint gain, relative gain, and own gain. These motivations are known as Social Value Orientations (SVO). Kuhlman and Marshello (1975) found that individuals consistently follow one of these orientations, acting either in a ProSocial (joint gain) or a ProSelf (individual gain or relative gain) manner. A meta-analysis finds that SVO has a "small to moderate" effect on cooperation (Balliet, Parks, & Joireman, 2009). In Study 2 of this thesis, participants' Social Value Orientation was assessed via Liebrand's (1984) so called "Ring Measure," which is widely used in SVO research. We expect that overall, ProSocials will be more cooperative than ProSelfs.  Whether SVO will moderate the effects of Game Payoffs and Partner Similarity is at this point an open question.

### 1.4 Overview of the Present Studies, Hypotheses

Fischer's (2009) SERS theory integrates both the payoffs of the game, which can be represented by the similarity threshold, and the perceived similarity of the other player. An interaction between perceived similarity and similarity threshold is logically predicted from this theory. Similarity should be more important in games with a high similarity threshold than in games with a low similarity threshold.

Instead of manipulating similarity in the lab, similarity ratings were collected in Study One of this thesis. In this first study, participants rated a set of photographs on similarity. These ratings were averaged across participants, and some photographs were selected for use in the second study.  Participants in the second study responded to a series of social dilemmas with partners who were rated high on similarity, moderate on similarity, and low on similarity.

This study's hypotheses are that a) individuals who are ProSocial (Cooperative SVO) will cooperate at a higher rate than those who are ProSelf (Individualist SVO and Competitor SVO), b) individuals will cooperate more in PDGs with a low similarity threshold than in PDGs with a high similarity threshold, and c) individuals will cooperate more with partners who are rated as "highly similar" in study one. Additionally, following Fischer's (2009) SERS theory, this thesis will test for an interaction between the perceived similarity of partner and the similarity threshold of the game. Specifically, the similarity of the partner is expected to be more important in games with a high similarity threshold, and less important in games with a low similarity threshold.

# Chapter 2

# STUDY ONE

## 2.1 Methods

### 2.1.1 Participants

One-hundred and one introductory psychology students from the University of Delaware participated in the study in partial fulfillment of a research participation requirement.

### 2.1.2 Materials

Participants viewed photographs of participants asked to pose a neutral expression; all photographed participants gave full consent for their photos to be used for research purposes. The participants shown in the photos were 125 white (63 female) University of Delaware undergraduates who participated in a study in the spring semester of 2013 and consented to having picture of their hands and face used for future studies (the hand photographs were not used in this study). The participants in the photos were not identified by name or any other information. The photographs were modified to be the same size, and also were greyscaled.

### 2.1.3 Procedure

Three different sessions were run – one in the spring semester of 2014, and two in the fall semester of 2014. During each session, participants reported to a large lecture hall. Upon entering the room, they received a folder containing a consent form, a scantron, and a folded and stapled sheet containing rating directions. Another sheet, numbered 1-125, was stapled to the outside of the folder. A seat assignment was listed on the folder as well.  This allowed for a random assignment of raters to seats, and kept raters at least one seat apart.

When instructed to open their folders, participants were first led through the consent document by a researcher. They then received instructions in the form of PowerPoint slides and told that they would see photos of 125 individuals, whom they would be rating. But first, they were shown all of the photos in order to get a feel for how long they would be viewing the photos, and ascertain whether or not they knew any of the individuals in the photos.

Before viewing any of the photos, participants were also instructed to open the folded and stapled sheet of paper, which contained their rating directions. Participants were in one of three conditions: two different similarity conditions, and one trust condition.

Decision Similarity:

*"We go through life making decisions. Some easy, some not so easy. Some important, others less so. How likely is it that this person will make the same decisions as you most of the time?"*

Person Similarity:

*"There are some people we know (or know about) that we feel are like us as a person. Not in terms of what they look like, their sex, age, or other such things. Rather, in terms of our "inner" or "true" selves. Please indicate the degree to which the person in the photo is similar to you in this respect."*

Trustworthiness:

*"This person has a good heart and strong conscience. He/she will do the morally correct thing whether or not people are watching.*

*How likely is it that this person fits the description above?"*

Participants were instructed to make a mark on the sheet stapled to the front of their folder, numbered 1-125, in the respective space, if they personally knew any of the individuals in the photos. They then saw a slideshow of 125 photographs, viewing each for approximately five seconds. In order to avoid participants rating the stimuli during the first round of viewing, the rating scale was not shown with the photographs.

After the initial viewing of all 125 faces, participants were instructed to reread the instructions which detailed how the participant was to rate the 125 faces. Then, the participants were shown the 125 photographs again, this time each stimuli paired with the same likert scale. The likert scale showed options A through E, with A denoting “Not at all” and E denoting “Extremely.” Though all participants did not have the same rating instructions, the instructions were all worded in a way which made this five-point scale valid and clear.

Participants rated all 125 faces according to their directions, and then were debriefed and dismissed.

## 2.2 Results

A total of 39 participants (13 males) rated the photos according to the Decision Similarity definition, 44 different participants (18 males) rated them according to the Personal Similarity definition, and 18 other participants' (7 males) ratings were made according to the Trustworthiness definition.

For each set of ratings a Sex of Judge by Sex of Target analysis of variance (ANOVA) was run, with Sex of Judge as a between subject variable and Sex of Target as within-subjects.

**Decision Similarity Ratings:** Overall, Male Judges (Mn = 2.58) did not differ from Female Judges (Mn = 2.48) ($p = 0.38$). In addition the ratings for Male Targets

(Mn = 2.47) did not differ from those for Female Targets (Mn = 2.59), ($p$ = 0.85). However, as shown in Figure 1, a significant Sex of Judge by Sex of Target Interaction was observed. ($F(1.37) = 8.59$, $p = 0.005$). Male judges rated male targets as more similar than female targets, which result was reversed in Female Judges.

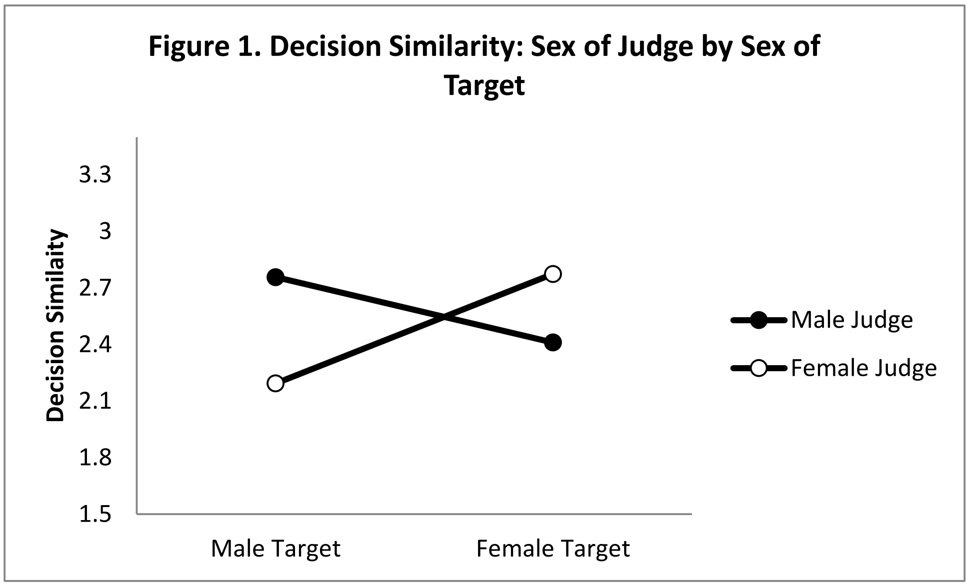


Figure 1 – Decision Similarity: Sex of Judge by Sex of Target

**Person Similarity Ratings:** The ratings of male judges (Mn = 2.27) and female judges (Mn = 2.20) did not differ ($p$ = 0.83). Similarly, male targets (Mn = 2.19) and female targets (Mn= 2.28) did not differ ($p$ = 0.14). A marginal interaction ($F(1,42)$= 3.267, $p$ = 0.08) was observed, and as can be seen in Figure 2 its structure was very similar to that observed for Decision Similarity ratings.

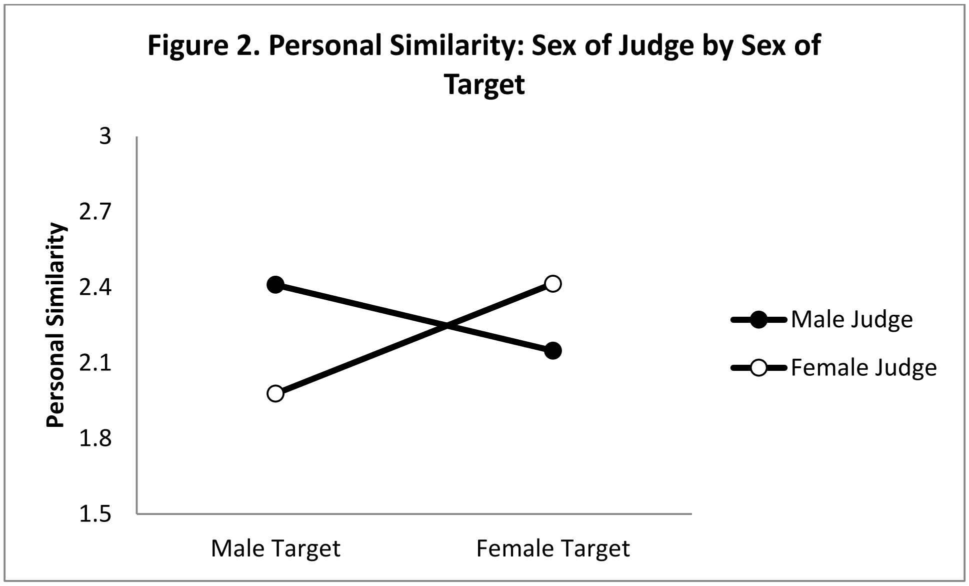


Figure 2 – Personal Similarity: Sex of Judge by Sex of Target

**Trustworthiness Ratings:** Male (Mn = 2.91) and female judges (Mn = 2.81) did not differ (p = 0.16). Female targets were rated higher on Trustworthiness (Mn = 3.11) than male targets (Mn = 2,61) (F(1,16) = 27.5, p<0.001). The significant interaction (F(1,16=8.28, p=0.011) between Sex of Judge and Sex of Participant is shown in Figure 3. For both male and female judges female targets are rated higher than male targets, but the effect for Sex of Judge is larger in female than in male targets.

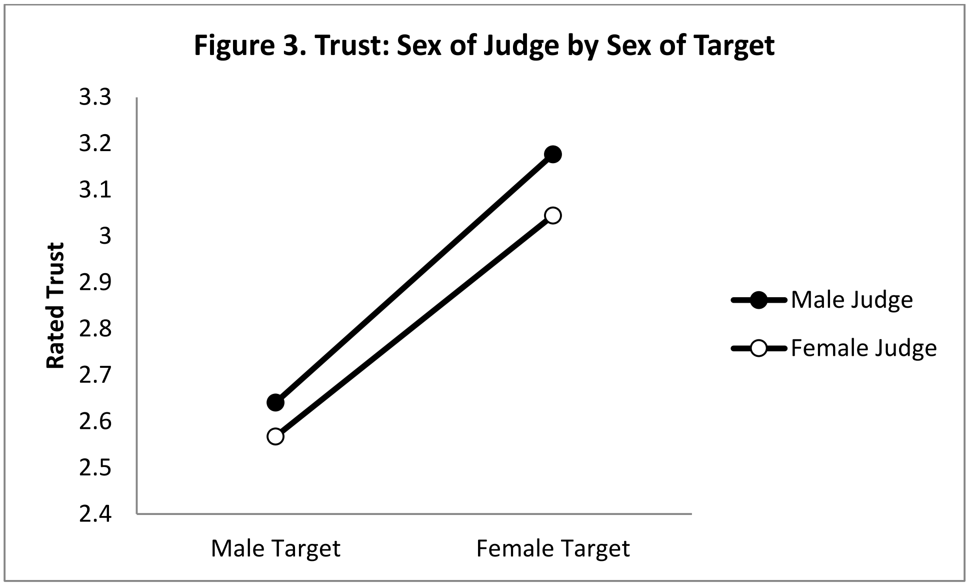


Figure 3 – Trust: Sex of Judge by Sex of Target

**Reliability Analyses:** Given that the average rating of each photo plays a very important role in Study 2 of this thesis, it is important to assess the inter-judge agreement of the ratings made in Study 1. Cronbach's $\alpha$ was computed for each type of rating (Decision Similarity, Personal Similarity and Trustworthiness) for male and female targets separately, and for all targets combined. In all cases, $\alpha$ was greater than 0.9.

**Relations Between the Mean Ratings:** Across the 125 photos, we anticipated that the mean ratings of Personal Similarity (made by one group of participants), Decision Similarity (another group) and Trustworthiness (still another group) would be correlated. Three regression analyses were run to examine each relation and to see if it was moderated by the sex of the target.

**Decision Similarity Predicted from Personal Similarity:** As shown in Figure 4 these two ratings were highly correlated (partial $r = 0.884$, $p < 0.001$).

Controlling for Personal Similarity, male and female targets did not differ on Decision Similarity (p = 0.45), nor was the relationship between Personal and Decision Similarity moderated by sex of the photo (p = 0.797).

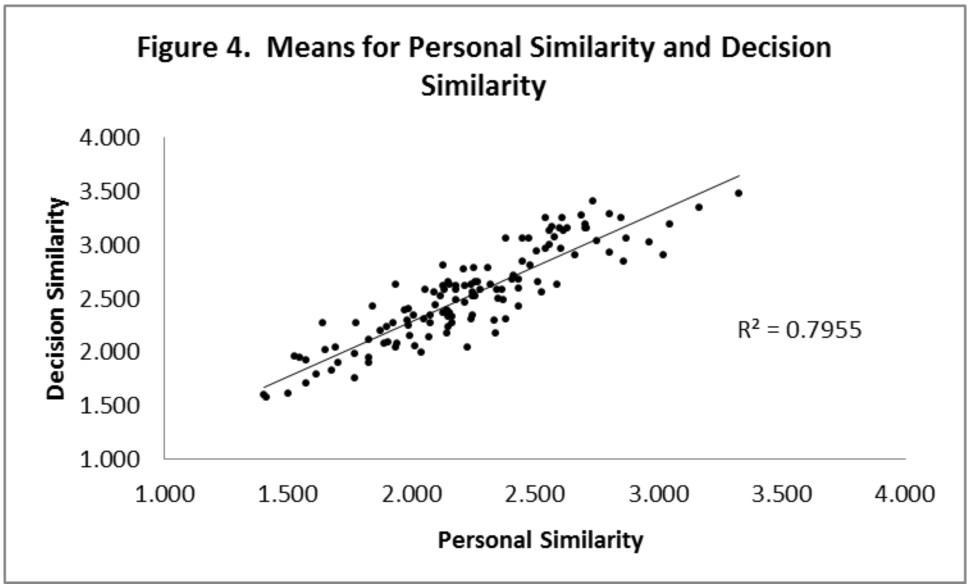


Figure 4 – Means for Personal Similarity and Decision Similarity

**Decision Similarity Predicted from Trustworthiness:** As shown in Figure 5 these rating were significantly correlated (partial r = 0.546, p < 0.001). Controlling for Trustworthiness, male (predicted Mn = 2.62) and female (Predicted Mn = 2.45) targets differed on Decision Similarity (F(1,121) = 5.002, p = 0.027). The relation between Trustworthiness and Decision Similarity was not moderated by sex of the photo (p=0.249)

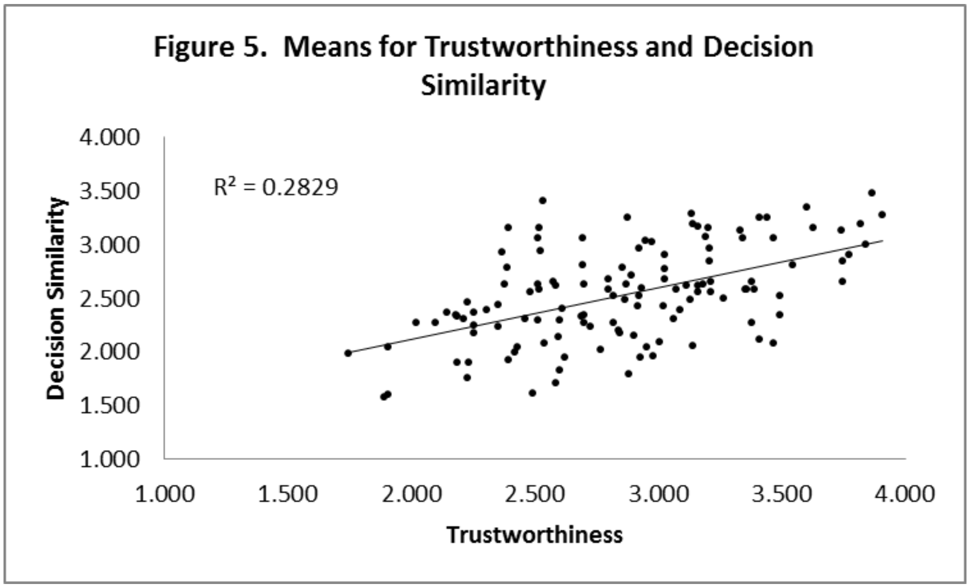


Figure 5 – Means for Trustworthiness and Decision Similarity

**Personal Similarity Predicted from Trustworthiness:** As shown in Figure 6 these rating were significantly correlated (partial r = 0.56, $p < 0.001$). Controlling for Trustworthiness, male (predicted Mn = 2.32) and female (Predicted Mn = 2.15) targets differed on Personal Similarity ($F(1,121) = 6.615$, $p = 0.011$). The relation between Trustworthiness and Personal Similarity was not moderated by sex of the photo ($p=0.08$)

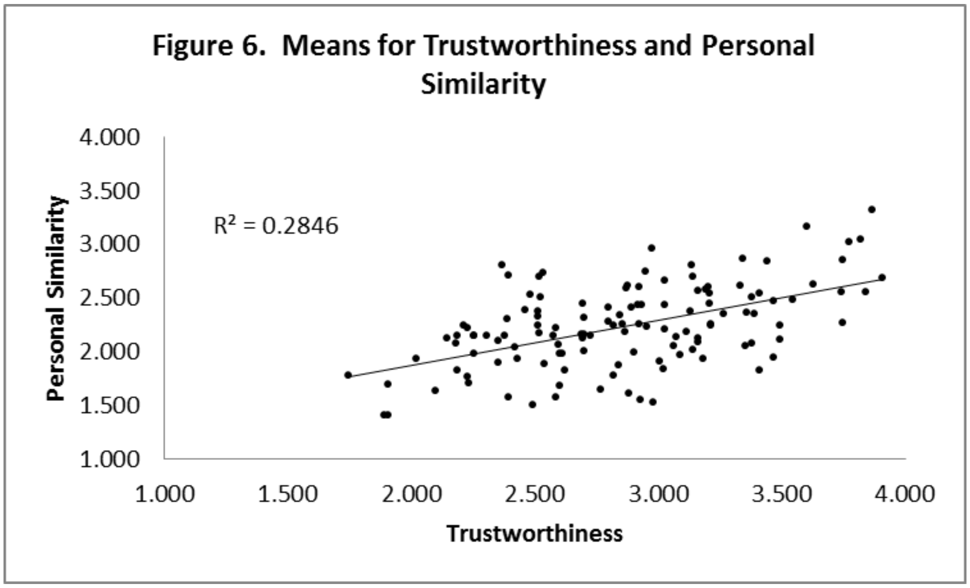


Figure 6 – Means for Trustworthiness and Personal Similarity

## 2.3 Transition to Study Two

One concern for this study was whether trustworthiness was sufficiently independent from similarity. We found correlations between trustworthiness ratings and ratings from both definitions of similarity, as well as average similarity ratings. However, these measures of similarity were not fully correlated with trustworthiness. So when participants are rating photographs based on our similarity definitions, they are looking at, at least in some part, different things than those rating the photographs on trustworthiness. This was important for our selection of photos to use in study two.

The ratings of the photographs were used to choose a subset for study two, in order to get photographs with systematically varying levels of similarity, while still controlling for trustworthiness.

# Chapter 3

# STUDY TWO

## 3.1 Methods

### 3.1.1 Participants

One-hundred and seventy-two undergraduate students from the University of Delaware participated in the study for partial class credit. Participants were chosen by SVO – roughly equal numbers of Cooperators, Individualists, and Competitors were selected to participate. SVO was measured in pretesting, weeks before the photo rating study.

**Materials**

Participants viewed a subset of the 125 photographs from Study 1. A total of eighteen photos were selected from these 125 – nine male and nine female photos. To select these eighteen photographs, they were first divided by sex. Then, each sex group was split into three sections using the decision-based similarity ratings from Study One: a high-similarity group, a low-similarity group, and a medium-similarity group. Three photographs were chosen from each of these six groups, so that they differed as much as possible in their trustworthiness ratings. For example, the female high-similarity group included one photograph rated as highly trustworthy, one rated as moderately trustworthy, and one rated as not trustworthy.

These photographs were paired with the three different PDG's shown in Table 1, which were referred to as "social decision tasks. So, each PDG was played with the three high similarity females, the three high similarity males, and so on, for a total of 54 trials.

### Procedure

Two sessions were run back-to back in a large lecture hall during the fall semester of 2014. Upon entering the room, they received a folder containing a consent form, and a scantron. A seat assignment was listed on the folder, and participants sat with an empty seat between themselves and another participant.

Participants were instructed to open their folders, and were led through the consent document by a researcher. They then received instructions in the form of PowerPoint slides and were told that they would see photos of 18 individuals, with whom they would be playing a series of social decision tasks. First, the social decision task (a prisoner's dilemma game) was explained. The participants were shown each of the three social decision tasks they would be responding to, first without the accompanying photographic stimuli. Three Prisoner's Dilemma Games were shown, one with a high similarity threshold ($T = 100$, $R = 60$, $P = 40$, $S = 0$, and $p_s^* = 0.83$), one with a moderate similarity threshold ($T = 100$, $R = 75$, $P = 30$, $S = 0$, and $p_s^* = 0.69$), and one with a low similarity threshold ($T = 100$, $R = 90$, $P = 10$, $S = 0$, and $p_s^* = 0.56$).

Then, they were shown each of the 18 photographs without a social decision task. Participants were instructed to indicate on their scantrons if they knew the person in the photograph, and if they did, to what degree.

Participants were then led through the social decision tasks. The tasks were presented in three groups; each PDG task was responded to with all 18 photos before moving on to the next task. In one session, the PDG tasks were shown in this order: high similarity threshold, moderate similarity threshold, low similarity threshold. In the other session, the games were shown in this order: low similarity threshold, moderate similarity threshold, high similarity threshold. After the three groups of 18 were shown, participants saw and responded to each of the three PDG's, but without a photograph to stand in for the other player.

Following the social decision tasks, participants completed Liebrand's Ring Measure (1984) of SVO.

Before leaving the study, participants were debriefed.

## 3.2 Results

Of the 172 participants, 13 failed to meet the Ring Measure consistency criterion for SVO classification. These participants were excluded from analysis, leaving a total of 159. Following common practice in SVO research, these 159 participants were classified as either ProSocial (SVO of Cooperation), or ProSelf (SVO of Individualism or Competition). Of the 54 classified Males, 39 (72%) were classified as ProSocial, and of the 105 classified Females, 69 (65%) were classified as ProSocial. Consistent with the SVO literature, Sex and SVO of participant were not related ($X^2 = 0.69$, df = 1, $p = 0.41$).

Each trial in this study presented the participant with one of 18 combinations of Partner Sex, Partner Similarity and the C-index of the PDG. And, each of the combinations was replicated 3 times for a total of 54 responses. The three replications differed in terms of the PDG. For the analyses to be reported here, the three replications of each Sex/Similarity/Game combination were averaged to produce a set of 18 scores, corresponding to a Sex (2) by Similarity (3) by PDG (3) repeated measures design.

A factorial analysis of variance (ANOVA) was performed with Participant Sex and Participant SVO as the two between subject factors and Partner Sex, Partner

Similarity  and PDG as the three within-subject factors.  The summary table for this analysis is in Appendix A.

Results for Overall Cooperation (average over the 18 measures) are shown in Figure 7. Male and Females did not differ, nor was there as Participant Sex by Participant SVO Interaction.  However, ProSocials were more cooperative than ProSelfs ($p=0.003$).  These results are commonly found in the SVO literature.

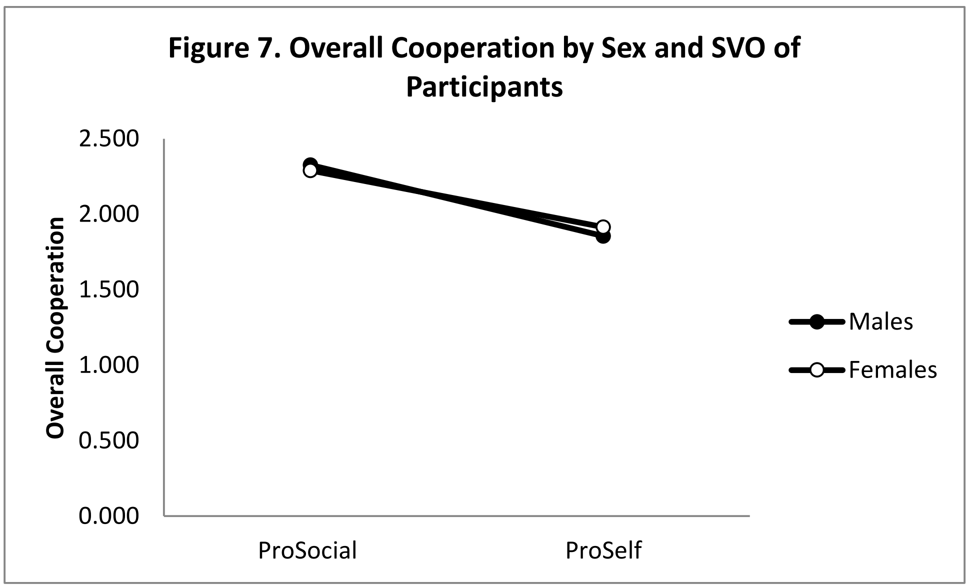


Figure 7 – Overall Cooperation by Sex and SVO of Participants

Results for Partner Sex showed more cooperation with Female Partners than with Males ($p < 0.001$), as shown in Figure 8.  The Partner Sex effect was not moderated by Participant Sex, Participant SVO or by the Partner Sex by Partner SVO interaction.

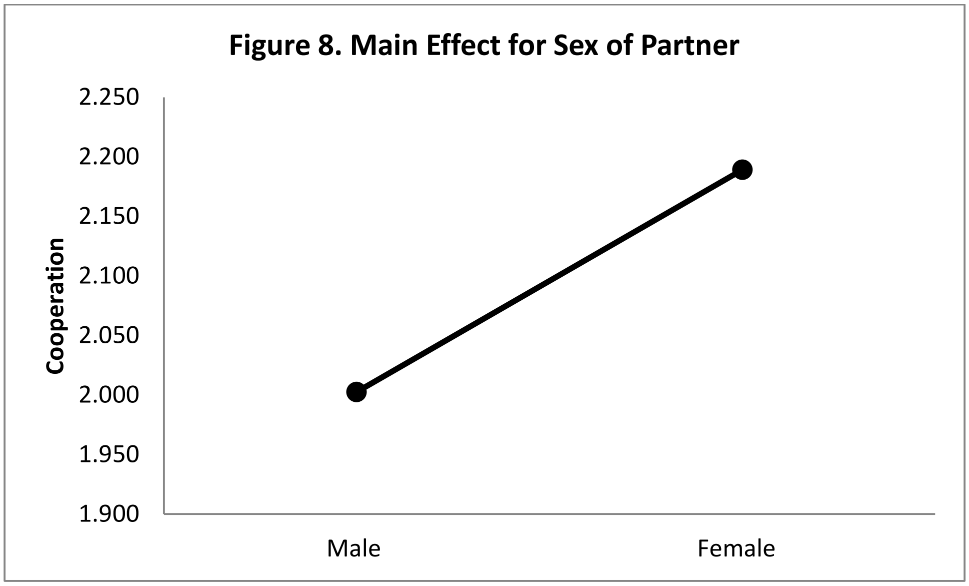


Figure 8 – Main Effect for Sex of Partner

Results for Partner Similarity are shown in Figure 9. The 2df Main Effect for Similarity was significant ($p<0.001$). Single df contrasts on this effect showed that High Similarity partners produced more cooperation than the average of Middle and Low Partners ($p < 0.001$), and that Middle Partners produced more cooperation than Low Partners ($p=0.034$). The effect for Partner Similarity was not moderated by Participant Sex, Participant SVO or the Sex by SVO interaction.

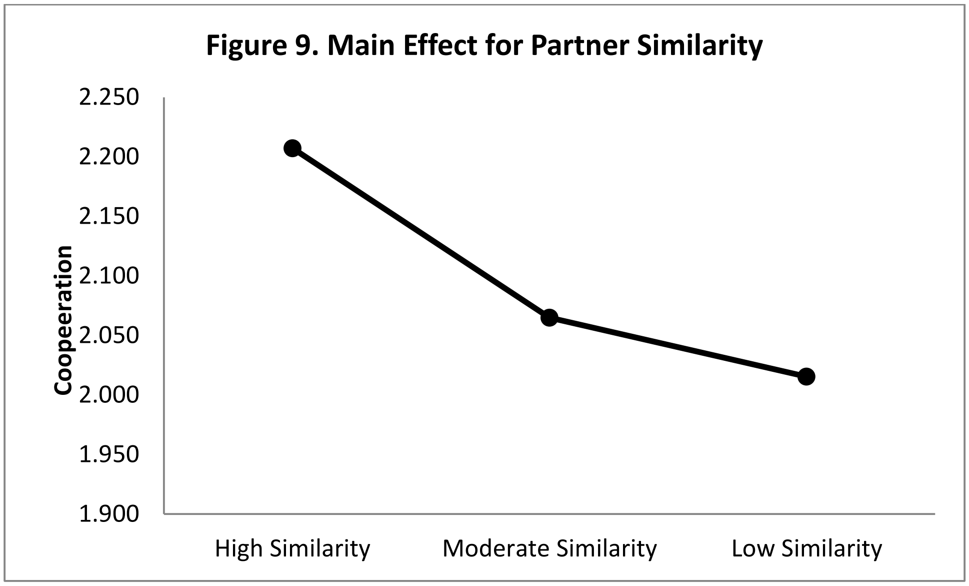


Figure 9 – Main Effect for Partner Similarity

Results for PDG are shown in Figure 10. The 2df Main Effect for Game was significant ($p < 0.001$).Single df contrasts on this effect showed that the High C PDG produced more cooperation than the average of Middle and Low C PDG's ($p < 0.0009$), but that Middle C and Low C PDG's did not differ ($p = 0.141$). The effect for Partner Similarity was not moderated by Participant Sex, Participant SVO or the Sex by SVO interaction.

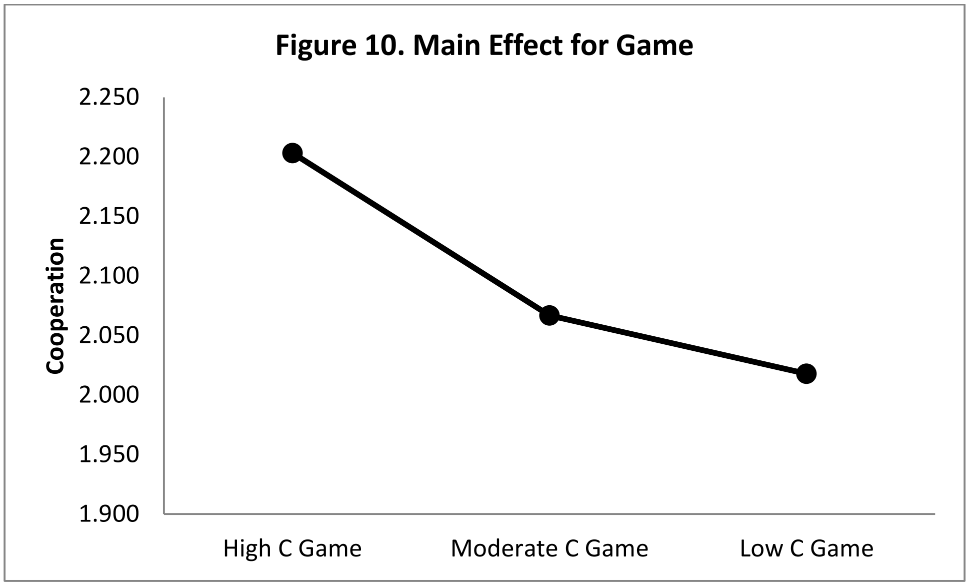


Figure 10 – Main Effect for Game

Tests involving the Partner Sex by Partner Similarity Interaction showed that overall, this interaction was not significant (p = 0.676). This interaction was not moderated by Participant Sex (p = 0.392) or by the Participant Sex by Participant SVO interaction (p = 0.546). However, this interaction was moderated by the Participant's SVO (p = 0.043). As can be seen in the ANOVA Summary Table, the Participant SVO by Partner Sex by Partner Similarity Interaction was due to differences between ProSocial and ProSelf Participants (p = 0.02). As can be seen in Figures 11a and 11b, ProSocials showed a larger distinction between Male and Female Partners who were highly similar than they did to those who were not highly similar. This difference was reversed in ProSelf Participants.

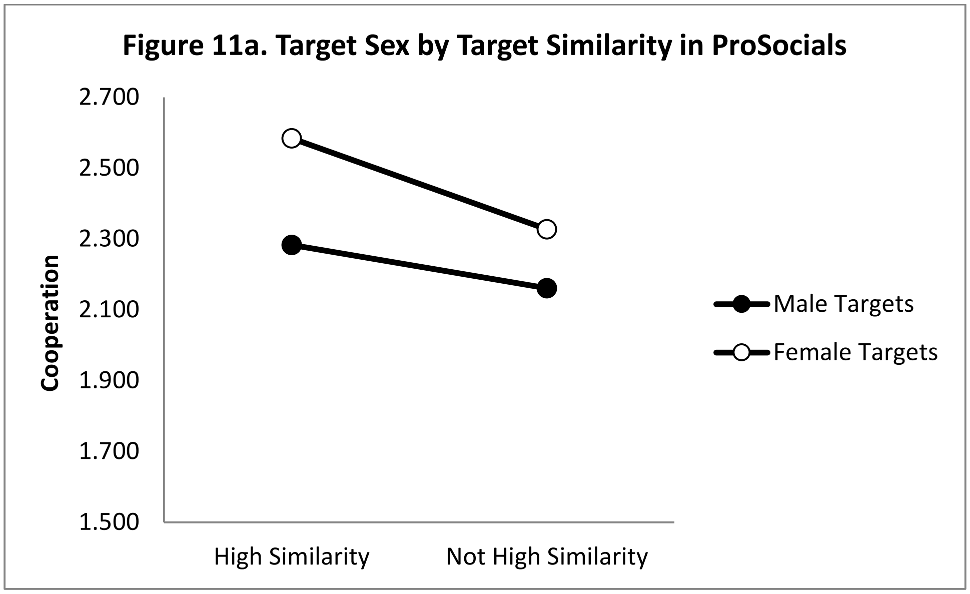


Figure 11a – Target Sex by Target Similarity in ProSocials

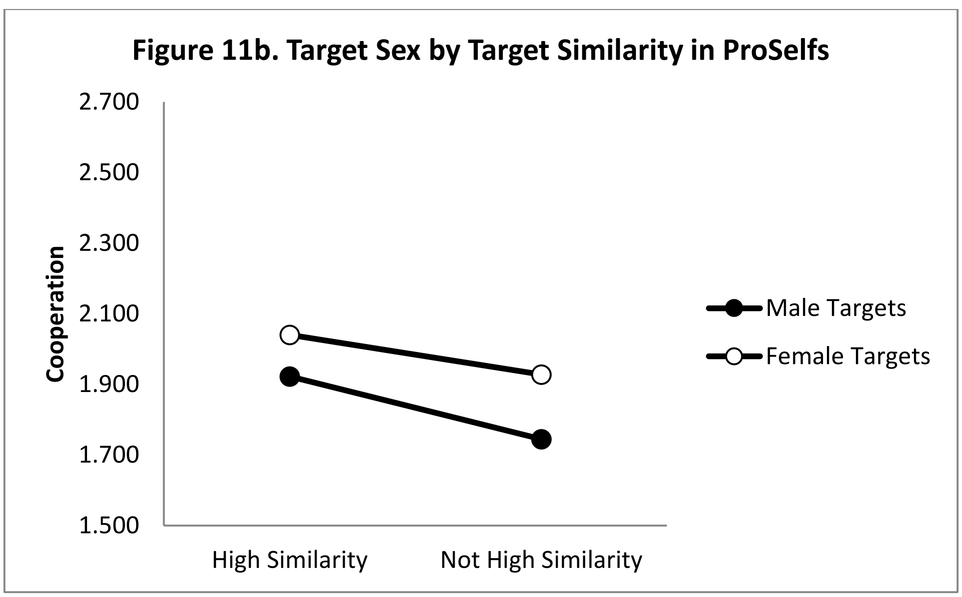


Figure 11b – Target Sex by Target Similarity in ProSelfs

Finally, as can be seen in the ANOVA Summary Table (Appendix A) no other effects were statistically significant. This includes the non-significant ($p = 0.762$) Partner Similarity by PDG Game Interaction, which was predicted to be significant. Given the theoretical importance of this interaction, it was decided to examine the means with which it is associated. They are shown in Figure 6, which makes quite clear that the "failure" to achieve significance was not a matter of statistical power. The three profiles are quite parallel.

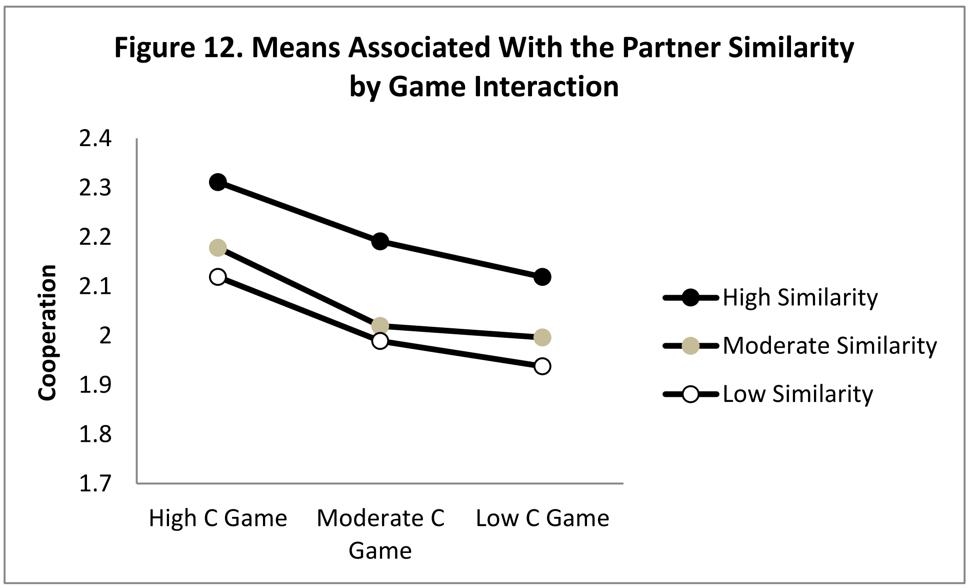


Figure 12 – Means Associated with the Partner Similarity by Game Interaction

# Chapter 4

## GENERAL DISCUSSION AND CONCLUSIONS

Overall, the study found clear, if unsurprising results. We looked at effects of the PDG, effects of the participant, and effects of the other player in the PDG.

In this thesis, participants were more likely to cooperate in games which had a low similarity threshold ($p_S = 0.56$). Fischer (2009) also found that participants were more likely to cooperate in a prisoner's dilemma game with a low similarity threshold ($p_S = 0.63$) than in a game with a high similarity threshold ($p_S = 0.80$). Additionally, this finding is supported by decades of research which study the effects of these PDG payoffs. The higher the K-index of the game, the more likely the players are to cooperate. So, this study contributes to the body of research which investigates cooperation as a result of PDG payoffs.

Participants, regardless of their own gender, cooperated more in the Prisoner's Dilemma when the other player was a female. The literature on gender effects in the Prisoner's Dilemma Game is varied – some finding show males are cooperated with more, some females, and some findings have null effects (Balliet, Li, Macfarlan, & Van Vugt, 2011; Rapoport & Chammah, 1965b).

However, the effect found for Social Value Orientation is consistent with its respective literature (Kuhlman & Marshello, 1975; Balliet, Parks, & Joireman, 2009). Overall, ProSocials do tend to cooperate more than ProSelfs, which is what our results show.

Additionally, and arguably most integral to the study – the similarity level of the partner was significant for cooperation. Participants cooperated more with photos, both male and female, who were rated as highly similar in the first study. This finding is consistent with Fischer's (2009) finding that that individuals cooperate more with partners who they believe to be more similar to the self. This study was a conceptual replication of Fischer's study, and even though we used very different methods, our results were similar. Our findings are also in line with previous studies which have shown similarity is important for cooperation in the context of procedural fairness (Cornelis, Van Heil, & De Cremer, 2011) and altruism and emotional closeness (Curry & Dunbar, 2013). Additionally, the findings suggest that similarity is not "in the eye of the beholder," but rather a trait of an individual, a new addition to the similarity literature.

Main effects were found for the similarity level of the partner, and an effect for the game, but no interaction was found between the two. Though it seems logical to predict an interaction between the similarity threshold of the game and the perceived similarity of the partner, it should be noted that the current study does replicate Fischer's (2009). As a conceptual replication, the procedures in the current study differ greatly, but replicate the results – main effects for similarity, and similarity threshold of the PDG, no interaction.

One possible explanation for the failure to find this interaction is procedural in nature. When the participant was viewing the screen, they were attending to multiple stimuli. They saw both a matrix (the game) and a photograph (the "other player"). Games were presented so that participants saw the same game in eighteen different trials before seeing another game. It is not unreasonable to assume some participants were game-focused, and tended to make their decision based on the game, rather than attending to both the changing photograph, as well as the game. Perhaps a design where both the photograph and the game were randomized by trial would have yielded different results.

Previously, Fischer, among others, has manipulated similarity. In this thesis, similarity was assessed in one study, and the ratings were used in a subsequent study. We offer another type of similarity manipulation, and demonstrate its effects on cooperation. In this research the manipulation similarity was more subtle, and less direct than the more explicit manipulations employed by Fischer. Nothing was said or done to suggest to the participant that our study was concerned with similarity. Participants simply viewed photos previously scaled for similarity according to Fisher's definition. Recent fMRI research (Engle, Haxby and Todorov (2007) has shown differential activation in the amygdala in response to faces previously scaled on trustworthiness. This is one example of the psychological impact of the human face as an important social signal. The present study makes a similar, behavioral demonstration for the face as a signal of similarity. This may help us to understand how cooperation can occur in the very early stages of interaction with a stranger before one has explicit information about his/her characteristics.

When individuals make decisions in the face of risk, they take a number of factors into account. They must assess the situation, their own assets, and any other individuals involved in the decision. Based on the current thesis, there is evidence for the idea that individuals, when deciding to cooperate with another person, assess that other's similarity to the self. Finally, given the attempt to control for trustworthiness in Study 2, these results suggest that similarity may operate as a second (in addition to trust) important form of social information.

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## Appendix A

### TABLE 1. ANALYSIS OF VARIANCE SUMMARY

## Note: SX is Subject Sex, SV is Subject SVO

**Tests involving Subject Sex and Subject SVO for Overall Cooperation**

| Source of Variation | SS | DF | MS | F | Sig of F |
|---|---|---|---|---|---|
| WITHIN CELLS | 1625.83 | 155 | 10.49 | | |
| SX | .06 | 1 | .06 | .01 | .941 |
| SV | 95.53 | 1 | 95.53 | 9.11 | .003 |
| SX BY SV | 1.21 | 1 | 1.21 | .12 | .734 |

**Tests involving Partner Sex (PSEX) Within-Subject Effect.**

| Source of Variation | SS | DF | MS | F | Sig of F |
|---|---|---|---|---|---|
| WITHIN CELLS | 78.02 | 155 | .50 | | |
| PSEX | 18.62 | 1 | 18.62 | 36.99 | .000 |
| SX BY PSEX | .38 | 1 | .38 | .75 | .386 |
| SV BY PSEX | .34 | 1 | .34 | .67 | .416 |
| SX BY SV BY PSEX | .00 | 1 | .00 | .01 | .923 |

**Tests involving the Partner Similarity (PSIM) Within-Subject Effect.**

| Source of Variation | SS | DF | MS | F | Sig of F |
|---|---|---|---|---|---|
| WITHIN CELLS | 112.16 | 310 | .36 | | |
| PSIM | 14.14 | 2 | 7.07 | 19.55 | .000 |
| JX BY PSIM | .76 | 2 | .38 | 1.05 | .350 |
| JV BY PSIM | .24 | 2 | .12 | .33 | .722 |
| JX BY JV BY PSIM | .41 | 2 | .21 | .57 | .565 |

**Single df Contrasts on the 2df Partner Similarity Effect (df for all t's = 155)**

**PSIM(1)**: High Similarity vs Average of Moderate and Low Similarity

PSIM(1): $t=4.995$, $p < 0.0001$

SX BY PSIM(1): $t=0.328$, $p = 0.744$

SV BY PSIM(1): $t=0.663$, $p = 0.508$

SX BY SV BY PSIM(1): $t=0.184$, $p = 0.853$

**PSIM(2)**: Moderate vs Low Similarity

PSIM(2): $t=2.128$, $p < 0.034$

```
       SX BY PSIM(2): t=1.919, p = 0.056
       SV BY PSIM(2): t=0.109, p = 0.913
 SX BY SV BY PSIM(2): t=1.437, p = 0.152
```

**Tests involving the GAME Within-Subject Effect.**

| Source of Variation | SS | DF | MS | F | Sig of F |
|---|---|---|---|---|---|
| WITHIN CELLS | 228.19 | 310 | .74 | | |
| GAME | 13.12 | 2 | 6.56 | 8.91 | .000 |
| SX BY GAME | .32 | 2 | .16 | .22 | .806 |
| SV BY GAME | .26 | 2 | .13 | .18 | .838 |
| SX BY SV BY GAME | 1.58 | 2 | .79 | 1.07 | .343 |

**Single df Contrasts on the 2df Game Effect (df for all t's = 155)**

**Game(1)**: High C Game vs Average of Moderate and Low C Games

```
             GAME(1): t= 3.362, p = 0.0009
       SX BY GAME(1): t=-0.462, p = 0.645
       SV BY GAME(1): t= 0.489, p = 0.625
 SX BY SV BY GAME(1): t= 0.783, p = 0.434
```

**Game(2)**: Moderate vs Low C Games

```
             GAME(2): t= 1.482, p = 0.141
       SX BY GAME(2): t= 0.474, p = 0.636
       SV BY GAME(2): t=-0.032, p = 0.974
 SX BY SV BY GAME(2): t= 1.538, p = 0.126
```

**Tests involving the Partner Sex by Partner Similarity Within-Subject Interaction**

| Source of Variation | SS | DF | MS | F | Sig of F |
|---|---|---|---|---|---|
| WITHIN CELLS | 58.74 | 310 | .19 | | |
| PSEX BY PSIM | .15 | 2 | .07 | .39 | .676 |
| SX BY PSEX BY PSIM | .17 | 2 | .08 | .44 | .646 |
| SV BY PSEX BY PSIM | 1.21 | 2 | .60 | 3.19 | .043 |
| SX BY SV BY PSEX BY PSIM | .32 | 2 | .16 | .85 | .429 |

**Single df Contrasts on the 2df Partner Sex by Partner Similarity Interaction (df for all t's = 155)**

**PSEX BY PSIM(1)**: PSEX by High Similarity vs Average of Mod/Low Similarity

```
             PSEX BY PSIM(1): t= 0.802, p = 0.423
       SX BY PSEX BY PSIM(1): t= 0.857, p = 0.392
       SV BY PSEX BY PSIM(1): t= 2.347, p = 0.020
```

```
 SX BY SV BY PSEX BY PSIM(1): t= 0.605, p = 0.546
```
**PSEX BY PSIM(2):** PSEX by Moderate vs Low Similarity
```
            PSEX BY PSIM(2): t=-0.219, p = 0.826
      SX BY PSEX BY PSIM(2): t= 0.179, p = 0.857
      SV BY PSEX BY PSIM(2): t=-0.044, p = 0.964
 SX BY SV BY PSEX BY PSIM(2): t= 1.229, p = 0.221
```

**Tests involving the Partner Sex by Game Within-Subject Interaction**

| Source of Variation | SS | DF | MS | F | Sig of F |
|---|---|---|---|---|---|
| WITHIN CELLS | 28.42 | 310 | .09 | | |
| PSEX BY GAME | .19 | 2 | .09 | 1.03 | .357 |
| SX BY PSEX BY GAME | .12 | 2 | .06 | .65 | .522 |
| SV BY PSEX BY GAME | .20 | 2 | .10 | 1.09 | .337 |
| SX BY SV BY PSEX BY GAME | .03 | 2 | .01 | .15 | .863 |

**Tests involving the Partner Similarity by Game Within-Subject Interaction**

| Source of Variation | SS | DF | MS | F | Sig of F |
|---|---|---|---|---|---|
| WITHIN CELLS | 54.49 | 620 | .09 | | |
| PSIM BY GAME | .16 | 4 | .04 | .46 | .762 |
| SX BY PSIM BY GAME | .32 | 4 | .08 | .92 | .449 |
| SV BY PSIM BY GAME | .11 | 4 | .03 | .30 | .876 |
| SX BY SV BY PSIM BY GAME | .23 | 4 | .06 | .64 | .631 |

**Tests involving the Partner Sex by Partner Similarity by Game Within-Subject Interaction**

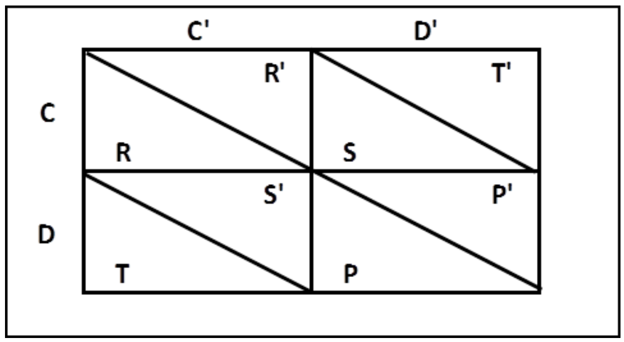
| Source of Variation | SS | DF | MS | F | Sig of F |
|---|---|---|---|---|---|
| WITHIN CELLS | 65.48 | 620 | .11 | | |
| PSEX BY PSIM BY GAME | .58 | 4 | .15 | 1.37 | .242 |
| SX BY PSEX BY PSIM BY GAME | .26 | 4 | .06 | .61 | .655 |
| SV BY PSEX BY PSIM BY GAME | .35 | 4 | .09 | .83 | .503 |
| SX BY SV BY PSEX BY PSIM BY GAME | .40 | 4 | .10 | .94 | .440 |

## Appendix B

## FISCHER'S SUBJECTIVE EXPECTED RELATIVE SIMILARITY (SERS) – RULES FOR COOPERATION

In the PDG each player has a choice between Cooperation (C) and Defection (D).
The Row Player's choices will be denoted as C and D. The Column Player's choices as C' and D'.

Below is the PDG in general form. Row Player's payoffs are below the diagonal, Column's above.




By definition in PDG: T > R > P > S.

If Row chooses C, his/her outcome is uncertain. It will either be R or S, depending on the choice of the partne
The same is true for a choice of D. The outcome will either be T or P, depending on partner's choice.

Thus, each choice is what Decision Theory refers to as a "gamble" or "risky option".

An important part of SERS theory concerns how decision makers are assume to evaluate the overall value of a gamble. Here, SERS makes use of the notion of Expected Value.

For a two outcome gamble expected value (EV) = p1(Outcome 1) + (1-p1)(Outcome 2), where p1 = the probability that Outcome 1 will occur.

In the case of PDG, EV(C) = pC'(R) + pD'(S) = pC'(R) + (1-pC')(S)
Where pC' is the probability that the partner chooses C'.
And, EV(D) = pC'(T) + pD'(P) = pC'(T) + (1-pC')(P)

SERS assumes that decision makers maximize EV. That is, they will choose the gamble with the highest expected value. If the gambles have the same expected value, the decision maker will be indifferent between them.

One centrally important idea in SERS is the notion of the similarity threshold of the game, $GAM_{sim}$ As will be shown below a PDG's similarity threshold is purely a function of the values of the outcomes (R, S, T and P).

However, to understand GAMsim it is necessary to understand the next centrally important idea is SERS theory, which is the similarity of the partner, $PAR_{sim}$.

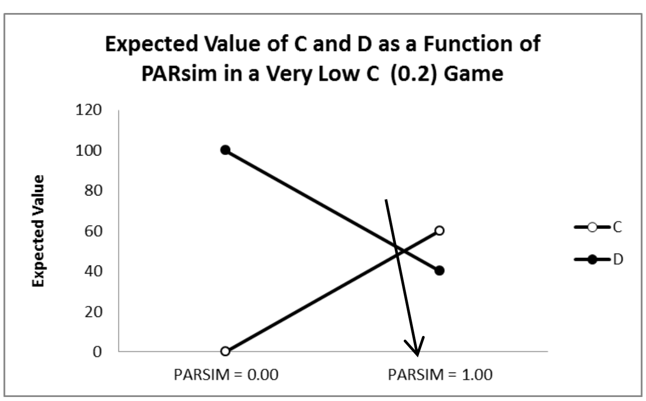
$PAR_{sim}$ is the probability that the partner will make the same decision as the self. It is the probability that both players will come to the same decision, either to both choose C (CC') or both choose D (DD').

Thus, the expected value of the C choice [EV(C)] is:

$EV(C) = PAR_{sim}(R) + (1-PAR_{sim})(S)$
and
$EV(D) = (1-PAR_{sim})(T) + PAR_{sim}(P)$

The four figures below show how EV(C) and EV(D) change as a function of PARsim. From the first to the fourth figure the C-level of the game is increasing. The C-level of a game is explained in the introduction to this thesis.

For the figure immediately below, the game has a very low C-level. From much prior research we know that this game produces a low level of cooperation.

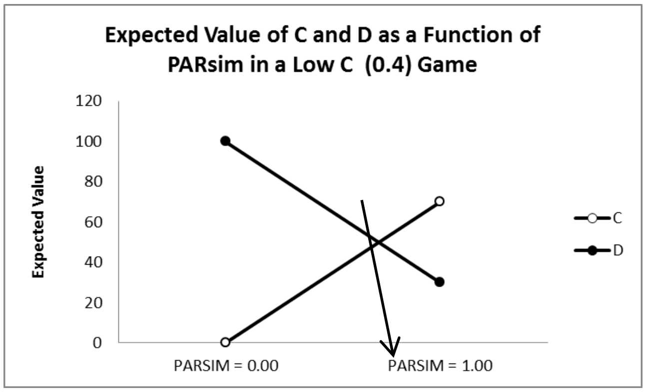


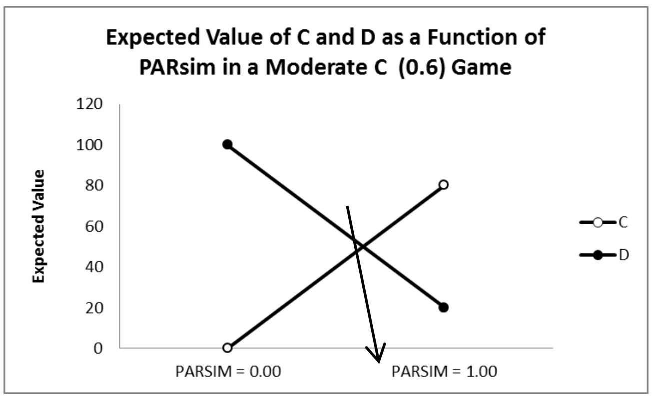
Note that the expected value of the C choice increases linearly with PARsim; as the partner becomes more and more likely to make the same (in this case, C) choice as you, EV of your C choice consistently improves.  Note that the expected value of the D choice decreases linearly with PARsim.  As the partner becomes more and more likely to make the same (in this case, D) choice as you, the EV of your D choice consistently deteroriates.

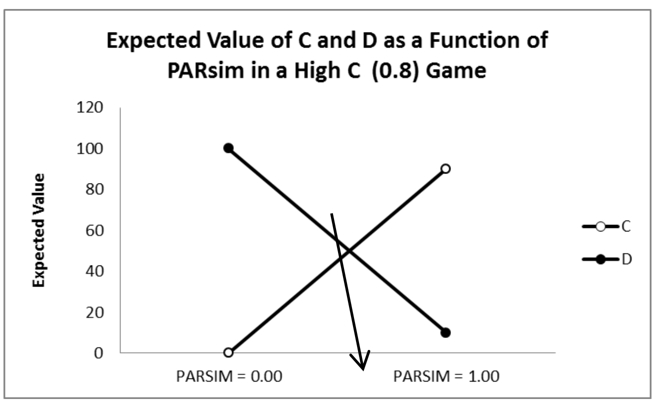
Also, note that these two functions intersect.  At this intersection point, EV(C) = EV(D).  That is, in this game there is a unique value of PARsim which makes the decision maker indifferent between C and D.  This value of PARsim is wholly determined by the payoffs in the game, and so will be called GAMsim.

Finally, note that for all values of PARsim to the left of GAMsim, EV(D) > EV(C).  That is, in this game, if PARsim is less than GAMsim, the decision maker would prefer D to C; he/she would be most likely to defect.  For all values of PARsim that are greater than GAMsim, EV(C) > EV(D).  Here the decsion maker would most likely choose C.

The following three figures are for PDG's in which the cooperation level systematically increases.  Note that GAMsim decreases as the cooperation level of the game increases.  That is,as the game produces more and more cooperation, the amount by which your partner needs to be similar to you decreases.




To summarize: For a given set of outcomes in PDG, there is a unique value of $PAR_{sim}$ that makes the <u>expected values of C and D the same</u>. This unique probability is referred to as GAMsim.

Or, $GAM_{sim}$ = that value of $PAR_{sim}$ for which EV(X) = EV(D).

EV(C) = EV(D) gives the equation below:

$$PAR_{sim}(R) + (1-PAR_{sim})(S) \quad = \quad (1-PAR_{sim})(T) + PAR_{sim}(P)$$

Solving for $PAR_{sim}$ gives the value for $GAM_{sim}$.

$$GAM_{sim} = (T-S)/(T - P + R -S)$$